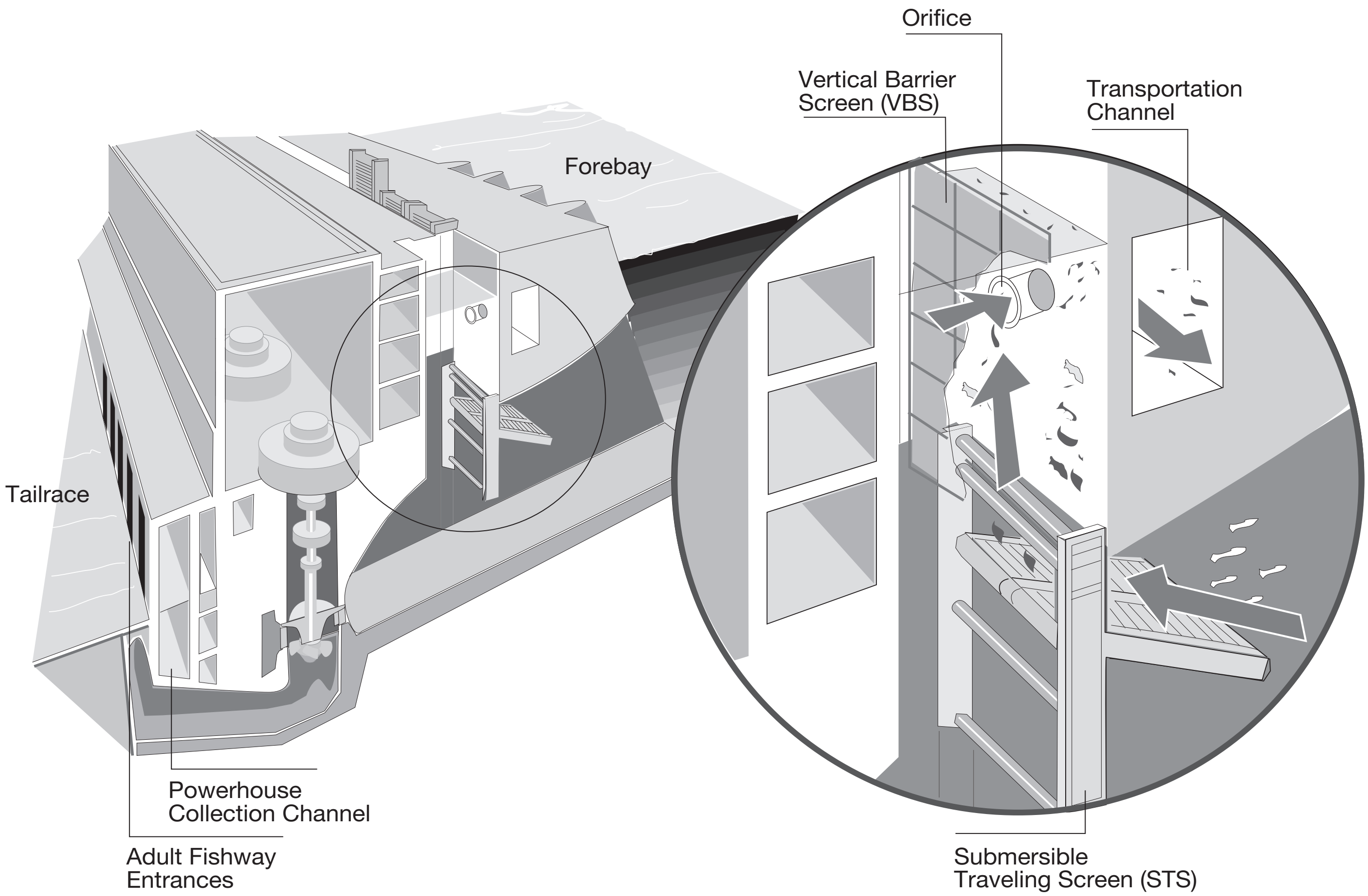
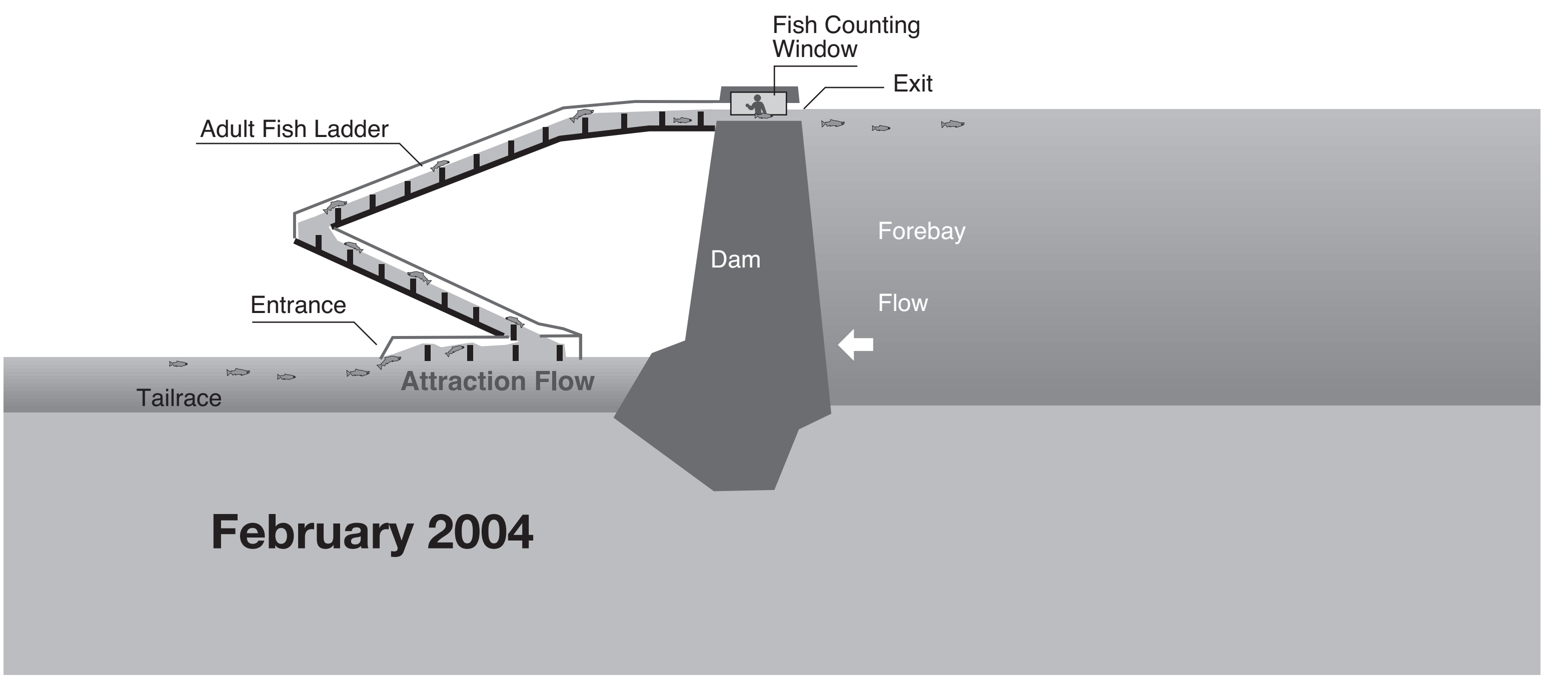
US Army Corps of Engineers®
Northwestern Division

Fish Passage Plan
Corps of Engineers Projects

CENWD-CM-WR-N





February 2004

FISH PASSAGE PLAN

FOR

CORPS OF ENGINEERS PROJECTS

U.S. ARMY CORPS OF ENGINEERS

NORTHWESTERN DIVISION

PORTLAND, OREGON

FEBRUARY 2004

Table of Contents

Section 1 Overview

Section 2 Bonneville Dam

Section 3 The Dalles Dam

Section 4 John Day Dam

Section 5 McNary Dam

Section 6 Ice Harbor Dam

Section 7 Lower Monumental Dam

Section 8 Little Goose Dam

Section 9 Lower Granite Dam

Appendices

Appendix A	Special Project Operations and Studies
Appendix B	Corps of Engineers Juvenile Fish Transportation Plan
Appendix C	Bonneville Power Administration's System Load Shaping Guidelines Regarding Turbine Operation and Best Efficiency
Appendix D	Corps of Engineers Plan of Action for Dissolved Gas Monitoring in 2004
Appendix E	Measures Related to Project Spill for Fish Passage, from the NMFS 2000 Biological Opinion on FCRPS Operation (Sections 9.6.1.4.3 and 9.6.1.4.4, pages 9-88 to 9-92)
Appendix F	Guidelines for Dewatering and Fish Handling Plans
Appendix G	Protocols for Adult Fish Trapping Operations at Bonneville, Ice Harbor, and Lower Granite Dams
Appendix H	Turbine Dewatering Procedure for Chief Joseph Dam
Appendix I	List of Acronyms

SECTION 1

OVERVIEW

1. Fish Passage Plan

1.1. Overview

The Fish Passage Plan (FPP) is developed by the U.S. Army Corps of Engineers (Corps) in coordination with the region's fish agencies, Indian tribes, Bonneville Power Administration (BPA), and other participants through the Corps' Fish Passage Operations and Maintenance Coordination Team (FPOM). The FPP describes year-round project operations necessary to protect and enhance anadromous and resident fish species listed as endangered or threatened under the Endangered Species Act (ESA), as well as other migratory fish species. The FPP guides Corps actions in regard to providing fish protection and passage at the eight Corps mainstem lower Columbia and Snake River projects, and at Chief Joseph Dam. Other Corps documents and agreements related to fish passage at these projects are consistent with the FPP.

The FPP is revised as necessary to incorporate changes to project operations and maintenance as a result of new facilities or changes in operational procedures. Revisions will incorporate changes adopted through coordination with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and U.S. Fish and Wildlife Service (USFWS) as part of the ESA Section 7 consultation, Recovery Plan, or Section 10 permit processes, and through consideration of other regional input and plans. The current revisions reflect provisions contained in the National Marine Fisheries Service (NMFS) Biological Opinion (BiOp), issued December 21, 2000 and titled "Reinitiation of Consultation on Operation of the Federal Columbia River Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin," and the USFWS BiOp, issued December 20, 2000 and titled "Effects to Listed Species from Operations of the Federal Columbia River Power System." The Corps prepared a "Record of Consultation and Statement of Decision" relative to these BiOps in May 2001, stating how the Corps plans to meet its ESA responsibilities to protect multiple ESA-listed fish species. Also, the Corps has prepared a combined 1- and 5-year Implementation Plan, as called for in the 2000 NMFS BiOp. Longer term project actions to increase capability and reliability of project fish passage are described in those Plans. When revising the FPP, the Corps considers the amended Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program to the fullest extent practicable.

Comments on the FPP are welcome and may be sent either to the FPOM or the Corps' Northwestern Division, Reservoir Control Center (RCC) Fish Team in Portland, Oregon.

1.2. Emergency Deviations From FPP. River operations emergencies may occur which require projects to deviate temporarily from the FPP. To the extent possible, these operations will be conducted to minimize fish impacts and coordinated with fish agencies and tribes. Normally, coordination occurs prior to an action. However, if an emergency situation requires immediate attention, coordination will be done as soon as possible afterwards.

The phrase "when practicable" appears in the FPP to help describe those project actions for fish that may vary on a case-by-case basis and thus require judgment calls by the project for a particular situation. This is due to factors such as real time biological or other environmental conditions, project manpower or mechanical equipment availability, and fish facility or dam structural integrity. In these cases the project biologist and other project personnel will consider all relevant factors and determine the best way to proceed, then implement the appropriate action. These actions will be coordinated with fish agencies and tribes when they deviate from the FPP.

1.3. Technical Management Team. In-season decisions on river operations to achieve BiOp performance standards for spring and summer outmigrants will be made in coordination with the Regional Forum Technical Management Team (TMT). Coordination of special operations identified in the FPP will occur through the TMT and will be identified in the Water Management Plan. These may include maintenance or research activities requiring unit outages that affect other river operations, operation of turbines outside of the 1% of best efficiency range, zero nighttime flow, and implementation of the Juvenile Fish Transportation Plan (JFTP - see Appendix B).

1.4. Spill at Corps Mainstem Projects. Corps mainstem projects will provide spill for juvenile fish passage in accordance with the NMFS BiOp (specifications in Appendix E) to protect ESA-listed salmon species. Spill at the three Snake River collector projects, Lower Monumental, Little Goose, and Lower Granite will occur when seasonal average flows are projected to meet or exceed 85 kcfs (NMFS BiOp, Action 40). Target spill levels and dates are developed through consultation with NOAA Fisheries and may be adjusted during the fish migration season as recommended by the TMT. Continuous spill is provided at Lower Monumental Dam, and nightly spill is provided at McNary, Little Goose, and Lower Granite Dams, for spring outmigrants. Continuous spill is provided at Bonneville, The Dalles, and Ice Harbor Dams, and nightly spill is provided at John Day Dam, for both spring and summer outmigrants to meet BiOp measures. Spill also may be provided under special circumstances for non-listed fish species if recommended by the fish agencies and tribes and if the recommendations are consistent with regional operational priorities and coordinated through TMT.

1.5. Total Dissolved Gas (TDG) Monitoring. TDG saturation levels are monitored at the forebay and tailrace of each mainstem project during the fish passage season. The water quality standard and criterion developed by the states of Idaho, Montana, Oregon, and Washington, in coordination with EPA is 110% of saturation at ambient temperature and pressure. The Corps' policy is to operate each mainstem project to meet state standards insofar as physically possible unless other overriding reasons cause temporary deviations. The Corps also recognizes that the NMFS 2000 BiOp calls for fish spill to be provided at levels that create TDG levels higher than 110% (Appendix D). That BiOp states that the Federal Columbia River Power System (FCRPS) projects should be operated so that forebays do not exceed 115% and tailwaters do not exceed 120% TDG levels for anadromous fish passage. In response to this recommendation by NOAA Fisheries, the Corps has worked with the states of Oregon and Washington to spill to these higher TDG levels. The State of Oregon has provided a variance through the 2007 spill season. The State of Washington has modified its rule to provide for spill recommended in the NMFS BiOp. In 2003 the State of Washington accepted the Corps’ gas abatement plan and is expected to do the same in 2004.

Spring freshet river flows above the generation capacity of the FCRPS projects has occurred in the past, causing TDG levels to exceed the 115% and 120% levels. Also, implementation of fish spill requests from fish agencies and tribes has resulted in TDG levels of 120% or greater. Therefore, fish spill implementation will be subject to further coordination with appropriate entities through TMT if excessive TDG levels occur or if evidence of gas bubble disease is observed in fish.

The Corps will take those actions necessary to coordinate with the region and provide spill to protect ESA-listed fish in 2004. RCC issues a teletype spill priority list which specifies spill discharge levels and the sequence in which projects are to spill at higher TDG levels in order to manage both spill for fish passage and involuntary spill. The sequence is coordinated through TMT while spill levels are evaluated daily by RCC during the spill season and modified as needed in subsequent teletypes. TDG information is provided to the TMT and summarized for the year in the Corps’ TDG and Water Temperature Annual Report.

The Corps is also coordinating with the Bureau of Reclamation on a joint operation of Chief Joseph and Grand Coulee dams to minimize TDG levels. This operation may result in more spill from Chief Joseph Dam (Appendix D). This is a spill management action to reduce TDG below those projects and is not a fish passage operation.

1.6. System Load Shaping. Guidelines coordinated by BPA on system load shaping to consider fish impacts are included in Appendix C. The guidelines describe procedures BPA follows to make hydropower load requests that enable the Corps to operate units consistent with the criterion to operate turbine units within 1% of best efficiency. The time period for this operation in 2004 is April 1 through October 31 at both the lower Columbia and lower Snake River projects.

1.7. Juvenile Fish Transportation Plan (JFTP). Juvenile fish will be transported in accordance with the NMFS BiOp and Section 10 permit. Transport criteria are contained in the JFTP, Appendix B. The JFTP covers collection, holding, and transport of juvenile fish. Other project criteria on operation of the juvenile fish bypass facilities are contained in Sections 2 through 9 of this document (project specific sections). Additional criteria may be developed as part of the ESA Section 10 permit process and/or in coordination with the TMT. Implementation of juvenile fish transportation, including deviation from the plan described in Appendix B, will be coordinated through the TMT and with NOAA Fisheries (ESA).

1.8. Project Fish Passage Facilities Inspection and Reporting Criteria.

1.8.1. General. Sections 2 through 9 of this document include detailed criteria for inspection and reporting for fish passage facilities at the Corps projects on the lower Snake and lower Columbia Rivers. The Corps provides weekly written inspection reports to the NOAA Fisheries Hydropower Program office in Portland, Oregon describing out-of-criteria situations, adjustments made to resolve problems, and a detailed account of how out-of-criteria situations affected project fish passage and survival. The weekly inspection reports also include summaries of equipment calibrations, adult fish collection channel velocity monitoring, and water temperature monitoring. Equipment which does not require calibration will not routinely be included in the weekly report. The Corps also provides an annual report to NOAA Fisheries that summarizes project operations and maintenance, fish passage facility inspections and monitoring, severity of out-of-criteria conditions, and avian predation abatement actions. In addition, the Corps is developing methods to report hourly individual spill bay and turbine unit operations at mainstem projects as called for in the NMFS BiOp. An acceptable procedure will be coordinated with NOAA Fisheries and other FPOM participants.

1.8.2. Annual Reporting of Excursions Outside the 1% of Best Efficiency Turbine Operating Range. Excursions outside the 1% of best efficiency turbine operating range are tracked by BPA for each project during the fish passage season. The Corps determines the cause of each excursion and provides this information to BPA. This information is compiled bi-weekly. After the fish passage season, BPA submits an annual report to the Corps and NOAA Fisheries which describes instances where turbines at lower Columbia and lower Snake River projects operate outside the 1% of best efficiency range for significant periods, as defined under the guidelines in Appendix C. The intent of excursion reporting is to provide a means for quality assurance for project operations.

1.9. Turbine Dewatering Procedure at Chief Joseph Dam. The Corps coordinated and adopted a procedure in 2002 to dewater turbine draft tubes for maintenance at Chief Joseph Dam (Appendix H). While this project does not have fish passage facilities, ESA-listed salmon and steelhead occur in the tailrace area. The procedure provides for turbine dewaterings and recovery of any trapped fish in a manner that protects those fish.

1.10. Implementation of the Fish Passage Plan.

Implementation of the FPP requires information from and coordination with NOAA Fisheries, BPA, other Federal and state fish agencies, and tribes. RCC coordinates operation of Corps projects that affect system water management, spill, unit availability, or other project uses through the TMT. District biologists coordinate directly with technical staff from the fish agencies and tribes on other project-specific operations that do not have system impacts.

The RCC participates in TMT meetings throughout the year to consider recommendations for river operations to implement the BiOps and other recommendations from fish interests. These meetings are held in the Corps' Northwestern Division office in Portland, Oregon, and are open to the public. Corps representatives are available at these meetings to discuss the latest weather and runoff forecasts, as well as fish, hydrologic, water quality, and power generation information to assist in planning upcoming operations for fish passage. Fish operation recommendations are evaluated by the Corps to determine impact on overall system operations. The Corps also coordinates with NOAA Fisheries and USFWS to meet ESA requirements for listed species.

1.10.1. Agency Responsibilities.

1.10.1.1. U.S. Army Corps of Engineers.

a. Coordinate with NOAA Fisheries and USFWS on operational actions that might impact threatened, endangered, or candidate species.

b. Prepare Water Management Plans for in-season management, in coordination with TMT members, to implement the Corps' Record of Consultation and Statement of Decision.

c. In cooperation with the fish agencies and tribes, provide fish passage monitoring, surveillance, and reporting at Corps projects throughout the migration period.

d. Provide timely information on all proposed and/or scheduled studies or special operations that may negatively impact or otherwise constrain fish passage or energy production. Discuss unforeseen changes in fish passage operation with fish agencies and tribes.

e. Carry out routine and emergency fish passage operations and maintenance procedures in accordance with criteria in Sections 2 through 9 and Appendix A.

f. Conduct the TDG Monitoring Program as described in Appendix D.

1.10.1.2. Fish Agencies and Indian Tribes.

a. Request spill for fish through TMT to protect ESA-listed species or other species in accordance with the TMT Guidelines.

b. Through TMT, provide RCC with a spill priority list and recommendations for modifications.

c. Provide biological monitoring and surveillance reports throughout the migration period from predetermined locations, such as Smolt Monitoring Program sample sites.

d. Provide status reports on the timing of the downstream migration, including pertinent marked fish release and recovery data, with weekly written reports estimating percentage of runs past key projects.

e. Where biologically and logistically feasible, coordinate hatchery releases to ensure they are protected by regulated fish flows and spills while minimizing impacts on ESA-listed species. Provide and update hatchery release schedules weekly.

f. Provide recommendations to the operating agencies for maintaining acceptable fish passage conditions. This information can be used to maximize other project uses, including power generation.

g. Provide information on all proposed and scheduled studies or special operations designed to improve fish passage operations that may affect energy production or project operation. Discuss unforeseen changes with the Corps.

h. Recommend viable methods and procedures to reduce mortality to migratory and resident fish. This may include such operations as collection and transport of migrants, use of alternate bypass strategies, or other methods to minimize fish mortality.

1.10.1.3. Bonneville Power Administration.

a. Report to RCC on updated load-resource studies during the April-to-September period to supplement the National Weather Service River Forecast Center's runoff volume forecast for fish passage planning assistance.

b. Provide to RCC, NOAA Fisheries, other fish agencies, and tribes, the BPA estimate of power market impacts of requested spill operations.

c. Utilize available flexibility of the Federal Columbia River Power System to shape flow requirements, spill priorities, and plant generation consistent with BPA policies and statutory requirements related to fish protection.

d. Adjust system generation to provide adequate water to meet fish operations requirements in accordance with the NMFS and USFWS BiOps on hydrosystem operations.

e. Provide project load requests on a real-time, hourly basis that enable the Corps to implement spill priorities.

f. Provide information on unit operation outside the 1% of best efficiency operating range, as indicated in Appendix C.

1.10.1.4. Mid-Columbia Public Utility Districts.

Operate projects for spill transfer in accordance with provisions of the FPP with at least one and one-half hours notification to start or stop spill.

1.10.2. Coordination Procedures.

1.10.2.1. Coordination of the FPP. The FPP is effective year-round and revisions are coordinated with FPOM, which includes NOAA Fisheries, other Federal and state fish agencies, tribes, and other interested parties. Different parts of the FPP may be revised at different times. Suggested revisions should be submitted to FPOM for consideration by the Corps. Draft FPP revisions will be provided for a two-week regional review. FPP revisions will be published two weeks after the close of the regional review period. FPP revisions are provided to TMT for use as part of the overall river operation plan. Sections dealing with special operational requirements also will be included in the Water Management Plans.

1.10.2.2. Coordination Process. Actions that may impact fish system wide will be coordinated and documented through the TMT process. Actions that may impact fish at a specific project which are a result of actual operations, implementation of RPA actions, incidental take terms and conditions contained in the 2000 BiOps, or research projects, will be coordinated through the process outlined below.

The party responsible for the action will prepare and e-mail a memo to the NOAA Fisheries point of contact who is responsible for activities at that dam which describes the action, BiOp measure addressed, how the action may impact fish, and how the action has been designed to minimize impacts. NOAA Fisheries will provide concurrence or recommended changes in an e-mail response. This coordination process is described in a letter to Brigadier General Carl A. Strock from Brian J. Brown, U.S. Dept. of Commerce, NOAA, National Marine Fisheries Service, dated June 5, 2001. A copy of this letter is available from the District Biologist.

1.10.2.3. Day-to-day Coordination of River System.

a. Flow Augmentation and Reservoir Operations Recommendations. Procedures described in the Water Management Plan will be used for fish operations. Coordination for system and project operations will occur through TMT. This will include requests for operation of turbine units outside of the 1% best efficiency range, zero nighttime flow in the Snake River, reservoir operation at minimum operating pool (MOP) or some other specific level, and special operations for implementation of approved research projects as identified in Appendix A. During the time when reservoirs are not being operated to provide special protection for fish passage, projects may be operated within the full reservoir operating range.

b. Fish Spill Management. The Corps will implement BiOp fish spill provisions described in Appendix E, including special TDG conditions for juvenile fish passage. The TDG and gas bubble trauma signs in fish will be monitored and evaluated during the spill season by the Corps, NOAA Fisheries, other fish agencies, tribes, and water quality agencies. Project spill levels will be adjusted as needed, based on daily physical and biological monitoring results, and coordinated with the TMT and tribes.

c. Special Operations Recommendations (Fish-related and for Project O&M Activities). Recommendations for special fish operations outside the Water Management Plan may be made to RCC. Coordination of these recommendations will be made through the TMT. Recommendations related to project O&M activities requiring special operations will be evaluated for impacts on fish migration and survival. Sufficient lead time will be given for a planned operation, whenever practical, to allow ESA coordination with the TMT, NOAA Fisheries, and USFWS. As much lead time as possible will be provided for activities requiring immediate action. After-action coordination will occur when advance notice is not possible, such as in emergency actions.

d. Other Operational Requests. As with Corps O&M requests, all other operational recommendations will be evaluated for impacts on fish migration and survival and effects on other project O&M requirements. Coordination of special operations with NOAA Fisheries, USFWS, other fish agencies, and tribes will occur through the TMT. Except as necessary for emergency actions, adequate time will be allowed for evaluation of all project and fish impacts prior to implementation. Coordination of emergencies, as identified in the Emergency Protocols adopted by the TMT (Water Management Plan, Appendix 2), will be followed.

1.10.2.4. Activities by Non-Corps Personnel. All non-Corps personnel intending to conduct any activity, such as fish handling or minor facility modifications, at a Corps facility must have prior written approval. This approval must be requested in writing to the Chief, Operations Division, at the Corps District office responsible for a particular project. If the activity could affect ESA-listed fish, proof of consultation with NOAA Fisheries or USFWS (Section 10 permit) must also be provided.

SECTION 2

BONNEVILLE DAM

Bonneville Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the following general site plans for Bonneville Lock and Dam (Figures BON-1 through BON-5). Dates for project operations for fish purposes and special operations are listed in Table BON-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description, First Powerhouse. Juvenile fish passage facilities at the Bonneville first powerhouse consist of STSs, VBSs, 12" gatewell orifices, fish bypass channel, excess water elimination facility, fish sampler, and a 24" fish transport pipe to the tailrace. All 10 main turbine units have STS capability if needed for deployment. A small unit (unit O) is located at the south end of the powerhouse and is not equipped with screens.

There are also small channels associated with the auxiliary water intakes for adult fishways at the south end of the powerhouse and at both ends of the spillway. These older juvenile fish passage channels discharge into the adult fishways at the ends of the spillway and into the ice and trash sluiceway at the south end of the powerhouse. These facilities are no longer operated on a regular basis.

1.1.2. Facilities Description, Second Powerhouse. Juvenile fish passage facilities at the Bonneville second powerhouse are comprised of turbine intake extensions (TIEs), streamlined trash racks, STSs, VBSs, two 12.5″ orifices per gatewell in units 11-14 and fish unit 2, and one 12.5″ orifice in all other gatewells flowing into a fish bypass channel, an excess water elimination facility, and a 48" fish transport pipe which connects the bypass channel to the tailrace. A 48″ and 42″ transport pipe at the high and low outfalls respectively, transport fish to the tailrace at the new outfall location. A juvenile fish sampling facility is included in the bypass. All eight main turbine units have STSs, TIEs, and streamlined trashracks. Two smaller turbines that supply adult fishway auxiliary water do not have STSs, TIEs, or streamlined trashracks; however, they have a fine trashrack with a 0.75 inch clear opening. The newly completed Powerhouse 2 Corner Collector located at the Ice/Trash Chute on the south side of the powerhouse will begin operation in 2004 to pass juveniles. The associated flume extends several hundred feet west on the south side of the Powerhouse 2 tailrace and empties at the tip of Cascades Island.

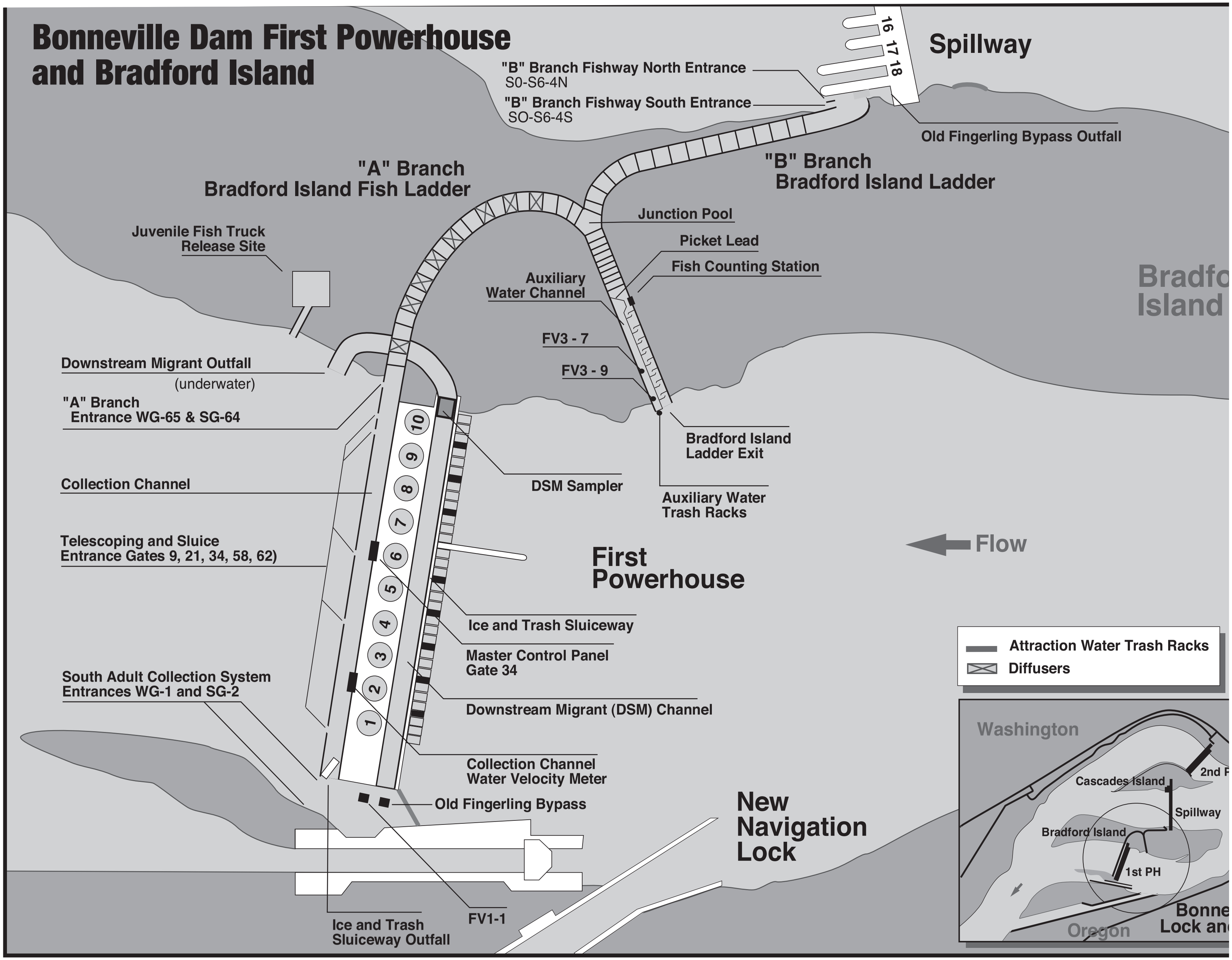


Figure BON-1 Bonneville Dam first powerhouse and Bradford Island fish ladder.

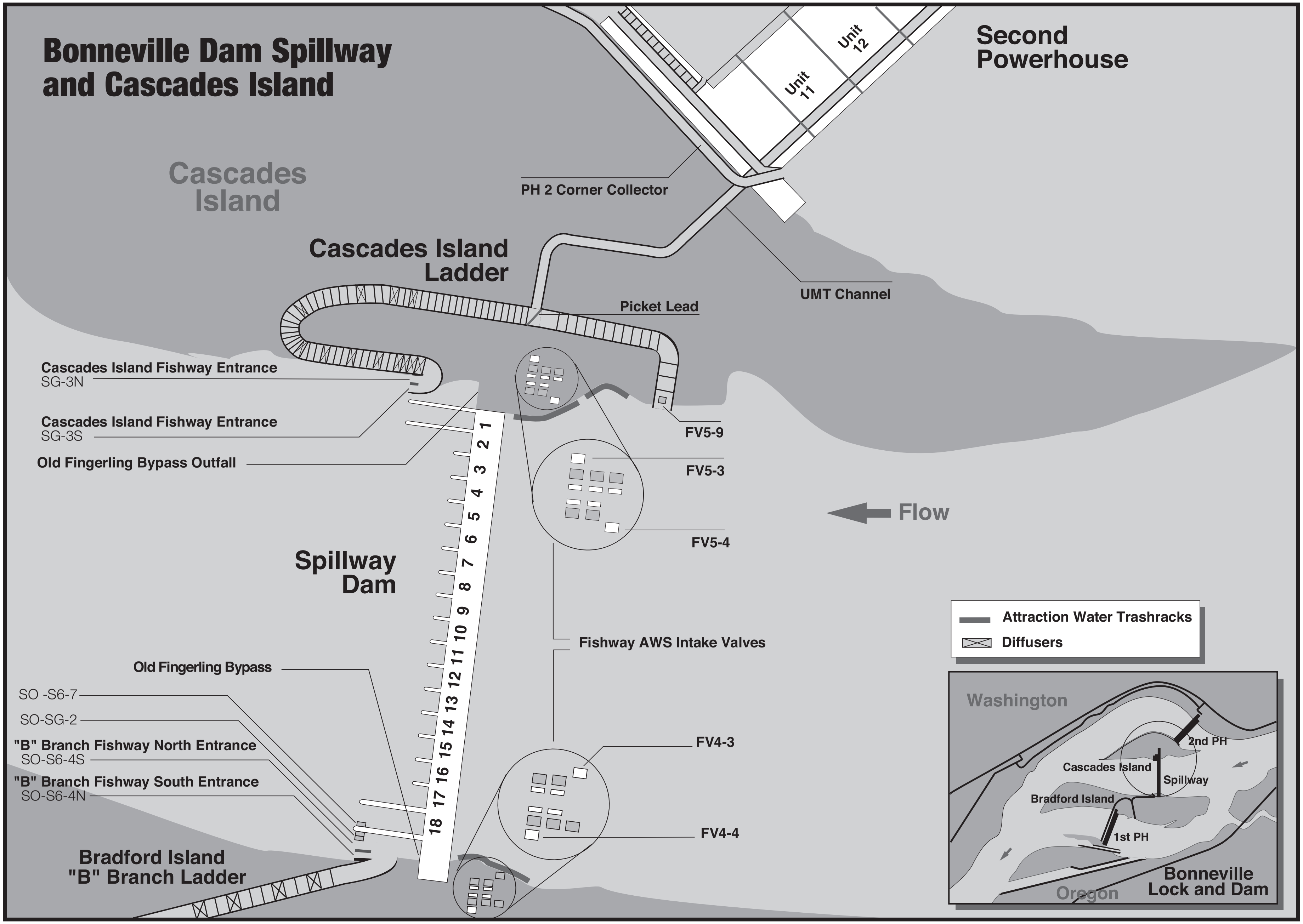


Figure BON-2 Bonneville Dam spillway, Cascades Island fish ladder and upstream migrant transportation channel (UMT).

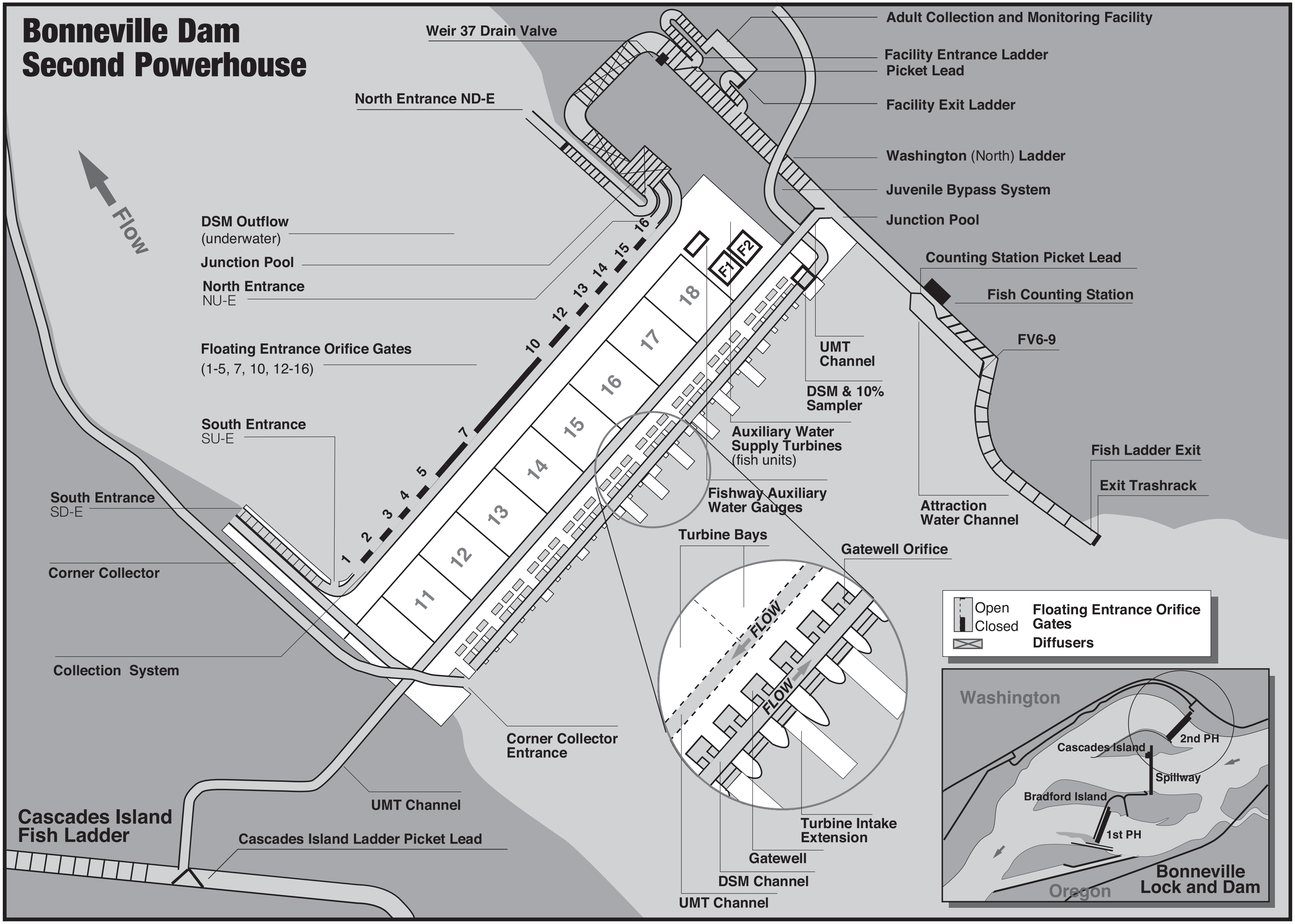


Figure BON-3 Bonneville Dam second powerhouse and Washington (north) fish ladder.

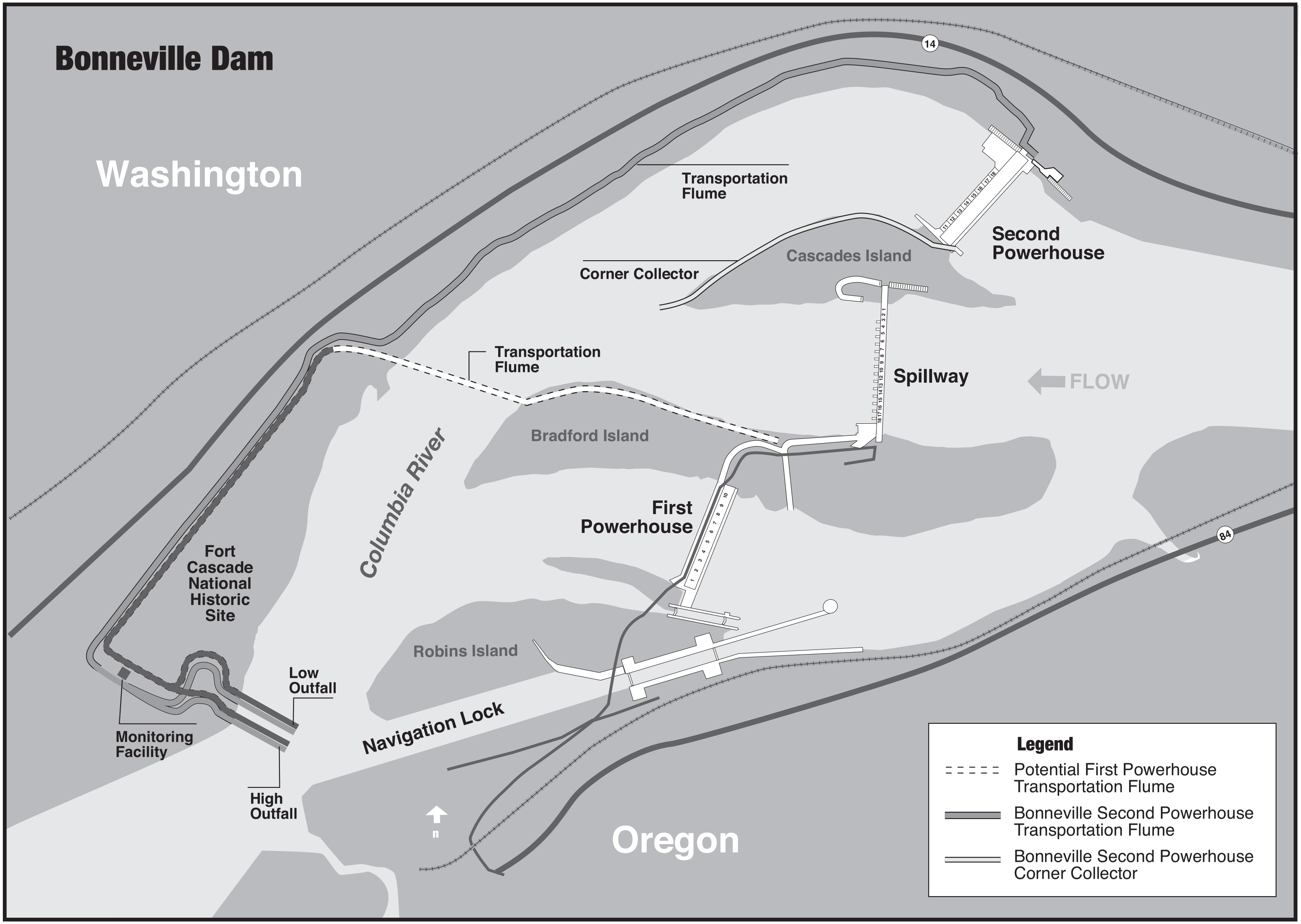


Figure BON-4 Bonneville juvenile fish passage system.

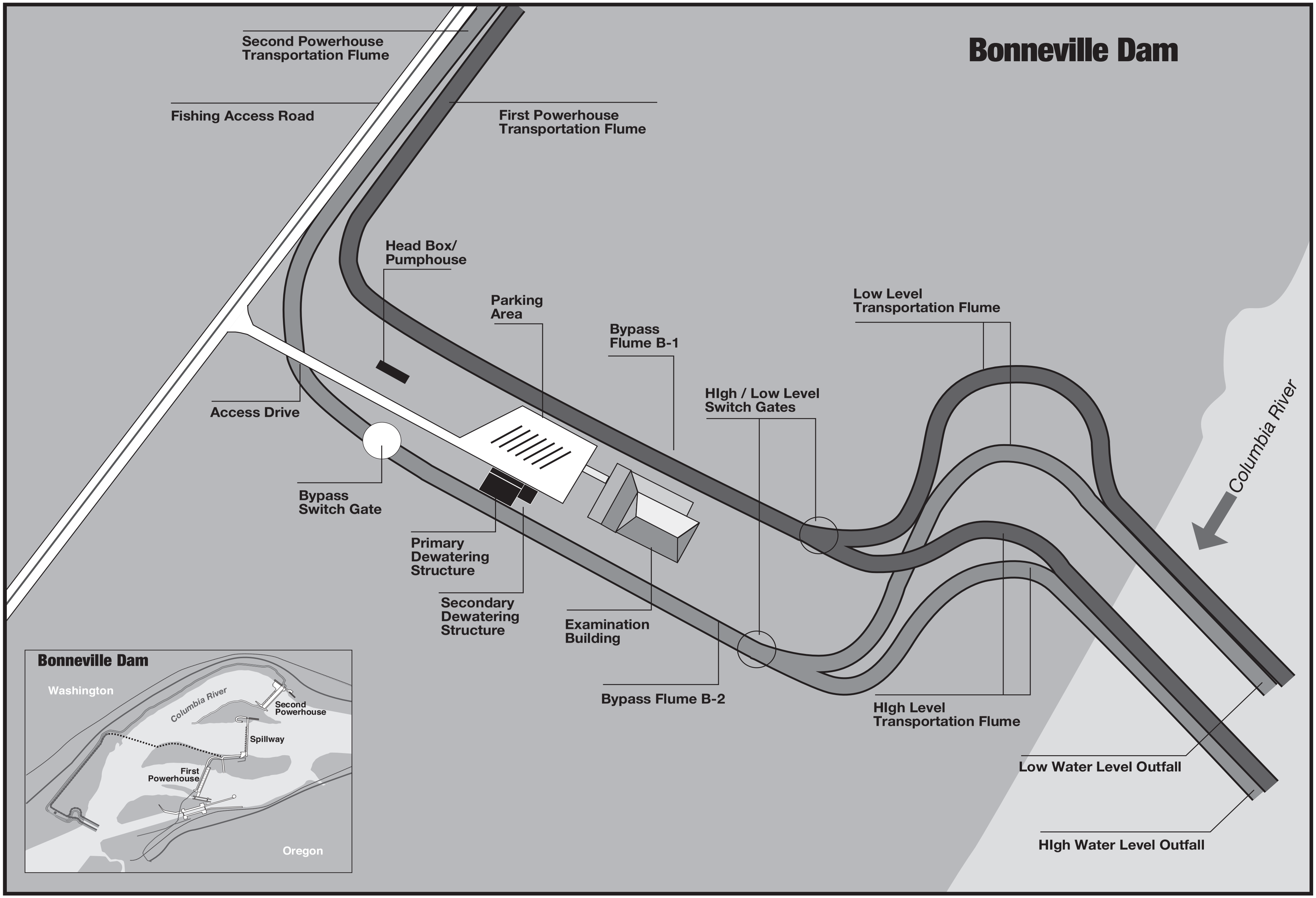
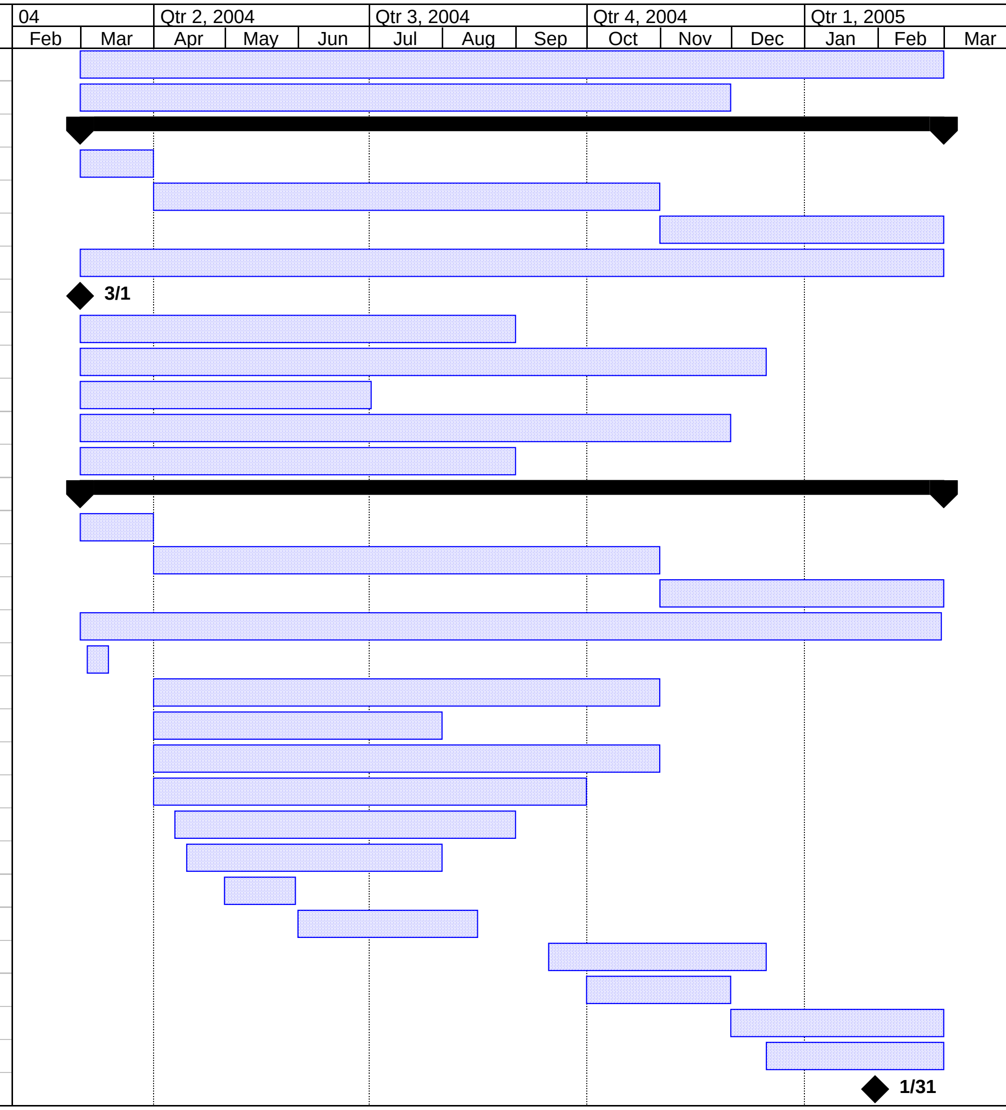


Figure BON-5 Bonnevillle Dam juvenile fish monitoring facility and outfall flumes.

Table BON-1. Dates of project operations for fish purposes at Bonneville, 2004

Task Name	Start	Finish	FPP Reference
Weekly Reports	3/1/04	2/28/05	Bon 2.6.3
Juvenile Migration Timing	3/1/04	11/30/04	Bon 1.1.3
Adult Fish Counting	**3/1/04**	**2/28/05**	**Bon 1.2.2**
Video Count 0400 - 2000 PST	3/1/04	3/31/04	Bon 1.2.2
Visual Count 0400 - 2000 PST	4/1/04	10/31/04	Bon 1.2.2
Video Count 0400 - 2000 PST	11/1/04	2/28/05	Bon 1.2.2
TDG Monitoring	3/1/04	2/28/05	App D Phase 2
Avian Abatement in Place	3/1/04	3/1/04	Bon 2.4.1.1 c
Operate Avian Cannons	3/1/04	8/31/04	Bon 2.4.2.4.b.5
Screens in Place - PH2	3/1/04	12/15/04	Bon 2.4.2.2
TIES in place	3/1/04	7/1/04	Bon 2.4.2.2.m
Adult Fish Passage Season	3/1/04	11/30/04	Bon 2.5.1.2
Spill Gates 1 and 18 Open 4"	3/1/04	8/31/04	Table Bon-6
1% limitations	**3/1/04**	**2/28/05**	**Bon 4.3**
1% soft constraint	3/1/04	3/31/04	Bon 4.3
1% hard constraint	4/1/04	10/31/04	Bon 4.3
1% soft constraint	11/1/04	2/28/05	Bon 4.3
PH2 - priority	3/1/04	2/28/05	Table Bon-5
Spring Creek Hatchery Release Approx.	3/4/04	3/12/04	App A Bon 1.1
Route Specific Survival Evaluation	4/1/04	10/31/04	App A Bon 2.2
Fish Passage Efficiency B2	4/1/04	7/31/04	App A Bon 2.3
Adult Salmon & Steelhead Eval	4/1/04	10/31/04	App A Bon 2.6
Eval of Gatewell Mods	4/1/04	9/30/04	App A Bon 2.4
Spill for Juvenile Fish	4/10/04	8/31/04	App A Bon 1.2
Prototype Testing FGE Mods B2	4/15/04	7/31/04	App A Bon 2.5
Bon Rehab Biological Testing	5/1/04	5/31/04	App A Bon 2.1
Special Spill Time for Sockeye	6/1/04	8/15/04	Bon 2.2.3
2 Screens in Place - PH1	9/15/04	12/15/04	Bon 2.4.1.2.f
Possible operation of Ice & Trash Chute	10/1/04	11/30/04	Bon 2.4.1.2.d
Maintenance of Adult Fish Facilities	12/1/04	2/28/05	Bon 1.2.2
Maintenance of Juvenile Fish Facilities	12/16/04	2/28/05	Bon 1.1.3
Annual Report	1/31/05	1/31/05	Bon 2.6.3



1.1.3. Juvenile Migration Timing. The juvenile fish migration season occurs from March 1 through November 30. Tables BON-2a and BON-2b show the primary passage periods for each species. Maintenance of juvenile fish facilities is scheduled for the period December 16 through February to reduce the impact on downstream migrants. These activities will be coordinated to minimize potential impacts on juvenile migrants that may be present at that time.

Table BON-2a. PH1 10%, 50%, and 90% passage dates for 1995-1999

Yearling Chinook				
	10 %	50%	90 %	# of Days
1995	17-Apr	09-May	26-May	40
1996	19-Apr	02-May	27-May	39
1997	20-Apr	4-May	26-May	37
1998	23-Apr	5-May	23-May	31
1999	21-Apr	9-May	30-May	40
MEDIAN	20-Apr	05-May	26-May	39
MIN	17-Apr	02-May	23-May	31
MAX	23-Apr	09-May	30-May	40

Subyearling Chinook - "Brights" Only				
	10 %	50%	90 %	# of Days
1995	6-Jun	23-Jun	15-Jul	40
1996	9-Jun	29-Jun	18-Jul	40
1997	7-Jun	26-Jun	29-Jul	53
1998	3-Jun	16-Jun	20-Jul	48
1999	11-Jun	30-Jun	25-Jul	45
MEDIAN	07-Jun	26-Jun	20-Jul	45
MIN	03-Jun	16-Jun	15-Jul	40
MAX	11-Jun	30-Jun	29-Jul	53

Unclipped Steelhead				
	10 %	50%	90 %	# of Days
1995	28-Apr	12-May	27-May	30
1996	24-Apr	6-May	26-May	33
1997	23-Apr	8-May	25-May	33
1998	27-Apr	12-May	31-May	35
1999	24-Apr	13-May	1-Jun	39
MEDIAN	24-Apr	12-May	27-May	33
MIN	23-Apr	06-May	25-May	30
MAX	28-Apr	13-May	01-Jun	39

Clipped Steelhead				
	10 %	50%	90 %	# of Days
1995	04-May	17-May	29-May	26
1996	27-Apr	16-May	29-May	33
1997	29-Apr	13-May	28-May	30
1998	2-May	15-May	1-Jun	31
1999	27-Apr	19-May	5-Jun	40
MEDIAN	29-Apr	16-May	29-May	31
MIN	27-Apr	13-May	28-May	26
MAX	04-May	19-May	05-Jun	40

Coho				
	10 %	50%	90 %	# of Days
1995	28-Apr	13-May	29-May	32
1996	23-Apr	14-May	28-May	36
1997	29-Apr	18-May	4-Jun	37
1998	3-May	20-May	4-Jun	33
1999	28-Apr	23-May	7-Jun	41
MEDIAN	28-Apr	18-May	04-Jun	36
MIN	23-Apr	13-May	28-May	32
MAX	03-May	23-May	07-Jun	41

Sockeye (Wild + Hatchery)				
	10 %	50%	90 %	# of Days
1995	10-May	19-May	27-May	18
1996	4-May	18-May	2-Jun	30
1997	6-May	21-May	22-Jun	48
1998	10-May	15-May	29-May	20
1999	10-May	17-May	1-Jun	23
MEDIAN	10-May	18-May	01-Jun	23
MIN	04-May	15-May	27-May	18
MAX	10-May	21-May	22-Jun	48

Table BON-2b. PH2 10%, 50%, and 90% passage dates for 2000-2003.

Yearling Chinook				
	10 %	50%	90 %	# of Days
2000	23-Apr	17-May	1-Jun	40
2001	26-Apr	11-May	6-Jun	42
2002	25-Apr	18-May	1-Jun	38
2003	22-Apr	14-May	31-May	40
MEDIAN	24-Apr	15-May	01-Jun	39
MIN	22-Apr	11-May	31-May	38
MAX	26-Apr	18-May	06-Jun	42

Subyearling Chinook[1]				
	10 %	50%	90 %	# of Days
2000	6-Jun	22-Jun	19-Jul	44
2001	7-Jun	9-Jul	15-Aug	70
2002	21-Jun	3-Jul	20-Jul	30
2003	15 Jun	1-Jul	19-Jul	35
MEDIAN	11-Jun	02-Jul	19-Jul	40
MIN	06-Jun	22-Jun	19-Jul	30
MAX	21-Jun	09-Jul	15-Aug	70

Unclipped Steelhead				
	10 %	50%	90 %	# of Days
2000	23-Apr	16-May	1-Jun	40
2001	2-May	18-May	9-Jun	39
2002	1-May	27-May	9-Jun	40
2003	3-May	27-May	9-Jun	38
MEDIAN	1-May	22-May	9-Jun	40
MIN	23-Apr	16-May	1-Jun	38
MAX	3-May	27-May	9-Jun	40

Clipped Steelhead				
	10 %	50%	90 %	# of Days
2000	28-Apr	18-May	4-Jun	38
2001	7-May	20-May	12-Jun	37
2002	2-May	27-May	11-Jun	41
2003	7-May	30-May	11-Jun	36
MEDIAN	4-May	23-May	11-Jun	39
MIN	28-Apr	18-May	4-Jun	36
MAX	7-May	30-May	12-Jun	41

Coho				
	10 %	50%	90 %	# of Days
2000	6-May	22-May	3-Jun	29
2001	15-May	24-May	3-Jun	20
2002	6-May	19-May	6-Jun	32
2003	29-Apr	16-May	9-Jun	42
MEDIAN	6-May	20-May	4-Jun	31
MIN	29-Apr	16-May	3-Jun	20
MAX	15-May	24-May	9-Jun	42

Sockeye				
	10 %	50%	90 %	# of Days
2000	5-May	25-May	7-Jun	34
2001	3-Jun	10-Jun	25-Jun	23
2002	13-May	23-May	9-June	28
2003	12-May	20-May	5-Jun	25
MEDIAN	12-May	24-May	8-Jun	28
MIN	5-May	20-May	5-Jun	23
MAX	3-Jun	10-Jun	25-Jun	34

[1] Includes upriver brights only (excludes influence by Spring Creek NFH Tules).

1.2. Adult Fish Passage.

1.2.1. Facilities Description. Adult fish passage facilities at Bonneville Dam consist of two main fishway segments. The first powerhouse collection system with A-branch ladder and the south spillway collection system with B-branch ladder join together at the Bradford Island ladder to form the Bradford Island fishway segment. The Cascades Island ladder at the north side of the spillway is connected to the Washington shore ladder by the upstream migrant transportation (UMT) channel. The second powerhouse collection system/ladder join together at the Washington shore to form the Washington shore fishway segment. Both the Bradford Island and the Washington shore fishways have counting stations. The second powerhouse ladder has an adult fish sampling facility. All four collection systems have auxiliary water supplies for fish attraction.

1.2.2. Adult Migration Timing. Upstream migrants are present at the project throughout the year and adult passage facilities are operated year round. Because passage through the winter months is relatively light, fish counting is by video taping (no visual counting), primarily to monitor winter steelhead passage. The adult fish counting schedule is shown in Table BON-3. Annual winter maintenance of adult fish facilities is scheduled from December 1 through February (in-water work period) to minimize the impact on upstream migrants and to minimize adult fall chinook and steelhead fallback.

Table BON-3. Adult fish counting schedule.

Period	Counting Method
January 1 – March 31	Video count 0400–2000 PST
April 1 – October 31	Visual count 0400-2000 PST
November 1 - December 31	Video count 0400–2000 PST

Adult migration count data for Bonneville Dam have been collected since 1938. Table BON-4 summarizes adult fish passage timing through 2003. The primary passage period and the earliest and latest peaks of migration recorded are listed for each species (from fish counts compiled by the Corps). Steelhead are counted by video at Bonneville Dam from November 1 through March 31 as described in Table BON-3, but the ESA-listed winter steelhead population passage period is considered to be from November 16 through March as described in Table BON-4. Peak winter steelhead migration timing for the years 1999-2003 appears in Table BON-4.

Table BON-4. Adult migration timing from fish counts, 1938-2003.

Species	Passage Period	Earliest Peak	Latest Peak
Spring Chinook	3/14 – 5/31	4/15	5/27
Summer Chinook	6/1 – 7/31	6/3	7/31
Fall Chinook	8/1 – 11/15	8/31	9/17
Steelhead	3/15 – 11/15	7/16	9/22
Coho	7/15 – 11/15	8/29	9/22
Sockeye	6/1 – 8/15	6/20	7/13
Winter steelhead	11/16 – 3/31	11/16	3/1

2. Project Operation.

2.1. General. Yearling chinook and most other juvenile salmonids migrate downstream in the spring, whereas during the summer, after mid-June, sub-yearling chinook dominate. Studies specific to Bonneville Dam indicate that fish survival rates for passage through various routes differ between spring and summer.

2.1.1. Powerhouse Flow Distribution. Bonneville turbine operating priority is established as outlined in Table BON-5. If a turbine is out of service, use the next turbine in the priority list. Improvements in 115 kilovolt line capacity were completed in 2000 so that the second powerhouse can now operate to meet local as well as system power needs independently of the first powerhouse.

2.1.2. When adult salmonid counts equal or exceed 30,000 fish/day before August 31, project fisheries will initiate FPOM coordination to discuss options for powerhouse flow-splitting to provide additional flow attraction areas to help balance adult passage among the project's fishways. When adult salmonid counts equal or exceed 25,000 fish/day after August 31, the Project will operate two priority turbines at PH1 in an attempt to balance adult passage between both powerhouses (assuming there was no prior unit operation at PH1).

2.1.3. Other Activities. Research, non-routine maintenance, other fish-related activities, and construction activities will not be conducted within 100' of any fishway entrance or exit or within 50' of the rest of the fishway, unless concurred with by regional fish managers through ESA and other fish passage forums. Currently approved special operations are described in Appendix A. Alternate actions will be considered by district and project biologists in coordination with the fish managers on a case by case basis. Emergency situations should be dealt with immediately by the project in consultation with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident. All activities within boat restricted zones (BRZ) will be coordinated in advance with the project.

Table BON-5. Turbine unit operating priorities, Bonneville first and second powerhouses.

PERIOD	PRIORITY
Year-round when adult fish ladders are in service	**18,11,17,12-16 1,2,3,4,5,6,10,9,7,8**
First Powerhouse Adult Fish Ladder out of service	**18,11,17,12-16 1,2,3,4,5,6,10,9,8,7**
Second Powerhouse Adult Fish Ladder out of service	**1,2,3,4,5,6,10,9,8,7 18,11,17,12-16**

STSs will be reinstalled in two PH1 priority units on 15 September for adult fallback.

See Appendix A, BON section, para. 3.0 for unit priorities during FGE and survival tests. Additional changes in unit priorities may occur and will be authorized in RCC teletypes as needed.

2.2. Spill Management.

2.2.1. General. Regardless of time of day, only one spill schedule will be used at Bonneville Dam (Table BON-15). Nighttime spill is limited as necessary to control total dissolved gas (TDG) supersaturation. Adjustments of the nighttime spill level may be granted on a case-by-case basis by the Reservoir Control Center (RCC), dependent upon TDG monitoring at stations downstream of the dam, biological monitoring, and fish movement. (Decisions regarding spill level changes will be made through regional agreement at TMT). The hours of nighttime spill are the daily complements of the periods of daytime spill (Table BON-6). The transition from daytime spill cap to nighttime spill cap and vice versa will normally take 15 to 20 minutes due to the time required to start, synchronize, and load multiple generators. Frequently, a total river discharge change will occur concurrently with these spill transitions. The transition to the daytime cap should begin early enough in the day to minimize chances of violating the defined daytime spill maximum. The transition to the nighttime spill period should not start until after the daytime cap period is over.

2.2.2. Juvenile Fish. Spill for juvenile fish passage will begin on April 10 and end August 31. These are planning dates and are flexible according to specific requirements relating to fish abundance. The daytime spill amount is 75 kcfs in order to reduce adult fallback (see section 2.2.3). The NMFS 2000 BiOp sets a minimum spill level of 50 kcfs. At night, the spill amount will be up to the 120% gas cap. The Ice-Trash Chute will not be operated for additional auxiliary water in the event of PH2 Fish Unit 1 or 2 out-of-service status as decided through regional agreement at FPOM (See also section 3.3.2.1.c., second paragraph).

2.2.3. Adult Fish. During the primary adult fish passage period, March 1 through November, daytime spill will be limited to 75 kcfs whenever possible. The NMFS 2000 BiOp sets a minimum spill level of 50 kcfs. Normally, this restriction will be from one hour before sunrise to one half hour before sunset (Table BON-6). However, during the sockeye passage season, which begins when at least 10 fish pass the project per day (in combined ladder counts), but no later than June 1 through August 15, the cap will apply until one hour after sunset.

2.3. Total Dissolved Gas (TDG) Management and Control. Implementation of spill requests will take into account TDG monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. The Corps will monitor TDG from a station in the Bonneville forebay and from several stations located below Bonneville Dam. The TDG data will be reported every four hours starting prior to the Spring Creek National Fish Hatchery (NFH) fish release, but not later than March 10 for all stations at Bonneville. Spill volume and total project flow will be reported at the same time. The TDG data collection will continue year round at Bonneville forebay and Warrendale stations. The TDG monitoring plan is described in detail in Appendix D.

Table BON-6. Daytime spill schedule for Bonneville Project.

Date	Daytime Spill	
	Begin	End
Mar 1 – 17	0500	1730
Mar 18 – Mar 31	0500	1800
Apr 1 – 21[1]	0500	1915
Apr 22 - May 10	0500	1945
May 11 – 31	0400	2015
Jun 1 – Jul 22[2]	0400	2145
Jul 23 – 31	0500	2145
Aug 1 – 15	0500	2130
Aug 16 – 31	0500	1930
Bays 1, 18: 3/1-8/31[3]	open	open

[1] Times after April 7 are in Daylight Savings Time.
[2] Start date for sockeye passage varies.
[3] Spill bays 1 and 18 open according to spill schedule in Table BON-15 from March through August and this time schedule (above). Bays 1 and 18 (formerly set at 6 inch openings for adult attraction spill) closed Sept. – Feb. (Pending decision by FPOM/TMT in 2004 to determine the need for attraction spill from these two bays.)

Excessive TDG levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by RCC, nighttime or daytime spill limits, and shaping of spill discharge.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria, First Powerhouse.

2.4.1.1. Prior to the Juvenile Fish Passage Season (December 1 through end of February).

a. Remove debris from forebay, trash racks, and gatewell slots such that these areas are free of debris.

b. Inspect VBSs for damage, holes, debris accumulations, and protrusions (video inspection acceptable). Clean and repair, as necessary, such that all VBSs in operable units are functional.

c. Avian Abatement Measures. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Avian abatement measures shall be in place by March 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as the weather permits after that date. However, there will be no avian abatement measures, other than avian lines, performed from September through March each year.

d. Inspections. The results of all inspections and the readiness of the facilities for operation will be reported to the Fish Passage Operations and Maintenance Coordination Team (FPOM) at the meeting immediately prior to the juvenile fish passage season.

2.4.1.2. Juvenile Fish Passage Season (March 1 through end of November).

a. Main unit gatewell drawdown will be measured a minimum of once per week. Remove debris from forebay and trashracks as required to maintain less than 1.5' of total drawdown in gatewells.

b. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, they will be removed within 24 hours. Appropriate procedures to remove fish during this situation will be determined in coordination with FPC and NOAA Fisheries. Regardless of unit operating status, oil accumulations will be dealt with promptly.

c. Reinstall or repair avian predator control lines in present locations as soon as possible following significant damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary from April through August only.

d. Open ice and trash sluiceway chain gate 7A to elevation 72' msl and close 10C. Open chain gate 2B and 6B to 72’ msl. However, if the forebay is expected to stay below 72.5' for more than 48 hours (as during a specially-coordinated low forebay period), then gate 7A should be set at 70' above msl with gate 10C still full open. The ice and trash sluiceway may be operated without restriction October 1 through November if it is determined, through FPOM coordination, that migrating juvenile salmonid numbers are low enough that operations will not adversely affect fish migration or fish condition. This authorization may be terminated at any time if problems arise that negatively impact fish migration or condition.

e. Inspect juvenile fish passage facilities three times per day. Project fish biologist and fish biological staff will conduct at least three inspections per week.

f. Screens will be placed in two (2) PH1 priority units from September 15 through December 15 to reduce the number of adults that fall back through the turbine units. There will also be a third set of screens available for backup.

2.4.1.3. Winter Maintenance Season (December 1 through February). Screens (STS, ESBS) in place in the two (2) PH1 priority units will remain until December 15 to prevent adult salmonids from falling back through turbine units, thereby shortening some aspects of the winter maintenance period by two weeks.

a. Remove both priority units’ STSs. (Note: As stated above, this cannot occur until after December 15.)

b. When STSs are removed at the end of the fish passage season, they are normally stored in a position extending up through the forebay deck. An alternate storage position is below the deck, but this places the screens close in front of the gatewell orifice. When it is necessary to make room on the forebay deck for priority activities at this time of year by storing the screens beneath the deck, the blocked orifices should be closed. The DSM channel should be drained if proper operating criteria cannot be maintained as the result of a large number of closed orifice valves.

2.4.2. Operating Criteria, Second Powerhouse.

2.4.2.1. Prior to the Juvenile Fish Passage Season (December 1 through February).

a. Remove debris from forebay, trash racks, and gatewell slots such that these areas are free of debris.

b. Inspect VBSs for damage, holes, debris accumulations, protrusions, and proper seating (video inspection acceptable). Clean and repair, as necessary, such that all VBSs in operable units are functional.

c. Inspect each STS and operate on trial run (dogged off at deck level). Install STS in each intake of operational units by the end of February.

d. Inspect and, where necessary, clean and/or repair all gatewell orifices, orifice lighting systems, and flushing systems such that the orifices and associated systems are fully functional.

e. Inspect and, where necessary, clean and/or repair dewatering screens and associated equipment.

f. Inspect and correct any deficiencies of DSM channel and conduit outfall walls and floor.

g. Flume Pipe (from exit of DSM to outfall). Visually inspect outfall flume pipe and associated switch gates once per year from the transition section leaving the powerhouse to the outfall return to the river for obstructions, protrusions, or structural deficiencies that may affect fish passage.

h. Juvenile Monitoring Facility (all equipment). Preseason inspections will focus on completion of winter work requests submitted by Pacific States Marine Fisheries Commission for both the juvenile monitoring facility and the juvenile sampling area in the first powerhouse. This effort should also include execution of the winter maintenance list for the rotating gates.

i. Avian Predation Lines. Reinstall or repair avian predator control lines in present locations as soon as possible following significant damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Avian abatement measures shall be in place by March 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as possible after that date. However, there will be no avian abatement measures, other than avian lines, performed from September through March each year.

j. Inspections. The results of all inspections and the readiness of the facilities for operation will be reported to the FPOM at the meeting immediately prior to the juvenile fish passage season.

2.4.2.2. Juvenile Fish Passage Season (March 1 through November). Juvenile fish protection devices (submersible traveling screens (STS), etc.) will be in place prior to the beginning of the juvenile fish passage season. (In the rare event that juvenile fish are released from Spring Creek NFH prior to March, the screens will be installed before the release occurs. The release is typically scheduled for mid-March.) Screens (STS) will remain in operation through December 15 to prevent adult salmonids from falling back through turbine units, even though the juvenile passage season officially ends November 30.

a. Main unit gatewell drawdown will be measured a minimum of once per week and reported in the weekly report. Remove debris from the forebay and trash racks as required to maintain less than 1.5' of drawdown in gatewells, or as indicated by fish condition (e.g., higher than expected descaling), or as determined by the project biologist. The STSs in units being raked will be run continuously during raking operations. Gatewell orifices of the unit being raked must be closed during the procedure.

b. Measure fish unit gatewell drawdown at least once per week. When the head across trash racks exceeds 1.5', the trash racks will be cleaned that day. This may be done by raking late in the workday or by turning the unit off at night and letting the debris float off the racks. However, if the head exceeds 3' or if the adult fishway head is reduced, the unit's racks will be raked immediately, even if it is early in the day. When debris accumulation is persistent, unit 18 may be operated while the fish unit is off at night to help draw loosened debris away. An

FPOM task group is developing operational guidelines with the intent of increasing measuring frequency.

c. Operate STSs at angle of 60^o from vertical.

d. Inspect each STS once per month (or 720 hours run time) and each VBS a minimum of once every two months (or 1440 hours run time) (video is acceptable). Frequency of monthly inspections may be based on individual turbine unit run time. No STS inspections will be scheduled when they will cause excessive TDG due to increased forced spill. Summaries of STS and VBS inspections will be included in weekly operation monitoring reports. VBS inspections will occur immediately prior to peaks in juvenile fish migrations, which begin about May 1, mid-July, and September 1. Inspections will be concentrated on the priority units and others with the longer operating time. More frequent inspections may be required by the project biologist or under the following conditions: deterioration of fish conditions, increased debris load in bypass system, and other indications of STS or VBS malfunctions or failure. Prior to pulling VBSs for inspections, shut off units and dip gatewells. It is not necessary to dip gatewells of units which have been off for 48 hours or longer.

If STS or VBS damage or plugging is detected, follow procedures in section 3. Fish Facilities Maintenance. Records of inspections or a summary of such records will be made available to FPOM by the February meeting, upon request.

e. Operate all gatewell orifice systems. Inspect each orifice three times daily to assure that the orifice valves and lights are operating correctly. Orifices are set to automatically flush 3 times per day, one orifice every 10 minutes. Orifices with less than a clear flow jet will be flushed manually during the inspection. Manually flush orifices known to have recurring plugging or other problems, especially at the north end. Orifice jets will be observed through the light tubes during the inspection. Light tubes and orifice tube lenses shall be replaced and kept clean as required so that visual observations of orifice jets are possible during fishway inspections. Replace all burned out orifice lights within 24 hours. Orifice lights shall remain lighted 24 hours/day. The DSM gallery lights should be left off except when project or other staff is in the gallery. Investigation has shown that darkening the gallery results in faster fish evacuation from the DSM channel.

f. Observe each STS watt and/or amp gauge at least once each day and record reading once per day. If an STS failure occurs, then follow procedures in Section 3. Fish Facilities Maintenance.

g. Inspect all STS gatewells daily. The project will clean gatewells before the water surface becomes one-half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fish measures, and then only on a last on/first off basis. The second powerhouse gatewell orifices will be closed during the cleaning operations. After cleaning a gatewell, inspect and, if necessary, clean the orifice in that gatewell and then check gatewell drawdown.

h. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, they will be removed within 24 hours. When this is not possible, the JBS orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in coordination with FPC and NOAA FISHERIES. Regardless of unit operating status, oil accumulations will be dealt with promptly.

i. Coordinate gatewell cleaning with personnel operating downstream migrant sampling facilities.

j. Reinstall or repair avian predator control lines in present locations as soon as possible following significant damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary from April through August only.

k. Turbine units without a full compliment of STSs will not operate except to be in compliance with other coordinated fish measures.

l. Inspect facilities three times per day. Project fish biologist and fish biological staff will conduct at least three inspections per week.

m. All TIEs will be removed following the spring juvenile yearling chinook outmigration period, usually in early July. The TIEs will be re-installed just prior to the start of the juvenile fish passage season, including, when practicable, prior to early fish releases from Spring Creek NFH.

2.4.2.3. DSM2 Channel Operation.

a. Background. The DSM channel is controlled by a Program Logic Controller (PLC) which receives analog signals representing the add-in water supply position, orifice positions, channel elevation, and dewatering screen cleaner operation. The new DSM channel consists of an add-in water supply system at the south end of the channel, 28 non-regulating (existing) orifices, 14 regulating (new) orifices, 19 dewatering weirs, 3 dewatering screen cleaners, and one airburst system. The add-in water supply system is designed to be operated continuously to increase velocities at the south end of the channel. Problems with fish entrainment into the add-in water have been corrected in 2002 and the system is operational for 2003.

Operation of the orifices is determined by the PLC measuring head differential between the channel and second powerhouse forebay. The 28 non-regulating orifices were part of the original system and are designed to remain open with the exception of F2A-N and F2B-N orifices. These orifices are designated as the “north” orifices in the new system. The 14 regulating orifices are the new orifices installed during system modifications. These orifices are designated as the “south” orifices. There is one new regulating orifice in each gatewell slot in units 11-14, including two at fish unit 2. These orifices are designed to operate according to channel and forebay differential. They are operated to regulate channel elevation by opening beginning at the south end of the channel northward with the exception of the fish units. See Table BON-7 for regulating orifice criteria. Fish unit orifices F2B-S and F2A-S are designed to remain open in automatic control. As forebay decreases or head differential between the channel and forebay elevation decreases, the more regulating orifices there will be open. The dewatering weirs are manually set to maintain approximately 31 cfs entering the transportation flume. The newly installed airburst system on the floor and wall screens upstream of the transportation flume entrance are designed to operate every 30 minutes. In the case that they system is unable to keep up with debris load then the three mechanical brush screen cleaners will be activated. The systems will be operated in tandem to main the correct water elevation in the system.

The new airburst systems will be the primary way that the wall and floor screens will be cleaned at DSM 2. During the Spring season (1 March through mid June) the airburst system will be set to clean all screens on a ½ hour cycle. In the event that the air system is unable to maintain the desired water elevation at the dewatering area then the duration of the cleaning cycle will be changed automatically to a full cleaning cycle every 15 minutes. If the system is still unable to accommodate the debris load then the mechanical brush system will be activated in conjunction with the airburst system to maintain the desired water elevation. The system will continue to work in tandem until the system can maintain a correct water elevation for at least 1 hour. If the above criteria are met then the mechanical system can be returned to standby and the airburst system cleaning will be the primary system once again. During the Summer months (1 July through September) the airburst system shall be set to clean the screens at least twice per day or as needed according the CPU controlling system (See also Appendix A). The Project Biologist shall have the discretion to modify the cleaning system program at anytime to maintain FPP criteria. Portland District will ask BON Fisheries to make recommendations post fish passage season as the final operating system configuration for FY05. The three screen cleaners are designed to operate in automatic control, cycling every 6 hours or more frequently at the discretion of the project biologist. If debris increases in the system, the frequency of revolutions will be increased.

Table BON-7. DSM2 regulating orifice control (FB is forebay and "X" is open).

Orifice	FB <=71.5	FB <=72.5	FB <=73.5	FB <=74.5	FB <=75.5	FB <=76.5
11A-S	X	X	X	X	X	
11B-S	X	X	X	X		
11C-S	X	X	X	x		
12A-S	X	X	X			
12B-S	X	X	X			
12C-S	X	X				
13A-S	X	X				
13B-S	X	X				
13C-S	X					
14A-S	X					
14B-S	X					
14C-S	X					

b. Operation. Maintain the channel elevation between 64.2' and 64.4' as indicated by the staff gauge in front of the ERG. The system is designed to maintain the channel elevation at 64.3' in automatic control. If the channel elevation increases or decreases, the PLC system will close or open orifices, respectively.

2.4.2.4. Fish Transport Pipe and Flume.

a. Background. A 48″ fish transport pipe connects the DSM channel to the tailrace outfalls. The transport pipe leaves the DSM underground before opening-up to an open flume just upstream of the Juvenile Monitoring Facility (JMF). At this location, there is a switchgate (referred to as the upper switchgate) to divert the flume to sampling or bypass mode. Below the JMF, there is another switchgate (referred to as the lower switchgate) to divert fish to the high or low tailrace outfall. The high and low outfalls consist of 48″ and 42″ fish transport pipes, respectively.

b. Operation.

1. JMF personnel will operate the upper switchgate as necessary for sampling requirements.

2. The lower switchgate is run in automatic control. JMF personnel (PSMFC) will monitor and report to Project biologists any problems with the lower switchgate.

3. On seasonal ascending tailwater elevations, the transition from low to high outfall should be between tailwater elevations at the upper end of 17′ to 13.5′ range.

4. On seasonal descending tailwater elevations, the transition from high to low outfall should be between tailwater elevations at the lower end of 17′ to 13.5′ range.

5. Operate the outfall avian cannons from March 1 through August 31. During August, avian cannons may be shut off if project observes no predatory birds at the outfall, and coordinates through FPOM. If birds reappear at the outfall, cannon operation will resume and FPOM will be informed. If only one outfall is used during the season, use either avian cannon, whichever is the most effective avian deterrent. The cannons will be operated from sunrise to sunset unless otherwise coordinated through FPOM.

2.4.2.5. Juvenile Monitoring Facility.

a. Background. The JMF is comprised of a transport flume, Primary Dewatering Structure (PDS), adult transport flume, juvenile hopper, Secondary Dewatering Structure (SDS), 3-way diverter gate, 2-way diverter gate, sampling facility, and juvenile release transport flume.

b. Operation.

1. JMF personnel will operate the sampling facility as necessary to meet their sampling requirements. The FPOM Coordination Team will be kept informed of progress and changes throughout the 2004 season.

2. The JMF will be monitored 24 hours per day, 7 days per week by PSMFC personnel to insure its proper functioning and provide quick response to an emergency while the JMF is in operation.

3. A PSMFC person on duty will perform a walk-through inspection of the entire facility (except the 2-mile transport flume) every two hours to ensure safe fish passage conditions. They will also observe video monitors at least every half hour or continually, and inspect manually every two hours or more frequently according to trash sweep operation or other debris potential. PSMFC shall monitor kelt passage over the separator.

4. Particular attention will be paid to the following: dewatering facilities including the PDS, SDS, PDS screen cleaner system, adult transport flume, juvenile hopper, all valves and auxiliary water systems, flushing water systems and their perforated plates, all gates including switch and diverter gates, PIT tag detectors, and all monitoring building systems including holding tanks, valves, and conduits to prevent injury and/or mortality to passing fish.

5. Monitor outfall avian cannons.

2.4.2.6. System Failures.

a. Any system failure will be reported to a project biologist as soon as possible. If a project biologist is unavailable, the control room will be contacted. The following actions should be taken in specific situations:

1. If a high water situation occurs in the PDS area, contact the control room immediately. If water level is uncontrollable, immediately switch the upper switchgate to bypass mode until the problem is corrected.

2. If a monitoring facility failure occurs, immediately switch the upper switchgate to bypass mode until repairs are made. Begin fish salvage operations immediately at the monitoring facility.

3. If a lower switchgate failure occurs that results in releasing to the wrong high or low outfall and repairs can not be made within 24 hours, the special operation will be coordinated through FPOM.

4. If a problem with either the 2 way or 3 way rotating gates (e.g. stuck open or partially open) is discovered, the response protocol should be as follows:

a. Switch upper main switch-gate to divert fish back to the river prior to following the sequence of directions in b. - f. (below).

b. Immediately turn off the air to the rotating gate and manually rotate the half-round pipe section to the bypass position.

c. Inspect the affected areas for stranded fish and return them to the flume. Dead fish should be held in a bucket for processing by SMP personnel.

d. Immediately contact the project biologist, or if that is not possible, the control room operator. The operator will contact repair personnel.

e. Repairs should commence within 4 hours of discovering the problem.

f. Once all fish safety issues have been addressed and repair requests made, the problem should be thoroughly documented in writing and that information e-mailed to the SMP site biologist and other interested parties.

2.4.2.7. Winter Maintenance Season (December 1 through February). Screens (STS) will remain in place until December 15 to prevent adult salmonids from falling back through turbine units, thereby shortening some aspects of the winter maintenance period by two weeks. STSs in priority units will be left in place during this period (Dec. 1 – 15). Screens from non-priority units may be removed between December 1 and 15, but only if scheduled for maintenance. In all units, screens that are not being serviced shall be left in place during this period. Unscreened units will be operated on a last-on, first-off basis. Beginning December 16, all remaining STSs may be removed. DSM may be dewatered (see section 5. Dewatering Plans) only when required for maintenance. The maintenance period will be minimized to the extent practicable. Facilities, when operating, are to be inspected at least once per day to assure criteria are being met. These inspections are to be performed at least three times per week by the project fish biologist and fish biological staff.

2.4.3. Spillway Operating Criteria.

2.4.3.1. Prior to Juvenile Fish Passage Season (December 1 through February).

a. Inspect and, where necessary, repair spill gates and control systems. The spillway, except for coordinated exceptions, must be able to achieve spill patterns on the first day of the juvenile fish passage season.

b. The results of all inspections and the readiness of the facilities for operation will be reported to the FPOM at the meeting immediately prior to the juvenile fish passage season.

2.4.3.2. Juvenile Fish Passage Season (March 1 through November). Bonneville Dam uses a single spill schedule for both day and night. Spill will be provided according to the guidance in section 2.2.

2.4.3.3. Winter Maintenance Season (December 1 through February). Refer to Appendix E for spill guidance during non-passage periods at Bonneville Project.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Prior to Primary Adult Passage Period (December 1 through end of February).

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

b. Unless specially coordinated, dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices that could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for and, when necessary, clear debris in the ladder exits.

d. Reinstall picket leads at counting stations prior to watering up the ladders during maintenance.

e. The results of all inspections and the readiness of the facilities for operation will be reported at the FPOM meeting immediately prior to the passage season.

2.5.1.2. Primary Adult Fish Passage Period (March 1 through end of November).

a. All Adult Facilities.

1. Maintain the water depth over fish ladder weirs at 1' +/- 0.1' during the non-shad passage season (August 16 through May 14) and 1.3' +/- 0.1' during the shad passage season (May 15 through August 15). These water depths will be measured at the A and B-branch staff gages in the Bradford Island fishway, at weirs 37 and 38 in the Washington shore fishway, and in the Cascades Island just downstream of the entrance to the UMT. For FV3-9 calibration purposes to achieve the target depth in the A and B branches, the depth in the main ladder below the count station is 1.2' during shad passage and 1.0 +/-0.1”' during the non-shad season.

2. Water temperature will be measured in an adult fishway at each powerhouse. When water temperature reaches 70^{o} F, all fish handling activities will be coordinated through FPOM prior to any action to verify protocols that will be followed. Fish handling activities in the Adult Fish Collection and Monitoring Facility (AFC&MF) will implement protocols in Appendix H.

3. Head on all entrances should be: 1' to 2' (1.5' preferred). Head at the NUE is calculated differently because the collection channel staff gauge is in the junction pool. A head of approximately 1' to 2' at the NUE entrance is indicated by a 1.2' to 2.2' (1.7' preferred) entrance head calculated using the fishway and tailwater staff gauges closest to NUE. Refer to section 3.3., Adult Fish Passage Facilities, when unable to achieve head criterion.

4. A water velocity of 1.5 to 4 fps (2 fps preferred) shall be maintained for the full length of the powerhouse collection channel, and the lower ends of the fish ladders that are below the tailwater. Water velocities will be measured directly, and monitored during fishway inspections to verify channels are operating between 1.5 and 4 fps. Water velocities in the UMT shall be maintained within criteria, but the channel will not contain a permanent velocity meter.

5. A maximum of 0.5' head will be allowed on the first powerhouse attraction water intakes and trash racks at all the ladder exits, with 4" maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period. These include the PH1 south collection channel, PH1 north collection channel, PH1 north tailwater, PH1 south forebay, BI A and B branch ladders, BI first weir, B branch entrance, CI entrance, CI ladder below the UMT entrance, NUE/NDE/SUE/SDE collection channel, NUE/SUE tailwater, and PH2 north forebay. Stillwells used in lieu of staff gauges will be checked for calibration once per week and summaries of these stillwell calibrations will be included in weekly operation monitoring reports.

7. The current fish counting program is conducted 16 hours per day, year around (See Table BON-3). Count station crowders shall remain in the operating position while visual counting and/or videotaping is being conducted. The crowder shall be closed to allow the count slot width to be no less than 18 inches. This will usually occur during high turbidity conditions to allow count accuracy criteria to be achieved. If passage is impaired by this condition, the count slot may be widened until proper passage conditions are achieved, even though count accuracy may be compromised to some degree. Project biologists, FFU, and the WDFW fish count supervisor shall coordinate to achieve optimum count slot passage and/or count accuracy conditions. If counting is temporarily discontinued due to unscheduled events, the crowder shall be fully opened. The crowder may remain in operating position during the counters' hourly ten-minute break period. Leave the fish passage slot lighted overnight.

8. Inspect facilities three times per day. Project fish biologist and fish biological staff will conduct at least three inspections per week.

9. Upstream light banks in both count stations shall remain off to facilitate fish passage through the count slot and help reduce the number of fish impacting the count window framework, unless other passage problems result, or count accuracy is compromised as determined by the fish count supervisor and coordinated through the FPOM.

10. Inspect and ensure that optimum passage conditions are maintained at fishway entrances, exits, and in the count slots. During periods of high adult passage, alternative powerhouse operations may be implemented to spread fish out among the adult passage systems, as per Paragraph 2.1.1.

11. STSs will be installed in two (2) PH1 priority units on 15 September. This is to prevent adult fallbacks from going through the turbines. The two priority units will be screened through December 15, with a spare set of STSs available for a third turbine if necessary. STSs will remain in operating PH2 units through December 15 to protect adult fallbacks. The first powerhouse DSM will be watered up on September 15, with water flow to the south. The DSM will operate as long as STSs are in place.

b. Spillway Ladders.

1. Spillway gates 1 and 18 shall be open 6” for adult attraction. This operation provides adult fish attraction flow adjacent to ladder entrances. When spilling exclusively for adult attraction, spill only during the daylight hours (see Table BON-6). An FPOM task group will develop criteria for operating gates 1 and 18 in the winter (December 1 through February).

2. Side entrances SW-SG-5 and SO-SG-7 shall remain closed. Downstream entrances SW-SG-1 and SO-SG-2 shall operate as continuously open free-flowing vertical slots. Downstream entrances SW-SG-3 and SO-SG-4 (adjacent to shore) consist of pairs of sluice gates. When the tailwater is below 9', sluice gates SW-SG-3N, SW-SG-3S, SO-SG-4N, and SO-SG-4S shall be open. When the tailwater is between 9' and 17', sluice gates SO-SG-4S and SW-SG-3N shall close. When the tailwater exceeds 17', sluice gates SW-SG-3N, SW-SG-3S, SO-SG-4N, and SO-SG-4S shall be closed.

c. First Powerhouse.

1. General. The Program Logic Controller (PLC) receives analog signals representing the 4 weir gate positions, the north, central, and south tailwater and collection channel water elevations, and the water pressure at the south end of the auxiliary water conduit. It also receives inputs from the bulkhead upper/lower limit switches. From this information, the PLC control program determines when to activate outputs which serve to raise or lower the weir gates, bulkheads, sluice gates, A branch diffusion gates, and fish valves FV1-1 and FV3-7. (Note: PH1 orifice gates will be closed and non-operational during 2003 and beyond).

2. Weir Gates. The first powerhouse weir gates will be operated as shown in Table BON-8.

3. Gate Pairing. The four weir gates will be operated in two pairs. Only one gate pair will be allowed to operate at any given time. Gates 1 and 65 will operate together as the

Table BON-8. Bonneville Dam first powerhouse weir gate requirements.

Weir Gate	Submergence Requirement	Differential Requirement	Sill Elevation
1	>8'	1'-2'	8.5'
2	>8'*	1'-2'	2'
64	8'-8.4'	1'-2'	2'
65	8'-8.4'	1'-2'	8.5'

* When tailwater is <13.5’, the 8’ submergence requirement can not be satisfied. From tailwater of 13.5’ to 10.0’ (when gate is on sill), the pressure differential between the auxiliary water supply conduit and the collection channel exceeds the safety limit of 10 psi.

active pair (enabled) for tailwater elevations greater than 23' msl., while gates 2 and 64 will operate together as the active pair (enabled) for tailwater elevations less than 26' msl. For tailwater elevations between 23' and 26', the designated active pair will depend on whether the tailwater elevation has been rising or falling with a "dead band" of 1.5'.

4. Gate Pair Enabling/Disabling. If the tailwater elevation is 26' or greater, gates 2 and 64 will be closed off (raised to their maximum position and their bulkheads lowered) and their control disabled. Gates 1 and 65 will be enabled and will therefore operate as described above. Gates 1 and 65 will then continue to be enabled (and gates 2 and 64 closed off and their control disabled) until the tailwater elevation drops below 23'. Once this occurs, the bulkheads for gates 2 and 64 will be raised, the control for gates 2 and 64 will be enabled and these gates will be moved to their appropriate post-transition positions, and gates 1 and 65 will be raised to their maximum closed positions. The control for gates 1 and 65 will then be disabled. Gates 2 and 64 will then be the active pair.

If the tailwater elevation is less than 23', gates 1 and 65 will be closed off (raised to their maximum positions) and their control disabled. Gates 2 and 64 will be enabled and will then operate as described above. Gates 2 and 64 will then continue to be enabled (and gates 1 and 65 closed off and their control disabled) until the tailwater elevation rises to 26'. Once this occurs, the control for gates 1 and 65 will be enabled and these gates will be moved to their appropriate post-transition positions, gates 2 and 64 will be raised to their maximum positions, and the bulkheads for gates 2 and 64 will be lowered. The control for gates 2 and 64 will then be disabled. Gates 1 and 65 will then be the active pair.

5. Transition Positioning. During a transition, the former active pair is closed and the new active pair is positioned according to tailwater. If gates 1 and 65 are the active pair and the tailwater falls below 23', there is a transition in which gates 2 and 64 will be enabled and moved to their appropriate post-transition positions. Gates 1 and 65 will then be raised to their maximum closed position (26'). If gates 2 and 64 are the active pair and the tailwater rises to more than 26', there is a transition in which gates 1 and 65 then become the active pair. Gates 1 and 65 will be enabled and moved to their appropriate post-transition positions. Gates 2 and 64 will be raised to their maximum closed position (gate 2: 11', gate 64: 18'). In either case, there is a 1.5' "dead band" as described above.

6. Control of Fish Valve FV1-1.

(a) Emergency Closure. If the collection channel/tailwater differential is greater than 2.5' or if the pressure differential between the auxiliary water supply conduit and the collection channel becomes excessive, as determined by operators.

(b) Differential. Low: if the collection channel/tailwater differential is less than 1'. High: if the collection channel/tailwater differential is more than 2.0'.

7. Control of Fish Valve FV3-7. Maintain the opening concurrent with the charts for valve opening, as set by the forebay and tailwater elevations.

8. Control of A-Branch Diffusion Gates FG3-3, 4, 5, 6, 7, 8, and 9. First powerhouse A-branch diffusers are open according to the pattern in Table BON-9.

9. First Powerhouse Collection Channel Diffusers. Diffuser valves are operated according to the pattern in Table BON-10.

d. Second Powerhouse.

1. Operate all north (NUE and NDE) and south (SUE and SDE) entrances. Operate weir crests at elevation 1' (fully lowered) for tailwater elevations up to 14'. For tailwater elevations greater than 14', operate weir crest 13' or greater below tailwater.

2. Operate all 12 powerhouse floating gate fishway entrances.

Table BON-9. Bonneville Dam A-branch diffuser operating ranges.

Diffusers	Operating Range (Tailwater Elevation)	Dead Bands
FG3-3	8.2' – 13.3'	7.8' – 8.2'
FG3-4	13.7' – 16.3'	13.3' – 13.7'
FG3-5	16.7' – 19.3'	16.3' – 16.7'
FG3-6	19.7' – 24.8'	19.3' – 19.7'
FG3-7	25.2' – 27.8'	24.8' – 25.2'
FG3-8	28.2' – 30.8'	27.8' – 28.2'
FG3-9	> 31.2'	30,8' - 31.2'

Table BON-10. Bonneville Dam first powerhouse adult fish collection channel diffuser valve settings.

Valve	Setting	Valve	Setting
FG2-1	Closed	FG2-13	Closed
FG2-2	Closed	FG2-14	Closed
FG2-3	Closed	FG2-15	Closed
FG2-4	Open	FG2-16	Closed
FG2-5	Closed	FG2-17	Closed
FG2-6	Closed	FG2-18	Closed
FG2-7	Closed	FG2-19	Open
FG2-8	Open	FG2-20	Open
FG2-9	Closed	FG2-21	Open
FG2-10	Closed	FG2-22A	Open
FG2-11	Closed	FG2-22B	Open
FG2-12	Open		

e. Spillway Operations. Bonneville Dam uses a single spill schedule (see Table BON-15) for both day and night. See section 2.2. Spill Management for guidance.

2.5.2. Winter Maintenance Period (December 1 through February).

2.5.2.1. Adult Fish Facilities. Operate the adult fish passage facilities according to the fish passage period standards above, except systems may be dewatered or operated out of criteria for repair and maintenance.

a. Only one of the ladders servicing the two powerhouses and the associated powerhouse collection system (including the auxiliary water supply system) may be out of service or operating out of standard operating criteria at any one time unless specifically coordinated. Turbines will be operated in the priority outlined in section 2.1.1. during the winter maintenance period. One of the two ladders servicing the spillway channel will be in full operation at all times unless specially coordinated. Outage periods will be minimized to the extent practicable.

b. Adult facilities will be inspected three times per day to assure operation as per criteria above. Project fish biologist and fish biological staff will conduct at least three inspections per week.

c. Spill bays 1 and 18 may be on seal throughout the winter operating period. Please see table Bon-6 or section 2.5.1.2.b

d. Adjust crowders at fish counting stations to full open if videotaping is temporarily discontinued due to unscheduled events or during the winter maintenance (dewatering) period only.

2.6. Facility Monitoring and Reporting.

2.6.1. Inspections. The project will inspect fish passage facilities at least three times per day to assure operation according to established criteria. More frequent inspections of some facility components will occur as noted throughout the text. The project fish biologist and fish biological staff will conduct at least three inspections per week. Additional fishway inspections may be performed by FFU and fish agencies.

2.6.2. Zebra Mussel Monitoring. A zebra mussel monitoring program will continue. These organisms have become a serious problem elsewhere in the country and may become introduced into the Columbia River basin. Inspections should also be made when dewatering all project facilities.

2.6.3. Reporting. Project biologists shall prepare weekly reports throughout the year summarizing project operations. The weekly reports will provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out-of-criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; AWS closures (i.e. cleaning times); times picket leads were lowered and raised in the Washington shore ladder when adult trapping is occurring in the adult fish collection and monitoring facility (AFC&MF); and any unusual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and the Operations Manager shall send them to CENWP-OP and other interested parties as soon as possible the following week, with a copy to RCC, Attention: Fish Team. The reports may be delivered electronically. The project biologist shall prepare an annual report by January 31, summarizing the operation of the project fish passage facilities for the previous year. The report will cover from the beginning of one adult fish facility winter maintenance period to the beginning of the next. The annual report also will 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. The annual report will be provided to CENWP-OP in time for distribution to FPOM members at the February meeting.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Routine Maintenance.

3.1.1.1. Staff gauges and other water-level sensors will be installed, cleaned, and/or repaired as required.

3.1.1.2. Scheduled fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest during the regular scheduled workday, to minimize impacts to migrating salmonids. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6.3.).

3.2. Juvenile Fish Passage Facilities.

3.2.1. Routine Maintenance.

3.2.1.1. Submersible Traveling Screens. The STS system will receive preventive maintenance or repair at all times of the year, including the winter maintenance period. Whenever a generator malfunctions or is scheduled for maintenance, the three STSs in that turbine may be maintained, repaired, or exchanged for other STSs needing maintenance or repair. One third of the STSs at Bonneville are scheduled for complete overhaul each year resulting in a three-year maintenance cycle unless future developments indicate that longer life expectancy is possible.

3.2.1.2. Juvenile Bypass System. The juvenile bypass facilities will receive preventive maintenance throughout the year. During the juvenile fish passage season, this will normally be above-water work such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period, the systems may be dewatered downstream of the gatewell orifices. The systems will then be visually inspected in all accessible areas for damaged equipment and in areas that may cause problems to the juvenile fish. Any problem areas identified are to be repaired if the project is able. In extreme cases the work will be contracted as soon as possible or repaired during the next winter maintenance period. Channel modifications and general maintenance also should be completed at this time.

The trash racks are to be raked just prior to the juvenile fish passage season and whenever trash accumulations are suspected because of increased head across the trash racks (>1.5') or increased juvenile fish descaling. Additional trash rack raking may be necessary when a storm brings large quantities of debris down river to the project. Gatewell orifices in the unit being raked will be closed during the procedure.

3.2.1.3. Turbines and Spillways. Maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires units to be shut down for extended periods of time (see section 5. Dewatering Plans). The maintenance schedules for these turbines and spillways will be coordinated with fish agencies through the FPOM. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to fishway entrances, to keep predator fish from accumulating near juvenile release sites, and to move juveniles downstream away from the project. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power, and water management and will be coordinated with the appropriate resource agencies. During the fish passage season, do not take units F1, F2, 1, 2, 9, 10, 11, 17, and 18 out of service, when practicable. Also, when practicable, do not take any other second powerhouse units out of service during June 21 through September 15, to minimize first powerhouse operation. However, (Project Maintenance states): “Experience has shown that cleaning of the fish unit brush rigging is necessary throughout the season. In the past, as carbon dust on the exciter slip rings flashes over, this causes unscheduled machine downtime to clean and repair the collector system. Through trial and error, it has been determined that the rigging should be cleaned two times during the passage season. One cleaning operation is performed in conjunction with the mid-year collection channel diffuser grating dive inspection, and the second stands alone on the outage schedule.” (Agreed to at FPOM, Jan/Feb., 2002).

Some types of turbine maintenance will require testing the turbine throughout its full operating range before returning it to normal service. These operations will be coordinated with the appropriate resource agencies.

3.2.2. Non-Routine Maintenance. Maintenance of facilities such as fish screens, which sometimes break down during the fish passage season, will be carried out as described below. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with FPOM and NOAA FISHERIES on a case-by-case basis by project and CENWP-OP biologists. The CENWP-OP biologists will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Operations Manager has the authority to initiate work prior to notifying CENWP-OP when delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWP-OP 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.

3.2.2.1. Submersible Traveling Screens. If an STS or VBS is found to be damaged or inoperative in an operating unit, the unit will be regarded as an unscreened unit. The screen will be repaired or replaced before returning the unit to normal service.

3.2.2.2. Juvenile Bypass System. Juvenile bypass systems are controlled automatically (PLC). When an automatic system fails, it can usually be operated manually. This allows either facility to operate according to criteria while repair of the automatic system is completed. Orifices allow fish out of the gatewells into a bypass channel. If an orifice valve system becomes inoperative, it will be repaired expeditiously. When the orifices become plugged with debris they are pneumatically flushed. If the automatic systems fail and the system is operated manually, facility inspections should be increased to a frequency that assures these systems continue to operate within criteria.

All STS gatewells will be inspected daily and the project will clean them before they become half covered with debris. If, due to volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated, except on a last on/first off basis, if required to be in compliance with other coordinated fish measures. This is to maintain clean orifices and minimize fish injury. The gatewell orifices will be closed during the cleaning operation. Check gatewell drawdown and clean trashracks if necessary.

a. First Powerhouse. PH1 juvenile passage facilities will not be in service in 2004.

b. Second Powerhouse. If the bypass system fails in the dewatering section or release pipe, fish may be released through the emergency relief conduit. This operation will continue until repairs are accomplished or until the end of the fish passage season. Any decision on whether or not to shut this system down for dewatering and repairs will be made in coordination with the FPOM. During this emergency operating mode, power generation will be minimized at the second powerhouse. Repairs will receive high priority.

c. During fishway inspections the VBSs may be found plugged, damaged, or not properly seated. In these cases, the associated unit will be taken out of service as if unscreened and repairs will be made before returning the unit to normal service. If screens are pulled and replaced, the underwater video inspection camera will be deployed to check the screens for proper seating.

3.2.2.3. Turbines and Spillways. If a spill gate becomes inoperable, the operator will make the changes necessary to accommodate the spill and then immediately notify the operations supervisor and project biologist to determine the best pattern to follow until repairs are completed. This interim operation shall be coordinated with the FPOM through the district biologist who will provide additional guidance to the project.

3.2.2.4. Diffuser Gratings: Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passage way and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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. If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffusers 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 FPOM coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

3.3. Adult Fish Passage Facilities.

3.3.1. Routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6.3).

3.3.1.1. Fishway Auxiliary Water Systems. Bonneville Project auxiliary water systems consist of gravity flow and hydroelectric generating systems. Preventive maintenance and normal repair are carried out as needed throughout the year. Trash racks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trash racks during the time of day when fish passage is least affected.

3.3.1.2. Powerhouse and Spillway Adult Fish Collection Systems. Preventive maintenance and repair occurs throughout the year. During the primary adult fish passage season this maintenance will not involve any operations which will cause failure to comply with the adult fishway criteria except as specially coordinated or as needed for semi-annual maintenance. Inspection of those parts of the adult collection channel systems which require dewatering, such as diffusion gratings, leads, and entrance gates, will be scheduled once per year during the winter maintenance season while the system is dewatered, with one additional inspection during the fish passage season, unless a channel must be dewatered for fishway modifications or to correct observed problems (see section 5. Dewatering Plans.). A diver or underwater video system may be used for the underwater inspections. This scheduled inspection and any associated maintenance will occur during the winter maintenance period (in-water work period) unless specially coordinated. Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

A project biologist or alternate Corps fish personnel will attend all dewatering activities potentially involving fish, as well as inspections, to provide fish-related input (see section 5. Dewatering Plans).

3.3.1.3. Adult Fish Ladders and Counting Stations. (Also see Appendix G for adult fish trapping protocols. The adult fish ladders will be dewatered once each year during the winter maintenance period. During this time, the ladders will be inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion gratings, unreadable or damaged staff gauges, defective diffusion valves, and malfunctioning operating equipment at the counting stations, as well as other potential problems. Problems identified throughout the passage year that do not affect fish passage, as well as those identified during the dewatered period, may then be repaired. Trash racks at the ladder exits will be raked when criteria is approached or exceeded. When practicable, rake trash racks during the time of day when fish passage is least affected, usually late morning Fish count station windows, light panels, and crowder panels will be cleaned as needed to achieve accurate counts and, when practicable, during the time of day when fish passage is least affected, usually late morning.

3.3.2. Non-routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6.3.). Non-routine maintenance that will significantly affect the operation of a facility, such as repair of displaced diffuser gratings, will be coordinated with the CBFWA (through the FPC) and NOAA Fisheries. Coordination procedures for non-routine maintenance of adult facilities are the same as for juvenile facilities (section 3.2.2). Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

3.3.2.1. Fishway Auxiliary Water Systems. Most fishway auxiliary water systems are operated automatically. If the automatic system fails, then the system will be manually operated by project personnel to maintain criteria while repair of the automatic system is carried out. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met. In the event of AWS failure, FPOM will be used in an advisory capacity to assist the project as needed.

a. First Powerhouse. If any of the valves or any other part of the system fails, then the project is to attempt to maintain criteria by adjusting those valves which continue to function. Conduit pressure must be monitored and not allowed to exceed the established limits. If this maneuver fails to keep the facility operating according to the adult fishway criteria and repairs cannot be made within 24 hours, then operation of gate 1 and gate 65 weirs becomes necessary. Operational guidelines of these gates appear in section 2.5.1.2.c.

When tailwater elevation is less than 17' and the gate 65 weir crest is at least 8' below tailwater, then operation of gates 1, 2, 64, and 65 becomes necessary. Operational guidelines of these gates appear in section 2.5.1.2.c.

b. Spillway. Two separate fishway auxiliary water valves add water to each spillway ladder (Cascades Island and B-branch ladders). If one of these valves or any other part of the system malfunctions, the functioning parts of the system are to be adjusted to compensate. If repairs cannot be made in 24 hours, close the sluice gate entrance, if open. This will divert the reduced available water to the entrance slots. If a head of 1' is still not achieved, stoplogs are to be added to the entrance slots until the desired head or a weir depth of not less than 6' below the tailwater surface is reached. At this point maintain the gate positions until the auxiliary water system is repaired.

c. Second Powerhouse.

1. If either of the fishway auxiliary water turbines is unable to provide water sufficient to meet full criteria, the adult facilities will be operated according to Table Bon-11, Emergency Operations for Bonneville Second Powerhouse AWS Systems Operations or until a fishway head of 1’ is achieved. Table Bon-11 is a guide for configuring turbine flows, floating orifices, diffuser gates, and main gates during emergency situations when one of the fish turbines has failed or been taken out of service.

Table Bon-11 was prepared for the *Bonneville Second Powerhouse AWS Backup Design Documentation Report* (DDR) and is designed for inclusion in the FPP. The emergency operations table provides a guide for configuring turbine flows, floating orifices, diffuser gates, and main gates during emergency situations when one of the Bonneville Second Powerhouse (B2) fish turbines has failed or been taken out of service. Many model runs using the *Bonneville Second Powerhouse Fishway Numerical Model* were analyzed in order to determine the optimal operational configuration for the range of tailwater elevations experienced at the fishway entrances. Table Bon-11 presents the recommended settings for each tailwater elevation.

Table Bon-11. Emergency Operations Table for Bonneville Second Power House AWS Systems Operation.

TW (ft)	Turbine MW	Turbine Q (cfs)	Floating Orifice Gates Closed	South "B" Diffuser Gates Closed	Power-House Diffuser Gates Closed	Main Entrance Gates Closed
8	13.90	2950	All	B3-8	C1-5	None
9	13.95	3010	All	B3-8	C1-5	None
10	14.05	3090	All	B3-8	C1-5	None
11	14.15	3165	All	B3-8	C1-5	None
12	14.20	3230	All	B3-8	C1-5	None
13	14.40	3340	All	B3-8	C1-5	None
14	14.40	3400	All	B3-8	C1-5	None
15	14.60	3520	All	B3-8	C1-5	None
16	14.30	3515	All	B3-8	C1-5	None
17	14.20	3560	All	B3-8	C1-5	None
18	14.00	3575	All	B5-8	None	NU-E
19	13.60	3535	All	B5-8	None	NU-E
20	13.30	3520	All	B4-8	None	NU-E
21	13.00	3510	All	B4-8	None	NU-E
22	12.70	3505	All	B4-8	None	NU-E
23	12.40	3505	All	B4-8	None	NU-E
24	12.20	3535	All	B4-8	None	NU-E
25	11.60	3535	All	B4-8	None	NU-E
26	11.10	3365	All	B4-8	None	NU-E
27	10.60	3285	All	B4-8	None	NU-E
28	10.00	3160	All	B3-8	None	NU-E

2. If both of the fishway auxiliary water turbines fail between September 1 and March 31, and repairs cannot be made within 8 hours, coordination with FPOM will occur to develop operational guidelines that may include alternative powerhouse priority operations. Appendix H guidance should be followed to the extent practicable, and shore entrance weirs should be raised in increments or closed as needed to maintain the proper fishway head.

3. If all auxiliary water systems fail or malfunction, close the NUE, SUE, and SDE and raise the NDE weir crest to 6' below tailwater with the floating orifice gates open. Maintain this configuration until the system is repaired. While under this configuration, power generation at the second powerhouse will be minimized to the extent practicable to reduce fish attraction into this area unless the first powerhouse facilities are dewatered.

4. Second powerhouse adult fishway diffusion system valves A3 and A4 were found damaged and have been removed. These valves were designed to be closed when tailwater drops below 11' and 9', respectively. Even though the valves cannot be closed, velocity in the channel has remained in criteria.

3.3.2.2. Powerhouse and Spillway Adult Fish Collection Systems. Bonneville Project contains several types of fishway entrances. In most cases, if failures occur, the entrance can and will be operated manually by project personnel until repairs are made. If this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently and returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. The first powerhouse ladder was completed in 1937 and the second powerhouse ladder in 1981. Modification of the first powerhouse ladder was completed during the winter of 1981-82. The components of the ladders include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Picket leads can cause problems. Pickets with excessive spacing (greater than 1"), concrete erosion around the leads, or missing pickets can allow fish into areas where escape is difficult. In some instances of picket lead failure, spare leads and spare installation slots are available. In these cases the spare leads are installed and the damaged leads are removed and repaired. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problems will be made in coordination with FPOM.

3.3.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passage way and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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. 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 FPOM coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Unit operating priority throughout the year is shown in section 2.1.1, Powerhouse Flow Distribution. Operating the end units provides attraction flow for adult fish at both powerhouses and helps move juvenile fish out of the first powerhouse tailrace

4.2. Turbine units will operate within 1% of best efficiency and within cavitation limits at various head ranges as shown in Tables BON-12 through BON-14 for both powerhouses. First powerhouse units 1, 3, 4, 5, and 6 have different MW output requirements because they are minimum gap runner units and have a different MW versus discharge relationship.

4.3. To the extent technically feasible, turbines will be operated within +/-1% of best turbine efficiency from April 1 through October 31 (as specified in the BPA load shaping guidelines) to avoid excess daytime spill (during the time of year when the 75 kcfs spill cap applies), or to comply with other coordinated fish measures. However, during the rest of the year, the project will continue to operate units within the 1% turbine efficiency range, except as specifically requested by BPA to do otherwise as provided in Appendix C. New, separate 1% operating criteria are provided for MGR units 3 through 6 (and unit 1 when it returns in the summer of 2004)(Table BON-13).

4.4. The project turbine unit maintenance schedules will be reviewed 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. See section 3.2.1.3.

4.4.1. Unit 1 provides important attraction flow for adult fish, and, when the juvenile bypass system flow is reversed, it also helps move juvenile fish downstream. Therefore, long-term outages will be avoided after the beginning of the juvenile fish passage season, until after the adult fall chinook and coho runs at the end of October.

4.4.2. In the event of long-term outages at Bonneville powerhouses, affected units will be exercised periodically. Each unit will be operated 4-8 hours every two weeks to exercise governor components and clean wetted surfaces of corrosion, so that if needed, fish injury will be minimized and the units will be in good operating condition. Actual runtime will be the minimum amount needed to keep the unit in good working condition. This may be performed at night, daytime, or whenever unit cycling will have the least effect on fish passage as determined by the project biologist.

4.5. Since problems with the second powerhouse hydraulic head gate operating system were corrected, the gates at units 11 through 18 have been dogged off and the system has been depressurized. (Oil leaks develop frequently when the system operates with normal pressure.) Further related instructions are described in a memorandum from the project operations superintendent. (Memorandum for All Operations, from BON Chief of Operations, dated September 23, 1993. Subject: Powerhouse 2 Hydraulic Head Gate Operation).

5. Dewatering Plans.

5.1. Guidelines for Dewatering and Fish Handling Plans (Appendix G) have been developed and are followed for most project facilities dewaterings. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation. Although it isn't a complete dewatering, the procedure for reversing flow in the first powerhouse DSM is also included in Appendix G. Whether pumps or drain valve are used, automatic pump shut off devices will be utilized to prevent stranding fish. If automatic pump shut off devices and low water alarms are not used, the dewatering process must be continuously monitored to prevent stranding.

5.2. A project biologist and/or alternate Corps fish personnel will attend all project activities involving fish handling.

5.3. The fish agencies and tribes will be invited to assist in any dewatering and, at a minimum, are invited to participate in all ladder dewaterings.

5.4. Juvenile bypass systems. Key elements of the Guidelines for Dewatering and Fish Handling Plans (Appendix F) for JBS flow reversal are shown in sections 5.4.1. through 5.4.5., below.

5.4.1. A project biologist will attend all activities, which involve dropping the JBS water surface below the end of the dewatering screen. Refer to the project Fish Salvage Plan for descriptions of JBS dewaterings. (The plan is available from project biologists).

Table BON-12. Turbine operating ranges within the 1% turbine efficiency range for Bonneville First Powerhouse, units 2 and 7-10.

	First Powerhouse (units 2 and 7-10)							
	With STS				Without STS			
Head (feet)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)
35	12.7	5,285	29.2	12,107	13.2	5,385	31.0	12,620
36	13.3	5,345	30.3	12,212	13.7	5,409	32.3	12,716
37	13.8	5,401	31.5	12,310	14.2	5,431	33.5	12,803
38	14.4	5,453	32.7	12,401	14.7	5,450	34.8	12,882
39	14.9	5,501	33.8	12,486	15.2	5,466	36.0	12,954
40	15.1	5,377	35.1	12,485	15.7	5,481	37.3	13,020
41	15.6	5,422	36.2	12,557	16.3	5,528	38.5	13,095
42	16.2	5,464	37.4	12,623	16.8	5,571	39.8	13,165
43	16.7	5,504	38.6	12,685	17.4	5,612	41.0	13,230
44	17.3	5,541	39.7	12,743	18.0	5,650	42.3	13,291
45	17.8	5,576	40.9	12,796	18.5	5,685	43.5	13,347
46	18.4	5,633	41.8	12,769	19.2	5,743	44.4	13,319
47	19.1	5,687	42.7	12,742	19.8	5,798	45.4	13,292
48	19.7	5,738	43.6	12,716	20.4	5,851	46.3	13,265
49	20.3	5,786	44.5	12,690	21.1	5,900	47.3	13,238
50	20.9	5,832	45.4	12,664	21.7	5,947	48.2	13,211
51	21.7	5,923	46.1	12,587	22.5	6,041	49.0	13,131
52	22.5	6,011	46.8	12,512	23.3	6,130	49.8	13,075
53	23.2	6,095	47.4	12,440	24.2	6,216	50.6	13,020
54	24.0	6,174	48.1	12,370	25.0	6,297	51.4	12,966
55	24.8	6,251	48.8	12,302	25.8	6,376	51.9	12,836
56	25.3	6,262	50.1	12,400	26.3	6,387	53.3	12,938
57	25.8	6,273	51.3	12,495	26.8	6,398	54.6	13,036
58	26.3	6,284	52.6	12,587	27.3	6,409	55.9	13,132
59	26.7	6,294	53.8	12,676	27.8	6,420	57.2	13,225
60	27.2	6,305	55.1	12,762	28.3	6,430	58.6	13,315
61	27.6	6,298	56.2	12,810	28.7	6,423	59.7	13,365
62	28.0	6,292	57.2	12,857	29.1	6,417	60.9	13,413
63	28.4	6,286	58.3	12,903	29.5	6,411	62.0	13,461
64	28.4	6,281	59.4	12,947	29.9	6,405	63.1	13,507
65	29.2	6,275	60.5	12,991	30.4	6,399	64.3	13,553
66	29.9	6,328	61.3	12,986	31.0	6,453	65.1	13,547
67	30.5	6,379	62.1	12,981	31.7	6,505	66.0	13,541
68	31.2	6,429	62.9	12,977	32.4	6,556	66.9	13,537
69	31.8	6,478	63.7	12,947	33.1	6,606	67.8	13,533
70	32.5	6,526	64.5	13,968	33.8	6,654	68.6	13,529

Table BON-13. Turbine operating ranges within the 1% turbine efficiency range for Bonneville First Powerhouse, units 1 and 3-6.

	First Powerhouse (units 1 and 3-6)							
	With STS				Without STS			
Head (feet)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)
35	17.6	6,757	24.0	9,200	18.9	7,203	23.6	9,019
36	18.2	6,771	24.6	9,181	19.5	7,205	24.3	8,985
37	18.7	6,783	25.3	9,163	20.1	7,205	25.0	8,951
38	19.3	6,794	26.0	9,145	20.7	7,2042	25.6	8,918
39	19.8	6,804	26.6	9,128	21.3	7,202	26.3	8,886
40	20.4	6,753	27.3	9,031	21.9	7,199	26.9	8,854
41	21.0	6,754	28.4	9,148	22.5	7,201	28.0	8,969
42	21.5	6,755	29.5	9,259	23.1	7,202	29.1	9,077
43	22.0	6,756	30.5	9,363	23.6	7,203	30.1	9,180
44	22.6	6,756	31.6	9,463	24.2	7,203	31.2	9,278
45	23.1	6,756	32.7	9,557	24.8	7,203	32.3	9,370
46	23.7	6,763	33.6	9,603	25.4	7,210	33.2	9,416
47	24.3	6,769	34.6	9,648	26.0	7,217	34.1	9,459
48	24.8	6,775	35.5	9,689	26.6	7,223	35.0	9,500
49	25.4	6,780	36.5	9,729	27.3	7,229	36.0	9,539
50	26.0	6,785	37.4	9,776	27.9	7,234	36.9	9,575
51	26.5	6,792	38.3	9,809	28.5	7,241	37.8	9,618
52	27.1	6,798	39.3	9,850	29.1	7,248	38.4	9,577
53	27.7	6,804	40.2	9,889	29.7	7,2542	39.0	9,537
54	28.3	6,810	41.2	9,927	30.3	7,260	39.7	9,499
55	28.8	6,815	42.1	9,962	30.9	7,266	41.6	9,768
56	29.4	6,817	43.1	10,003	31.5	7,269	42.5	9,808
57	29.9	6,820	44.0	10,042	32.1	7,272	43.4	9,846
58	30.4	6,823	45.0	10,079	32.7	7,274	44.4	9,883
59	31.0	6,825	45.9	10,115	33.3	7,277	45.3	9,918
60	31.5	6,827	46.9	10,150	33.8	7,2792	46.3	9,952
61	32.1	6,842	47.6	10,128	34.5	7,296	46.9	9,930
62	32.8	6,857	48.3	10,106	35.1	7,311	47.6	9,909
63	33.4	6,871	49.0	10,085	35.8	7,326	48.3	9,889
64	34.0	6,884	49.7	10,064	36.5	7,340	49.0	9,868
65	34.6	6,897	50.4	10,044	37.1	7,354	49.7	9,849
66	35.0	6,885	51.2	10,072	37.6	7,341	50.6	9,876
67	35.5	6,873	52.1	10,099	38.1	7,329	51.4	9,902
68	35.9	6,862	53.0	10,126	38.6	7,317	52.3	9,928
69	36.4	6,851	53.9	10,152	39.0	7,305	53.2	9,954
70	36.8	6,841	54.8	10,177	39.6	7,294	54.1	9,979

Table BON-14. Turbine operating ranges within the 1% turbine efficiency range for Bonneville second powerhouse (units 11-18), with or without STSs in place.

	Second Powerhouse (units 11-18)							
	With STS				Without STS			
Head (feet)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)
35	26.7	10,619	41.9	16,628	26.2	10,330	39.9	15,746
36	27.6	10,630	43.3	16,657	27.0	10,341	41.2	15,773
37	28.5	10,639	44.7	16,680	27.9	10,350	42.6	15,795
38	29.4	10,645	46.1	16,699	28.8	10,356	43.9	15,813
39	30.3	10,649	47.6	16,713	29.7	10,360	45.3	15,827
40	31.2	10,651	49.0	16,724	30.5	10,362	46.7	15,837
41	32.0	10,624	50.4	16,756	31.3	10,336	48.0	15,869
42	32.8	10,597	51.9	16,786	32.1	10,310	49.4	15,897
43	33.5	10,571	53.3	16,812	32.8	10,285	50.8	15,922
44	34.3	10,544	54.8	16,834	33.6	10,259	52.2	15,943
45	35.1	10,518	56.2	16,854	34.3	10,234	53.5	15,962
46	35.9	10,514	57.7	16,917	35.1	10,230	55.0	16,021
47	36.7	10,510	58.5	16,770	35.9	10,226	55.8	15,888
48	37.5	10,505	59.3	16,629	36.7	10,222	56.6	15,761
49	38.3	10,500	60.1	16,493	37.5	10,217	57.3	15,637
50	39.1	10,495	63.8	17,133	38.3	10,212	60.8	16,226
51	40.0	10,529	66.0	17,365	39.2	10,245	62.9	16,446
52	41.0	10,561	68.2	17,588	40.1	10,276	65.0	16,657
53	41.9	10,591	70.4	17,801	41.0	10,305	67.1	16,860
54	42.8	10,620	72.6	18,006	41.9	10,333	96.2	17,054
55	43.8	10,647	74.8	18,203	42.8	10,360	71.3	17,240
56	45.2	10,766	75.2	17,925	44.2	10,476	71.6	16,977
57	46.6	10,880	75.6	17,656	45.6	10,586	72.0	16,723
58	48.0	10,987	76.0	17,397	46.9	10,691	72.4	16,478
59	49.4	11,090	76.4	17,146	48.3	10,792	72.7	16,240
60	50.8	11,188	76.7	16,903	49.7	10,887	73.1	16,010
61	51.2	11,099	80.1	17,375	50.1	10,800	76.3	16,458
62	51.6	11,012	83.5	17,834	50.5	10,715	79.5	16,892
63	52.0	10,928	86.9	18,279	50.8	10,634	82.8	17,313
64	52.3	10,847	90.3	18,711	51.2	10,555	86.0	17,723
65	52.7	10,769	93.7	19,132	51.6	10,479	89.2	18,121
66	53.7	10,810	95.1	19,138	52.6	10,519	90.6	18,127
67	54.8	10,850	96.6	19,145	53.6	10,558	92.0	18,133
68	55.8	10,889	98.1	19,151	54.6	10,595	93.4	18,139
69	56.8	10,926	99.6	19,157	55.6	10,632	94.8	18,145
70	57.8	10,963	101.0	19,163	56.6	10,668	96.2	18,150

5.4.2. Personnel involved in use of the sampling facilities will be advised before facilities are drained.

5.4.3. Automatic controls for the trash sweeps will be turned off.

5.4.4. Flow through the dewatering screen will be reduced before the water level drops below the upper end of the screen. Refer to the Fish Salvage Plan.

5.4.5. The area beneath the dewatering screen will be filled before allowing water in the channel to rise to the elevation of the dewatering screen.

5.5. Adult Fish Ladder.

5.5.1. Routine Maintenance.

5.5.1.1. When possible operate the ladder to be dewatered at a reduced flow for at least 24 hours, and up to 96 hours, prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow. This operation shall not be initiated prior to 1800 hours on November 30th if a ladder outage is scheduled for December 1st.

5.5.1.2. Discontinue all fishway auxiliary water supplies at least 24 hours, but no more than 96 hours, prior to dewatering. This operation shall not be initiated until 1800 hours on November 30th if a ladder outage is scheduled for December 1st.

5.5.1.3. A project biologist will assure that fish rescue equipment is available and will coordinate to assure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.5.1.4. Project personnel will install head gates to shut down ladder flow. Where possible, a minimum flow depth of 1" - 2" will be maintained in the ladder until fish are rescued.

5.5.1.5. A project biologist or alternate Corps fish personnel will oversee fish rescue when the ladders are dewatered according to specifications in the Dewatering Plans. The project biologist will invite fish agency and/or tribal biologists to participate in the dewatering. Adult fish will be released into the forebay and juvenile fish will be released into the tailrace. If a ladder is dewatered in the spring or summer, steelhead kelts will be released into the tailrace.

5.5.1.6. Orifice blocking devices that are placed in the lower-most weirs to prevent fish from re-ascending the dewatered portion of the adult fishway shall have ropes placed on them to be tied to fishway railings. The orifice blocks shall be removed just before the fishway is returned to service. The ropes will help identify and prevent the orifice blocks from being accidentally left in place after fishway water-up. The orifice blocking devices will appear on the pre-water-up checklist maintained by the project biologist.

5.5.2. Non-Routine Maintenance.

5.5.2.1. When possible discontinue fishway auxiliary water and operate the ladder at orifice flow as long as possible (prefer 3-24 hours) prior to dewatering.

5.5.2.2. Follow guidance in sections 5.5.1.3. through 5.5.1.5. above.

5.6. Powerhouse Fish Collection System.

5.6.1. Routine Maintenance.

5.6.1.1. During the pumping or draining operation to dewater a portion or the entire collection channel, the water level will not be allowed to drop to a level, which strands fish. Personnel shall remain onsite during pumping operations to ensure stranding does not occur, or a water-level sensor that deactivates the dewatering process will be used.

5.6.1.2. A project biologist will assist directly in fish rescue operations, provide technical guidance to assure fish safety, and assure that rescue equipment and personnel are available if needed.

5.7. Turbines.

5.7.1. Immediately before setting the head gates, remove juvenile fish from the gatewell(s) that will be drained. This is done by use of a special dipping basket. Typically, one of the three gatewells is drained to allow ventilation into the draft tube.

5.7.2. When possible place head gates and tail logs immediately after a turbine unit is shut down if the draft tube is to be dewatered. This is necessary for both scheduled and unscheduled outages.

5.7.3. If a turbine unit draft tube is to be dewatered and the turbine unit has been idle, it will be operated when possible at speed/no load and stop logs will then be placed immediately.

5.7.4. Water levels in the draft tube will not be allowed to drop to a level that strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.7.5. Fish rescue personnel will inspect dewatered turbine draft tubes, scroll cases, and intakes as soon as the water levels reach a depth permitting visual inspection and the hatch cover is opened. A project biologist and/or alternate Corps fish personnel will provide technical guidance for fish safety and will directly participate in fish salvage.

5.7.6. A project biologist will invite FPOM members to participate in the dewatering, and will assure that rescue equipment is available if needed.

5.7.7. If the unit is planned to be out of service and partially drained for less than 4 days and low numbers of fish are trapped, then it will not be necessary to remove fish from draft tubes as long as an adequate safety pool is maintained. Adequate inspections will be conducted to ensure the safety pool is maintained and fish are in good condition.

6. Forebay Debris Removal. Debris can impact fish passage conditions in several ways. It can plug or block trash racks, VBSs, gatewell orifices, dewatering screens, and facility piping, resulting in impingement, injuries, and descaling of fish. Debris is removed by operating the ice and trash sluiceway at the first powerhouse, the ice and trash chute at the second powerhouse, or passing it through the spillway with special spill gate operation.

Special spill operations that don’t follow the normal spill schedule or volume limits will be coordinated prior to their execution. Normally, the project shall contact CENWP-OP at least two workdays prior to the day the special operation is required. Using information provided by the project, CENWP-OP will coordinate with RCC, NOAA FISHERIES, and other FPOM members as necessary. Once the coordination is complete, RCC will issue a Teletype detailing the specifics of the special operations.

7. Response to Hazardous Materials Spills. Bonneville Project's guidance for responding to hazardous substance spills is contained in its Emergency Spill Response Plan. This guidance will be followed in case of a spill. The project biologist will be contacted as soon as possible after a hazardous material release. The project biologist will in turn contact the CENWP-OP biologist, NOAA FISHERIES, and FPC.

Table BON-15. Spill patterns for Bonneville Dam.

Spillway Bay Number																		Stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
0.5																	0.5	2	3.6
0.5	0.5																0.5	3	5.4
0.5	0.5															0.5	0.5	4	7.2
0.5	0.5														0.5	0.5	0.5	5	9.0
0.5	0.5		0.5												0.5	0.5	0.5	6	10.7
0.5	0.5		0.5	0.5											0.5	0.5	0.5	7	12.5
0.5	0.5		0.5	0.5									0.5		0.5	0.5	0.5	8	14.3
0.5	0.5		0.5	0.5							0.5		0.5		0.5	0.5	0.5	9	16.1
0.5	0.5		0.5	0.5					0.5		0.5		0.5		0.5	0.5	0.5	10	17.9
0.5	0.5		0.5	0.5			0.5		0.5		0.5		0.5		0.5	0.5	0.5	11	19.7
0.5	0.5	0.5	0.5	0.5			0.5		0.5		0.5		0.5		0.5	0.5	0.5	12	21.5
0.5	0.5	0.5	0.5	0.5			0.5		0.5		0.5		0.5		0.5	1	0.5	13	22.8
0.5	1	0.5	0.5	0.5			0.5		0.5		0.5		0.5		0.5	1	0.5	14	24.0
0.5	1	0.5	0.5	0.5	0.5		0.5		0.5		0.5		0.5		0.5	1	0.5	15	25.8
0.5	1	0.5	0.5	0.5	0.5		0.5		0.5		0.5		0.5	0.5	0.5	1	0.5	16	27.6
0.5	1	0.5	0.5	0.5	0.5	0.5	0.5		0.5		0.5		0.5	0.5	0.5	1	0.5	17	29.4
0.5	1	0.5	0.5	0.5	0.5	0.5	0.5		0.5		0.5	0.5	0.5	0.5	0.5	1	0.5	18	31.2
0.5	1	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	19	33.0
0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	20	34.8
0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	21	36.0
0.5	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	22	37.3
1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	23	38.6
1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	24	39.8
1	1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	25	41.1
1	1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	1	1	26	42.3
1	1	1	1	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	1	1	1	1	27	43.6
1	1	1	1	0.5	0.5	1	0.5	1	0.5	0.5	0.5	0.5	0.5	1	1	1	1	28	44.9
1	1	1	1	0.5	0.5	1	0.5	1	0.5	0.5	1	0.5	0.5	1	1	1	1	29	46.1
1	1	1	1	0.5	1	1	0.5	1	0.5	0.5	1	0.5	0.5	1	1	1	1	30	47.4
1	1	1	1	0.5	1	1	0.5	1	0.5	0.5	1	1	0.5	1	1	1	1	31	48.7
1	1	1	1	0.5	1	1	0.5	1	1	0.5	1	1	0.5	1	1	1	1	32	49.9
1	1	1	1	1	1	1	0.5	1	1	0.5	1	1	0.5	1	1	1	1	33	51.2
1	1	1	1	1	1	1	1	1	1	0.5	1	1	0.5	1	1	1	1	34	52.5
1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1	35	53.7
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	36	55.0
1	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	37	56.1
1	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1	38	57.2
1	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5	1	39	58.3
1	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5	1	40	59.5
1.5	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5	1	41	60.6
1.5	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5	1.5	42	61.7
1.5	1.5	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1.5	2	1.5	43	62.7
1.5	2	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1.5	2	1.5	44	63.8
1.5	2	1.5	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1.5	45	64.8
1.5	2	1.5	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	46	65.9
2	2	1.5	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	47	66.9
2	2	1.5	1	1	1	1	1	1.5	1	1	1	1	1	1	2	2	2	48	68.0

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
2	2	2	1	1	1	1	1	1.5	1	1	1	1	1	1	2	2	2	49	69.0
2	2	2	1	1.5	1	1	1	1.5	1	1	1	1	1	1	2	2	2	50	70.2
2	2	2	1.5	1.5	1	1	1	1.5	1	1	1	1	1	1	2	2	2	51	71.3
2	2	2	1.5	1.5	1	1	1	1.5	1	1	1.5	1	1	1	2	2	2	52	72.4
2	2	2	1.5	1.5	1	1	1	1.5	1	1	1.5	1	1.5	1	2	2	2	53	73.5
2	2	2	1.5	1.5	1	1.5	1	1.5	1	1	1.5	1	1.5	1	2	2	2	54	74.6
2	2	2	1.5	1.5	1	1.5	1	1.5	1	1	1.5	1	1.5	1	2	2.5	2	55	75.6
2	2.5	2	1.5	1.5	1	1.5	1	1.5	1	1	1.5	1	1.5	1	2	2.5	2	56	76.6
2	2.5	2	1.5	1.5	1.5	1.5	1	1.5	1	1	1.5	1	1.5	1	2	2.5	2	57	77.7
2	2.5	2	1.5	1.5	1.5	1.5	1	1.5	1	1	1.5	1	1.5	1.5	2	2.5	2	58	78.8
2	2.5	2	1.5	1.5	1.5	1.5	1	1.5	1.5	1	1.5	1	1.5	1.5	2	2.5	2	59	80.0
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1.5	1	1.5	1.5	2	2.5	2	60	81.1
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1	1.5	1.5	1.5	1.5	2	2.5	2	61	82.2
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2.5	2	62	83.3
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	2	63	84.3
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	3	2	64	85.2
2	2.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	3	2.5	65	86.2
2	3	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	3	2.5	66	87.1
2	3	2	1.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	3	2.5	67	88.2
2	3	2	1.5	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2.5	3	2.5	68	89.2
2	3	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2.5	3	2.5	69	90.2
2	3	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	2	2.5	3	2.5	70	91.3
2	3	2	2	2	1.5	1.5	2	1.5	1.5	1.5	1.5	2	1.5	2	2.5	3	2.5	71	92.3
2.5	3	2	2	2	1.5	1.5	2	1.5	1.5	1.5	1.5	2	1.5	2	2.5	3	2.5	72	93.3
2.5	3	2	2	2	1.5	1.5	2	1.5	2	1.5	1.5	2	1.5	2	2.5	3	2.5	73	94.3
2.5	3	2	2	2	1.5	1.5	2	1.5	2	1.5	1.5	2	1.5	2	3	3	2.5	74	95.3
2.5	3	2	2	2	2	1.5	2	1.5	2	1.5	1.5	2	1.5	2	3	3	2.5	75	96.3
2.5	3	2	2	2	2	1.5	2	1.5	2	1.5	1.5	2	2	2	3	3	2.5	76	97.3
2.5	3	2	2	2	2	1.5	2	1.5	2	1.5	1.5	2	2	2	3	3	3	77	98.3
2.5	3	2	2	2	2	1.5	2	1.5	2	1.5	2	2	2	2	3	3	3	78	99.3
3	3	2	2	2	2	1.5	2	1.5	2	1.5	2	2	2	2	3	3	3	79	100.2
3	3	2.5	2	2	2	1.5	2	1.5	2	1.5	2	2	2	2	3	3	3	80	101.2
3	3	2.5	2	2	2	2	2	1.5	2	1.5	2	2	2	2	3	3	3	81	102.3
3	3	2.5	2	2	2	2	2	2	2	1.5	2	2	2	2	3	3	3	82	103.3
3	3	2.5	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	83	104.3
3	3	2.5	2	2.5	2	2	2	2	2	2	2	2	2	2	3	3	3	84	105.3
3	3	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	3	3	3	85	106.3
3	3	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2	3	3	3	86	107.3
3	3	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	3	3	3	87	108.2
3	3.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	3	3	3	88	109.1
3	3.5	3	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	3	3	3	89	110.1
3	3.5	3	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	3	3.5	3	90	111.0
3	3.5	3	2.5	2.5	2.5	2	2	2	2	2	2	2	2.5	2.5	3	3.5	3	91	111.9
3	3.5	3	2.5	2.5	2.5	2	2	2	2	2	2	2	2.5	2.5	3.5	3.5	3	92	112.8
3	3.5	3	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2.5	2.5	3.5	3.5	3	93	113.8
3	3.5	3	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2.5	3	3.5	3.5	3	94	114.8
3	3.5	3	2.5	3	2.5	2.5	2	2	2	2	2	2	2.5	3	3.5	3.5	3	95	115.7

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
3	3.5	3	3	3	2.5	2.5	2	2	2	2	2	2	2.5	3	3.5	3.5	3	96	116.6
3	3.5	3	3	3	2.5	2.5	2.5	2	2	2	2	2	2.5	3	3.5	3.5	3	97	117.6
3	3.5	3	3	3	2.5	2.5	2.5	2	2	2	2	2.5	2.5	3	3.5	3.5	3	98	118.6
3	3.5	3	3	3	2.5	2.5	2.5	2	2	2	2.5	2.5	2.5	3	3.5	3.5	3	99	119.5
3	3.5	3	3	3	2.5	2.5	2.5	2	2.5	2	2.5	2.5	2.5	3	3.5	3.5	3	100	120.5
3	3.5	3.5	3	3	2.5	2.5	2.5	2	2.5	2	2.5	2.5	2.5	3	3.5	3.5	3	101	121.4
3	3.5	3.5	3	3	2.5	2.5	2.5	2	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3	102	122.4
3	3.5	3.5	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3	103	123.4
3	3.5	3.5	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3	104	124.3
3	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3	105	125.2
3	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	3.5	3.5	106	126.1
3	3.5	3.5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	4	3.5	107	127.0
3	3.5	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	3	3.5	4	3.5	108	127.9
3	3.5	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3.5	4	3.5	109	128.9
3	3.5	3.5	3	3	3	3	3	2.5	2.5	2.5	2.5	3	3	3	3.5	4	3.5	110	129.8
3	3.5	3.5	3	3	3	3	3	2.5	2.5	3	2.5	3	3	3	3.5	4	3.5	111	130.7
3	3.5	3.5	3	3	3	3	3	2.5	2.5	3	3	3	3	3	3.5	4	3.5	112	131.7
3.5	3.5	3.5	3	3	3	3	3	2.5	2.5	3	3	3	3	3	3.5	4	3.5	113	132.6
3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	3	3	3	3	3	3.5	4	3.5	114	133.5
3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	3	3	3	3	3	3.5	4	4	115	134.3
3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	3	3	3	3	3.5	3.5	4	4	116	135.2
3.5	3.5	3.5	3.5	3	3	3	3	2.5	2.5	3	3	3	3	3.5	4	4	4	117	136.1
3.5	3.5	3.5	3.5	3	3	3	3	2.5	3	3	3	3	3	3.5	4	4	4	118	137.0
3.5	3.5	3.5	3.5	3	3	3	3	3	3	3	3	3	3	3.5	4	4	4	119	138.0
3.5	4	3.5	3.5	3	3	3	3	3	3	3	3	3	3	3.5	4	4	4	120	138.8
3.5	4	4	3.5	3	3	3	3	3	3	3	3	3	3	3.5	4	4	4	121	139.7
4	4	4	3.5	3	3	3	3	3	3	3	3	3	3	3.5	4	4	4	122	140.6
4	4	4	4	3	3	3	3	3	3	3	3	3	3	3.5	4	4	4	123	141.5
4	4	4	4	3	3	3	3	3	3	3	3	3	3	4	4	4	4	124	142.3
4	4	4	4	3	3.5	3	3	3	3	3	3	3	3	4	4	4	4	125	143.2
4	4	4	4	3.5	3.5	3	3	3	3	3	3	3	3	4	4	4	4	126	144.1
4	4	4	4	3.5	3.5	3	3	3	3	3	3	3.5	3	4	4	4	4	127	145.0
4	4	4	4	3.5	3.5	3	3	3	3	3	3	3.5	3.5	4	4	4	4	128	145.9
4	4	4	4	3.5	3.5	3	3	3	3	3	3	3.5	3.5	4	4	4.5	4	129	146.8
4	4	4	4	3.5	3.5	3.5	3	3	3	3	3	3.5	3.5	4	4	4.5	4	130	147.7
4	4	4	4	3.5	3.5	3.5	3	3	3	3	3.5	3.5	3.5	4	4	4.5	4	131	148.6
4	4	4	4	3.5	3.5	3.5	3	3	3	3	3.5	3.5	3.5	4	4.5	4.5	4	132	149.4
4	4.5	4	4	3.5	3.5	3.5	3	3	3	3	3.5	3.5	3.5	4	4.5	4.5	4	133	150.2
4	4.5	4.5	4	3.5	3.5	3.5	3	3	3	3	3.5	3.5	3.5	4	4.5	4.5	4	134	151.1
4	4.5	4.5	4	3.5	3.5	3.5	3	3	3.5	3	3.5	3.5	3.5	4	4.5	4.5	4	135	152.0
4	4.5	4.5	4	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3.5	3.5	4	4.5	4.5	4	136	152.9
4	4.5	4.5	4	3.5	3.5	3.5	3.5	3	3.5	3.5	3.5	3.5	3.5	4	4.5	4.5	4	137	153.8
4	4.5	4.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4.5	4.5	4	138	154.7
4	4.5	4.5	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4.5	4.5	4	139	155.5
4	4.5	4.5	4	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4.5	4.5	4	140	156.4
4	4.5	4.5	4	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	4.5	4	141	157.3
4	4.5	4.5	4	4	4	4	3.5	3.5	3.5	3.5	3.5	3.5	4	4	4.5	4.5	4	142	158.2

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
4	4.5	4.5	4	4	4	4	3.5	3.5	3.5	3.5	3.5	4	4	4	4.5	4.5	4	143	159.0
4	4.5	4.5	4	4	4	4	3.5	3.5	3.5	3.5	4	4	4	4	4.5	4.5	4	144	159.9
4	4.5	4.5	4	4	4	4	4	3.5	3.5	3.5	4	4	4	4	4.5	4.5	4	145	160.8
4	4.5	4.5	4	4	4	4	4	3.5	3.5	4	4	4	4	4	4.5	4.5	4	146	161.6
4	4.5	4.5	4	4	4	4	4	4	3.5	4	4	4	4	4	4.5	4.5	4	147	162.5
4	4.5	4.5	4	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	4	148	163.4
4	4.5	4.5	4.5	4	4	4	4	4	4	4	4	4	4	4	4.5	4.5	4	149	164.2
4	4.5	4.5	4.5	4	4	4	4	4	4	4	4	4	4	4.5	4.5	4.5	4	150	165.1
4	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4	4	4	4.5	4.5	4.5	4	151	165.9
4	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4	152	166.7
4	4.5	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4	153	167.6
4	4.5	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4.5	4	154	168.4
4	4.5	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4.5	4.5	4.5	4.5	5	4	155	169.2
4	5	4.5	4.5	4.5	4.5	4	4	4	4	4	4	4.5	4.5	4.5	4.5	5	4	156	170.1
4	5	4.5	4.5	4.5	4.5	4	4	4	4	4	4.5	4.5	4.5	4.5	4.5	5	4	157	170.9
4	5	4.5	4.5	4.5	4.5	4.5	4	4	4	4	4.5	4.5	4.5	4.5	4.5	5	4	158	171.7
4	5	4.5	4.5	4.5	4.5	4.5	4	4	4	4	4.5	4.5	4.5	4.5	5	5	4	159	172.5
4	5	4.5	4.5	4.5	4.5	4.5	4	4	4	4.5	4.5	4.5	4.5	4.5	5	5	4	160	173.4
4	5	5	4.5	4.5	4.5	4.5	4	4	4	4.5	4.5	4.5	4.5	4.5	5	5	4	161	174.2
4	5	5	4.5	4.5	4.5	4.5	4	4	4	4.5	4.5	4.5	4.5	5	5	5	4	162	175.0
4	5	5	5	4.5	4.5	4.5	4	4	4	4.5	4.5	4.5	4.5	5	5	5	4	163	175.8
4	5	5	5	4.5	4.5	4.5	4	4.5	4	4.5	4.5	4.5	4.5	5	5	5	4	164	176.7
4	5	5	5	4.5	4.5	4.5	4	4.5	4	4.5	4.5	4.5	5	5	5	5	4	165	177.5
4	5	5	5	4.5	4.5	4.5	4.5	4.5	4	4.5	4.5	4.5	5	5	5	5	4	166	178.3
4	5	5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5	5	4	167	179.2
4	5	5	5	4.5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5	5	4	168	180.0
4	5	5	5	4.5	5	4.5	4.5	4.5	4.5	4.5	5	4.5	5	5	5	5	4	169	180.8
4	5	5	5	4.5	5	4.5	4.5	4.5	4.5	4.5	5	5	5	5	5	5	4	170	181.6
4	5	5	5	5	5	4.5	4.5	4.5	4.5	4.5	5	5	5	5	5	5	4	171	182.4
4	5	5	5	5	5	4.5	5	4.5	4.5	4.5	5	5	5	5	5	5	4	172	183.2
4	5	5	5	5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	4	173	184.0
4	5	5	5	5	5	4.5	5	5	5	4.5	5	5	5	5	5	5	4	174	184.8
4	5	5	5	5	5	5	5	5	5	4.5	5	5	5	5	5	5	4	175	185.6
4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	176	186.4
4	5.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	177	187.4
4	5.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.5	4	178	188.4
4	5.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	4	179	189.3
4	5.5	5.5	5	5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	4	180	190.3
4	5.5	5.5	5	5.5	5	5	5	5	5	5	5	5	5	5	5.5	5.5	4	181	191.3
4	5.5	5.5	5	5.5	5	5	5	5	5	5	5	5	5	5.5	5.5	5.5	4	182	192.2
4	5.5	5.5	5.5	5.5	5	5	5	5	5	5	5	5	5	5.5	5.5	5.5	4	183	193.2
4	5.5	5.5	5.5	5.5	5	5	5	5	5.5	5	5	5	5	5.5	5.5	5.5	4	184	194.2
4	5.5	5.5	5.5	5.5	5	5	5.5	5	5.5	5	5	5	5	5.5	5.5	5.5	4	185	195.1
4	5.5	5.5	5.5	5.5	5	5	5.5	5	5.5	5	5	5.5	5	5.5	5.5	5.5	4	186	196.1
4	5.5	5.5	5.5	5.5	5	5	5.5	5.5	5.5	5	5	5.5	5	5.5	5.5	5.5	4	187	197.0
4	5.5	5.5	5.5	5.5	5.5	5	5.5	5.5	5.5	5	5	5.5	5	5.5	5.5	5.5	4	188	198.0
4	5.5	5.5	5.5	5.5	5.5	5	5.5	5.5	5.5	5	5.5	5.5	5	5.5	5.5	5.5	4	189	199.0

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
4	5.5	5.5	5.5	5.5	5.5	5	5.5	5.5	5.5	5	5.5	5.5	5.5	5.5	5.5	5.5	4	190	199.9
4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5	5.5	5.5	5.5	5.5	5.5	5.5	4	191	200.9
4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4	192	201.9
4	5.5	5.5	5.5	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4	193	202.8
4	5.5	5.5	5.5	6	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6	5.5	5.5	5.5	5.5	4	194	203.8
4	5.5	5.5	5.5	6	5.5	5.5	5.5	5.5	5.5	5.5	6	6	5.5	5.5	5.5	5.5	4	195	204.7
4	5.5	5.5	5.5	6	6	5.5	5.5	5.5	5.5	5.5	6	6	5.5	5.5	5.5	5.5	4	196	205.7
4	5.5	5.5	5.5	6	6	5.5	6	5.5	5.5	5.5	6	6	5.5	5.5	5.5	5.5	4	197	206.6
4	5.5	5.5	5.5	6	6	5.5	6	5.5	6	5.5	6	6	5.5	5.5	5.5	5.5	4	198	207.6
4	6	5.5	5.5	6	6	5.5	6	5.5	6	5.5	6	6	5.5	5.5	5.5	5.5	4	199	208.5
4	6	5.5	5.5	6	6	5.5	6	5.5	6	5.5	6	6	5.5	5.5	5.5	6	4	200	209.5
4	6	5.5	5.5	6	6	5.5	6	5.5	6	5.5	6	6	5.5	5.5	6	6	4	201	210.4
4	6	6	5.5	6	6	5.5	6	5.5	6	5.5	6	6	5.5	5.5	6	6	4	202	211.4
4	6	6	5.5	6	6	5.5	6	5.5	6	5.5	6	6	6	5.5	6	6	4	203	212.3
4	6	6	5.5	6	6	5.5	6	5.5	6	5.5	6	6	6	5.5	6	6	4.5	204	213.2
4.5	6	6	5.5	6	6	5.5	6	5.5	6	5.5	6	6	6	5.5	6	6	4.5	205	214.0
4.5	6	6	6	6	6	5.5	6	5.5	6	5.5	6	6	6	5.5	6	6	4.5	206	215.0
4.5	6	6	6	6	6	5.5	6	5.5	6	5.5	6	6	6	6	6	6	4.5	207	215.9
4.5	6	6	6	6	6	5.5	6	6	6	5.5	6	6	6	6	6	6	4.5	208	216.9
4.5	6	6	6	6	6	6	6	6	6	5.5	6	6	6	6	6	6	4.5	209	217.8
4.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4.5	210	218.8
4.5	6	6	6	6.5	6	6	6	6	6	6	6	6	6	6	6	6	4.5	211	219.7
4.5	6	6	6	6.5	6	6	6	6	6	6	6	6.5	6	6	6	6	4.5	212	220.6
4.5	6	6	6	6.5	6	6	6	6	6	6	6.5	6.5	6	6	6	6	4.5	213	221.6
4.5	6	6	6	6.5	6.5	6	6	6	6	6	6.5	6.5	6	6	6	6	4.5	214	222.5
4.5	6	6	6	6.5	6.5	6	6.5	6	6	6	6.5	6.5	6	6	6	6	4.5	215	223.4
4.5	6	6	6	6.5	6.5	6	6.5	6	6	6	6.5	6.5	6	6	6	6.5	4.5	216	224.4
4.5	6.5	6	6	6.5	6.5	6	6.5	6	6	6	6.5	6.5	6	6	6	6.5	4.5	217	225.3
4.5	6.5	6	6	6.5	6.5	6	6.5	6	6	6	6.5	6.5	6	6	6.5	6.5	4.5	218	226.3
4.5	6.5	6.5	6	6.5	6.5	6	6.5	6	6	6	6.5	6.5	6	6	6.5	6.5	4.5	219	227.2
4.5	6.5	6.5	6	6.5	6.5	6	6.5	6	6.5	6	6.5	6.5	6	6	6.5	6.5	4.5	220	228.1
4.5	6.5	6.5	6	6.5	6.5	6	6.5	6	6.5	6	6.5	6.5	6	6.5	6.5	6.5	4.5	221	229.1
4.5	6.5	6.5	6.5	6.5	6.5	6	6.5	6	6.5	6	6.5	6.5	6	6.5	6.5	6.5	4.5	222	230.0
4.5	6.5	6.5	6.5	6.5	6.5	6	6.5	6	6.5	6	6.5	6.5	6.5	6.5	6.5	6.5	4.5	223	230.9
4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6	6.5	6	6.5	6.5	6.5	6.5	6.5	6.5	4.5	224	231.9
4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	4.5	225	232.8
4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	4.5	226	233.8
4.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	5	227	234.6
5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	5	228	235.4
5	6.5	6.5	6.5	7	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	5	229	236.3
5	6.5	6.5	6.5	7	6.5	6.5	6.5	6.5	6.5	6.5	6.5	7	6.5	6.5	6.5	6.5	5	230	237.2
5	6.5	6.5	6.5	7	6.5	6.5	6.5	6.5	6.5	6.5	7	7	6.5	6.5	6.5	6.5	5	231	238.2
5	6.5	6.5	6.5	7	7	6.5	6.5	6.5	6.5	6.5	7	7	6.5	6.5	6.5	6.5	5	232	239.1
5	6.5	6.5	6.5	7	7	6.5	7	6.5	6.5	6.5	7	7	6.5	6.5	6.5	6.5	5	233	240.0
5	6.5	6.5	6.5	7	7	6.5	7	6.5	6.5	6.5	7	7	6.5	6.5	6.5	7	5	234	240.9
5	7	6.5	6.5	7	7	6.5	7	6.5	6.5	6.5	7	7	6.5	6.5	6.5	7	5	235	241.9
5	7	6.5	6.5	7	7	6.5	7	6.5	6.5	6.5	7	7	6.5	6.5	7	7	5	236	242.8

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
5	7	7	6.5	7	7	6.5	7	6.5	6.5	6.5	7	7	6.5	6.5	7	7	5	237	243.7
5	7	7	6.5	7	7	6.5	7	6.5	7	6.5	7	7	6.5	6.5	7	7	5	238	244.6
5	7	7	6.5	7	7	6.5	7	6.5	7	6.5	7	7	6.5	7	7	7	5	239	245.6
5	7	7	7	7	7	6.5	7	6.5	7	6.5	7	7	6.5	7	7	7	5	240	246.5
5	7	7	7	7	7	6.5	7	6.5	7	6.5	7	7	7	7	7	7	5	241	247.4
5	7	7	7	7	7	7	7	6.5	7	6.5	7	7	7	7	7	7	5	242	248.3
5	7	7	7	7	7	7	7	6.5	7	7	7	7	7	7	7	7	5	243	249.3
5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	244	250.2
5	7	7	7	7.5	7	7	7	7	7	7	7	7	7	7	7	7	5	245	251.1
5	7	7	7	7.5	7	7	7	7	7	7	7	7.5	7	7	7	7	5	246	252.0
5	7	7	7	7.5	7	7	7	7	7	7	7.5	7.5	7	7	7	7	5	247	252.9
5	7	7	7	7.5	7.5	7	7	7	7	7	7.5	7.5	7	7	7	7	5	248	253.8
5	7	7	7	7.5	7.5	7	7.5	7	7	7	7.5	7.5	7	7	7	7	5	249	254.8
5	7	7	7	7.5	7.5	7	7.5	7	7	7	7.5	7.5	7	7	7.5	7	5	250	255.7
5	7	7.5	7	7.5	7.5	7	7.5	7	7	7	7.5	7.5	7	7	7.5	7	5	251	256.6
5	7	7.5	7	7.5	7.5	7	7.5	7	7.5	7	7.5	7.5	7	7	7.5	7	5	252	257.5
5	7	7.5	7	7.5	7.5	7	7.5	7	7.5	7	7.5	7.5	7	7.5	7.5	7	5	253	258.4
5	7	7.5	7.5	7.5	7.5	7	7.5	7	7.5	7	7.5	7.5	7	7.5	7.5	7	5	254	259.3
5	7	7.5	7.5	7.5	7.5	7	7.5	7	7.5	7	7.5	7.5	7.5	7.5	7.5	7	5	255	260.2
5	7	7.5	7.5	7.5	7.5	7.5	7.5	7	7.5	7	7.5	7.5	7.5	7.5	7.5	7	5	256	261.2
5	7	7.5	7.5	7.5	7.5	7.5	7.5	7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7	5	257	262.1
5	7	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7	5	258	263.0
5	7	7.5	7.5	8	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7	5	259	263.9
5	7	7.5	7.5	8	7.5	7.5	7.5	7.5	7.5	7.5	7.5	8	7.5	7.5	7.5	7	5	260	264.8
5	7	7.5	7.5	8	7.5	7.5	7.5	7.5	7.5	7.5	8	8	7.5	7.5	7.5	7	5	261	265.7
5	7	7.5	7.5	8	8	7.5	7.5	7.5	7.5	7.5	8	8	7.5	7.5	7.5	7	5	262	266.6
5	7	7.5	7.5	8	8	7.5	8	7.5	7.5	7.5	8	8	7.5	7.5	7.5	7	5	263	267.5
5	7	7.5	7.5	8	8	7.5	8	7.5	7.5	7.5	8	8	7.5	7.5	7.5	7.5	5	264	268.4
5	7.5	7.5	7.5	8	8	7.5	8	7.5	7.5	7.5	8	8	7.5	7.5	7.5	7.5	5	265	269.3
5	7.5	7.5	7.5	8	8	7.5	8	7.5	7.5	7.5	8	8	7.5	7.5	8	7.5	5	266	270.2
5	7.5	8	7.5	8	8	7.5	8	7.5	7.5	7.5	8	8	7.5	7.5	8	7.5	5	267	271.1
5	7.5	8	7.5	8	8	7.5	8	7.5	8	7.5	8	8	7.5	7.5	8	7.5	5	268	272.0
5	7.5	8	7.5	8	8	7.5	8	7.5	8	7.5	8	8	7.5	8	8	7.5	5	269	273.0
5	7.5	8	8	8	8	7.5	8	7.5	8	7.5	8	8	7.5	8	8	7.5	5	270	273.9
5	7.5	8	8	8	8	7.5	8	7.5	8	7.5	8	8	8	8	8	7.5	5	271	274.8
5	7.5	8	8	8	8	8	8	7.5	8	7.5	8	8	8	8	8	7.5	5	272	275.7
5	7.5	8	8	8	8	8	8	7.5	8	8	8	8	8	8	8	7.5	5	273	276.6
5	7.5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7.5	5	274	277.5
5	7.5	8	8	8.5	8	8	8	8	8	8	8	8	8	8	8	7.5	5	275	278.4
5	7.5	8	8	8.5	8	8	8	8	8	8	8	8.5	8	8	8	7.5	5	276	279.3
5	7.5	8	8	8.5	8	8	8	8	8	8	8.5	8.5	8	8	8	7.5	5	277	280.2
5	7.5	8	8	8.5	8.5	8	8	8	8	8	8.5	8.5	8	8	8	7.5	5	278	281.0
5	7.5	8	8	8.5	8.5	8	8.5	8	8	8	8.5	8.5	8	8	8	7.5	5	279	281.9
5	7.5	8	8	8.5	8.5	8	8.5	8	8	8	8.5	8.5	8	8	8	8	5	280	282.8
5	8	8	8	8.5	8.5	8	8.5	8	8	8	8.5	8.5	8	8	8	8	5	281	283.7
5	8	8	8	8.5	8.5	8	8.5	8	8	8	8.5	8.5	8	8	8.5	8	5	282	284.6
5	8	8.5	8	8.5	8.5	8	8.5	8	8	8	8.5	8.5	8	8	8.5	8	5	283	285.5

Table BON-15 (cont). Spill patterns for Bonneville Dam.

Spillway Bay Number																		stops	FB=74.0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	ft.	Kcfs
vertical gate opening (ft.)																			
5	8	8.5	8	8.5	8.5	8	8.5	8	8.5	8	8.5	8.5	8	8	8.5	8	5	284	286.4
5	8	8.5	8	8.5	8.5	8	8.5	8	8.5	8	8.5	8.5	8	8.5	8.5	8	5	285	287.3
5	8	8.5	8.5	8.5	8.5	8	8.5	8	8.5	8	8.5	8.5	8	8.5	8.5	8	5	286	288.2
5	8	8.5	8.5	8.5	8.5	8	8.5	8	8.5	8	8.5	8.5	8.5	8.5	8.5	8	5	287	289.1
5	8	8.5	8.5	8.5	8.5	8.5	8.5	8	8.5	8	8.5	8.5	8.5	8.5	8.5	8	5	288	290.0
5	8	8.5	8.5	8.5	8.5	8.5	8.5	8	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8	5	289	290.9
5	8	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8	5	290	291.8
5	8	8.5	8.5	9	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8	5	291	292.7
5	8	8.5	8.5	9	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	8.5	8.5	8.5	8	5	292	293.6
5	8	8.5	8.5	9	8.5	8.5	8.5	8.5	8.5	8.5	9	9	8.5	8.5	8.5	8	5	293	294.4
5	8	8.5	8.5	9	9	8.5	8.5	8.5	8.5	8.5	9	9	8.5	8.5	8.5	8	5	294	295.3
5	8	8.5	8.5	9	9	8.5	9	8.5	8.5	8.5	9	9	8.5	8.5	8.5	8	5	295	296.2
5	8	8.5	8.5	9	9	8.5	9	8.5	8.5	8.5	9	9	8.5	8.5	8.5	8.5	5	296	297.1
5	8	8.5	8.5	9	9	8.5	9	8.5	8.5	8.5	9	9	8.5	8.5	9	8.5	5	297	298.0
5	8	9	8.5	9	9	8.5	9	8.5	8.5	8.5	9	9	8.5	8.5	9	8.5	5	298	298.9
5	8	9	8.5	9	9	8.5	9	8.5	9	8.5	9	9	8.5	8.5	9	8.5	5	299	299.8
5	8	9	8.5	9	9	8.5	9	8.5	9	8.5	9	9	8.5	9	9	8.5	5	300	300.7

SECTION 3

THE DALLES DAM

The Dalles Dam

1. Fish Passage Information. The locations of fish passage facilities at The Dalles Dam are shown on Figures TDA-1 through TDA-3. Dates for project operations for fish purposes and special operations are listed in Table TDA-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Turbine units at The Dalles Dam are not screened. Juvenile fish passage consists of the ice and trash sluiceway and one 6”-orifice in each gatewell. The ice and trash sluiceway is a rectangular channel extending along the total length of the 22-unit powerhouse and is located in the forebay side of the powerhouse. Gatewell orifices allow flow into the sluiceway, providing a potential means of passing fish from the gatewells to the sluiceway. When any of the sluiceway gates (located in the forebay side of the sluiceway) are opened, water and juvenile migrants are skimmed from the forebay into the sluiceway and deposited in the tailrace downstream of the project.

1.1.2. Juvenile Migration Timing. The primary juvenile fish passage period at The Dalles Dam is April through November. Currently juvenile migration timing is monitored by PSMFC at John Day Dam. Table JDA-2 in section 4 of the FPP reports data from 1994 to 2003. Since no juvenile monitoring is done at The Dalles Dam, refer to this table, and add approximately 1 day to the dates reported for each species to estimate juvenile fish arrival at The Dalles.

Diel passage at The Dalles sluiceway is affected by spill and flow conditions. In years of consistently high flow and spill, fish may be distributed higher in the water column and daytime passage may increase.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. Adult fish passage facilities at The Dalles Dam are composed of a north shore fish ladder, which passes fish collected at the north end of the spillway, and an east fish ladder that passes those fish collected at the south end of the spillway and across the downstream face of the powerhouse.

A small hydropower facility, utilizing the north fishway ladder auxiliary water supply, was constructed in 1991 and is operated by the North Wasco PUD. Adult fishway criteria associated with this facility are monitored and maintained during

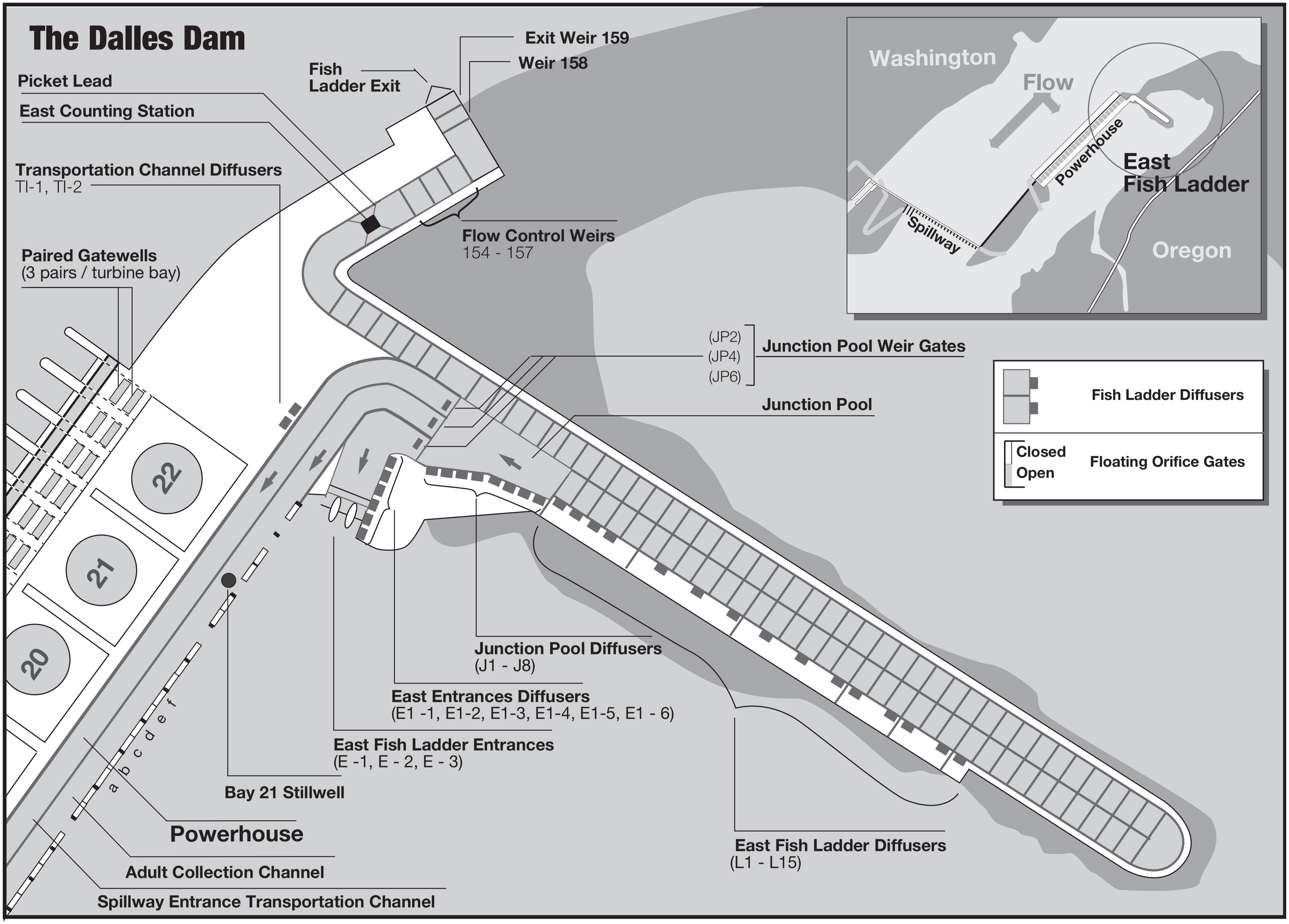


Figure TDA-1 The Dalles Dam east fish ladder.

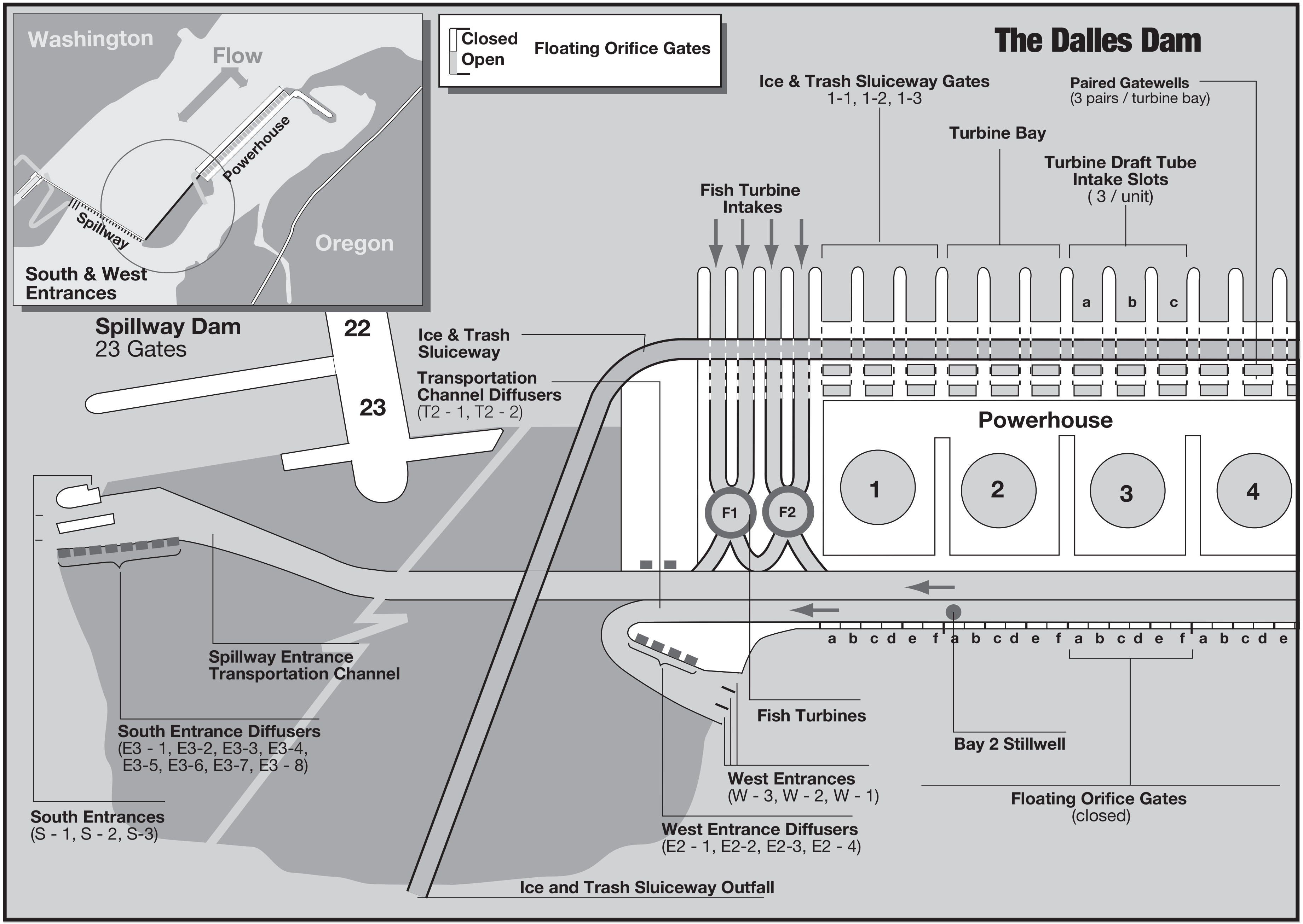


Figure TDA-2 The Dalles Dam south and west fish ladder entrances.

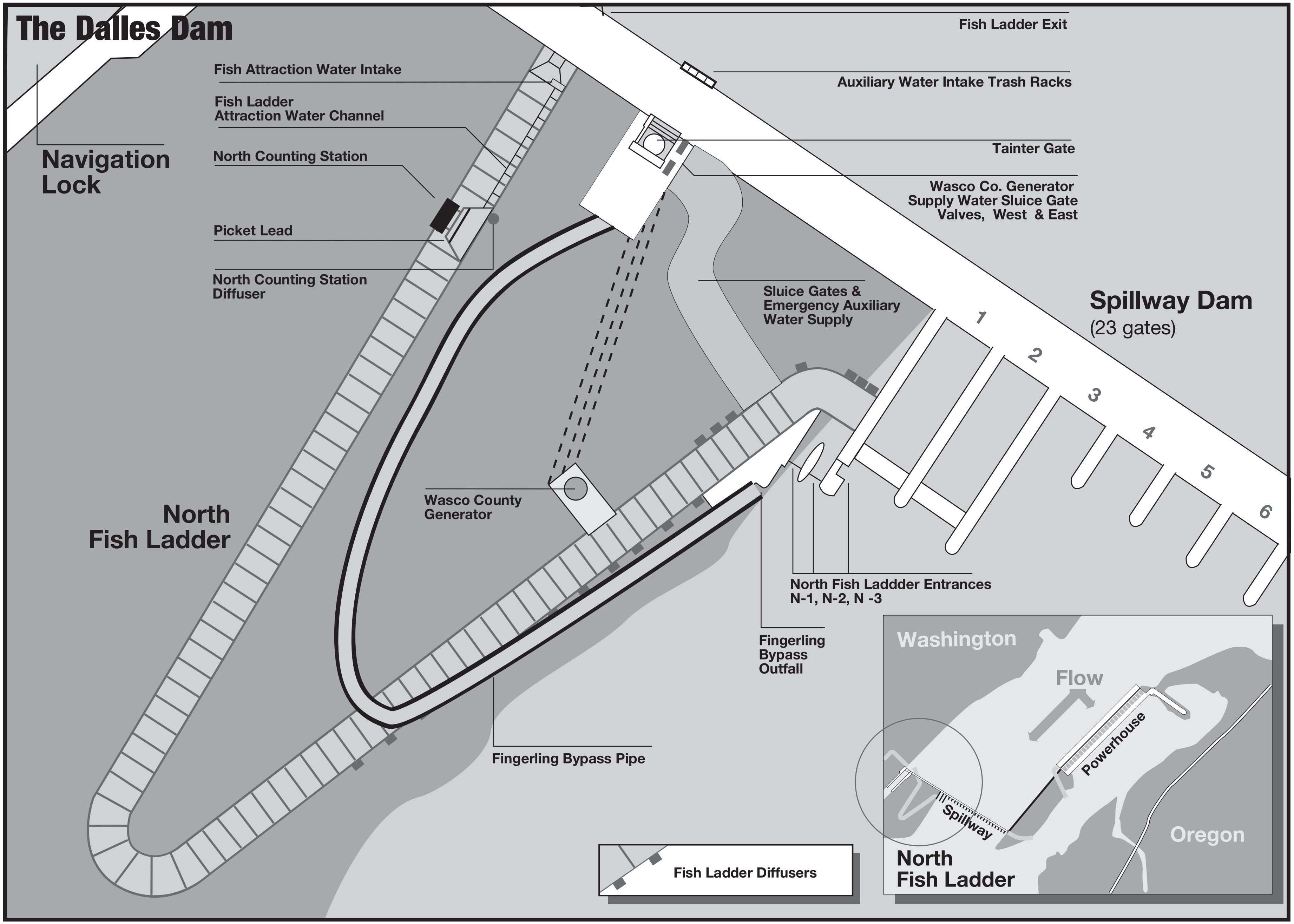
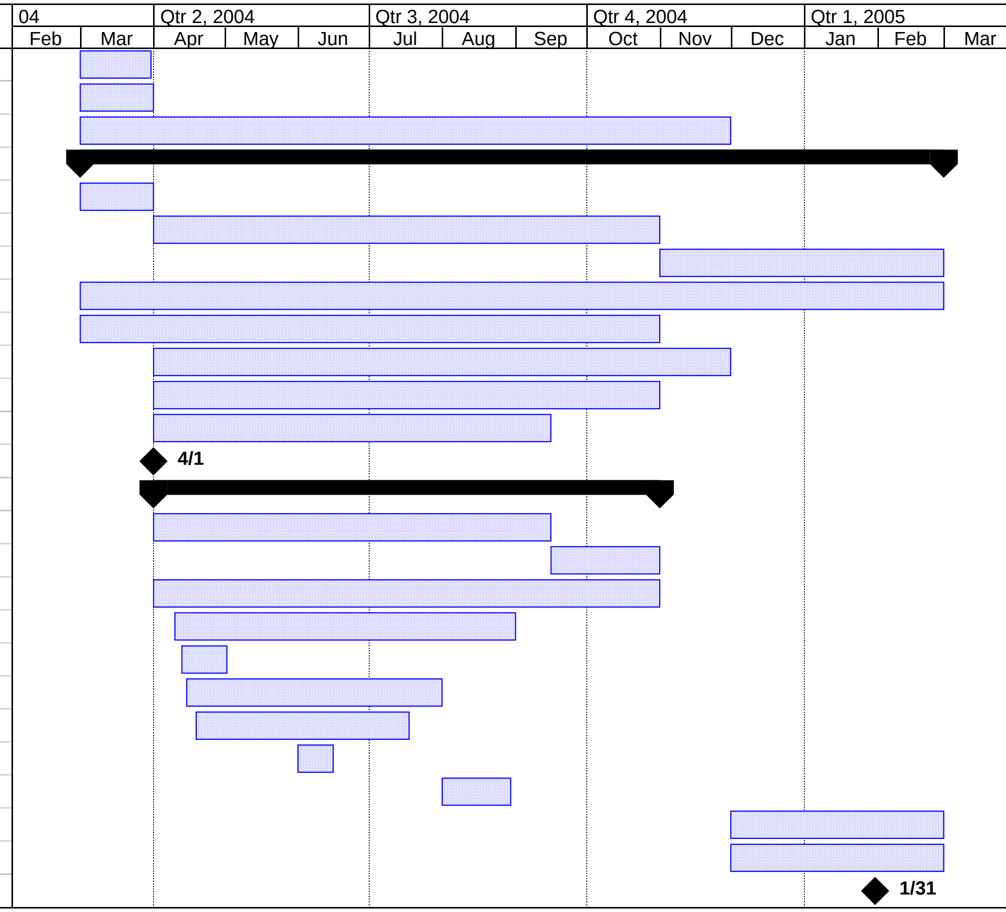


Figure TDA-3 The Dalles Dam north fish ladder and spillway.

Table TDA-1. Dates of project operations for fish purposes at The Dalles, 2004

Task Name	Start	Finish	FPP Reference
Juvenile Fish Maintenance Season	3/1/04	3/31/04	Tda 2.4.1.1
Equipment Installation	3/1/04	3/31/04	App A Tda 2.6
Adult Fish Passage Period	3/1/04	11/30/04	Tda 2.5.1.2
1% limitations	**3/1/04**	**2/28/05**	**Tda 4.4**
1% soft	3/1/04	3/31/04	Tda 4.4
1% hard	4/1/04	10/31/04	Tda 4.4
1% soft	11/1/04	2/28/05	Tda 4.4
Weekly Reports	3/1/04	2/28/05	Tda 2.6
Adult Sturgeon Eval	3/1/04	10/31/04	App A Tda 2.5
Juvenile Passage Period	4/1/04	11/30/04	Tda 1.1.2
Adult Fish Counting (Visual 0400 -2000) pst	4/1/04	10/31/04	Tda 1.2.2
TDG Monitoring	4/1/04	9/15/04	App D Phase 2
Avian Abatement in Place	4/1/04	4/1/04	Tda 2.4.1.1 e
Operate Ice and Trash Chute	**4/1/04**	**10/31/04**	**Tda 2.4.1.2 e**
24 hours a day	4/1/04	9/15/04	Tda 2.4.1.2 e
Daytime Hours	9/16/04	10/31/04	Tda 2.4.1.2 e
Adult Salmon & Steelhead Eval	4/1/04	10/31/04	App A Tda 2.4
Spill for Fish	4/10/04	8/31/04	App A Tda 1.1
Spillwall Post Const Eval	4/13/04	5/1/04	App A Tda 2.1
FPE Eval & Forebay Approach Eval	4/15/04	7/31/04	App A Tda 2.2
Sluice Operation Eval	4/19/04	7/17/04	App A Tda 2.3
Rake Trash Racks Again	6/1/04	6/15/04	Tda 2.4.1.2 a
Equipment Removal	8/1/04	8/30/04	App A Tda 2.6
Winter Maintenance Adult Facilities	12/1/04	2/28/05	Tda 1.2.2
Juvenile Fish Maintenance Season	12/1/04	2/28/05	Tda 2.4.1.1
Annual Report	1/31/05	1/31/05	Tda 2.6



the daily fishway inspections. A backup auxiliary water supply system, unscreened for juveniles has been upgraded to facilitate its use if required.

1.2.2. Adult Migration Timing. Upstream migrants are present at The Dalles Dam throughout the year. However, passage through the winter months is relatively light and there is no fish counting. The adult fish counting schedule is shown in Table TDA-2. Annual winter maintenance of adult fish facilities is scheduled from December 1 through February (in-water work period) to minimize impacts on upstream migrants. Table TDA-3 shows the passage period by species and the earliest and latest recorded dates of peak passage since 1957.

Table TDA-2. Adult fish counting schedule at The Dalles Dam.

Period	Counting Method
April 1 – October 31	Visual count 0400-2000 PST
November 1 – March 31	No Counting

Table TDA-3. The Dalles Dam adult migration timing, 1957-2003.

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/3	4/13	5/13
Summer Chinook	6/4 - 8/3	6/6	8/1
Fall Chinook	8/4 – 10/31	9/2	9/16
Sockeye	4/1 – 10/31	6/20	7/10
Steelhead	4/1 – 10/31	7/9	9/22
Coho	4/1 – 10/31	9/3	10/25

2. Project Operation.

2.1. General.

2.1.1. Research, non-routine maintenance, other fish related activities, and construction activities will not be conducted within 100' of any fishway entrance or exit, or within 50' of any other part of the adult fishway, or directly in, above, or adjacent to any fishway, unless coordinated by the project with regional fish managers through ESA and other fish passage forums. Currently coordinated special operations are described in Appendix A. Alternate actions will be considered by district and project biologists in conjunction with the fish managers on a case by case basis. Emergency situations should be dealt with immediately by the project in coordination with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident. All activities within the boat-restricted zone (BRZ) will be coordinated at least 2 weeks in advance with the project, unless it is deemed an emergency.

2.2. Spill Management. The spill schedules contained the spreadsheet titled “TDASpillPatterns04.xls” will be utilized to provide spill for juvenile fish passage in 2004. A summary of the spill patterns is provided in Table TDA-5 at the end of this section.

2.3. Total Dissolved Gas Management and Control. Additional spill management will be based on total dissolved gas (TDG) monitoring data and the observed condition of migrant juvenile and adult fish, along with juvenile migration data. The Corps will monitor TDG at The Dalles Dam forebay and tailrace. Data from automated stations will be reported every four hours from April 1 until September 15. The TDG monitoring system is described in detail in Appendix D.

Excessive TDG levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by Reservoir Control Center (RCC), nighttime or daytime spill limits, and shaping of spill discharge.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria.

2.4.1.1. Winter Maintenance Season (Preparation for Juvenile Passage Season) (December 1 through March).

a. With the use of an ROV, inspect trashracks and main unit intakes, and if necessary, remove debris from forebay, trashracks, gatewell slots, and gatewell orifices such that these areas are free of debris on April 1.

b. Inspect, lubricate, and test hoist-operated chain gates, end gates, and hoists for operation as needed.

c. Inspect and correct any epoxy or concrete deficiencies on the ice and trash sluiceway walls and floors, where accessible.

d. Inspect and, where necessary, repair spill gates and control systems. The spillway, except for coordinated changes, must be able to achieve spill patterns on April 1.

e. Reinstall or repair avian predator control lines in the present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Avian abatement measures shall be in place by April 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as the weather permits after that date. However, there will be no avian abatement measures, other than avian lines, performed from September through March each year.

f. The results of all inspections and the readiness of the facility for operation will be reported to the FPOM immediately prior to the juvenile fish passage season.

2.4.1.2. Juvenile Fish Passage Season (April 1 through November).

a. Measure gatewell drawdown a minimum of once per week, and more frequently, three times per week or more, as needed during high debris periods. Clean trashracks as flow conditions dictate, or when drawdown in gatewell slots exceeds 1.5’'. Rake trashracks in front of turbine units FU-1 through at least main unit 5 again between June 1 and June 15. All trashracks can be raked using the Hammerhead crane that has been repaired.

b. Remove debris from the forebay as needed by operating sluiceway.

c. Inspect all gatewells daily. The project will clean gatewells before the gatewell water surface becomes half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces at least clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fish measures, and then only on a last on/first off basis.

d. Project maintenance will permanently close the gate slot orifices as the unit intakes are serviced over the next few years, utilizing orifice plates as covers.

e. Operate ice and trash sluiceway gates 1-1, 1-2, and 1-3. The ice and trash sluiceway will be operated on a 24-hour basis April 1 through September 15. During September 16 through the end of October, operate the sluiceway during daytime hours with skimmer gates in place. From December 1 through the end of February, put the ITS on seal (do not operate). In addition, per January 2004 FPOM agreement, during November 2004 and the winter maintenance season, the ITS will not be operated. During periods when gates do not operate, set the top of the bottom end gate at elevation 142' to create an orifice plunge pool.

f. Once each week, and more frequently if accumulations of debris are observed in the sluiceway, close gates 1-1, 1-2, and 1-3, and open gates 17-3, 18-1, and 18-2 for 30 minutes to flush debris and fish being held in the sluiceway channel east of unit 1. When units are being dewatered, set top of bottom end gate at elevation 142' to create an orifice plunge pool, and install orifice blocker. After orifice-sealing devices are installed, end gate should be returned to its original elevation of 161' msl during the juvenile passage season.

g. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in coordination with FPOM. Regardless of unit operating status, oil accumulations will be dealt with promptly.

h. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary from April through August only.

i. During chain gate operation, maintain forebay level above elevation 158′ to the extent practicable. Management of this operation will maintain a tailwater elevation of 158′ or greater at John Day Dam to assure adequate adult fishway entrance and collection facility operation at John Day.

j. Inspect facilities three times each day.

k. Follow the schedule in Table TDA-5 for spill. This schedule was developed for juvenile fish passage.

2.4.1.3. Winter Maintenance Season (December 1 through March).

a. November 1 through February (per January 2004 FPOM agreement), discontinue operation of the Ice-Trash Sluiceway on a 24 hour basis. Close endgate, and open sluicegates 1-1 and 17-3 to allow fish egress from the ITS that has equalized with the forebay.

b. During March, set top of bottom endgate at elevation 142’ to create an orifice plunge pool. Maintain orifices clear of debris.

c. During March, inspect operating facilities once per day by project fish staff.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Winter Maintenance Season (Preparation for Adult Passage Season) (December 1 through February).

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

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices that could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for, and when necessary, clear debris from the ladder exits.

d. Reinstall picket leads at counting stations prior to watering up the ladders during maintenance, and ensure the leads are properly seated.

e. The results of all inspections and the readiness of the facilities for operation will be reported at the Fish Passage O & M Coordination Team (FPOM) meeting immediately prior to the passage season.

2.5.1.2. Adult Fish Passage Period (March 1 through November).

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1.0’ +/- 0.1'. During the shad passage season (> 5000 shad/count station/day): 1.3’ +/- 0.1’. (See 2.5.1.2.b.2. and 3. for an exception).

2. Water temperatures will be measured in each adult fishway and station service penstock. Temperatures will be recorded in the fishway status report. When water temperature reaches 70º F, all fish handling activities will be coordinated through FPOM prior to any action to verify protocols that will be followed.

3. Head on all entrances: 1' to 2' (1.5′ optimum). Refer to paragraph 3.3.1., Routine Maintenance, when unable to achieve head criteria.

4. A water velocity of 1.5 to 4 fps (2 fps optimum) shall be maintained for the full length of the powerhouse collection channel and the lower ends of the fish ladders that are below the tailwater. Water velocities will be measured directly and monitored during fishway inspections to verify channels are operating within velocity criteria.

5. Remove debris as required to maintain head below 0.5' on attraction water intakes and trash racks at all the ladder exits, with a 0.3' maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Necessary staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period and calibration checked weekly. Instruments will be recalibrated ASAP if out of calibration.

7. Main entrance weir depths: 8' or greater below tailwater. Maintain a minimum tailwater at 70' msl to remain in entrance weir criteria operating range

8. Count station crowders shall remain in the operating position while visual counting and/or video-taping is being conducted. The crowder shall be closed to allow the count slot width to be no less than 18". This will usually occur during high turbidity conditions to allow count accuracy criteria to be achieved. If passage is impaired by this condition, the count slot may be widened until proper passage conditions are achieved, even though count accuracy may be compromised to some degree. Project biologists, FFU, and fish counters shall coordinate to achieve optimum count slot passage and/or count accuracy conditions. The crowder shall remain fully open during hours that no fish counting is performed. Leave fish passage slot lighted overnight.

9. Inspect facilities three times each day.

10. Inspect and ensure that optimum passage conditions are maintained at fishway entrances, exits, and count slots.

b. East Fishway.

1. Removable weirs #154 -#157 will drop into the ladder at a differential (water surface at respective weir location relative to the forebay) of 2.5' +/- 0.1'.

2. Telescoping weir #159 will adjust to maintain 1.2 +/- 0.1' depth over the weirs, measured below the counting station.

3. Telescoping weir #158 will track 1' +/- 0.1' below weir #159 at all times during fishway operation.

c. North Fishway Entrance. Operate one entrance weir, N1 or N2 regardless of spill. Entrance weirs shall be operated only by project fish biologists when in manual control. If the Wasco County PUD operates entrance weirs in automatic control, they shall be required to keep them within established fishway criteria.

d. Powerhouse.

1. West Powerhouse Entrance: Operate entrance weirs (W1 and W2).

2. East Powerhouse Entrance: Operate entrance weirs E2 and E3 to maintain gate crest at >8′ below tailwater. Set E1 with the gate crest at 81' msl.

3. Operate east ladder junction pool weirs at the following minimum depths in relation to east entrance tailwater surface elevation:

JP2..........................12'
JP4..........................10'
JP6...........................7'

4. South Spillway Entrance: Operate entrance weirs S1 and S2 to maintain gate crest at 8′ or greater below tailwater.

5. Discharge from the two operating fish units will be adjusted to maintain criteria at all associated fishway entrances. Discharge should be no less than 4300 cfs total.

2.5.1.3. Winter Maintenance Season (In-water Work Period) (December 1 through February).

a. Operate the powerhouse and south spillway adult fish passage facilities according to the fish passage period standards above except the system may be dewatered or operated out of criteria for repair and maintenance. Adjust the counting station fish crowder to full open and rotate picket leads to the open position at the counting station at the end of the counting season.

b. Operate the north fishway adult fish passage facilities according to fish passage season standards listed above, except the system may be dewatered or operated out of criteria for repair and maintenance. Adjust the counting station fish crowder to full open and pull picket leads at counting station at the end of the counting season.

c. Only one of the two adult fish facilities may be out of service at any one time unless specially coordinated. The operating facility will be able to be operated at full fish passage season criteria unless specially coordinated. Outage periods will be minimized to the extent practicable.

d. Inspect operating facilities once per day by project fish staff.

2.6. Facility Monitoring and Reporting. Project staff shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Additional fishway inspections may be performed by FFU and/or fisheries agencies. The project fish biologist and fish biological staff shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; and any unusual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and shall be sent to CENWP-OP and other interested parties as soon as possible the following week, with a copy to RCC, Attention: Fish Team. The project biologist shall prepare an annual report by January 31, summarizing the operation of the project fish passage facilities for the previous year. The report will cover from the beginning of one adult fish facility winter maintenance season to the beginning of the next. The annual report also will include a description of all action taken to discourage avian predation at the project, with an overview of the effectiveness of the activities in discouraging avian predation. The annual report will be provided to CENWP-OP in time for distribution to FPOM members at the February meeting.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Routine Maintenance.

3.1.1.1. Staff gauges will be installed, cleaned, and/or repaired as required.

3.1.1.2. A zebra mussel monitoring program will continue. This includes veliger (free-swimming juvenile life-stage) sampling, colonization sample units, and dewatering inspections. These organisms have become a serious problem elsewhere in the country and may become introduced into the Columbia River basin.

3.1.1.3. Routine fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest to minimize impacts to migrating salmonids. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (paragraph 2.6).

3.2. Juvenile Fish Passage Facilities.

3.2.1. Routine Maintenance.

3.2.1.1. Collection and Transportation Systems. The Dalles Dam ice and trash sluiceway will receive preventive maintenance throughout the year. During the juvenile fish passage season, this will normally be above-water work, such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period, the systems are dewatered downstream of the gatewell orifices. The system is then visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problem areas identified are repaired and modifications to the channel and general maintenance are completed. The trash racks are raked if necessary as determined by ROV inspection just prior to the juvenile fish passage season (April 1), between June 1 and June 15, and whenever trash accumulations are suspected because of increased head across the trash racks.

3.2.1.2. Turbines and Spillways. Maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see section 5. Dewatering Plans.) The schedule for this maintenance is reviewed by the project and district biologists and coordinated within NWP, NWD, BPA, and among fish agencies and tribes through the FPOM. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the fishway entrance areas. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power, and water management, and will be coordinated with the appropriate resource agencies. No other fish related restrictions regarding maintenance will be placed on any units at this project, except to coordinate research activities. Some types of turbine maintenance will require testing operation of the turbine throughout its full range before returning it to normal service. Units which should receive low priority for scheduling maintenance during the fish passage season are F1, F2, 1, 2, 3, 4 (during ice and trash sluiceway operation).

3.2.2. Non-Routine Maintenance. Maintenance of all fish related facilities will be carried out as described below. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA (through the FPC) and NOAA Fisheries on a case-by-case basis by project and CENWP-OP biologists. The CENWP-OP biologists will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Operations Manager has the authority to initiate work prior to notifying CENWP-OP when delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWP-OP 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.

3.2.2.1. Collection and Transportation Systems. The ice and trash sluiceway is now being used as a juvenile bypass system.

a. The chain gates are fully opened during normal operation. If a chain gate fails, an adjacent gate can be operated until repairs can be made.

b. Inspect all gatewells daily. The project will clean gatewells before the gatewell water surface becomes half covered with debris. If due, to the volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except on a last on/first off basis, if required to be in compliance with other coordinated fish measures. This is to maintain clean orifices and minimize fish injury.

c. If a gate hoist fails, it will be repaired promptly. The gate will be removed when there are problems with the seal and the difficulty cannot be repaired promptly. If the epoxy-lined section of the sluiceway is damaged, it will be repaired.

3.2.2.2. Turbines and Spillways- Spill Gate Failure. If a spill gate becomes inoperable, the operators will make the changes necessary to accommodate the spill and then immediately notify the Operations supervisor and the project biologist to determine the best pattern to follow until repairs can be made. This interim operation shall be coordinated with the FPOM through the district biologist, who will, depending on coordination, provide additional guidance to the project.

3.3. Adult Fish Passage Facilities.

3.3.1. Routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (paragraph 2.6).

3.3.1.1. Fishway Auxiliary Water Systems. The Dalles Project fishway auxiliary water is provided by discharge from hydroelectric turbine systems. Preventive maintenance and normal repair occur throughout the year. Trashracks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trashracks during the time of day when fish passage is least affected.

3.3.1.2. Powerhouse and Spillway Adult Collection Systems. Preventive maintenance and repair occurs throughout the year. During the adult fish passage season the maintenance will not involve any operations that will cause a failure to comply with the fishway criteria, unless specially coordinated. Inspection of those parts of the adult collection channel systems, such as diffusion gratings, picket leads, and entrance gates, will be scheduled once per year during the winter maintenance season while the system is dewatered. An additional inspection during the fish passage season with the system watered up will also be conducted (see section 5. Dewatering Plans.). A diver or underwater video system may be used for underwater inspections. This scheduled inspection and any associated maintenance will occur during the winter maintenance period (in-water work period), unless specially coordinated. Any non-routine maintenance and fishway modification will be handled on a case-by-case basis.

The project fish biologist or alternate Corps fish personnel will attend all dewatering activities potentially involving fish, as well as inspections to provide fish input (see section 5.).

3.3.1.3. Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year during the winter maintenance period. Unless specially coordinated, only one ladder will be dewatered at a time, with the other ladder capable of operating within criteria. During this time, the ladders are inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffuser valves, ladder orifice reduction plates, malfunctioning equipment at the counting stations, and other potential problems. Problems identified throughout the passage year that do not affect fish passage, as well as those identified during the dewatered period are then repaired. Trashracks at the ladder exits will be raked when criteria are exceeded. When practicable, rake trashracks during the time of day when fish passage is least affected. Fish count station windows will be cleaned when necessary, and when practicable, during the time of day when fish passage is least affected.

3.3.2. Non-Routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6). Non-routine maintenance that will significantly affect the operation of a facility, such as repair of displaced diffuser gratings, will be coordinated with the Region, including NOAA Fisheries, through FPOM. Coordination procedures for non-routine maintenance of adult facilities are the same as for juvenile facilities (paragraph 3.2.2).

3.3.2.1. Fishway Auxiliary Water Systems. Most fishway auxiliary water systems operate automatically. If the automatic system fails, the system will be manually operated by the project personnel. This will allow the fish facility to operate according to criteria while the automatic system is repaired. When this operation becomes necessary, project personnel will increase surveillance on the adult system to ensure that criteria are being met. In the event of AWS failure, FPOM will work with the project to determine the best operating procedure.

a. Powerhouse. If one of the two fishway auxiliary water turbines fails or malfunctions use the following sequential procedure until a fishway entrance head of 1' is achieved:

1. Increase discharge of remaining operating fish unit to maximum operating capacity.

2. Raise entrance weir E2 and E3 to 8′ depth.

3. Close entrance weir S1.

4. Close entrance weir S2 in 1′ increments.

5. Close entrance weir W2 in 1′ increments.

6. Close entrance weir W1 in 1′ increments.

7. Differentials for open entrances should be checked between each of the above steps.

c. If both of the fishway auxiliary water turbines fail or malfunction, regardless of fish passage season, the adult fish passage facility will be operated as follows:

1. Close south entrance.

2. Close west entrance.

3. Close entrance weir E1 and E2 and keep E3 at 6′ depth.

d. North Ladder. If the North Wasco County power unit auxiliary water system fails, the backup auxiliary water system will be started and the system operated at criteria. If the backup auxiliary water system fails, N1 will remain open with a weir depth of 6' below the tailwater surface.

3.3.2.2. Powerhouse and Spillway Adult Fish Collection Systems. The Dalles Dam contains several types of fishway entrances. In most cases, if failures occur, the entrance will be operated manually by project personnel until repairs are made. If this operation becomes necessary, project personnel will increase surveillance on the adult system to ensure criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently, and it will be returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. The ladder structures include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Picket leads with excessive spacing (greater than 1"), erosion of concrete around the picket leads or missing pickets can allow fish into areas where escape is not likely. If picket lead failure or concrete erosion occurs, then the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in coordination with the fish agencies and tribes through the FPOM.

3.3.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passage system and physically inspecting the diffuser gratings, or using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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. 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 FPOM coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Throughout the juvenile fish passage season, either turbine unit 1 or unit 2 or both units will operate during daylight hours unless specially coordinated with FPOM. Operate units 1 and 2 as first-on/last-off in 2004 due to the unavailability of units 3 and 4 from the T3 transformer failure.

4.2. The project turbine unit maintenance schedules will be reviewed by project and district biologists for fish impacts and be coordinated with FPOM.

4.3. Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are shown in Table TDA-4.

4.4. To the extent technically feasible, turbines will be operated within +/- 1% of best turbine efficiency from April 1 through October 31 (as specified in the BPA load shaping guidelines). However, during the rest of the year, the project will continue to operate units within the turbine efficiency range, except as specifically requested by BPA to do otherwise as power requirements demand.

4.5. When it is necessary to operate turbines outside of the 1% efficiency range, the units will be selected according to the following guidance: Units 7 through 14 will be selected first, spacing by at least one unit. For example, assuming they are available to operate, the following sequence might be used: 7, 9, 11, 13, 15, 5, 2, 1, 8, etc. Since each successive unit in this list is thought to pass more fish, this outage priority sequence is intended to have a lower negative impact on fish during turbine unit passage, if units are taken out of service in this order.

4.6. In order to provide favorable fish passage conditions while meeting transmission line needs, the main powerhouse turbine units will operate in the following priority order: Unit 1 then Unit 2 at the west end of the powerhouse, then place every other available unit on line until the east end of the powerhouse is reached. Then go back to the west end of the powerhouse and place the remaining available units on line, from west to east, until all the available units are on line. Reverse the order when reducing load.

5. Dewatering Plans.

5.1. Guidelines for Dewatering and Fish Handling Plans have been developed by the projects and approved by FPOM, and are followed for most project facilities dewaterings. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation.

5.2. The project fish biologist and/or alternate Corps fish personnel will attend all project activities involving fish handling.

5.3. The fish agencies and tribes are encouraged to participate in all ladder dewaterings.

5.4. Adult Fish Ladder.

5.4.1. Routine maintenance.

5.4.1.1. When possible, operate the ladder to be dewatered at a reduced flow for at least 24 hours, but not more than 96 hours prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow.

5.4.1.2. Discontinue all fishway auxiliary water supply at least 24 hours, but no more than 96 hours prior to dewatering.

5.4.1.3. A project biologist will assure that fish rescue equipment is available, and will coordinate to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.4.1.4. Project personnel will install head gates to shut down ladder flow. Where possible, a minimum flow of 1"-2" will be maintained in the ladder until fish are rescued.

5.4.1.5. The project biologist or alternate Corps fish personnel will oversee fish rescue when the ladders are dewatered. The fish are then transported to the forebay or tailwater, depending on the fish life stage (adults to forebay, juveniles to tailrace), for release. If a ladder is dewatered in the spring or summer, steelhead kelts should be released into the tailrace.

5.4.1.6. Orifice blocking devices, with attachment ropes tied to handrails, will be placed in the lower-most weirs to prevent fish from re-ascending the dewatered portion of the adult fishway. These will have clearances placed on them by project operations. Clearances shall be removed just before the fishway is returned to service. This will prevent the orifice blocks from being accidentally left in place after fishway water-up.

The fishway return-to-service checklist is as follows:

a. Remove orifice blocking devices.

b. Activate automation for weir crest depth.

c. Assure all count station lighting is operational.

d. Close count station crowder to desired width (minimum 18”).

e. Close picket leads.

f. Remove all tools, equipment, and debris from inside ladder.

g. Assure all entrance weir automation is operational and activated.

h. Remove all safety clearances by the designated clearance holder.

5.4.2. Non-Routine Maintenance.

5.4.2.1. When possible, discontinue fishway auxiliary water and operate ladder at reduced flow as long as possible (prefer 3-24 hours) prior to dewatering.

5.4.2.2. Follow steps 5.4.1.3. through 5.4.1.5. above.

5.5. Powerhouse Collection System.

5.5.1. Routine Maintenance.

5.5.1.1. During the pumping or draining operation to dewater a portion or all of the collection channel, the water level will not be allowed to drop so low it strands fish. Personnel shall remain present onsite during pumping operations to ensure stranding does not occur or a water level sensor that de-activates the dewatering process will be used.

5.5.1.2. The project biologist will ensure that rescue equipment is available if needed.

5.5.1.3. The project biologist or alternate Corps fish personnel will provide technical guidance on fish safety and will assist directly in rescue operations.

5.6. Turbines.

5.6.1. Gatewells need not be dipped as is required at other projects due to the lack of VBSs. Instead, the following procedure shall be used. The unit will be shut down for at least 24 hours before it is drained. Then, immediately before draining it will be operated at speed/no load briefly to flush fish out of the draft tube.

Table TDA-4. Ranges for turbine operation within 1% of best efficiency at The Dalles Dam.

Head Ft	Units 1-14				Units 15-22			
	Lower Limit MW	Lower Limit cfs	Upper Limit MW	Upper Limit cfs	Lower Limit MW	Lower Limit cfs	Upper Limit MW	Upper Limit cfs
55	35	8,854	44	11,108	39	9,643	49	12,346
56	36	8,875	45	11,147	39	9,554	51	12,402
57	37	8,894	46	11,184	39	9,468	52	12,454
58	38	8,912	47	11,219	40	9,384	53	12,503
59	38	8,929	48	11,252	40	9,302	54	12,548
60	39	8,945	49	11,282	41	9,223	56	12,590
61	40	8,870	51	11,415	42	9,219	57	12,599
62	40	8,798	52	11,543	42	9,215	58	12,607
63	40	8,728	54	11,665	43	9,211	59	12,613
64	41	8,660	55	11,783	44	9,207	60	12,619
65	41	8,593	57	11,896	45	9,202	61	12,624
66	42	8,614	58	11,939	45	9,164	63	12,719
67	43	8,633	59	11,980	46	9,127	64	12,810
68	43	8,652	60	12,019	46	9,091	65	12,899
69	44	8,670	62	12,056	47	9,056	67	12,984
70	45	8,686	63	12,092	47	9,021	68	13,066
71	46	8,693	64	12,111	48	9,019	70	13,168
72	46	8,700	64	12,067	49	9,016	71	13,105
73	47	8,706	65	12,024	49	9,014	71	13,043
74	48	8,712	66	11,982	50	9,011	72	12,983
75	49	8,717	68	12,179	51	9,008	76	13,542
76	49	8,673	69	12,226	51	8,984	78	13,638
77	50	8,629	70	12,270	52	8,960	79	13,731
78	50	8,587	72	12,314	52	8,936	81	13,821
79	50	8,545	73	12,356	53	8,913	83	13,908
80	51	8,505	74	12,396	54	8,891	84	13,993
81	51	8,493	75	12,471	54	8,896	86	14,092
82	52	8,482	77	12,543	55	8,902	88	14,188
83	53	8,471	78	12,613	56	8,908	89	14,283
84	53	8,460	80	12,681	56	8,914	91	14,375
85	54	8,449	81	12,748	57	8,919	92	14,465
86	54	8,441	83	12,833	57	8,898	94	14,564
87	55	8,433	84	12,916	58	8,877	96	14,660
88	55	8,425	86	12,997	58	8,856	97	14,755
89	56	8,417	87	13,076	59	8,836	99	14,848
90	57	8,409	89	13,154	59	8,817	101	14,939
91	57	8,411	90	13,201	60	8,815	102	14,908
92	58	8,414	91	13,248	61	8,813	103	14,878
93	59	8,416	92	13,293	61	8,811	103	14,848
94	59	8,418	94	13,338	62	8,809	104	14,819
95	60	8,420	95	13,381	63	8,808	105	14,790

5.6.2. When possible, place head gates and tail logs immediately after the turbine unit is shut down if the draft tube is to be dewatered. Install bottom two tail logs side-by-side first before stacking the remainder to minimize sturgeon from entering the draft tube before dewatering. This is necessary for both scheduled and unscheduled outages.

5.6.3. If a turbine unit draft tube is to be dewatered and the unit has been idle for any length of time, it will be operated when possible at speed/no load to flush fish. Stop logs will then be placed immediately.

5.6.4. If a turbine unit is idle and partially dewatered, and tail logs are put into place, an adequate safety pool may be maintained for up to 4 days to accommodate fish trapped in the draft tube (If longer timeframes are needed for the safety pool, project fisheries will coordinate with FPOM on a case-by-case basis). Adequate inspections will need to be conducted to ensure the safety pool is maintained and fish are in good condition. Water levels in the draft tube will not be allowed to drop to a level which stresses fish. The appropriate level will be determined by the project biologist.

5.6.5. Fish rescue personnel will inspect dewatered turbine draft tubes and intakes as soon as the water levels reach a depth permitting visual inspection and the hatch cover is opened. The project biologist or alternate Corps fish personnel will provide technical guidance on fish safety, will assure that rescue equipment is available if needed, and will directly participate in fish salvage.

6. Forebay Debris Removal. Debris at projects can impact fish passage conditions. It can plug or block trashracks, 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 a debris problem 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.

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 CENWP-OP at least two work days prior to the day they want the special project operations for spilling to pass debris. CENWP-OP shall coordinate the special operations with RCC and NOAA FISHERIES. Project personnel shall provide CENWP-OP 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.

Table TDA-5. Examples of spill patterns for juvenile fish passage at The Dalles Dam. The full spill patterns are contained in the spreadsheet titled "TDASpillPatterns04.xls". Patterns vary as a function of total river flow, forebay elevation, and tailwater elevation at the spillway stilling basin.

Gate # (Opening in feet)																							Total Feet	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
4																							4	6
4	4																						8	12
6	6																						12	18
		4	4	4	4																		16	24
	4	4	4	4	4																		20	30
4	4	4	4	4	4																		24	36
4.5	4.5	4.5	4.5	4.5	4.5																		27	40.5
5	5	5	5	5	5																		30	45
5.5	5.5	5.5	5.5	5.5	5.5																		33	49.5
6	6	6	6	6	6																		36	54
6.5	6.5	6.5	6.5	6.5	6.5																		39	58.5
7	7	7	7	7	7																		42	63
7.5	7.5	7.5	7.5	7.5	7.5																		45	67.5
8	8	8	8	8	8																		48	72
8.5	8.5	8.5	8.5	8.5	8.5																		51	76.5
9	9	9	9	9	9																		54	81
9.5	9.5	9.5	9.5	9.5	9.5																		57	85.5
10	10	10	10	10	10																		60	90
10.5	10.5	10.5	10.5	10.5	10.5																		63	94.5
11	11	11	11	11	11																		66	99
11.5	11.5	11.5	11.5	11.5	11.5																		69	103.5
12	12	12	12	12	12																		72	108
12.5	12.5	12.5	12.5	12.5	12.5																		75	112.5
13	13	13	13	13	13																		78	117
13.5	13.5	13.5	13.5	13.5	13.5																		81	121.5
14	14	14	14	14	14																		84	126
14	14	14	14	14	14	12																	96	144
14	14	14	14	14	14	12	12																108	162
14	14	14	14	14	14	12	12	12															120	180
14	14	14	14	14	14	12	12	12	12														132	198
14	14	14	14	14	14	12	12	12	12	12													144	216
14	14	14	14	14	14	12	12	12	12	12	12												156	234
14	14	14	14	14	14	12	12	12	12	12	12	12											168	252
14	14	14	14	14	14	12	12	12	12	12	12	12	12										180	270
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12									192	288

Table TDA-5 (cont). Examples of spill patterns for juvenile fish passage at The Dalles Dam. The full spill patterns are contained in the spreadsheet titled "TDASpillPatterns04.xls". Patterns vary as a function of total river flow, forebay elevation, and tailwater elevation at the spillway stilling basin.

Gate # (Opening in feet)																							Total Feet	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12								204	306
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12							216	324
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12						228	342
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12	12					240	360
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12	12	12				252	378
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12			264	396
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12		276	414
14	14	14	14	14	14	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	288	432

SECTION 4

JOHN DAY DAM

John Day Dam

1. Fish Passage Information. The locations of fish passage facilities at John Day Lock and Dam are shown on Figures JDA-1 and JDA-2. Dates for project operations for fish purposes and special operations are listed in Table JDA-1.

1.1. Juvenile Fish Passage

1.1.1 Juvenile Bypass Facilities Description. Juvenile fish bypass facilities at John Day Dam, completed in 1987, with the new SMF completed in 1998, include one vertical barrier screen (VBS), submersible traveling screen (STS) and one 14" diameter orifice per gatewell in each of the project’s 16 turbine units for a total of 48 orifices. The bypass collection conduit leads to a transport channel which carries collected juvenile fish to the river below the dam when the smolt monitoring facility is not in operation (bypass mode). Differential between the forebay and bypass conduit is controlled by the tainter gate, and has a criterion of 4' to 5' (water level in the conduit is measured at unit 16).

1.1.2 Smolt Monitoring Facilities Description. During the juvenile sampling season, flow with collected fish from the JBS is sent over the crest gate and down an elevated chute to the dewatering structure. Most of the flow is dewatered and the remaining water, 30 cfs, is directed to the transport flume and past a switch gate. This gate directs fish to either the sampling building or directly to the outfall (emergency bypass only). Fish diverted for sampling pass a fish and debris separator, where debris and adult fish are directed into a separate discharge flume, leading to the outfall. Juvenile fish are interrogated by PIT tag detectors and are diverted either to the outfall or to the laboratory building for sampling (shown in Figure JDA-1).

1.1.3. Juvenile Migration Timing. Juvenile passage timing has been determined by past gatewell and SMF sampling at John Day Dam (Table JDA-2.) Ongoing research shows that daytime operation shows significant daytime passage (results to date). Smolt monitoring facility operation will be discontinued on September 15 unless there is late season research or special PIT-tagged fish present in the river. Maintenance of juvenile fish facilities is scheduled from approximately December 16 through March 31 to minimize impact on downstream migrants and reduce the possibility of adult fallbacks through turbine units. During this time the juvenile bypass system will be dewatered.

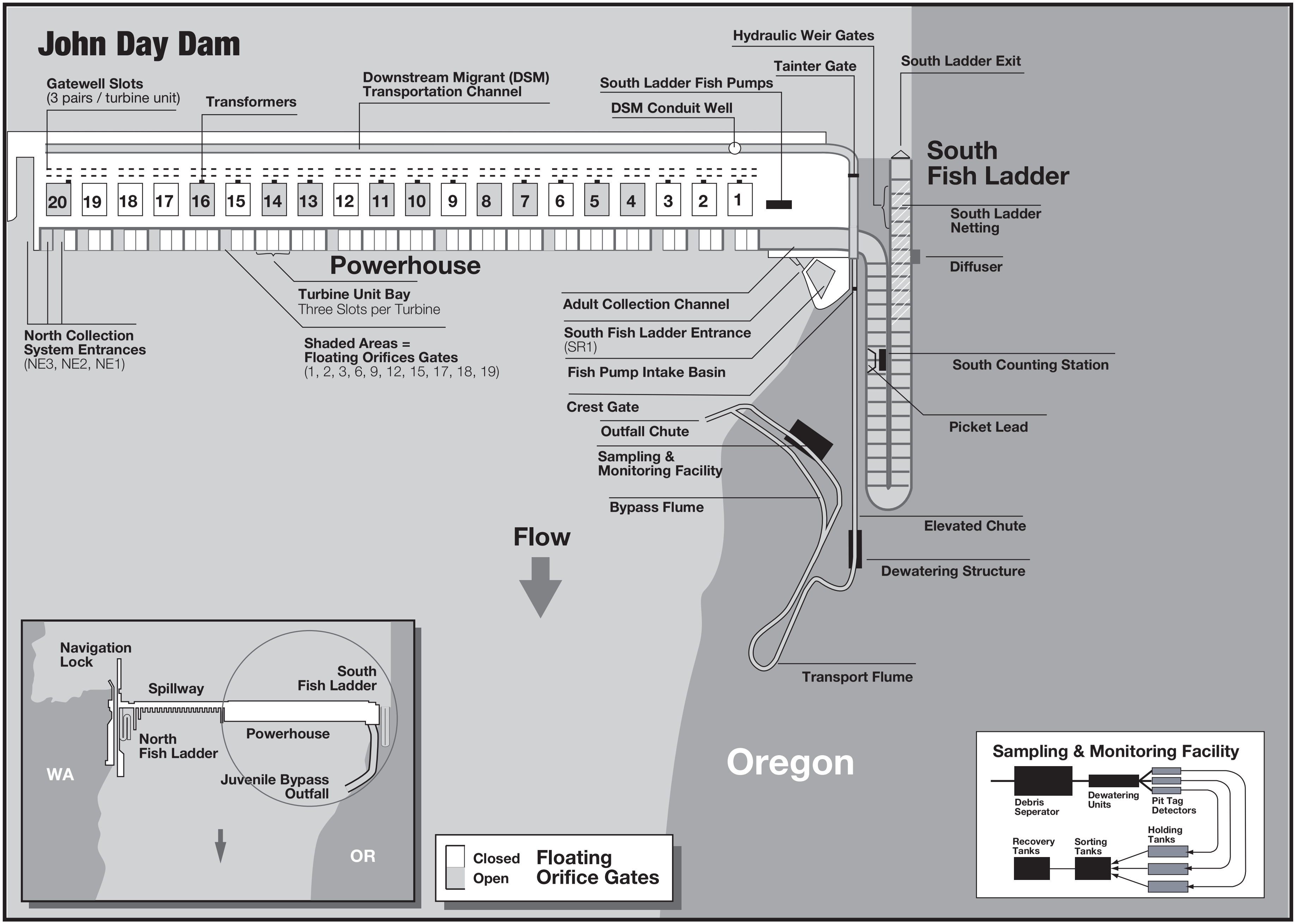


Figure JDA-1 John Day south fish ladder, powerhouse collection system, and juvenile fish bypass system.

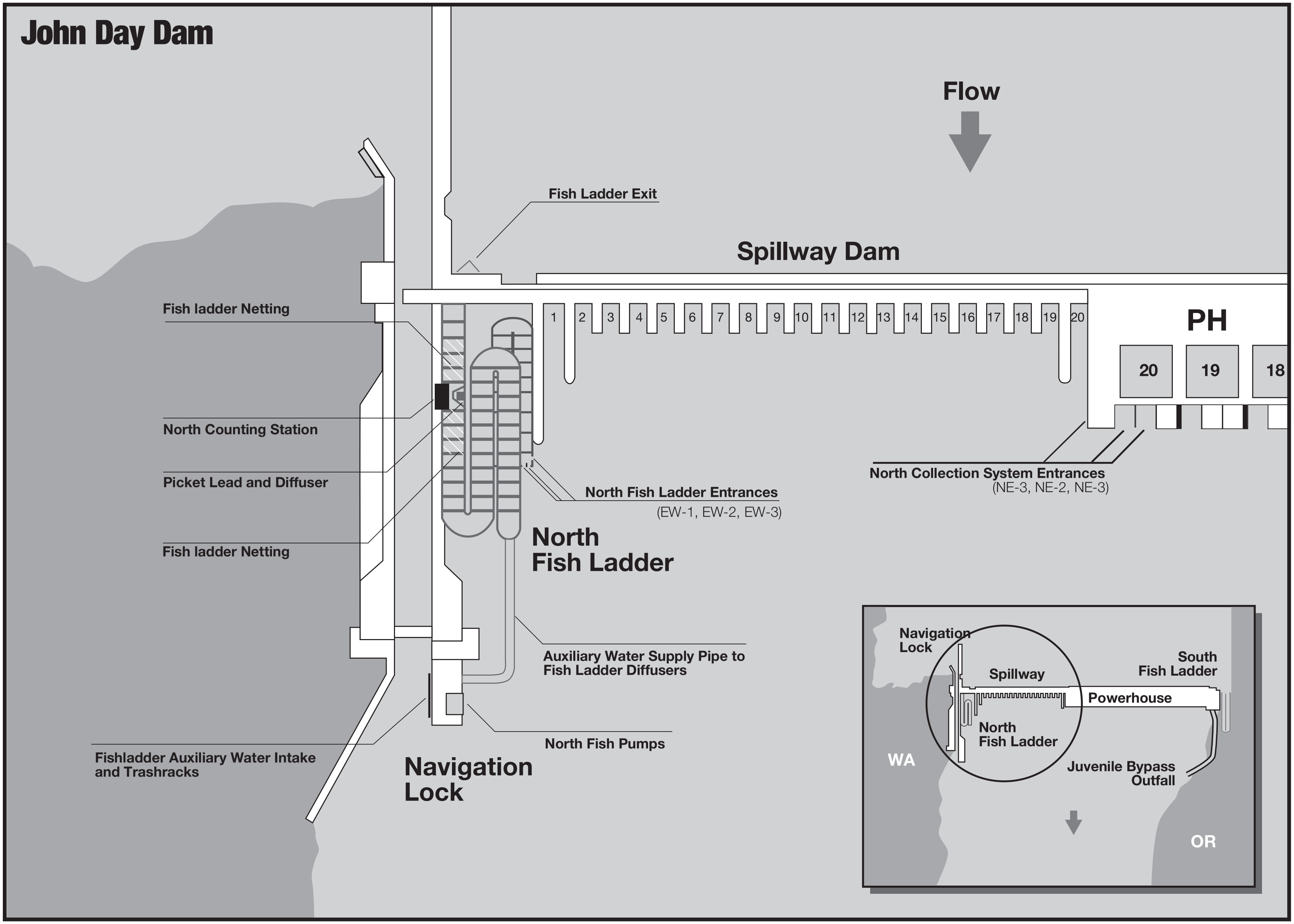
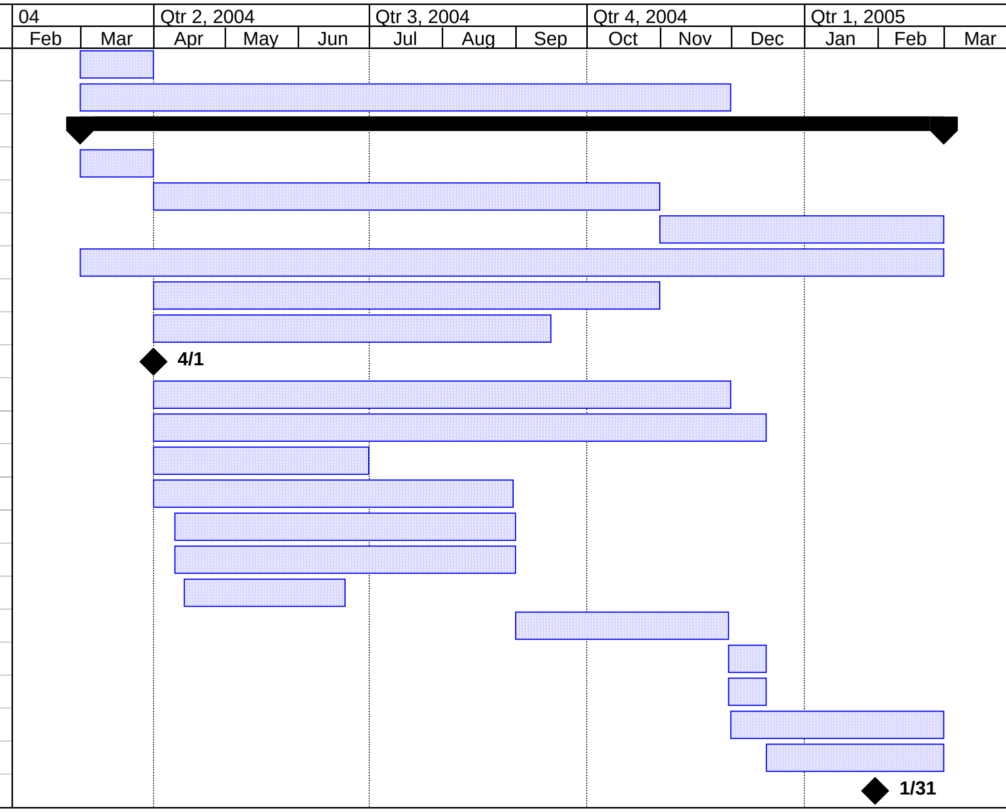


Figure JDA-2 John Day Dam spillway and north fish ladder.

Table JDA-1. Dates of project operations for fish purposes at John Day, 2004

Task Name	Start	Finish	FPP Reference
Maintenance of Juvenile Facilities	3/1/04	3/31/04	Jda 1.1.3
Adult Fish Passage Period	3/1/04	11/30/04	Jda 2.5.1.2
1% limitations	**3/1/04**	**2/28/05**	**Jda 4.1**
1% Soft	3/1/04	3/31/04	Jda 4.1
1% Hard	4/1/04	10/31/04	Jda 4.1
1% Soft	11/1/04	2/28/05	Jda 4.1
Weekly Reports	3/1/04	2/28/05	Jda 2.6
Adult Fish Counting (Visual 0400 - 2000) pst	4/1/04	10/31/04	Jda 1.2.2
TDG Monitoring	4/1/04	9/15/04	App D Phase 2
Avian Abatement in Place	4/1/04	4/1/04	Jda 2.4.1.1 j
Juvenile Fish Passage Season	4/1/04	11/30/04	Jda 2.4.1.2
Operate Gatewell Orifices	4/1/04	12/15/04	Jda 2.4.1.2.g
Special Unit Raking	4/1/04	7/1/04	Jda 2.4.1.2.b
Continue Avian Abatement Measures	4/1/04	8/31/04	Jda 2.4.1.2.I
Adult Passage Evaluations	4/10/04	8/31/04	App A Jda 2.2
Spill for Fish	4/10/04	8/31/04	App A Jda 1.1
ESBS Testing	4/14/04	6/20/04	App A Jda 2.1
Spill Through Bay 2	9/1/04	11/30/04	Jda 2.5.1.2 b 2
Additional DSM Channel Operation	11/30/04	12/15/04	Jda 2.4.1.3 a
Screens Remain in Place	11/30/04	12/15/04	Jda 2.4.1.3 a
Maintenance of Adult Fish Facilities	12/1/04	2/28/05	Jda 1.2.2
Maintenance of Juvenile Facilities	12/16/04	2/28/05	Jda 1.1.3
Annual Report	1/31/05	1/31/05	Jda 2.6



Diel passage was monitored by hydroacoustics and gatewell sampling (see Section 7. Endnotes [a b c d]). Peak passage occurs between 2300 and 2400 hours with a long period of elevated passage until dawn when passage decreases. Passage increases dramatically at dusk (about 2000 hours). Gatewell sampling data indicate that roughly 80% of the juvenile migrants pass John Day Dam between 2100 and 0600 hours. For example, the weighted average passage for subyearling chinook during these hours in

Table JDA-2. John Day 10%, 50%, and 90% juvenile passage dates, 1995 to 2003, with duration of middle 80% in days.

Yearling Chinook	10 %	50%	90 %	# of Days
1985[1]	9-May	20-May	1-Jun	24
1986	19-Apr	14-May	29-May	41
1987	3-May	16-May	1-Jun	30
1988	25-Apr	14-May	1-Jun	38
1989	3-May	16-May	28-May	26
1990	26-Apr	11-May	22-May	27
1991[1]	26-Apr	19-May	7-Jun	43
1992	3-May	20-May	10-Jun	39
1993	6-May	20-May	1-Jun	27
1994	2-May	22-May	18-Jun	48
1995	29-Apr	14-May	19-May	21
1996	21-Apr	8-May	28-May	38
1997	20-Apr	4-May	28-May	39
1998	28-Apr	16-May	2-Jun	36
1999	22-Apr	13-May	31-May	40
2000	20-Apr	9-May	28-May	39
2001	6-May	27-May	20-Jun	46
2002	1-May	17-May	1-Jun	32
2003	3-May	19-May	2-Jun	31
MEDIAN	28-Apr	16-May	1-Jun	35
MIN	19-Apr	4-May	19-May	21
MAX	9-May	27-May	20-Jun	48

Subyearling Chinook	10 %	50%	90 %	# of Days
1985[1]	12-Jul	22-Jul	5-Aug	25
1986	9-Jun	22-Jul	24-Aug	77
1987	7-Jun	23-Jul	18-Sep	104
1988	22-Jun	20-Jul	8-Sep	79
1989	8-Jun	19-Jul	16-Aug	70
1990	19-Jun	30-Jun	2-Aug	45
1991[1]	7-Jun	18-Jul	16-Aug	71
1992	25-Jun	18-Jul	15-Aug	52
1993	21-Jun	10-Jul	17-Aug	58
1994	8-Jul	22-Jul	2-Aug	26
1995	8-Jun	30-Jun	24-Jul	47
1996	12-Jun	9-Jul	19-Aug	69
1997	1-Jun	2-Jul	16-Aug	77
1998	11-Jun	30-Jun	29-Jul	49
1999	18-Jun	29-Jun	25-Jul	38
2000	6-Jun	29-Jun	3-Aug	59
2001	27-Jun	30-Jul	22-Aug	57
2002	20-Jun	30-Jun	20-Jun	31
2003	6-Jun	27-Jun	30-Jul	55
MEDIAN	15-Jun	14-Jul	15-Aug	50
MIN	1-Jun	29-Jun	20-Jul	26
MAX	12-Jul	30-Jul	18-Sep	77

Unclipped Steelhead	10 %	50%	90 %	# of Days
1985[1]	6-May	22-May	4-Jun	30
1986	26-Apr	18-May	4-Jun	40
1987	1-May	16-May	29-May	29
1988	26-Apr	15-May	3-Jun	39
1989	24-Apr	15-May	28-May	35
1990[1, 2]	26-Apr	4-May	18-May	23
1991	29-Apr	19-May	29-May	31
1992	23-Apr	10-May	25-May	33
1993	30-Apr	17-May	26-May	27
1994	27-Apr	19-May	26-May	30
1995	3-May	12-May	25-May	23
1996	24-Apr	13-May	24-May	31
1997	23-Apr	1-May	24-May	32
1998	27-Apr	9-May	29-May	33
1999	26-Apr	23-May	5-Jun	41
2000	18-Apr	5-May	28-May	41
2001	28-Apr	5-May	30-May	33
2002	19-Apr	19-May	8-Jun	51
2003	30-Apr	28-May	4-Jun	36
MEDIAN	26-Apr	15-May	28-May	32
MIN	18-Apr	1-May	18-May	23
MAX	6-May	23-May	5-Jun	51

Clipped Steelhead	10 %	50%	90 %	# of Days
1985[1]	ALL STEELHEAD IN UNCLIPPED			
1986				
1987				
1988				
1989				
1990[1,2]	3-May	14-May	25-May	23
1991	5-May	20-May	30-May	26
1992	8-May	19-May	29-May	22
1993	10-May	18-May	26-May	17
1994	9-May	24-May	1-Jun	24
1995	7-May	18-May	26-May	20
1996	28-Apr	16-May	27-May	30
1997	27-Apr	12-May	26-May	30
1998	4-May	15-May	1-Jun	29
1999	29-Apr	28-May	7-Jun	40
2000	15-Apr	2-May	24-May	40
2001	2-May	17-May	10-Jun	40
2002	24-Apr	14-May	6-Jun	44
2003	2-May	29-May	4-Jun	34
MEDIAN	3-May	17-May	28-May	28
MIN	15-Apr	2-May	24-May	17
MAX	10-May	28-May	10-Jun	44

[1] Years in which the sample unit was out of service (1985: April 2 to April 26; 1990: May 30 to June 9).
[2] Unclipped and clipped steelhead were not differentiated before 1990.

Coho	10 %	50%	90 %	# of Days
1985[1]	7-Jun	16-Jun	26-Jun	20
1986	22-May	29-May	7-Jun	17
1987	6-May	13-May	31-May	26
1988	7-May	13-May	1-Jun	26
1989	28-Apr	13-May	29-May	32
1990[1]	28-Apr	5-May	20-May	23
1991	11-May	22-May	5-Jun	26
1992	3-May	13-May	27-May	25
1993	9-May	17-May	30-May	22
1994	12-May	18-May	29-May	18
1995	8-May	13-May	21-May	14
1996	27-Apr	8-May	21-May	25
1997	30-Apr	20-May	9-Jun	41
1998	10-May	22-May	2-Jun	24
1999	30-Apr	22-May	2-Jun	34
2000	5-May	13-May	8-Jun	35
2001	17-May	1-Jun	14-Aug	90
2002	7-May	1-Jun	12-Jun	37
2003	9-May	30-May	8-Jun	31
MEDIAN	7-May	17-May	1-Jun	27
MIN	27-Apr	5-May	20-May	14
MAX	7-Jun	16-Jun	14-Aug	90

Sockeye (Wild + Hatchery)	10 %	50%	90 %	# of Days
1985[1]	12-May	26-May	10-Jun	30
1986	4-May	23-May	5-Jun	33
1987	14-May	28-May	6-Jun	24
1988	13-May	22-May	4-Jun	23
1989	9-May	20-May	3-Jun	26
1990[1]	5-May	16-May	28-May	24
1991	17-May	23-May	1-Jun	16
1992	9-May	14-May	27-May	19
1993	16-May	21-May	31-May	16
1994	11-May	24-May	5-Jun	26
1995	9-May	19-May	26-May	18
1996	3-May	19-May	3-Jun	32
1997	10-May	25-May	21-Jun	43
1998	8-May	16-May	31-May	24
1999	10-May	17-May	1-Jun	23
2000	30-Apr	14-May	9-Jun	41
2001	1-Jun	14-Jun	27-Jun	27
2002	9-May	21-May	2-Jun	25
2003	10-May	19-May	2-Jun	24
MEDIAN	9-May	21-May	3-Jun	24
MIN	30-Apr	14-May	26-May	16
MAX	1-Jun	14-Jun	27-Jun	43

July and August, 1986, was 82%. However, some variation from this pattern has been noted. In 1984 daytime passage at John Day Dam increased beginning on May 23. During the peak spring juvenile migration period at John Day Dam, 40% of the spring chinook and steelhead daily passage occurred between 0700 and 2200 hours. Unit 3 gatewell sampling and hydroacoustic sampling confirmed the diel pattern. Note the above information is for powerhouse passage only. Recent radio-tracking and hydroacoustic information indicates different passage patterns for the spillway and project when spill is occurring 24 hours a day.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at John Day Dam include a north shore fish ladder that passes fish from entrances at the north end of the spillway, and a south shore fish ladder that passes fish from entrances along a collection channel which extends the full length of the powerhouse. Auxiliary water is provided to all collection systems by pumping from the tailrace. South auxiliary water also includes forebay water from the fish turbines. Counting stations are provided in both fishways.

1.2.2. Adult Migration Timing. Upstream migrant fish are present at John Day Dam throughout the year. Adult passage facilities are operated year round. However, passage through the winter months is relatively light and there is no regular fish counting. Fish counting at John Day Dam normally extends from April 1 through October 31. The adult fish counting schedule is shown in Table JDA-3. Annual winter maintenance of adult fish facilities is scheduled from December 1 through February (in-water work period) to minimize the impact on upstream migrants and to minimize adult fall chinook and steelhead fallback. Table JDA-4 shows fish counting periods by species and earliest and latest recorded dates of peak passage, from fish count data compiled by the Corps.

Table JDA-3. Adult fish counting schedule.

Period	Counting Method
April 1 - October 31	Visual count 0400-2000 PST
November 1 – March 31	No Counting

Table JDA-4. John Day Dam adult migration timing, 1968-2003.

Species	Passage Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/5	4/14	5/22
Summer Chinook	6/6 - 8/5	6/7	8/2
Fall Chinook	8/6 - 10/31	9/2	9/25
Steelhead	4/1 - 10/31	8/25	10/6
Sockeye	4/1 - 10/31	6/21	7/10
Coho	4/1 - 10/31	9/4	10/26

2. Project Operation.

2.1. General.

2.1.1. Research, non-routine maintenance, other fish related activities, and construction activities will not be conducted within 100' of any fishway entrance or exit, within 50' of any other part of the adult fishway, or directly in, above, or adjacent to any fishway, unless concurred with by regional fish managers through ESA and other fish passage forums. Currently approved special operations are described in Appendix A. Alternate actions will be considered by district and project biologists in conjunction with the fish managers on a case by case basis. Emergency situations should be dealt with immediately by the project in coordination with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident. All activities within boat restricted zone (BRZ) will be coordinated in advance with the project.

2.2. Spill Management. Spill patterns formulated with spillway deflectors in place are provided in Table JDA-9. These will be used for both adult and juvenile patterns. Minimum spill of 30%

is to provide adequate tailrace egress for juvenile salmonids. Spill from Bay 2 is provided for adult attraction during daylight hours between September 1 and the end of November. Provisions are in place for deviations from normal spill patterns for barge traffic entering the navigation lock and have been coordinated with the fish agencies and tribes through the proper fish regulatory forums (TMT, FPOM, etc.).

2.3. Dissolved Gas Management and Control. Spill management requests will be based upon total dissolved gas (TDG) monitoring data and the observed condition of migrating juveniles and adults, along with juvenile migration monitoring data. Total TDG monitoring will be conducted by the Corps at the John Day Dam forebay and tailrace automated stations and reported every four hours from April 1 through September 15. Related data reported at the same time, includes volume and total project flow. The TDG monitoring system is described in detail in Appendix D. Excessive total TDG levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by Reservoir Control Center (RCC), nighttime or daytime spill limits, and shaping of spill discharge.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria.

2.4.1.1. Winter Maintenance Period (Preparation for Juvenile Passage Season) (December 1 through March).

a. Remove debris from the forebay, all trash racks, and gatewell slots, so that these areas are debris-free on April 1.

b. Inspect all VBSs for damage, holes, debris accumulations, or protrusions (video inspection acceptable). Clean and repair when necessary.

c. Inspect each STS and operate on trial run (dogged off at deck level).

d. By April 1, place STSs in each intake slot of all operational units unless otherwise coordinated with the fish agencies and tribes.

e. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems, such that these systems are debris-free and operable on April 1.

f. Check automatic control calibration for the DSM tainter gate and other necessary sensors weekly and recalibrate as necessary. Report summaries of equipment recalibration in the weekly Smolt Monitoring Facility operation monitoring reports.

g. Inspect, maintain and, where necessary, repair the DSM conduit tainter gate.

h. Inspect and correct any deficiencies of walls and floor of DSM conduit, raceway, and outfall.

i. Inspect and, where necessary, repair spill gates and the associated control system. Spillways, except for coordinated exceptions, must be able to achieve standard spill patterns on April 1.

j. Avian Abatement Measures. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Avian abatement measures shall be in place by April 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as the weather permits after that date. However, there will be no avian abatement measures, other than avian lines, performed from September through March each year.

k. Inspections. The results of all inspections and the readiness of the facility for operation will be reported at the FPOM meeting immediately prior to the start of the juvenile fish passage season.

l. Smolt Monitoring Facility: Insure all of the following items are fully operational:

1. Dewatering facilities, including weir gates, clean perforated plates, the screens (free of holes or gaps), and the screen cleaner brush system.

2. All valves and auxiliary water systems.

3. Flushing water valves and their perforated plates.

4. All gates, including the crest, tainter, switch, and rotating gates.

5. Fish and debris separator, including perforated plates and the adult passage chamber.

6. PIT tag detectors.

7. All sampling building systems, including holding tanks, valves, and conduits. (Note: A more specific list can be found in the Smolt Monitoring Facility Operation and Maintenance Manual.)

2.4.1.2. Juvenile Fish Passage Season (April 1 through November)

Juvenile fish protection devices (submersible traveling screens (STS), Extended Length Bar Screens (ESBS), etc.) will be in place prior to the beginning of the juvenile fish passage season. Screens (STS, ESBS) will remain in operation through December 15 to prevent adult salmonids from falling back through turbine units, even though the juvenile passage season officially ends November 30.

a. Measure gatewell drawdown a minimum of once per week. Remove debris from forebay and trash racks as required to maintain less than 1.5' of drawdown in gatewell.

b. Units 1 through 5 will be raked, if necessary as determined by ROV inspection, every two weeks between April 1 and July 1. Units 6 through 10 or units 11 through 16 will be alternately raked with units 1 through 5 from April 1 through July 1. After July 1, units will be raked as necessary as determined by ROV inspection, or as needed to avoid exceeding gatewell drawdown criterion.

c. Debris accumulations in the forebay of 300' or more in any direction from the face of the dam will be removed within 48 hours. Debris removal efforts should continue until the debris load has been removed.

d. If debris loads are obvious in the forebay, trash will be raked in front of the affected units weekly until the debris load has been removed.

e. Additional raking will occur whenever trash accumulations are suspected because of increased differential (1.5') across the trash racks, or as determined by the project biologist in reference to indicators such as increased juvenile fish descaling at the dam, deteriorating fish condition as noted by SMF personnel, or increased accumulations of tumbleweeds in the forebay. The STSs in units being raked will run continuously during raking operations. Gatewell orifices of the unit being raked must be closed during the raking operation.

f. Inspect each STS once per month (or 720 hours run time), and each VBS a minimum of once every two months (or 1440 hours run time). Video inspections are acceptable. VBS inspections will occur immediately prior to peaks in the juvenile fish migrations (early-May and early-July). Inspections will be concentrated on the priority units and those others with longer operating times. More frequent inspections may be required under the following conditions: deterioration of fish condition, increased debris load in bypass system, and other indications of STS or VBS malfunction or failure. If STS or VBS damage or plugging is detected, follow procedures in Section 3., Fish Facilities Maintenance. Records of inspections will be reported in weekly fishway status reports and provided to FPOM. Screen inspections will not occur in unit 1 until after 1200 hours. Unit 2 will operate when unit 1 is out of service for STS inspections.

g. Operate all gatewell orifices (April 1 – December 15). Inspect orifice lights daily to assure that the orifice lights are operating. Replace all burned out orifice lights within 24 hours. Close and open each orifice three time daily, or more frequently, to be determined by the project biologist, as necessary due to heavy debris accumulations in gatewells. If a unit goes out of service, orifices are to remain open in associated gatewells for a 24-hour period afterward to allow fish to escape the gatewells into the DSM.

h. Observe each STS amp and/or watt meter readings at least once per shift. If an STS failure occurs, then follow procedures in Section 3. Fish Facilities Maintenance.

i. Inspect all STS gatewells daily. The project will clean gatewells before the gatewell water surface becomes half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces at least clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fish measures, and then only on a last on/first off basis. The powerhouse gatewell orifices will be closed during the cleaning operation. After debarking a gatewell, cycle the orifice in that gatewell. Check gatewell drawdown.

j. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, the JBS orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in coordination with FPC or NOAA Fisheries. Regardless of unit operating status, oil accumulations will be dealt with promptly.

k. Coordinate gatewell cleaning with personnel operating the Smolt Monitoring Facility.

l. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary from April through August only.

m. Turbine units without a full complement of rotating STSs will not operate, except to be in compliance with other coordinated fish measures.

n. Inspect facilities three times each day, unless other guidance is provided elsewhere within this plan for specific facilities.

o. Smolt Monitoring Facility. Ensure the proper function of sampling systems. Particular attention is directed toward the following:

1. Dewatering facilities, including the screens being free of holes or gaps, and the screen cleaner brush system.

2. All valves and auxiliary water systems.

3. Flushing water valves and their perforated plates.

4. All gates, including the crest, tainter, switch, and rotating gates.

5. Fish and debris separator, including perforated plates and the adult passage chamber.

6. Pit tag detectors.

7. All sampling building systems, including holding tanks, valves, and conduits.

8. Dewater the Primary Dewatering Structure to remove adult fish that have accumulated in the structure, as determined by the project biologist. This should be performed during daylight hours only when the water temperature is below 70 degrees F. Do not dewater facility if water temperature is 70^{o} F or greater. The number of adult salmonids, by species, shall be reported in the subsequent Weekly Fish Status Report.

9. The smolt monitoring facility (SMF) will be monitored on a 24 hours per day, 7 days per week basis by the project fish personnel to ensure its proper functioning and provide quick response to an emergency. Therefore, the system will be fully staffed while the SMF is in operation (i.e., crest gate is deployed and the primary dewatering structure is receiving fish-laden flow).

10. Cycle Primary Dewatering Screen (PDS) sweepers twice per shift (6x per day) during low to normal debris loads. If debris loads increase, increase frequency of screen sweeper cycling as determined by the project biologist through inspections.

11. A person on duty will perform a walking inspection of the entire SMF system every two hours to ensure safe passage condition. The walk-through will result in 12 daily visual PDS screen cleaner inspectons. An inspection form designated for this purpose will indicate the areas that need to be checked.

12. Particular attention will be paid to the fish/debris separator (FDS) that needs to be visually inspected every 30 minutes to prevent injury and/or mortality to passing fish.

13. During any high debris loading periods (likely during spring run off) additional personnel may be required to keep the Fish/Debris Separator (FDS) free of any obstruction to fish passage. The project biologist will decide to assign a person to remove debris from the FDS on a shift basis (possible constant, 24 hours/day presence) for as long as it is necessary to assure the safety of passing fish.

14. For adult fish removal from the PDS area when river temperatures reach 70°F or greater, all fish handling will be coordinated through FPOM.

2.4.1.3. Winter Maintenance Season (December 1 through March).

a. Screens (STS, ESBS) will remain in place through December 15 to prevent adult salmonids from falling back through turbine units, thereby shortening some aspects of the winter maintenance period by two weeks. To reduce adult fallback mortality, the juvenile bypass system, or DSM channel will operate from November 30 through December 15. Priority units will be left screened during this period to the extent practicable (barring operational failure), and screens from non-priority units will only be removed when necessary to begin maintenance. If units are required for operation during this period, and are unscreened, they will be operated on a last on/first off basis. After December 15, all STSs may be removed.

b. Dewater DSM channel only when required for inspection, maintenance, or structural modifications (see section 5. Dewatering Plans.; also, paragraph 3.2.1.2. Juvenile Bypass System). The outage period will be minimized to the extent practicable.

c. All units are available to meet power demands.

d. Inspect facilities once per day. These are to be performed at least three times per week by project fish staff.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Winter Maintenance Season (Preparation for Adult Passage Period) (December 1 through March).

a. Inspect and calibrate all staff gauges, water level sensors, and indicators. Repair and/or clean where necessary.

b. Dewater and inspect all ladders and all other dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for and, when necessary, clear debris in ladder exits.

d. Reinstall picket leads at counting stations prior to watering up ladders during maintenance.

e. Repair or, when necessary, upgrade netting and padding at top of both fish ladders to address the fish jumping problem in this area.

f. The results of all inspections and the readiness of the facility for operation will be reported at the FPOM meeting immediately prior to the fish passage season.

2.5.1.2. Adult Fish Passage Period (March 1 through November).

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1' +/-0.1'. When shad numbers exceed 5000 fish per day per count station, water depth should be increased to 1.3' +/- 0.1'. This criteria was established by the COE through FPOM in 2001 to allow more efficient lamprey passage through orifices for a longer period each season, as it shortens the window for higher flow operation. Pacific lamprey are better able to negotiate orifices with the 1'+/- 0.1' operation.

2. Measure water temperatures at the count stations of each ladder and enter the weekly means in the status report. When water temperature reaches 70^{o} F all fish handling activities will be coordinated through FPOM prior to any action to verify protocols that will be followed.

3. Head on all entrances: 1' to 2' (1.5' optimum). Refer to paragraph 3.3.1. when unable to achieve head criteria.

4. A water velocity of 1.5' to 4 fps per second (2 fps optimum) shall be maintained in all channels and the lower ends of the fish ladders that are below the tailwater.

5. Maximum of 0.5' head on attraction water intakes and trash racks at all the ladder exits, with a 0.3' maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period, and calibration checked weekly. Recalibrate ASAP if out of calibration.

7. Main entrance weir depths: 8' or greater below tailwater. Maintain tailwater elevation greater than 158'msl to stay within criteria operation range for the entrance weirs.

8. Count station crowders shall be at maximum width that allows count or video tape accuracy. The minimum count slot width shall be no less than 18 inches. If passage is impaired by narrow count slot conditions, the count slot will be widened until proper passage conditions are achieved, despite count accuracy. Project biologists, FFU, and WDFW fish counters shall coordinate to achieve optimum count slot passage and/or count accuracy conditions. If counting is temporarily discontinued due to unscheduled events, the crowder shall be fully opened. The crowder shall remain in operating position during the counters' hourly ten minute break periods. Leave fish passage slot lighted overnight after counting ends each day.

9. Inspect facilities three times each day.

10. Maintain netting and padding for both fishways that address the jumping problem. All holes in the netting large enough to catch or allow escapement of an adult salmonid must be closed.

b. North Fishway.

1. Operate one entrance weir (EW-1) at 8’or greater weir depth. Entrance head: 1’ to 2’ (1.5’ optimum). Testing will be conducted to determine if the use of one entrance at greater than 8’ depth allows better passage conditions. (Study plan will be developed through the AFEP Studies Review Work Group.)

2. Starting September 1, spill from Bay 2 for adult attraction during daylight hours through November.

c. South Fishway. Operate entrance weir SE-1.

d. Powerhouse.

1. Operate entrances NE-1 and NE-2.

2. Operate ten powerhouse floating orifices (1, 2, 3, 6, 9, 12, 15, 17, 18, and 19) and open associated auxiliary water diffusers.

3. From 0400 to 2000 hours, operate unit 1 near 100 megawatts (+/- 10 MW) to facilitate best entrance conditions. If additional load is required by BPA, unit 1 may be operated at above 100MW, but it should be the last to be brought up to full load when demand increases and the first to drop off when demand decreases. (See also Load Shaping Guidelines, Appendix C).

2.5.1.3. Winter Maintenance Period (In-water Work Period) (December 16 through February).

a. Adult Fish Facilities.

1. Operate according to fish passage season standards, except facilities may be dewatered or operated out of criteria for maintenance or repair. Outage periods will be minimized to the extent practicable.

2. Only one of the two adult fish passage facilities may be out of service at a time. The other facility must be operated at full passage season criteria unless specially coordinated with the fish agencies and tribes through FPOM.

However, operation of unit 2 may be substituted for unit 1 without special coordination.

3. Pull picket leads at counting stations and have crowders adjusted such that the counting slots are fully open at the end of the counting season (this will be done shortly after adult fish counting ends).

4. Maximum of 0.5' head on attraction water intakes and trash racks at all ladder exits. Debris shall be removed when significant amounts accumulate.

5. Inspect the operating facilities once per day. These are to be performed at least three times per week by project fish staff.

2.6. Facility Monitoring and Reporting. Project staff shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Additional fishway inspections may be performed by FFU and/or fish agencies. Project biologists shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any usual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and shall be sent to CENWP-OP as soon as possible the following week via electronic mail, with a copy to RCC, Attention: Fish Team. The project biologist shall prepare an annual report by January 31 summarizing the operation of the project fish passage facilities for the previous year. The report will cover from the beginning of an adult fish facilities winter maintenance season to the beginning of the next winter maintenance season. The annual report will be provided to CENWP-OP in time for distribution to FPOM members at the February meeting.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Routine Maintenance. Scheduled fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest to minimize impacts to migrating salmonids. Maintenance activities that occur during the fish passage period and that may affect fish passage, will be reported in the weekly reports (section 2.6).

3.1.1.1. Staff gauges will be installed, cleaned, and/or repaired as required.

3.1.1.2. A zebra mussel monitoring program will continue. This includes veliger (free-swimming juvenile life-stage) sampling, colonization sample units, and dewatering inspections. These organisms have become a serious problem elsewhere in the country and may become introduced into the Columbia River basin.

3.2. Juvenile Fish Passage Facilities.

3.2.1. Routine Maintenance.

3.2.1.1. Submersible Traveling Screens. The STS system may receive preventive maintenance or repair at any time during the year as necessary. Most maintenance will occur during the winter maintenance period when all STSs may be removed from the intakes. During the designated juvenile passage season, a turbine unit cannot operate without a full compliment of functioning STSs.

3.2.1.2. Juvenile Bypass System. The juvenile bypass facilities may receive preventive maintenance at any time of the year as deemed necessary in coordination with FPOM. During the juvenile fish passage season, this will normally be above water work, such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period, the system is dewatered. The system is visually inspected in all accessible areas for damaged equipment and areas that may cause potential problems to juvenile fish. Identified problems will be repaired by project maintenance or the contractor as soon as possible. Extended repair projects will be coordinated through FPOM.

3.2.1.3. Turbines and Spillway. Maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for extended periods of time (see section 5. Dewatering Plans.) Maintenance schedules for these turbines and spillways will be coordinated through FPOM. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish near fishway entrances to keep predator fish from accumulating in the area of juvenile release sites and to move juveniles downstream away from the project. The maintenance schedules for these turbines and spillways will reflect equal weight given to fish, power, and water management and will be coordinated with the appropriate fish agencies. Units that should not be scheduled for maintenance during the fish passage season are 1, 2, and 5.

Some types of turbine maintenance will require testing turbine operation throughout the full operating range before returning it to normal service.

3.2.2. Non-Routine Maintenance. Non-routine maintenance of facilities will be carried out as described below. Activities that will have a significant impact on juvenile fish passage shall be coordinated through FPOM on a case-by-case basis by project and CENWP-OP biologists. The CENWP-OP biologists will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Operations Manager has the authority to initiate work prior to notifying CENWP-OP when delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWP-OP 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.

3.2.2.1. Submersible Traveling Screens. If an STS or VBS is damaged or inoperative in an operating unit, the unit will be regarded as an unscreened unit. The screen will be repaired or replaced before returning the unit to service.

3.2.2.2. Juvenile Bypass System.

a. The juvenile bypass system is automatically controlled. If the automatic system fails, it will be operated manually until automation repairs are made. If the orifices become plugged with debris, the turbine will not be operated until it has been cleaned.

b. Inspect all STS gatewells daily. The project will clean gatewells before the water surface becomes one half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least daily. Turbines with a gatewell fully covered with debris will not be operated except on a last on/first off basis if required to be in compliance with other coordinated fish measures. The gatewell orifices must be closed during the cleaning process. Juvenile mortality numbers will be monitored in all gatewells, as potential indicators of gatewell environment problems. Mortality estimates will be recorded and reported in the weekly status reports.

c. If the bypass system fails in the powerhouse conduit, tainter gate, or transportation outfall making the system unsafe for fish, an action decision will be made in coordination with the FPOM. During this emergency operating mode, power generation will be minimized to the extent practicable. If this operating mode is expected to last longer than four days, then all units required for generation will be sequentially shut down, fish salvaged from the gatewells, the STSs removed, and the unit restarted. The orifice gates will be closed during this process.

d. During fishway inspection activities, VBSs may be found plugged with debris, damaged or not properly seated. In these cases, the associated unit will be regarded as if unscreened and repairs will be made before returning the unit to operation.

3.2.2.3. Turbines and Spillways.

a. If a spill gate becomes inoperable, the operators will make the changes necessary to accommodate the spill and then immediately notify the operations supervisor and project biologist to determine the best pattern to follow until repairs can be made. This interim operation shall be coordinated with the FPOM through the district biologist who will provide additional guidance to the project.

b. Unit 2 will replace unit 1 for adult attraction whenever unit 1 is not operating.

3.3. Adult Passage Facilities.

3.3.1. Routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6).

3.3.1.1. Fishway Auxiliary Water Systems. John Day Dam has tailwater pump auxiliary water systems. Preventive maintenance and normal repair are carried out throughout the year. Trash racks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trash racks during the time of day when fish passage is least affected.

During the annual navigation lock maintenance outage, the north fish ladder auxiliary water is shut off for about half a day. This is required to allow divers to clean off the navigation lock discharge sill so that a bulkhead can be placed.

3.3.1.2. Powerhouse and Spillway Fish Collection Systems. Preventive maintenance and repair occurs throughout the year as needed. During the adult fish passage season, this maintenance will not involve operation that will cause failure to comply with the adult fishway criteria, unless coordinated through the FPOM. During the winter maintenance season, an inspection will occur through dewatering or divers per discretion of the project biologists. One additional underwater diver or video inspection will occur during the middle of fish passage season. Timing of this inspection will be coordinated through FPOM. The project biologist or alternate Corps fish personnel will attend all dewatering and inspection activities potentially involving fish (see section 5. Dewatering Plans).

3.3.1.3. Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year during the winter maintenance period. Unless specially coordinated, only one ladder will be dewatered at a time, with the other ladder capable operating within criteria. During this time the ladders are inspected for necessary maintenance needs and potential fish passage problems. These include blocked orifices, projections into the fishway that may injure fish, unstable weirs, damaged picket leads, exit gate problems, loose diffuser gratings, unreadable or damaged staff gauges, defective diffuser valves, and malfunctioning equipment at the counting stations. Potential problems identified throughout the passage year that do not impact fish passage, as well as those identified during the dewatered period, are then repaired. Trash racks at the ladder exits will be raked when criteria are exceeded. When practicable, rake trash racks during the time of day when fish passage would be least affected. Fish count station windows, light panels, and crowder panels will be cleaned, as needed, to achieve accurate counts and, when practicable, during the time of day when fish passage is least affected. Netting installed on the ladders to prevent fish leaping will be inspected weekly and maintained when necessary. Summaries of inspections will be included in the weekly activity report.

3.3.2. Non-Routine Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6.). Non-routine maintenance that will significantly affect the operation of a facility, such as repair of displaced diffuser gratings, will be coordinated through FPOM. Coordination procedures for non-routine maintenance of adult facilities are the same as for juvenile facilities (section 3.2.2).

3.3.2.1. Fishway Auxiliary Water Systems. The fishway auxiliary water systems are mostly automated. If the automatic system fails, the system will be operated manually by project personnel. This will allow the fish facility to operate according to criteria while the automatic system is repaired. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met. The FPOM will work with the project to determine the best operation in the event of an AWS failure during the adult passage season.

a. South Ladder. If one of the three auxiliary water turbines fails, assuming all three turbines are being used to meet criteria, bulkheads will be installed in the failed turbine discharge conduit and the output of the two remaining turbines will be increased to meet adult fishway criteria. If a second turbine unit fails, bulkheads will be installed in that turbine intake conduit also and the adult fish facility will be operated as follows until a fishway head of 1' is achieved.

1. Increase discharge of the remaining unit to maximum capacity.

2. Close NE-1.

3. Raise the south powerhouse entrance weir (SE-1) in 1' increments to 6' depth below the tailwater surface.

4. Close NE-2 in 1’ increments to 6’.

5. Close the center five floating submerged orifice gate entrances starting at the north end (17, 15, 12, 9, 6).

6. If the above criteria are still not achieved, then leave in this configuration until more auxiliary water becomes available. Then reverse the above procedure.

If all three turbine units fail, bulkheads will be installed in the failed turbine discharge conduits and the adult fish facility will be operated as follows until repairs can be made.

1. SE-1 will be open with the weir crest 6' below the tailwater surface.

2. Cross channel bulkheads will be placed in the powerhouse collection channel between units 2 and 3.

3. The floating orifice gate in front of unit 2 will be closed, leaving the floating orifice gate in front of unit 1 open.

b. North Ladder. This system cannot operate according to the adult fishway criteria under any conditions due to design limitations. Three of the six available pumps can be operated simultaneously. If one pump fails, one of the standby pumps will be started. This routine will be followed until the available pumps can no longer meet the adult fishway criteria. If this occurs, EW2 will be closed and EW1 will be set at the maximum weir depth needed to maintain fishway criteria. (Portland District hydraulics investigation ongoing, and to reported on in April, 2002.) Present design capability: 2 pumps with tailwater <160 msl; 3 pumps with tailwater >160 msl.

3.3.2.2. Powerhouse and Spillway Fish Collection Systems. John Day Dam contains several types of fishway entrances. In most cases, if failures occur, the entrance can be operated manually by project personnel until repairs are made. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently and the entrance will be returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. Pickets with excessive spacing (greater than 1"), erosion of concrete around the picket leads, or missing pickets can allow fish into areas where escape is not possible. The north count station upstream picket leads have an exit hatch that can be opened to allow fish to escape. Repair will be required for picket lead failure at the south count station. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in coordination with the FPOM.

3.3.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally inspected during the winter maintenance period to assure integrity. These inspections are done by either dewatering the fishway and/or collection channel, or by using video cameras and divers or other methods to inspect the gratings underwater. 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 to or suspected of having 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. If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffusers 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.

4. Turbine Unit Operation and Maintenance. Unit operating priority is shown in Table JDA-5, including that time when synchronous condensing occurs. Unit maintenance schedules will be reviewed by project and district biologists for fish impacts.

Table JDA-5. Turbine unit operating priority for John Day Dam.

Season	Time of Day	Unit Operating Priority
March 1 through November	24 hours/day	5, 1, 2, 3, then 4 and 6-16 in any order.
December 1 through February	0600-2000 hrs	5, , then unpaired units in any order
	2000-0600 hrs	5, , then any unit

4.1. Guidelines for operating units within the 1% turbine efficiency range at various heads are shown in Tables JDA-6 to JDA-8. To the extent technically feasible, turbines will be operated within +/- 1% of best turbine efficiency, unless operation outside of that range is necessary to meet load requirements of the BPA administrator, consistent with the BPA System Load Shaping Guidelines (Appendix C), or to comply with other coordinated fish measures. The System Load Shaping Guidelines apply between April 1 and October 31. However, during the rest of the year, the project will continue to operate units within the 1% turbine efficiency range, except as specifically requested by BPA for power production.

4.2. Juvenile fish passage decreases through units from south to north, making inefficient operation of unit 16 least likely to impact fish. Based on this, if it is necessary to select turbines to operate outside the 1% efficiency range, they will be selected in sequence from north to south. However, allowance will also be given to special project requirements for stable voltage control which require load distribution between transformer banks.

5. Dewatering Plans. Guidelines for dewatering and fish handling plans (Appendix G) have been developed and are followed for dewatering project facilities. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation. The project fish biologist and/or alternate Corps fish personnel will attend all project activities involving fish handling. The fish agencies and tribes will be encouraged to participate in all ladder dewaterings. During the pumping or draining operation to dewater a portion or all, the water level will not be allowed to drop so low it strands fish. Personnel shall remain present onsite during pumping operations to ensure stranding does not occur or a water level sensor that deactivates the dewatering process will be used.

5.2. Adult Fish Ladders.

5.2.1. Routine Maintenance.

5.2.1.1. When possible, operate ladders to be dewatered at reduced flow for at least 24 hours, but not more than 96 hours prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow.

5.2.1.2. The project biologist will assure that fish rescue equipment is available, and will coordinate to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.2.1.3. Project personnel will install head gates to shut down ladder flow. Where possible, a flushing flow of 1-2" will be maintained in the ladder until fish are rescued.

5.2.1.4. The project biologist or alternate Corps fish personnel will oversee fish rescue when the ladders are dewatered. The project biologist will invite fish agency and/or tribal biologists to participate in the dewatering activities. Captured fish will then be transported to the forebay or tailwater, depending on the fish life stage (adults to forebay, juveniles to tailrace), for release. If a ladder is dewatered in the spring or summer, steelhead kelts should be released into the tailrace.

Table JDA-6. Turbine units with standard-length submersible traveling screens installed.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	65.4	11,338	118.0	20,472
81	66.7	11,416	120.8	20,671
82	68.1	11,492	123.6	20,864
83	69.4	11,566	126.4	21,052
84	70.8	11,638	129.1	21,234
85	72.1	11,707	131.9	21,411
86	72.9	11,692	134.7	21,593
87	73.7	11,676	137.5	21,770
88	74.5	11,661	140.2	21,942
89	75.3	11,646	143.0	22,110
90	76.1	11,632	145.8	22,274
91	77.0	11,622	146.9	22,164
92	77.9	11,613	148.0	22,057
93	78.8	11,604	149.1	21,951
94	79.7	11,595	150.2	21,848
95	80.6	11,585	151.3	21,746
96	81.7	11,604	151.6	21,532
97	82.8	11,623	151.8	21,323
98	83.8	11,640	152.1	21,118
99	84.9	11,657	152.4	20,917
100	86.0	11,674	152.7	20,720
101	86.9	11,675	154.9	20,800
102	87.9	11,677	157.1	20,877
103	88.8	11,678	159.3	20,953
104	89.7	11,679	161.5	21,027
105	90.6	11,680	163.7	21,100
106	91.4	11,658	165.2	21,084
107	92.1	11,637	166.7	21,068
108	92.8	11,615	168.3	21,052
109	93.6	11,594	169.8	21,036
110	94.3	11,574	171.3	21,021

NOTE: Table prepared by HDC dated November 2002

Table JDA-7. Turbine units with extended-length submersible bar screens installed.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information for John Day Dam. This table is based on data from Little Goose Dam.

Table JDA-8. Turbine units without screens:

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	71.7	12,305	122.8	21,074
81	73.2	12,391	125.7	21,290
82	74.7	12,473	128.7	21,500
83	76.1	12,554	131.6	21,703
84	77.6	12,631	134.6	21,901
85	79.1	12,707	137.5	22,093
86	80.0	12,690	140.1	22,223
87	80.9	12,674	142.6	22,349
88	81.7	12,657	145.1	22,471
89	82.6	12,641	147.6	22,591
90	83.5	12,625	150.2	22,707
91	84.5	12,616	151.7	22,656
92	85.5	12,606	153.2	22,606
93	86.4	12,596	154.8	22,556
94	87.4	12,586	156.3	22,507
95	88.4	12,576	157.8	22,459
96	89.6	12,597	158.2	22,243
97	90.8	12,617	158.5	22,032
98	92.0	12,636	158.8	21,826
99	93.1	12,655	159.2	21,623
100	94.3	12,673	159.5	21,425
101	95.3	12,675	161.8	21,507
102	96.4	12,676	164.1	21,587
103	97.4	12,678	166.4	21,666
104	98.4	12,679	168.7	21,742
105	99.4	12,680	171.0	21,817
106	100.2	12,656	172.6	21,801
107	101.0	12,633	174.2	21,785
108	101.8	12,610	175.8	21,768
109	102.6	12,587	177.4	21,752
110	103.5	12,565	179.0	21,736

NOTE: Table prepared by HDC dated November 2002

5.2.1.5. Orifice blocking devices, which are placed in the lower-most weirs to prevent fish from re-ascending the dewatered portion of the adult fishway, shall have ropes attached to them by project operations and be tied off to fishway railings. The blocking devices shall be removed just before the fishway is returned to service. These devices will be noted on the pre-water-up checklist maintained by project fish biologists. This will prevent the orifice blocks from being unintentionally left in place following fishway water-up.

5.2.2. Non-Routine Maintenance.

5.2.2.1. When possible, discontinue auxiliary water and operate ladder at reduced flow as long as possible up to 72 hours prior to dewatering.

5.2.2.2. Follow guidance in paragraphs 5.4.1.3. through 5.4.1.6.

5.3. Powerhouse Fish Collection System.

5.3.1. Routine Maintenance. During the pumping or draining operation to dewater a portion or all of the collection channel, the water will not be allowed to drop to a level which strands fish. Personnel shall remain present onsite during pumping operations to ensure that stranding does not occur. The project biologist will assure that all necessary rescue equipment is available. The project biologist or alternate Corps fish personnel will provide technical guidance on fish safety and will assist directly in rescue operations.

5.4. Juvenile Bypass System.

5.4.1. Routine Maintenance. It is normal practice, when draining the juvenile bypass channel, to flush the channel with only the bypass orifices in bay 16 open. The associated gatewells will be dipped in advance to minimize the number of fish contained in this flushing water.

5.5. Turbines.

5.5.1. Remove juvenile fish from the gatewell(s) that will be drained. This is done by use of a special dipping basket. Immediately before setting the headgates, spin the unit to move fish out of the draft tube.

5.5.2. When possible, place head gates and tail logs immediately after the turbine unit is shut down if the draft tube is to be dewatered. This is necessary for both scheduled and unscheduled outages.

5.5.3. If the turbine unit draft tube is to be dewatered and the turbine unit has been idle for any length of time, it will be briefly operated when possible, at speed/no load, and stop logs will then be placed immediately.

5.5.4. If a turbine unit is idle and partially dewatered, and tail logs are to be put into place, an adequate safety pool may be maintained for up to 4 days to accommodate fish trapped in the draft tube. If longer timeframes are needed for the safety pool, project fisheries will coordinate with FPOM on a case-by-case basis. Adequate inspections will need to be conducted to ensure that the safety pool is maintained and fish are in good condition. Water levels in the draft tube will not be allowed to drop to a level that strands fish.

5.5.5. Fish rescue personnel will inspect dewatered turbine draft tubes, scroll cases, and intakes as soon as they can gain access and the water levels reach a depth permitting visual inspection. The project biologist or alternative fish personnel will provide technical guidance on fish safety and will directly participate in fish salvage.

5.5.6. The project biologist will assure that all necessary rescue equipment is available.

6. Forebay Debris Removal. Debris at projects can impact fish passage conditions. It can plug or block trash racks, 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. In this case, the only viable alternative is to spill to pass the debris.

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 CENWP-OP at least two work-days prior to the day they want the special project operations for spilling to pass debris. CENWP-OP shall coordinate the special operations with the FPOM. Project personnel shall provide CENWP-OP 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.

7. Endnotes.

[a] Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam in 1983. R. Magne et.al., US COE research Report. 35 pp. plus appendices.

[b] Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam 1984-85. R. Magne et. al. , US COE Research Report. 29 pp. plus appendices.

[c] Hydroacoustic Evaluation of Juvenile Salmonid Fish Passage at John Day Dam in Summer 1986. Sue Kuehl, BioSonics, Inc. Final Report. Prepared for US COE under Contract No. DACW57-86-C-0088. 61 pp. plus appendices.

[d] Hydroacoustic Evaluation of the Spill Program for Fish Passage at John Day Dam in 1987. L. Johnson et. al., Associated Fish Biologists, Inc. Final Report prepared for US COE under Contract No. DACW57-87-C-0077. 71 pp. plus appendices.

Table JDA-9. Spill patterns for John Day Dam.

BAY NUMBER																				STOPS	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
0	3	2	1																	6	9.6
0	3	2	2																	7	11.2
0	3	3	2																	8	12.8
0	3	3	2	1																9	14.4
0	3	3	2	2																10	16.0
0	3	3	2	2	1															11	17.6
0	3	3	2	2	2															12	19.2
0	3	3	2	2	2	1														13	20.8
0	3	3	2	2	2	2														14	22.4
0	3	3	2	2	2	2	1													15	24.0
0	3	3	3	2	2	2	1													16	25.6
0	3	3	3	2	2	2	2													17	27.2
0	3	3	3	2	2	2	2	1												18	28.8
0	3	3	3	3	2	2	2	1												19	30.4
0	3	3	3	3	3	2	2	1												20	32.0
0	3	3	3	3	3	2	2	2												21	33.6
0	3	3	3	3	3	2	2	2	1											22	35.2
0	3	3	3	3	3	2	2	2	2											23	36.8
0	3	3	3	3	3	2	2	2	2	1										24	38.4
0	3	3	3	3	3	2	2	2	2	2										25	40.0
0	3	3	3	3	3	2	2	2	2	2	1									26	41.6
0	3	3	3	3	3	2	2	2	2	2	2									27	43.2
0	3	3	3	3	3	3	2	2	2	2	2									28	44.8
0	3	3	3	3	3	3	2	2	2	2	2	1								29	46.4
0	3	3	3	3	3	3	2	2	2	2	2	2								30	48.0
0	3	3	3	3	3	3	2	2	2	2	2	2	1							31	49.6
0	3	3	3	3	3	3	3	2	2	2	2	2	1							32	51.2
0	3	3	3	3	3	3	3	2	2	2	2	2	2							33	52.8
0	3	3	3	3	3	3	3	2	2	2	2	2	2	1						34	54.4
0	3	3	3	3	3	3	3	2	2	2	2	2	2	2						35	56.0
0	3	3	3	3	3	3	3	2	2	2	2	2	2	2	1					36	57.6
0	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2					37	59.2
0	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1				38	60.8
0	4	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1				39	62.4
0	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	1				40	64.0
0	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1				41	65.6
0	4	4	4	4	3	3	3	2	2	2	2	2	2	2	2	1				42	67.2
0	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1				43	68.8
0	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	1				44	70.4
0	4	4	4	4	4	3	3	3	3	2	2	2	2	2	2	1				45	72.0
0	4	5	4	4	4	3	3	3	3	2	2	2	2	2	2	1				46	73.6
0	4	5	4	4	4	3	3	3	3	2	2	2	2	2	2	2				47	75.2

Table JDA-9 (cont). Spill patterns for John Day Dam.

BAY NUMBER																				STOPS	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
0	4	5	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1			48	76.8
0	4	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	1			49	78.4
0	4	5	4	4	4	3	3	3	3	3	3	2	2	2	2	2	1			50	80.0
0	4	5	5	4	4	3	3	3	3	3	3	2	2	2	2	2	1			51	81.6
0	4	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	1			52	83.2
0	4	5	5	4	4	4	3	3	3	3	3	3	2	2	2	2	1			53	84.8
0	4	5	5	4	4	4	3	3	3	3	3	3	3	2	2	2	1			54	86.4
0	4	5	5	4	4	4	3	3	3	3	3	3	3	3	2	2	1			55	88.0
0	4	5	5	4	4	4	3	3	3	3	3	3	3	3	3	2	1			56	89.6
0	4	5	5	4	4	4	4	3	3	3	3	3	3	3	3	2	1			57	91.2
0	4	5	5	4	4	4	4	4	3	3	3	3	3	3	3	2	1			58	92.8
0	4	5	5	5	4	4	4	4	3	3	3	3	3	3	3	2	1			59	94.4
0	4	5	5	5	4	4	4	4	3	3	3	3	3	3	3	2	2			60	96.0
0	4	5	5	5	4	4	4	4	4	3	3	3	3	3	3	2	2			61	97.6
0	4	5	5	5	4	4	4	4	4	3	3	3	3	3	3	2	2	1		62	99.2
0	4	5	5	5	4	4	4	4	4	4	3	3	3	3	3	2	2	1		63	100.8
0	4	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	2	1		64	102.4
0	4	5	5	5	4	4	4	4	4	4	4	3	3	3	3	3	2	1		65	104.0
0	4	4	4	4	3	3	4	3	4	3	3	3	3	4	3	4	3	4	3	66	105.6
0	4	4	4	4	3	3	4	3	4	3	4	3	3	4	3	4	3	4	3	67	107.2
0	4	4	4	4	4	3	4	3	4	3	4	3	3	4	3	4	3	4	3	68	108.8
0	4	4	4	4	4	3	4	3	4	3	4	3	3	4	3	4	4	4	3	69	110.4
0	4	4	4	4	4	3	4	3	4	3	4	3	3	4	4	4	4	4	3	70	112.0
0	4	4	4	4	4	3	4	3	4	3	4	3	4	4	4	4	4	4	3	71	113.6
0	4	4	4	4	4	4	4	3	4	3	4	3	4	4	4	4	4	4	3	72	115.2
0	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4	3	73	116.8
0	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	3	74	118.4
0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	75	120.0
0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	76	121.6
0	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	77	123.2
0	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	78	124.8
0	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	79	126.4
0	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	4	5	4	80	128.0
0	4	5	5	4	4	4	4	4	4	4	4	4	4	5	4	5	4	5	4	81	129.6
0	4	5	5	5	4	4	4	4	4	4	4	4	4	5	4	5	4	5	4	82	131.2
0	4	5	5	5	4	4	5	4	4	4	4	4	4	5	4	5	4	5	4	83	132.8
0	4	5	5	5	4	4	5	4	5	4	4	4	4	5	4	5	4	5	4	84	134.4
0	4	5	5	5	4	4	5	4	5	4	5	4	4	5	4	5	4	5	4	85	136.0
0	4	5	5	5	5	4	5	4	5	4	5	4	4	5	4	5	4	5	4	86	137.6
0	4	5	5	5	5	4	5	4	5	4	5	4	4	5	4	5	5	5	4	87	139.2

Table JDA-9 (cont). Spill patterns for John Day Dam.

BAY NUMBER																				STOPS	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
0	4	5	5	5	5	4	5	4	5	4	5	4	4	5	5	5	5	5	4	88	140.8
0	4	5	5	5	5	5	5	4	5	4	5	4	4	5	5	5	5	5	4	89	142.4
0	4	5	5	5	5	5	5	4	5	4	5	4	5	5	5	5	5	5	4	90	144.0
0	4	5	5	5	5	5	5	5	5	4	5	4	5	5	5	5	5	5	4	91	145.6
0	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	92	147.2
0	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	93	148.8
0	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	94	150.4
0	4	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	95	152.0
0	4	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	96	153.6
0	4	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	97	155.2
0	4	6	6	5	5	5	5	5	5	5	5	5	5	5	5	6	5	6	5	98	156.8
0	4	6	6	5	5	5	5	5	5	5	5	5	5	6	5	6	5	6	5	99	158.4
0	4	6	6	6	5	5	5	5	5	5	5	5	5	6	5	6	5	6	5	100	160.0
0	4	6	6	6	5	5	6	5	5	5	5	5	5	6	5	6	5	6	5	101	161.6
0	4	6	6	6	5	5	6	5	6	5	5	5	5	6	5	6	5	6	5	102	163.2
0	4	6	6	6	5	5	6	5	6	5	6	5	5	6	5	6	5	6	5	103	164.8
0	4	6	6	6	6	5	6	5	6	5	6	5	5	6	5	6	5	6	5	104	166.4
0	4	6	6	6	6	5	6	5	6	5	6	5	5	6	5	6	6	6	5	105	168.0
0	4	6	6	6	6	5	6	5	6	5	6	5	5	6	6	6	6	6	5	106	169.6
0	4	6	6	6	6	6	6	5	6	5	6	5	5	6	6	6	6	6	5	107	171.2
0	4	6	6	6	6	6	6	5	6	5	6	5	6	6	6	6	6	6	5	108	172.8
0	4	6	6	6	6	6	6	6	6	5	6	5	6	6	6	6	6	6	5	109	174.4
0	4	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	5	110	176.0
0	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	111	177.6
0	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	112	179.2
0	4	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	113	180.8
0	4	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	114	182.4
0	4	6	7	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	6	115	184.0
0	4	6	7	6	6	6	6	6	6	6	6	6	6	7	6	7	6	7	6	116	185.6
0	4	6	7	7	6	6	6	6	6	6	6	6	6	7	6	7	6	7	6	117	187.2
0	4	6	7	7	6	6	7	6	6	6	6	6	6	7	6	7	6	7	6	118	188.8
0	4	6	7	7	6	6	7	6	7	6	6	6	6	7	6	7	6	7	6	119	190.4
0	4	6	7	7	6	6	7	6	7	6	7	6	6	7	6	7	6	7	6	120	192.0
0	4	6	7	7	7	6	7	6	7	6	7	6	6	7	6	7	6	7	6	121	193.6
0	4	6	7	7	7	6	7	6	7	6	7	6	6	7	6	7	7	7	6	122	195.2
0	4	6	7	7	7	6	7	6	7	6	7	6	6	7	7	7	7	7	6	123	196.8
0	4	6	7	7	7	7	7	6	7	6	7	6	6	7	7	7	7	7	6	124	198.4
0	4	6	7	7	7	7	7	6	7	6	7	6	7	7	7	7	7	7	6	125	200.0
0	4	6	7	7	7	7	7	7	7	6	7	6	7	7	7	7	7	7	6	126	201.6
0	4	6	7	7	7	7	7	7	7	7	7	6	7	7	7	7	7	7	6	127	203.2

Table JDA-9 (cont). Spill patterns for John Day Dam.

BAY NUMBER																				STOPS	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
0	4	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	128	204.8
0	4	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	129	206.4
0	4	6	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	130	208.0
0	4	6	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	7	131	209.6
0	4	6	8	7	7	7	7	7	7	7	7	7	7	7	7	8	7	8	7	132	211.2
0	4	6	8	7	7	7	7	7	7	7	7	7	7	8	7	8	7	8	7	133	212.8
0	4	6	8	8	7	7	7	7	7	7	7	7	7	8	7	8	7	8	7	134	214.4
0	4	6	8	8	7	7	8	7	7	7	7	7	7	8	7	8	7	8	7	135	216.0
0	4	6	8	8	7	7	8	7	8	7	7	7	7	8	7	8	7	8	7	136	217.6
0	4	6	8	8	7	7	8	7	8	7	8	7	7	8	7	8	7	8	7	137	219.2
0	4	6	8	8	8	7	8	7	8	7	8	7	7	8	7	8	7	8	7	138	220.8
0	4	6	8	8	8	7	8	7	8	7	8	7	7	8	7	8	8	8	7	139	222.4
0	4	6	8	8	8	7	8	7	8	7	8	7	7	8	8	8	8	8	7	140	224.0
0	4	6	8	8	8	8	8	7	8	7	8	7	7	8	8	8	8	8	7	141	225.6
0	4	6	8	8	8	8	8	7	8	7	8	7	8	8	8	8	8	8	7	142	227.2
0	4	6	8	8	8	8	8	8	8	7	8	7	8	8	8	8	8	8	7	143	228.8
0	4	6	8	8	8	8	8	8	8	8	8	7	8	8	8	8	8	8	7	144	230.4
0	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	145	232.0
0	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	146	233.6
0	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	9	8	147	235.2
0	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	9	8	9	8	148	236.8
0	4	6	8	8	8	8	8	8	8	8	8	8	8	9	8	9	8	9	8	149	238.4
0	4	6	8	9	8	8	8	8	8	8	8	8	8	9	8	9	8	9	8	150	240.0
0	4	6	8	9	8	8	9	8	8	8	8	8	8	9	8	9	8	9	8	151	241.6
0	4	6	8	9	8	8	9	8	9	8	8	8	8	9	8	9	8	9	8	152	243.2
0	4	6	8	9	8	8	9	8	9	8	9	8	8	9	8	9	8	9	8	153	244.8
0	4	6	8	9	9	8	9	8	9	8	9	8	8	9	8	9	8	9	8	154	246.4
0	4	6	8	9	9	8	9	8	9	8	9	8	8	9	8	9	9	9	8	155	248.0
0	4	6	8	9	9	8	9	8	9	8	9	8	8	9	9	9	9	9	8	156	249.6
0	4	6	8	9	9	9	9	8	9	8	9	8	8	9	9	9	9	9	8	157	251.2
0	4	6	8	9	9	9	9	8	9	8	9	8	9	9	9	9	9	9	8	158	252.8
0	4	6	8	9	9	9	9	9	9	8	9	8	9	9	9	9	9	9	8	159	254.4
0	4	6	8	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	8	160	256.0
0	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	161	257.6
0	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	162	259.2
0	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	9	163	260.8
0	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	10	9	10	9	164	262.4
0	4	6	8	9	9	9	9	9	9	9	9	9	9	10	9	10	9	10	9	165	264.0
0	4	6	8	10	9	9	9	9	9	9	9	9	9	10	9	10	9	10	9	166	265.6
0	4	6	8	10	9	9	10	9	9	9	9	9	9	10	9	10	9	10	9	167	267.2

Table JDA-9 (cont). Spill patterns for John Day Dam.

BAY NUMBER																				STOPS	Kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
0	4	6	8	10	9	9	10	9	10	9	9	9	9	10	9	10	9	10	9	168	268.8
0	4	6	8	10	9	9	10	9	10	9	10	9	9	10	9	10	9	10	9	169	270.4
0	4	6	8	10	10	9	10	9	10	9	10	9	9	10	9	10	9	10	9	170	272.0
0	4	6	8	10	10	9	10	9	10	9	10	9	9	10	9	10	10	10	9	171	273.6
0	4	6	8	10	10	9	10	9	10	9	10	9	9	10	10	10	10	10	9	172	275.2
0	4	6	8	10	10	10	10	9	10	9	10	9	9	10	10	10	10	10	9	173	276.8
0	4	6	8	10	10	10	10	9	10	9	10	9	10	10	10	10	10	10	9	174	278.4
0	4	6	8	10	10	10	10	10	10	9	10	9	10	10	10	10	10	10	9	175	280.0
0	4	6	8	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	9	176	281.6
0	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	177	283.2
0	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	178	284.8
0	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	11	10	179	286.4
0	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	11	10	11	10	180	288.0
0	4	6	8	10	10	10	10	10	10	10	10	10	10	11	10	11	10	11	10	181	289.6
0	4	6	8	10	10	10	11	10	10	10	10	10	10	11	10	11	10	11	10	182	291.2
0	4	6	8	10	10	10	11	10	11	10	10	10	10	11	10	11	10	11	10	183	292.8
0	4	6	8	10	10	10	11	10	11	10	11	10	10	11	10	11	10	11	10	184	294.4
0	4	6	8	10	11	10	11	10	11	10	11	10	10	11	10	11	10	11	10	185	296.0
0	4	6	8	10	11	10	11	10	11	10	11	10	10	11	10	11	11	11	10	186	297.6
0	4	6	8	10	11	10	11	10	11	10	11	10	10	11	11	11	11	11	10	187	299.2
0	4	6	8	10	11	11	11	10	11	10	11	10	10	11	11	11	11	11	10	188	300.8
0	4	6	8	10	11	11	11	10	11	10	11	10	11	11	11	11	11	11	10	189	302.4
0	4	6	8	10	11	11	11	11	11	10	11	10	11	11	11	11	11	11	10	190	304.0
0	4	6	8	10	11	11	11	11	11	11	11	10	11	11	11	11	11	11	10	191	305.6
0	4	6	8	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	192	307.2
0	4	6	8	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	193	308.8
0	4	6	8	10	11	11	11	11	11	11	11	11	11	11	11	11	11	12	11	194	310.4
0	4	6	8	10	11	11	11	11	11	11	11	11	11	11	11	12	11	12	11	195	312.0
0	4	6	8	10	11	11	11	11	11	11	11	11	11	12	11	12	11	12	11	196	313.6
0	4	6	8	10	11	11	12	11	11	11	11	11	11	12	11	12	11	12	11	197	315.2
0	4	6	8	10	11	11	12	11	12	11	11	11	11	12	11	12	11	12	11	198	316.8
0	4	6	8	10	11	11	12	11	12	11	12	11	11	12	11	12	11	12	11	199	318.4
0	4	6	8	10	12	11	12	11	12	11	12	11	11	12	11	12	11	12	11	200	320.0

SECTION 5

MCNARY DAM

McNary Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the general site plan for McNary Lock and Dam (Figure MCN-1). Dates of project operations for fish purposes and special operations are listed in Table MCN-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The juvenile facilities at McNary Dam consist of extended-length submersible bar screens (ESBS) with flow vanes, vertical barrier screens, gatewell orifices, a concrete collection channel with emergency bypass outlets, primary and secondary dewatering structures, a pipeline/corrugated metal flume for transporting juvenile fish to the transportation facilities or bypassing them back to the river, and a full-flow PIT tag detection system. Juvenile transportation facilities at McNary include: a separator to sort juvenile fish by size and to separate them from adult fish; a flume system for distributing fish among the raceways; covered raceways for holding fish; sampling facilities; an office and sampling building with fish marking facilities; barge and truck loading facilities; and PIT tag detection and deflection systems.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at McNary Dam is indicated in Table MCN-2. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities, which may impact juvenile fish passage or facility operations, should be conducted during the maintenance season.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at McNary consist of separate north and south shore facilities. The north shore facilities are made up of a fish ladder with counting station, submerged orifice PIT tag antennas in the ladder, a small collection system, and a gravity-flow auxiliary water supply system. The gravity-flow auxiliary water supply system has a turbine unit installed on it, operated by North Wasco County PUD. The gravity-flow auxiliary water supply system takes water from the forebay through 2 conduits, passes the water through a turbine unit or through a bypass/energy dissipater when the turbine unit is not in operation, and distributes the water through a diffuser system at the bottom of the ladder and in the transportation channel. The north shore collection system has three downstream entrances and a side entrance into the spillway basin. Two of the downstream

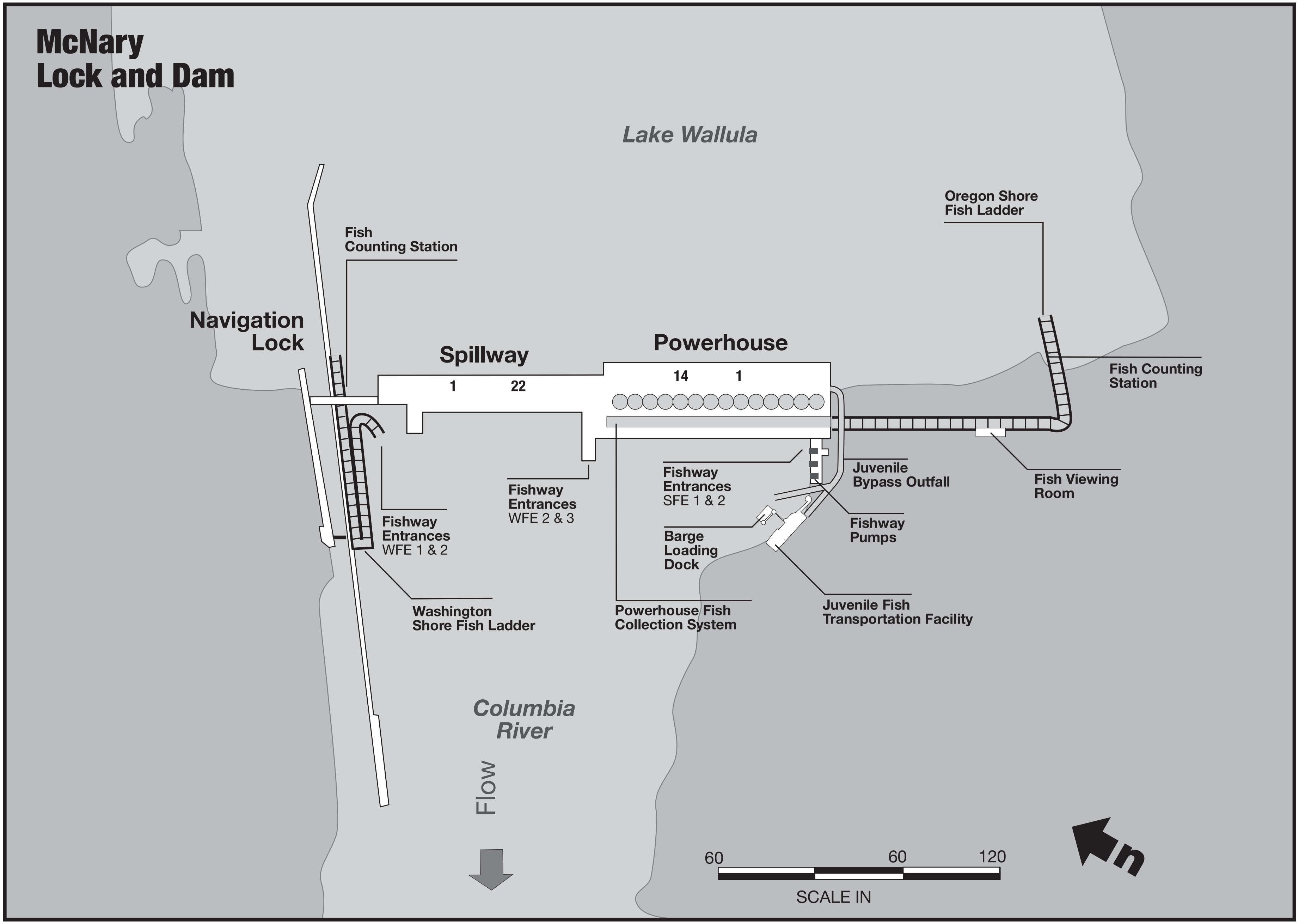


Figure MCN-1 McNary Lock and Dam general site plan.

Table MCN-1. Dates of project operations for fish purposes at McNary, 2004

Task Name	Start	Finish	FPP Reference
Rehab of Spillway Gates	3/1/04	4/15/04	App A Mcn 1.5
Adult Fish counting	**3/1/04**	**12/31/04**	**Mcn 1.2.2**
Counting to set maintenance schedules	3/1/04	3/31/04	Mcn 1.2.2
Fish Counting (Visual 0400 - 2000) pst	4/1/04	10/31/04	Mcn 1.2.2
Counting to set maintenance schedules	11/1/04	12/31/04	Mcn 1.2.2
TDG Monitoring	3/1/04	2/28/05	App D Phase 2
Maintenance of Juvenile Facilities	3/1/04	3/31/04	Mcn 2.3.1.1
Adult Passage Period	3/1/04	12/31/04	Mcn 2.3.2.2
Weekly Reports	3/1/04	12/31/04	Mcn 2.3.3
Operate Turbines for Fish Passage	3/1/04	11/30/04	Mcn 4.1
1% limitations	**3/1/04**	**2/28/05**	**Mcn 4.1**
1% Soft	3/1/04	3/31/04	Mcn 4.1
1% Hard	4/1/04	10/31/04	Mcn 4.1
1% Soft	11/1/04	2/28/05	Mcn 4.1
Adult Migration Study	3/1/04	12/31/04	App A Mcn 2.2
Final Report	3/15/04	3/15/04	Mcn 2.3.3
Survival Studies	4/1/04	10/31/04	App A Mcn 2.4
Operation Outside 1% Test	4/1/04	6/30/04	App A Mcn 1.6
Backflush orifices twice daily	4/1/04	8/15/04	Mcn 2.3.1.2.c.6
Operate Juvenile Facilities	4/1/04	12/15/04	Mcn 2.3.1
Turbine Upgrade Study	4/1/04	10/31/04	App A Mcn 2.3
Spill for Juvenile Fish	4/10/04	6/30/04	Mcn 2.1
Levee Inspection	5/11/04	5/12/04	App A Mcn 1.4
Water Temperature Measurement	6/15/04	8/31/04	App B 4.f(3)
Juvenile Fish Transportation	6/20/04	9/30/04	App B 3
Transport vs. In-river Survival	6/20/04	9/30/04	App A Mcn 2.1
Turbines - Gates in Standard Position	8/1/04	12/15/04	Mcn 4.2
Doble Testing	**8/1/04**	**8/31/04**	**App A Mcn 1.3**
Doble Testing T4 Units 7, 8	8/1/04	8/31/04	App A Mcn 1.3
Doble Testing T6 Units 11,12	8/1/04	8/31/04	App A Mcn 1.3
Circuit Breaker replacement	9/1/04	12/31/04	App A Mcn 1.2
Maintenance of Juvenile Facilities	12/16/04	2/28/05	Mcn 2.3.1.1
Maint of Upstream Passage Facilities	1/1/05	2/28/05	Mcn 1.2.2
Draft Final Report	2/10/05	2/10/05	Mcn 2.3.3

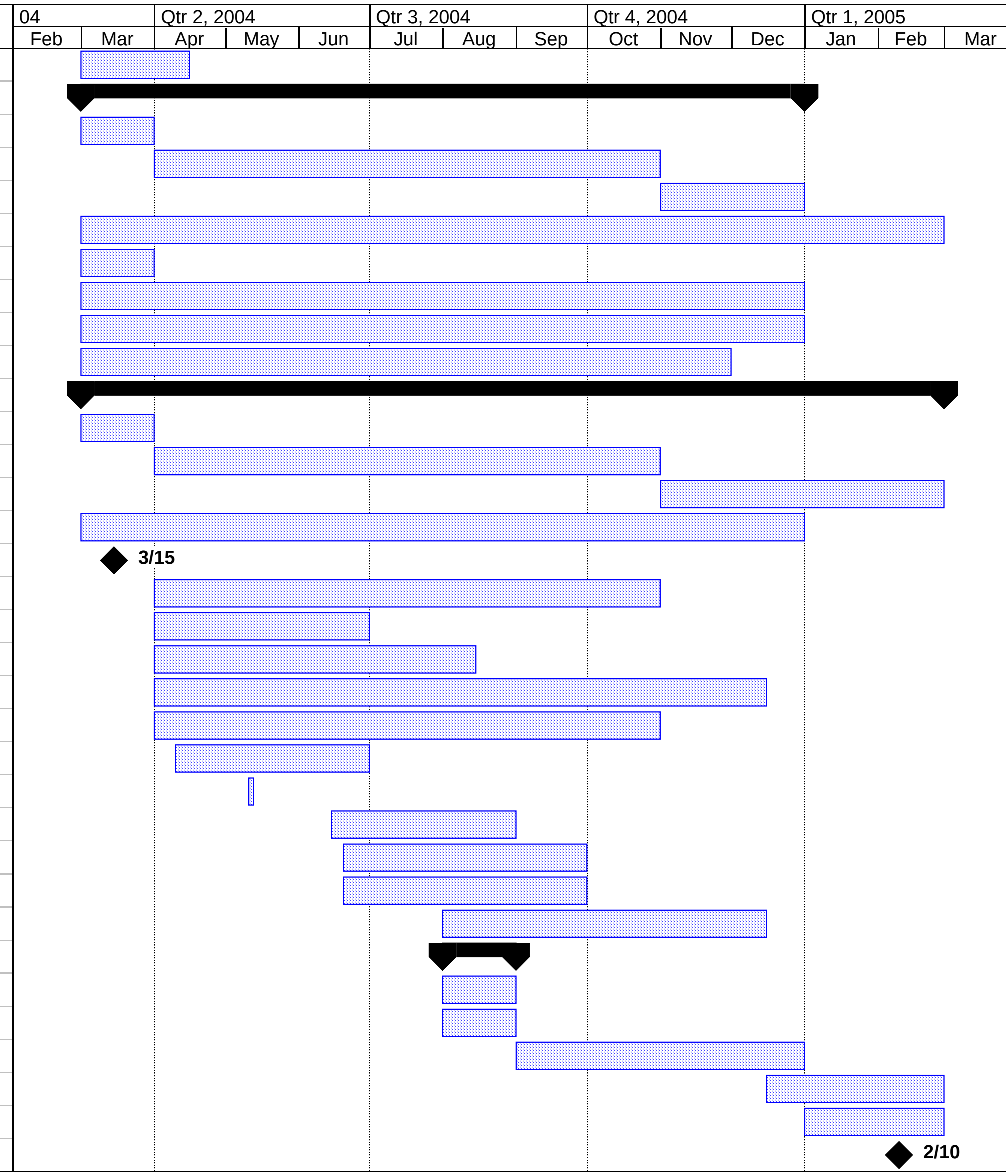


Table MCN-2. Juvenile migration timing at McNary Dam based on juvenile fish collection numbers.

% Collection	1999	2000	2001	2002	2003
Yearling Chinook					
10%	4/14	4/28	5/11	5/2	4/29
90%	5/26	6/2	6/7	5/26	5/29
Subyearling Chinook					
10%	6/18	6/22	6/20	6/22	6/18
90%	8/10	8/1	7/28	8/12	7/29
Hatchery Steelhead					
10%	4/10	4/11	4/26	4/21	4/29
90%	6/1	6/7	6/9	6/4	6/2
Wild Steelhead					
10%	4/22	4/20	5/4	4/24	4/27
90%	5/31	6/2	6/13	6/2	6/4
Sockeye					
10%	5/6	4/29	5/27	5/4	5/3
90%	5/27	8/1	6/9	5/25	5/27

entrances are used during normal operation. The south shore facilities are comprised of a fish ladder with counting station, submerged orifice PIT tag antennas in the ladder and experimental antennas at the counting station, two south shore entrances, a powerhouse collection system, and gravity and pumped auxiliary water supply systems. The powerhouse collection system contains three downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, twelve operating floating orifices, and a common transportation channel. At the north end of the powerhouse, two of the downstream entrances are used during normal operation with the other downstream and side entrances closed. The gravity-flow auxiliary water is provided by one conduit from the forebay and supplies the diffusers at the bottom of the ladder at tailwater level. The pumped auxiliary water is supplied by three electric pumps with variable-pitched blades. Two pumps are capable of providing the required flow when the third pump is bulkheaded to prevent water from flowing back through the pump to the river. The electric pumps supply the auxiliary water for the diffusers at the entrances and in the transportation channel. Excess water from the primary dewatering structure in the juvenile fish collection channel is routed to the adult collection system at the north end of the powerhouse.

1.2.2. Adult Migration Timing. Upstream migrants are present at McNary Dam all year. Maintenance of upstream passage facilities is scheduled for January and February to minimize impacts on adult migrants. Table MCN-3 shows primary passage periods by species and the earliest and latest dates of peak passage on record from fish count data compiled by the Corps of Engineers. Adult fish (salmon, steelhead, bull trout, and lamprey) are normally counted 16 hours per day (0400 through 2000 hours Pacific Standard Time) from April 1 through October 31. Additional 16 hour per day counting will take place during March, November, and December 2004 for gathering data for setting non-routine maintenance schedules.

Table MCN-3. Adult migration timing at McNary Dam based on fish counts, 1954-2001.

Species	Count Period	Date of Peak Passage	
		Earliest	Latest
Spring chinook	4/1-6/8	4/20	5/26
Summer chinook	6/9-8/8	6/17	7/26
Fall chinook	8/9-10/31	9/10	9/25
Steelhead	4/1-10/31	7/9	10/13
Coho	4/1-10/31	9/5	10/11
Sockeye	4/1-10/31	6/23	7/16

2. Project Operation.

2.1. Spill Management. Involuntary spill at McNary 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 McNary shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section in Table MCN-5. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research). Special spills for juvenile fish passage normally occur during the spring, from approximately April 10 through late June, when the project is bypassing collected fish. Spill may continue after this date in accordance with Appendix A or if river flow is above powerhouse capacity. If possible, when powerhouse generation load/spill changes greater then 50,000 cfs are made, they should be ramped over a one-hour period to minimize rapid flow changes in the juvenile fish collection channel.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at McNary are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels are monitored at two locations in the McNary forebay: at the navigation lock on the north shore, to monitor the mid-Columbia arm of the McNary pool, and on the south end of the powerhouse, to monitor Snake River inflow. The TDG levels will also be monitored in the McNary tailrace. The TDG will be recorded every half-hour and reported hourly via computer year-round. Related data collected at the same time for McNary Project include spill volume and total project flow. Implementation of spill requests at McNary will be based in part upon TDG monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migrant monitoring data. Spill requests will be coordinated through the Technical Management Team (TMT).

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through September 30 for juvenile fish bypass, collection, and transportation and from October 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 maintain, as needed, the items listed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay and trash racks.

2. Rake trash racks.

3. Remove debris from gatewell slots.

4. Measure and log drawdown in gatewell slots.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Maintenance completed on all ESBSs.

2. Inspect ESBSs for good running order and operate debris cleaner one trial run (dogged off at deck level).

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

4. Inspect all VBSs at least once per year by either raising the VBS and visually inspecting or inspecting with an underwater video camera.

c. Collection Channel.

1. Orifice lights are operational.

2. Orifices are clean and valves operate correctly.

3. Orifice air back flush system works correctly.

4. Netting over handrails and orifice chutes maintained and in good condition. Repair or replace as needed.

5. Plastic covers on orifice chutes maintained and in good condition and clean so orifice flow is visible.

d. Dewatering Structure and Flume.

1. Inclined and side dewatering screens are clean and in good condition with no gaps between screen panels, no damaged panels, and no missing silicone.

2. Cleaning brush systems are maintained and operating correctly.

3. All valves in good condition and operating correctly.

4. Stilling well water level sensing device inspected and operable.

5. Flume and pipe interiors smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate is maintained and operational.

2. Flume is smooth with no rough edges.

3. Perforated plate and bar screen edges are smooth with no rough edges.

4. Wet separator and fish distribution system maintained and operating as designed.

5. Brushes on all crowders in good condition or new.

6. Crowders maintained and operating properly.

7. All valves, slide gates, and switch gates maintained and operating correctly.

8. Raceway and tank retainer screens set in place with no holes or sharp wires protruding.

9. Barge and truck loading pipes are free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling equipment should be maintained and operating correctly.

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.

g. Fish Transport Trailers.

1. All systems are maintained, including refrigeration system, and operating properly.

2. No leaks around air stone fittings; repair where necessary.

3. Plugs should be placed in end of air stones.

4. Turn air stones on lathe if necessary to allow free air passage through stones.

5. Each trailer should carry two hoses of the right size with the necessary cam lock caps.

6. All air and water valves should operate correctly.

7. Overall condition of trailer should be maintained and in good condition including hatch covers, release gates, and oxygen manifold system.

h. Maintenance Records. Record all maintenance and inspections.

2.3.1.2. Fish Passage Period (April 1 through December 15). Operate facilities as detailed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily 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 results from fish sampling give indications that an orifice may be partially obstructed with debris, the orifice(s) 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.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot 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. 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.

4. Remove debris from forebay and trashracks as required to minimize impacts on fish condition. Additional raking may be required when heavy debris loads are present in the river. Fish quality will also be an indicator of debris buildup on the trash racks. Project biologist shall determine when additional trash raking is required.

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

6. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

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 good fish condition, with initial settings of every 15 minutes. Increase cleaning frequency if needed to maintain clean screens.

3. Inspect ESBSs in at least 3 operating turbine units per week by means of underwater video. Spot-check VBSs at the same time.

4. Conduct additional ESBS inspections if fish condition warrants it.

5. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, or VBS. Turbine units shall not operate for more than 10 hours, *and preferably less than 3 hours*, with ESBSs in place and orifices closed. Orifice closure time should be minimized by efficient planning and completion of the work to be done (e.g. having equipment, materials, and personnel ready before orifices are closed).

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

7. Measure head differentials across VBSs daily during times of debris. 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 generation loading if the VBSs can not be cleaned within 8 hours, to minimize loading on the VBS and potential fish impingement.

8. Inspect at least 4 VBSs in 2 different turbine units between the spring and summer migration periods. Both turbine units should have been operated frequently during the spring. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

9. Inspect all vertical barrier screens at least once per year and whenever pulled for cleaning. Repair as needed.

c. Collection Gallery.

1. Operate at least one orifice per gate slot (preferably the south orifice). 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 10 hours. If possible, orifice closures should be limited to less than 3 hours. During periods of high fish numbers or high debris, this time period may be less. Monitor fish condition in gatewells hourly during orifice closure.

2. Orifices are clean of debris and operating correctly.

3. Orifice lights are operating on open orifices.

4. Orifice jets are hitting no closer than 3' from wall (bypass gallery full).

5. Orifice valves are either full open or closed.

6. Backflush orifices at least once per day. During periods of high fish and debris passage, April 1 through August 15, orifices should be inspected and backflushed twice daily or more frequently as determined by the project biologist, to keep orifices clean.

d. Dewatering Structure.

1. No gaps between panels or missing silicone in side and inclined screens.

2. Trash sweeps operating correctly.

3. The project biologist shall determine the frequency of operation of the trash sweeps. The sweeps should operate at a frequency to maintain a clean screen given present debris loads. Frequency of operation may vary from as low as once every 15 minutes to once every 2 or more hours.

4. If automated cleaning system problems occur, project personnel shall operate cleaners at least once per shift unless determined differently by the project biologist.

5. The dewatering structure may be dewatered twice during the season, during low fish passage periods in June and September, for inspection and cleaning of the dewatering screens. Before dewatering occurs, the project biologist must notify

CENWW-OD-T who in turn will coordinate the proposed action with NOAA Fisheries and the FPC.

e. Transportation Facilities. Note: Normal operations when not transporting fish in the spring is to operate the juvenile bypass facilities in full flow bypass to the river. During this operation, fish may be periodically routed through the transportation facilities to sample fish for the Smolt Monitoring Program or for routine sampling to monitor facility descaling and fish condition. Sampling during full flow bypass operations will be coordinated on an as needed basis. Sampling during the spring is normally done every other day per Appendix B.

1. There should be no holes or gaps between screen panels. All silicone sealer should be in good condition.

2. Crowder screen brushes should be in good operating condition.

3. Assure that retainer screens in raceways and tanks are clean with no holes or protruding wires.

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

5. Project personnel shall release ice blocks through each 10-inch bypass line, one to three times per day as warranted by woody debris loads, during the spring as a preventative measure for debris plugging. Additional ice blocks shall be passed down the pipelines during high debris periods as needed to keep the pipes debris free. Releasing ice blocks through the pipes should continue during the summer when transporting fish, as determined by the project biologist to keep the pipelines debris free.

6. Truck and barge loading facilities should be kept in good operating condition.

f. Avian Predation Areas (Forebay and Tailrace).

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

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

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

g. Facility Inspections. Inspect all facilities according to fish facilities monitoring plan. Record all inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities as described below.

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

a. Inspect all staff gauges and water level indicators: repair and/or clean where necessary.

b. Dewater all ladders and inspect all sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Fish ladder exit trashracks must have smooth surfaces where fish pass, and must have downstream edges that are adequately rounded or padded. Inspect all diffuser gratings and chambers annually by dewatering and physically inspecting the gratings and chambers or by using divers or video inspection techniques. Once collection channel stoplogs are replaced, all diffuser gratings and chambers are to be dewatered and physically inspected at least every 3 years. Repair deficiencies.

c. Prior to the fish passage period, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

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

2.3.2.2. Fish Passage Period (March 1 through December 31).

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

b. Counting Window Widths. Counting windows should be operated as far out as possible (minimum of 18") while maintaining adequate counting conditions.

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

d. Collection Channel Transportation Velocity. 1.5' to 4' per second.

e. North Shore Entrances (WFE 1 & 2).

1. Operate 2 downstream gates (Controlled by North Wasco County PUD).

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

f. North Powerhouse Entrances (NFE 2 & 3).

1. Operate 2 downstream gates.

2. Weir depth: 9' or greater below tailwater.

g. Powerhouse Collection System Floating Orifices. Operate 12 floating orifices (O.G. numbers 1, 3, 4, 8, 14, 21, 26, 32, 37, 41, 43, and 44).

h. South Shore Entrances (SFE 1 & 2).

1. Operate 2 entrances.

2. Weir depth: 9' or greater below tailwater.

i. Head on Trashracks.

1. Maximum head of 0.5' on ladder exits.

2. Maximum head on picketed leads shall be 0.5'. Normal head differential on clean leads is 0.3'.

3. Trashracks and picketed leads installed correctly.

j. Staff Gauges and Water Level Indicators. Shall be readable at all water levels encountered during the fish passage period.

k. 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 inspected during all inspections to ensure they are clean and in the correct position (all the way down).

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

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

6. Record all inspections.

2.3.3. Facility monitoring and reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. 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. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities that occurred at the project that may affect fish passage. 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. 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. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing zebra 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 the river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T.** Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification 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 to 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 which will impact fish passage and/or survival. Maintenance of facilities such as fish screens, which sometimes break down during the fish passage season, will be carried out as described below. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA (through the FPC) and NOAA Fisheries 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 (ESBS). The ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning ESBS or VBS, or without a full compliment of ESBSs, flow vanes, and VBSs. If a screen 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 affected screen can be removed and repaired or replaced.

3.1.2.2. Vertical Barrier Screen (VBS) Cleaning. The ESBSs deflect fish and water up the gatewell slots as part of the fish collection process. Each gatewell has a VBS located vertically between the bulkhead slot and the operating gate slot. The VBSs keep guided juvenile and adult fish from passing through the bulkhead slot into the operating gate slot where the fish can pass back into the turbine intake. The VBSs are designed to distribute the flow evenly through the screens to minimize fish impingement and descaling. The water surface elevations in the gatewells are routinely measured to determine head differential across the VBSs caused by debris plugging the VBSs. VBSs are to be pulled and cleaned when head differentials reach 1.5'. Prior to pulling a VBS for cleaning, the turbine unit loading will be lowered to the lower end of the 1% turbine efficiency range and the gatewell dipped with a gatewell basket to remove all fish present in the gatewell unless doing so results in increased mortality (e.g. high numbers of adult or juvenile shad in gatewells). Immediately after dipping, the VBS shall be raised and impinged debris hosed off. The turbine unit shall remain operating at the lower end of the 1% turbine efficiency range while the VBS is being cleaned so gatewell flow will carry the debris into the operating gatewell, where it will pass through the turbine unit. Immediately after cleaning the VBS, the VBS shall be lowered to the normal operating position to prevent fish passage from the bulkhead slot into the operating gate slot. The VBSs shall not be raised longer than 30 minutes with the turbine unit running. If VBSs can not be cleaned within one work day of the head differential reaching 1.5', the turbine unit loading will be lowered to the lower end of the 1% turbine efficiency range until the VBS can be cleaned. If the cleaning frequency of VBSs exceeds project personnel’s cleaning capability of approximately 10 VBSs per day, 7 days per week, project personnel will notify CENWW-OD-T. Then CENWW-OD-T will coordinate with NOAA Fisheries regarding an exemption to dipping gatewells prior to cleaning VBSs. An exemption to dipping gatewells prior to cleaning VBSs will be based on fish numbers and TDG levels. If a VBS is found to be damaged during an inspection or cleaning, the VBS panel will be repaired or replaced with a spare panel. The turbine unit will not be operated with a known damaged VBS.

3.1.2.3. Gatewell Orifices. Each gatewell has two orifices with valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell (normally the south orifice) is operated. If an orifice becomes blocked with debris or is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If there is a major failure with the bypass system that prevents the gatewell orifices from operating, traveling screens and bar screens will remain in operation. Turbine units shall not be operated with blocked or closed orifices for longer than 10 hours. During any orifice closure, project personnel shall monitor gatewells for signs of fish problems or mortality. If repairs are expected to take longer than two days, a salvage program will be initiated to dip the juveniles from the gatewells with a gatewell basket until repairs are made and the system watered up again or orifices opened. Juvenile fish shall not remain in gatewells longer than 48 hours. During periods of high fish passage, it may be necessary to cease operation of turbine units with ESBSs in place and with closed orifices in less than 10 hours, depending on fish numbers and condition. Spill may occur to provide an alternate avenue for fish passage during facility outages.

3.1.2.4. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the bypass pipe/flume. An inclined screen and a side dewatering screen allow excess water to be bled off, with all fish and remaining water transitioning into the bypass pipe. Some of the excess water is discharged into the adult fish facility auxiliary water supply system and some is used as the water supply for the transportation facilities. The dewatering structure contains trash sweeps and an air-burst system for cleaning the dewatering screens of impinged debris. If a trash sweep breaks and interferes with juvenile fish passage through the structure or if a screen is damaged, an emergency bypass system in the collection channel may be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upstream end of the dewatering structure. The emergency bypass is then opened and the bypass system operated with one orifice per gatewell open. Spill may also be required to bypass juvenile fish while in emergency bypass operations. Prior to any emergency dewatering of the collection channel, CENWW-OD-T will be notified. Then CENWW-OD-T will be responsible for notifying NOAA Fisheries and the FPC of the action and coordinating changes in spill or other project operations.

3.1.2.5. Bypass Pipe/Flume. The bypass pipe/corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project through the primary bypass pipe. If there is a problem with the flume that interferes with its operation, the emergency bypass system in the collection system can be opened and all of the fish in the bypass system diverted into the ice and trash sluiceway and passed to the river through the north powerhouse ice and trash sluiceway exit.

3.1.2.6. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to separate fish by species (based on fish size), enumerate the fish through the sampling system, and bypass part or all of the fish back to the river (secondary bypass). If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the switch gate in the bypass flume will be used to bypass fish directly to the river until repairs can be made (primary bypass).

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not affect fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to the normal operating criteria, unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with the CBFWA (through the FPC) and NOAA Fisheries. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. 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 so there will be less impact of it being unwatered or taken out of service. 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 Ladders and Counting Stations. The fish ladders contain tilting weirs, fixed weirs, counting stations with picket leads, and fish exits with trash racks. If any part of the fish ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picket leads, tilting weir mechanisms, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fish agencies and tribes.

3.2.2.2. North Shore Auxiliary Water Supply System. The auxiliary water for the north shore fish ladder is provided by gravity-flow from the forebay. The water passes either through a turbine unit or through a bypass system. The turbine/bypass system is operated by North Wasco County PUD. During normal operations, when the turbine unit is operating, water passes through conduits 3 and 4 to the turbine unit. From the turbine unit, the water discharges into an open pool where it feeds into ladder diffusers. If there are problems with the turbine unit, automatic valves close and the auxiliary water is diverted through conduits 1 and 3A to the baffled bypass system within the old fish lock, where the hydraulic head is dissipated and the water discharged into the diffuser pool.

3.2.2.3. South Shore Auxiliary Water Supply System. The south shore auxiliary water is made up of a combination of gravity flow from the forebay and pumped water from the tailrace. The gravity flow supplies the diffusers above weir 253 (diffusers 7 through 14) and the pumps supply the diffusers below weir 253 (diffusers 1 through 7 and the main unit diffusers). Diffuser 7 is where both systems meet and is supplied by either gravity flow or pumped flow. The gravity flow diffusers are regulated by rotovalves and the pumped flow diffusers by sluice gates. If a rotovalve fails, the nearest closed rotovalve will be opened to supply the flow. If more rotovalves fail than there are closed valves the sluice gates in diffusers 3 through 7 will be opened more to provide the required transportation flows. If any sluice gates fail, the sluice gates nearest it will be opened further to make up the water. If one pump fails, the other two pumps will be operated to maintain the facilities within criteria. If two pumps fail, SFE2 and NFE3 will be closed and SFE1 and NFE2 will be operated as deep as possible to maintain the 1' to 2' head differential. If all three pumps fail and the outage is expected to last six days or longer, the powerhouse transportation channel will be bulkheaded off at the junction pool and SFE1 and SFE2 operated a deep as possible and to maintain the 1' to 2' head differential. If a depth of 6' on both gates cannot be maintained, SFE2 will be closed. If all three pumps fail and the outage is expected to last five days or less, CENWW-OD-T will be notified and in turn will coordinate with NOAA Fisheries and the FPC. If the gravity flow and pumped auxiliary water supply systems both fail, the powerhouse transportation channel will be bulkheaded off at the junction pool, SFE2 closed, and SFE1 operated at 6' below tailwater until repairs can be made.

3.2.2.4. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which are designed to regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure, which prevents the entrance from being operated manually, the entrance may be lowered down and left in an operating position or an alternate entrance opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and replaced with a spare floating orifice.

3.2.2.5. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passageway and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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 paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in 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 (as needed to meet generation requirements) in the following order: 1, 2, 3 through 10 (in any order), and then 11 through 14 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. If the project is bypassing juvenile fish back to the river through the juvenile release pipe, turbine units 1 through 4 shall be operated first (if available for operation) to provide positive downstream flows at the outfall. During the summer, (when all collected fish are transported) turbine operating priority may change to north powerhouse loading if warm water temperatures result in increased juvenile fish mortality or if project temperature monitoring indicates a temperature gradient exists across the powerhouse. Under north powerhouse loading, turbine units shall be loaded consecutively from unit 14 back towards unit 1. Turbine units 1, 2, and 3 may also be taken off-line during parts of the summer to avoid adding warmer water to the juvenile fish collection channel. Starting and stopping of units should be avoided if possible during periods of warm water, especially between 1000 and 2400 hours.

Turbine units will be operated within 1% of best efficiency from April 1 through October 31 (as specified in BPA's load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines or 2) be in compliance with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% turbine 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 turbine units within the 1% efficiency range at various heads are listed in Table MCN-4.

Table MCN-4. Turbine unit operating range with extended-length submersible bar screens installed for 1% best efficiency, McNary Dam.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
67	37.5	7,934	56.7	11,997
68	38.0	7,911	58.2	12,121
69	38.5	7,887	59.7	12,240
70	39.0	7,864	61.2	12,355
71	39.6	7,874	62.1	12,355
72	40.2	7,883	62.8	12,298
73	40.9	7,892	63.4	12,242
74	41.5	7,901	64.1	12,188
75	42.2	7,909	65.8	12,350
76	42.8	7,907	66.4	12,282
77	43.4	7,905	67.1	12,216
78	44.0	7,903	67.7	12,151
79	44.6	7,900	68.3	12,088
80	45.2	7,897	68.9	12,026
81	45.9	7,893	70.0	12,039
82	46.5	7,889	71.1	12,050
83	47.2	7,884	72.2	12,061

Note: The turbine efficiency table was revised in June 1999 to reflect new information regarding ESBSs using the 1998 index test and 1955 Prototype Hill Curve. This table contains the best information currently available.

Table MCN-4.1. Turbine unit operating range <u>without</u> extended-length submersible bar screens installed for 1% best efficiency, McNary Dam.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
67	37.7	7,739	57.9	11,887
68	38.2	7,716	59.4	12,009
69	38.7	7,694	60.9	12,128
70	39.2	7,671	62.5	12,243
71	39.8	7,681	63.4	12,243
72	40.0	7,691	64.4	12,242
73	41.1	7,699	65.3	12,241
74	41.7	7,708	66.3	12,240
75	42.4	7,716	67.2	12,239
76	43.0	7,714	67.9	12,172
77	43.6	7,713	68.5	12,107
78	44.2	7,711	69.1	12,043
79	44.8	7,709	69.7	11,980
80	45.5	7,706	70.3	11,920
81	46.1	7,720	71.5	11,961
82	46.8	7,734	72.6	12,000
83	47.4	7,747	73.7	12,038

Note: The turbine efficiency table was revised to reflect new information using the 1998 index test and 1955 Prototype Hill Curve. This table contains the best information currently available.

4.2. 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 which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late December time frame. The maintenance of priority units for adult passage is normally conducted in mid-August or November and December, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent best efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish.

Turbine units at McNary Dam are to be operated with raised operating gates to improve fish passage conditions when ESBSs are installed. To facilitate annual maintenance, operating gates are used to unwater the turbine units. To minimize turbine outage periods to the actual time required for maintenance (during the August 1 through December 15 time period), operating gates may be lowered to the standard operating position and connected to hydraulic cylinders on the afternoon of the last regular work day (normally Thursday) prior to the start of the maintenance. With the operating gate in the standard operating position, turbine units may be operated until 0700 hours of the next regular work day (normally Monday) with generation loads restricted to 60 MWs or less. On the completion of maintenance, the turbine unit can be operated with the operating gates in the standard operating position at 60 MWs or less until the 0700 hours of the first regular work day after the maintenance is completed. The project biologist will be notified when the operating gates are set in the standard operating position. The gatewells will be monitored 2 times per day to observe fish condition while the operating gates are in the standard operating position. If turbine maintenance or the raising of the operating gates to the raised operating position is delayed after the time periods stated above, the turbine unit shall be immediately taken out of service until the work can be accomplished. Operation of turbine units with operating gates in the standard operating position shall be restricted to the August 1 through December 15 time period, and shall not begin until juvenile fish collection numbers drop to less than 10,000 fish per day. No more than 2 turbine units at a time shall be operated with operating gates in the standard operating position and the turbine units will be operated on last on, first off operating priority.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. 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 before hand.

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.

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 work days prior to the day they want the special project operations for spilling to pass debris. Then CENWW-OD-T shall coordinate the special operations with Reservoir Control Center (RCC) and NOAA Fisheries. 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.

Table MCN-5. McNary Dam spill pattern for fish passage.
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																						Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
3.9																			2				2
7.8																			2	2			4
9.5																			2.5	2.5			5
11.7																		2	2	2			6
13.4																		2	2.5	2.5			7
15.6																	2	2	2	2			8
17.3																	2	2.5	2.5	2			9
19.5															2		2	2	2	2			10
21.2															2		2	2.5	2.5	2			11
23.4													2		2		2	2	2	2			12
25.1													2		2		2	2.5	2.5	2			13
27.3											2		2		2		2	2	2	2			14
29.0											2		2		2		2	2.5	2.5	2			15
31.2									2		2		2		2		2	2	2	2			16
32.9									2		2		2		2		2	2.5	2.5	2			17
35.1									2		2		2		2	2	2	2	2	2			18
36.8									2		2		2		2	2	2.5	2	2.5	2			19
39.0							2		2		2		2		2	2	2	2	2	2			20
40.7							2		2		2		2		2	2	2.5	2	2.5	2			21
42.9					2		2		2		2		2		2	2	2	2	2	2			22
44.6					2		2		2		2		2		2	2	2.5	2	2.5	2			23
46.8					2		2		2		2		2	2	2	2	2	2	2	2			24
48.5					2		2		2		2		2	2	2	2.5	2	2.5	2	2			25
50.7					2		2		2		2		2	2	2	2	2	2	2	2	2		26
52.4					2		2		2		2		2	2	2	2.5	2	2.5	2	2	2		27
54.6					2		2		2		2		2	2	2	2	2	2	2	2	2	2	28
56.3					2		2		2		2		2	2	2	2.5	2	2.5	2	2	2	2	29
58.5					2		2		2		2	2	2	2	2	2	2	2	2	2	2	2	30
60.2					2		2		2		2	2	2	2	2	2.5	2	2.5	2	2	2	2	31
61.9					2		2		2		2	2	2	2.5	2	2.5	2	2.5	2	2.5	2	2	32
63.6					2		2		2		2	2	2	2.5	2	2.5	2.5	2.5	2	2.5	2.5	2	33
65.3					2		2		2		2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	34
67.0					2		2		2		2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	35
68.7					2		2		2		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	36
70.4					2		2		2		2.5	2.5	2.5	2.5	2.5	3	2.5	3	2.5	2.5	2.5	2.5	37

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

<u>Opening sequence:</u>

- **a) Open Bays 2 – 21 first, as specified in the spill pattern table.**
- **b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.**

<u>Closing Sequence:</u>

- **a) Close Bays 1 & 22 prior to closing Bays 2-21.**

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																						Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
71.3	2	3.5	3.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2						37
73.0	2	3.5	3.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2						38
74.7	2.5	3.5	3.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2						39
76.3	2.5	4	4	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2						40
78.0	2.5	4	4	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2						41
79.6	2.5	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2						42
81.3	2.5	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2						43
82.9	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2						44
85.1	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2					45
86.8	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2					46
88.5	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2					47
90.2	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2					48
92.4	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2				49
94.1	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2	2				50
95.8	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2				51
98.0	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2	2	2			52
99.7	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2	2.5	2			53
101.4	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2			54
103.1	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2			55
105.3	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2	2		56
107.0	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		57
108.7	3	5	5	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		58
110.4	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		59
112.1	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		60
114.3	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	61
116.0	3.5	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	62
117.7	3.5	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	63
119.4	3.5	5	5	3	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	64
121.1	3.5	5	5	3	3	3	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	65
122.8	3.5	5	5	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	66
124.5	3.5	5	5	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	67
126.0	3.5	6	6	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	68
127.6	4	6	6	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	69
129.3	4	6	6	3	3	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	70
131.0	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	3	2.5	2.5	2.5	71

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

<u>Opening sequence:</u>

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

<u>Closing Sequence:</u>

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total Stops
132.7	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.5	72
134.4	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	73
136.0	4	6	6	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	74
137.6	4	6	6	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	75
139.2	4	6	6	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	76
140.8	4.5	7	7	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	77
142.4	4.5	7	7	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	78
144.0	4.5	7	7	3.5	3.5	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	79
145.6	4.5	7	7	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	80
147.2	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	81
148.8	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	3	3	3	3	3	3	82
150.4	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	83
152.0	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	84
153.6	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	85
155.2	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	86
157.0	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	87
158.6	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	88
160.2	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5	4	3.5	3.5	3.5	3.5	89
161.8	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5	4	3.5	4	3.5	4	3.5	3.5	90
163.4	4.5	8	8	4	3.5	4	3.5	3.5	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	3.5	91
165.0	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	92
166.6	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	4	4	4	4	3.5	4	93
168.2	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4	4	4	3.5	4	94
169.8	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4	4	4	4	4	4	4	95
171.4	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4	4.5	4	4	4	4	96
173.0	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4	4	4	97
174.6	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	98
176.2	5	8	8	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	99
177.8	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	100
179.4	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4	101
181.0	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	102
182.6	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	4.5	4.5	4.5	4.5	103
184.2	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	4.5	104
185.8	5	8	8	4	4	4	4	4	4	4.5	4	4.5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	4.5	105
187.4	5	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	4.5	5	5	5	4.5	5	4.5	4.5	106

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																						Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
189.0	6	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	4.5	5	5	5	4.5	5	4.5	4.5	107
190.6	6	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	5	5	5	5	5	5	4.5	4.5	108
192.2	6	8	8	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	5	5	5	5	5	5	5	5	4.5	109
193.8	6	8	8	4.5	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	5	5	5	5	5	5	5	5	4.5	110
195.4	6	8	8	4.5	4	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	111
197.0	6	8	8	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	112
198.6	6	8	8	4.5	4.5	4.5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	113
200.2	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	114
201.8	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	5	5	5	115
203.4	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	6	5	5	5	5	5	116
206.6	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	6	5	6	5	6	5	5	5	118
209.8	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	6	5	6	5	6	5	6	5	6	5	120
213.0	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	6	5	6	6	6	6	6	5	6	5	122
216.2	6	8	8	5	5	5	5	5	5	5	5	5	6	5	6	6	6	6	6	5	6	5	124
219.4	7	9	8	5	5	5	5	5	5	5	5	5	6	5	6	6	6	6	6	5	6	5	126
222.6	7	9	8	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	5	128
225.8	7	9	8	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	130
229.0	7	9	8	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	132
232.2	7	9	8	5	5	5	5	5	5	6	6	6	6	6	7	6	6	7	6	6	6	6	134
235.4	7	9	8	5	5	5	5	5	5	6	6	6	6	6	7	7	6	7	7	6	6	6	136
238.6	7	9	8	5	5	5	5	5	5	6	6	6	6	7	7	7	7	7	7	6	6	6	138
241.8	7	9	8	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	7	6	6	6	140
245.1	7	9	8	5	5	5	5	6	6	6	6	6	6	7	7	7	8	7	7	7	6	6	142
248.5	7	9	8	5	5	5	5	6	6	6	6	6	6	7	8	7	8	7	8	7	6	6	144
251.7	7	9	8	5	5	5	5	6	6	7	6	7	6	7	8	7	8	7	8	7	6	6	146
254.9	7	9	8	6	5	6	5	6	6	7	6	7	6	7	8	7	8	7	8	7	6	6	148
258.1	7	9	8	6	5	6	5	6	6	7	6	7	7	7	8	7	8	7	8	7	7	6	150
261.4	7	9	8	6	5	6	5	6	6	7	6	7	8	7	8	7	8	7	8	7	7	7	152
264.6	7	9	8	6	6	6	6	6	6	7	6	7	8	7	8	7	8	7	8	7	7	7	154
267.9	7	9	8	6	6	6	6	6	6	7	7	7	8	7	8	8	8	7	8	7	7	7	156
271.3	7	9	8	6	6	6	6	6	6	7	7	7	8	8	8	8	8	8	8	7	7	7	158
274.7	7	9	8	6	6	6	6	6	6	7	7	8	8	8	8	8	8	8	8	8	7	7	160
277.9	7	9	8	6	6	7	6	6	7	7	7	8	8	8	8	8	8	8	8	8	7	7	162
281.3	7	9	8	6	6	7	6	6	7	7	8	8	8	8	8	8	8	8	8	8	8	7	164
284.5	7	9	8	7	6	7	6	7	7	7	8	8	8	8	8	8	8	8	8	8	8	7	166

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

<u>Opening sequence:</u>

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

<u>Closing Sequence:</u>

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																						Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
287.9	7	9	8	7	6	7	6	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	168
291.1	7	9	8	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	170
294.5	8	9	8	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	172
297.9	8	9	8	7	8	7	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	174
301.3	8	9	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	176

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

SECTION 6

ICE HARBOR DAM

Ice Harbor Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the general site plan for Ice Harbor Lock and Dam in Figure IHR-1. Dates of project operations for fish purposes and special operations are listed in Table IHR-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The juvenile fish passage facilities at Ice Harbor consist of standard length STSs, vertical barrier screens, 12" orifices, collection channel and dewatering structure, sampling facilities, and transportation flume/pipe to the tailrace below the project.

1.1.2. Juvenile Migration Timing. Juvenile passage timing at Ice Harbor Dam corresponds closely with juvenile passage at Lower Monumental Dam. Maintenance of juvenile fish passage facilities is scheduled during the winter maintenance periods detailed in the facility operating criteria and project maintenance sections.

1.2. Adult fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Ice Harbor are made up of separate north and south shore facilities. The north shore facilities include a fish ladder with counting station, a small collection system, and a pumped auxiliary water supply system. The collection system includes two downstream entrances and one side entrance into the spillway basin. In normal operation one downstream entrance is used and the other two entrances are closed. The auxiliary water is supplied by three electric pumps with two pumps normally operated. The south shore facilities are comprised of a fish ladder with counting station, two south shore entrances, a powerhouse collection system, and a pumped auxiliary water supply system. The powerhouse collection system includes two downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, seven operating floating orifices, and a common transportation channel. One of the downstream north powerhouse entrances and seven of the floating orifices are used during normal operation. At the south shore entrances, one entrance is normally used. The auxiliary water is supplied by eight electric pumps of which from six to eight are normally used to provide the required flows. The excess water from the juvenile fish passage facilities is routed into the fish pump discharge chamber to provide additional attraction flow. Four weirs in the upper end of both ladders were outfitted with PIT tag detectors in early 2003.

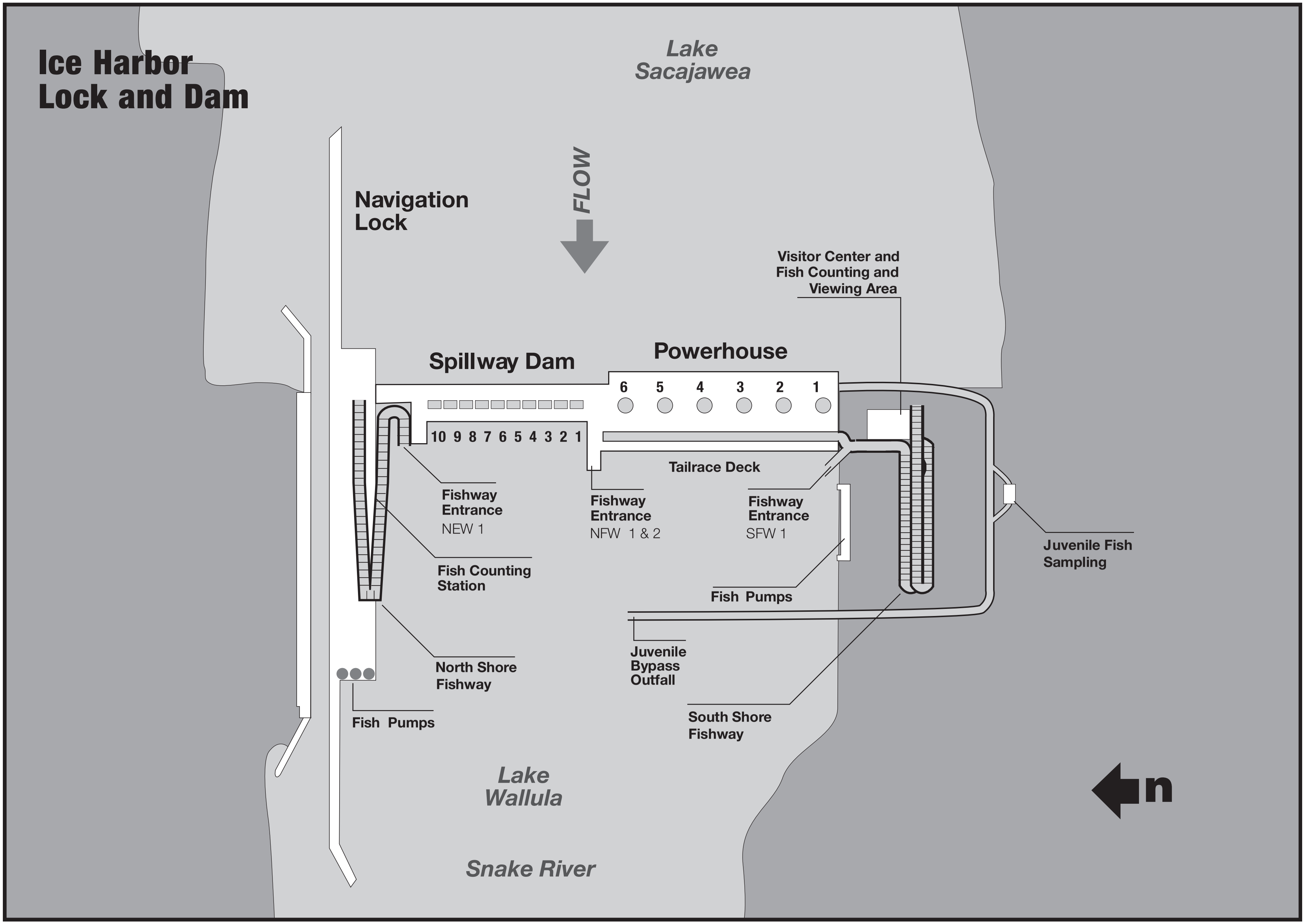
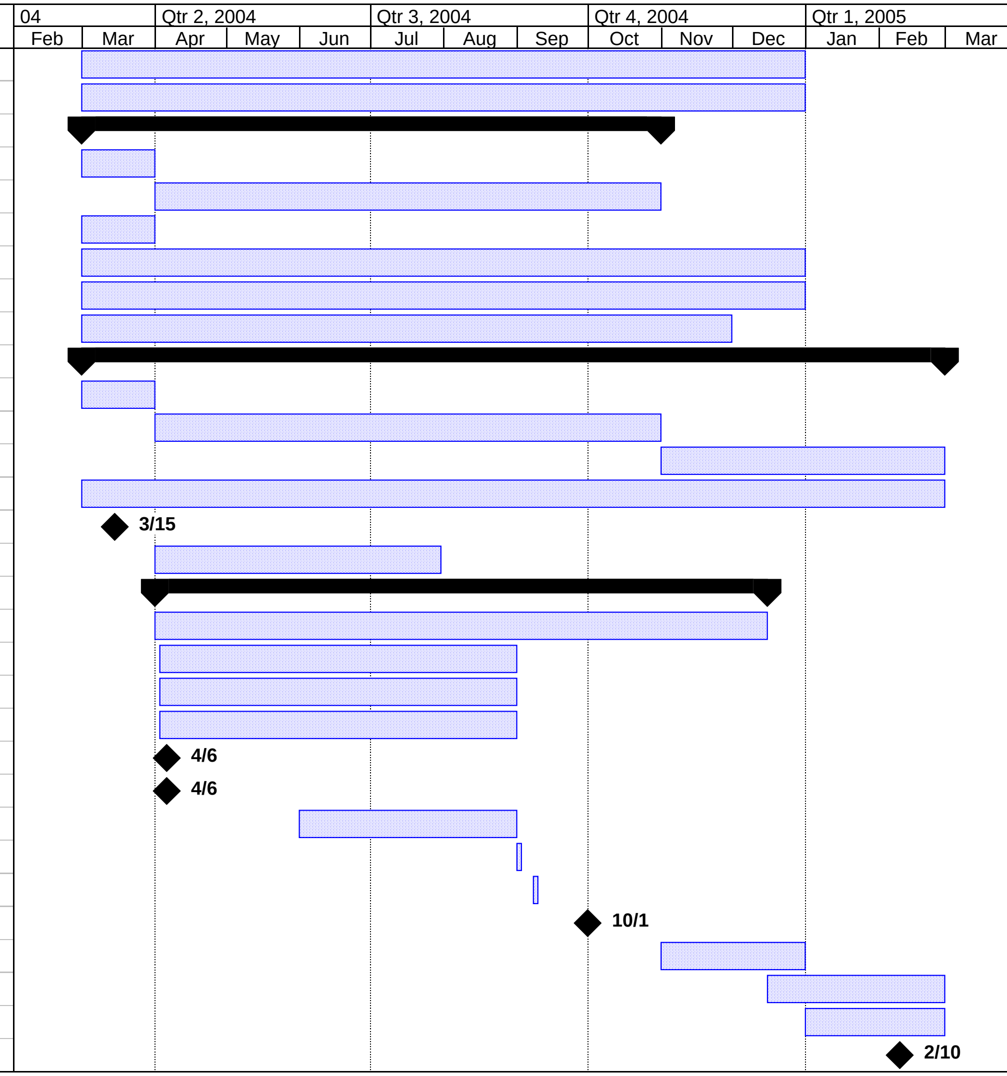


Figure IHR-1 Ice Harbor Lock and Dam general site plan.

Table IHR-1. Dates of project operations for fish purposes at Ice Harbor, 2004

Task Name	Start	Finish	FPP Reference
Adult Fishway Eval	3/1/04	12/31/04	App A Ihr 2.4
Adult Migration Study	3/1/04	12/31/04	App A Ihr 2.3
Adult Fish counting	**3/1/04**	**10/31/04**	**Ihr 1.2.2**
0600 - 1600 PST	3/1/04	3/31/04	Ihr 1.2.2
0400 - 2000 PST	4/1/04	10/31/04	Ihr 1.2.2
Winter Maintenance Period Juvenile	3/1/04	3/31/04	Ihr 2.3.1.1.
Adult Fish Passage Period	3/1/04	12/31/04	Ihr 2.3.2.2
Weekly Reports	3/1/04	12/31/04	Ihr 2.3.3
Operate Turbines for Fish Passage	3/1/04	11/30/04	Ihr 4.1
1% limitations	**3/1/04**	**2/28/05**	**Ihr 4.1**
1% Soft	3/1/04	3/31/04	Ihr 4.1
1% Hard	4/1/04	10/31/04	Ihr 4.1
1% Soft	11/1/04	2/28/05	Ihr 4.1
TDG Monitoring	3/1/04	2/28/05	App D Phase 2
Final Report	3/15/04	3/15/04	Ihr 2.3.3
Backflush orifices once per shift	4/1/04	7/31/04	Ihr 2.3.1.2.c.4
Operate juvenile facilities	**4/1/04**	**12/15/04**	**Ihr 2.3.1**
Juvenile Passage Period	4/1/04	12/15/04	Ihr 2.3.1.2
Spillway Survival Study	4/3/04	8/31/04	App A Ihr 2.1
Spill for Fish	4/3/04	8/31/04	Ihr 2.1
Prototype Separator Eval	4/3/04	8/31/04	App A Ihr 2.2
Spillway Emer Gen Test	4/6/04	4/7/04	App A Ihr 1.7
Shoreline Erosion Inspection	4/6/04	4/7/04	App A Ihr 1.6
Spillway Gate Testing	6/1/04	8/31/04	App A Ihr 1.5
Spillway Stilling Basin Survey	9/1/04	9/2/04	App A Ihr 1.8
Doble Test Line 1 Units 1 & 2	9/8/04	9/9/04	App A Ihr 1.2
1/2 STS May Be Pulled	10/1/04	10/1/04	Ihr 2.3.1.2.b.6
AWS Pump Maintenance North Shore	11/1/04	12/31/04	App A Ihr 1.3
Winter Maintenance Period Juvenile	12/16/04	2/28/05	Ihr 2.3.1.1.
Maintenance of Adult Facilities	1/1/05	2/28/05	Ihr 1.2.2
Draft Final Report	2/10/05	2/10/05	Ihr 2.3.3



1.2.2. Adult Migration Timing. Upstream migrants are present at Ice Harbor Dam all year. Maintenance of adult passage facilities is scheduled for January and February to minimize impacts on adult migrants. Table IHR-2 shows primary passage periods for each species and shows earliest and latest dates of peak passage on record from fish count data compiled by the Corps of Engineers. Adult fish (salmon, steelhead, bull trout, and lamprey) are counted 16 hours per day (from 0400 to 2000 hours Pacific Standard Time)from April 1 through October 31. From March 1 through March 31, adult fish will be counted 10 hours per day (0600 to 1600 hours Pacific Standard Time) to gather information for setting non-routine maintenance schedules.

Table IHR-2. Adult migration timing at Ice Harbor Dam from 1962-2002 based on fish counts.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
Spring Chinook	4/1 - 6/11	4/22	5/26
Summer Chinook	6/12 - 8/11	6/12	7/23
Fall Chinook	8/12- 12/15	9/5	9/30
Steelhead	4/1 – 12/15	9/15	10/12
Sockeye	4/1 – 12/15	7/1	9/22

2. Project Operation.

2.1. Spill Management. Involuntary spill at Ice Harbor 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 Ice Harbor will be distributed in accordance with the adult spill pattern listed in Table IHR-3. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research). Special spills for juvenile fish passage normally occur during the spring and summer, from approximately April 3 through August 31.

2.2. Dissolved Gas Management and Control. Total dissolved gas TDG) levels at Ice Harbor are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG will be monitored in the Ice Harbor forebay and tailrace. The TDG data will be collected every half-hour and transmitted hourly via computer year-round. Related data collected at the same time will be spill volume and total project flow. Implementation of requests for spill will be based in part upon TDG monitoring data along with juvenile migration data. Requests for spill will be coordinated through the Technical Management Team (TMT).

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish passage and from November 1 through December 15 for protecting adult fallbacks. The facilities should be operated according to the following criteria:

2.3.1.1. Winter Maintenance Period (December 16 through March 31). Check and maintain, as needed, the items listed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trash racks just prior to the operating season.

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

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Maintenance completed on all screens.

2. Inspect STSs prior to installation and operate one trial run (dogged off on deck) to ensure proper operation.

3. Log trial Run.

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

c. Collection Gallery.

1. Water-up valve capable of operating when needed.
2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

4. Netting along handrails maintained and in good condition. Repair or replace as needed.

5. Netting or covers over orifice chutes maintained and in good condition. Repair or replace as needed.

d. Dewatering Structure and Flume.

1. Inclined screen should be clean and in good condition with no gaps between screen panels, damaged panels, or missing silicone.

2. Screen cleaning system (brush and air flush) maintained and operating correctly.

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

4. All valves should be operating correctly.

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

e. Sampling Facilities.

1. Flume dewatering structure should be maintained and in good operating condition with no holes or gaps between dewatering screen panels. Silicone sealer should be in good condition.

2. Flume drop gate should be maintained and in good operating condition.

3. The wet separator and fish distribution system should be maintained and ready for operation as designed.

4. All dewatering screens and seals in separator and flume must be in good condition with no holes or gaps between panels, or sharp edges.

5. All valves and switch gates maintained and in good operating condition.

6. All sampling equipment 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.

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

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Remove debris from 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. Coordinate turbine unit outages with other project work activities, if possible, to minimize turbine unit outages during the spring.

3. Inspect gatewell slots daily 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 surfaces at least half clear, they should be cleaned at least once daily. If flows through an orifice 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 shall not be operated until the gatewell and orifices are cleared of debris.

4. 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. 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.

5. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Operate STSs in cycling mode when average fork length of subyearling chinook or sockeye is greater than 120 mm at Lower Monumental collection facility.

2. Operate STSs in continuous operational mode when average fork length of subyearling chinook or sockeye is less than 120 mm at Lower Monumental collection facility, or if there is other evidence that smaller juvenile fish are present at the project.

3. Inspect each STS once per month by means of underwater video. Spot check VBSs at the same time.

4. Record STS amp readings daily.

5. If an STS or VBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of STSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged STS or VBS.

6. Up to one-half of the STSs may be removed after October 1 for annual maintenance provided there is no operation of units without screens.

7. Make formal determination at end of season as to adequacy of STS screen mesh and replacement if necessary.

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

c. Collection Gallery Checks.

1. Orifices clean and operating. Operate at least one 12" orifice per slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain full collection channel. If the collection channel is dewatered for emergency maintenance, monitor the gatewells hourly for fish condition and behavior.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets hitting no closer than 3' from the opposite wall (bypass channel full). The orifice jets should be checked at least once per day.

4. Back flush 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 shift or more frequently as determined by the project biologist, to keep orifices clean.

5. Water-up valve should be capable of operating when needed.

6. The netting along handrails should be maintained in good condition with no holes or gaps in the netting. Repair or replace as needed.

7. Netting or covers over orifice chutes in good condition. Repair or replace as needed.

d. Dewatering Structure.

1. Trash sweep operating correctly. The frequency of sweep should be set as necessary to maintain a clean screen, with a minimum operation of at least once per hour. If automated cleaning system problems occur, operate manually at least once per work shift, or more as necessary, to maintain a clean screen.

2. Clean trapezoidal section at least once per day, and more frequently if required, to maintain a clean condition.

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

4. There should be no gaps between screen panels in the inclined screen or holes in the screen panels.

e. Sampling Facilities.

1. All screens should be inspected to make sure there are no holes or sharp edges.

2. Operate wet separator and fish distribution system as designed. Sample fish twice per week during the main juvenile bypass season to monitor juvenile fish descaling and other fish condition parameters. Provide information in project weekly report.

3. Crowder screen brushes should be maintained in good operating condition with no holes or sharp edges in the crowder screen.

4. Operate preanesthetic system as designed.

f. Avian Predation Areas (Forebay and Tailrace).

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

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

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

g. Inspection and Record Keeping. Inspect all facilities according to fish facilities monitoring plans. Record all maintenance and inspections.

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

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

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

b. Dewater all ladders 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. Fish ladder exit trashracks must have smooth surfaces where fish pass, and must have downstream edges that are adequately rounded or padded. Spare trashracks should be on hand for use as necessary. Inspect all diffuser gratings and chambers annually by dewatering and physically inspecting the gratings and chambers 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. Prior to the fish passage season, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

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

2.3.2.2. Fish Passage Period (March 1 through December 31). **[Note**: During extremely high flow periods when tailwater level exceeds elevation 363' msl, the fish pumps may have to be turned off so that the head differential on the auxiliary water supply conduit ceiling slab does not exceed structural design criteria.]

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

b. Counting Window Widths. Counting windows should be operated as far out as possible while maintaining adequate counting conditions. When possible, the minimum counting slot width should be 18". All equipment should be maintained and in good condition.

c. Head On All Entrances. Head range: 1' to 2'

d. North Shore Entrance (NEW 1). Elevation of top of gate when on sill = 332.25'.

1. Operate downstream gate closest to shore.

2. Weir depth: 8' or greater below tailwater. At tailwaters less than elevation 340.25', weirs should be on sill. Note that at low river flow and tailwater, some of the diffusers are above tailwater and project may only be able to maintain a 6' weir depth.

e. North Powerhouse Entrance (NFE 1 and 2). Elevation of top of gate when on sill = 332.25'.

1. Operate 1 downstream gate.

2. Weir depth: 8' or greater below tailwater. At tailwaters less than elevation 340.25', weirs should be on sill.

[**Note:** At low tailwater, weirs will bottom out and will be less than 8' below tailwater.]

f. Powerhouse Collection System. Operate 7 floating orifices (O.G. numbers 1, 2, 4, 6, 8, 10, and 12).

g. South Shore Entrance (SFE-1). Elevation of top of gate when on sill = 332.25'.

1. Operate entrance closest to powerhouse.

2. Weir depth: 8' or greater below tailwater. At tailwaters less than elevation 340.25', weirs should be on sill.

[**Note:** At low tailwater, weirs will bottom out and will be less than 8' below tailwater.]

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

i. Head on Trashracks.

1. Maximum head of 0.5' on ladder exits.

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

3. Trashracks and picketed leads installed correctly.

j. Staff Gages and Water Level Indicators. Shall be readable at all water levels encountered during fish passage period. Repair or clean as necessary throughout the passage season.

k. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day shift and check computer monitor information at least once during each back shift. Maintain computerized fishway control system record keeping system.

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

3. Picketed leads shall be inspected during all inspections to ensure they are clean and in the correct position (all the way down).

4. Project personnel shall check computerized fishway control system twice per month to ensure that it is kept within calibrations.

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

6. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. 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. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities that occurred at the project that may affect fish passage. 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. 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. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing zebra 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 plans. **When river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T**. Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the non-fish passage season from December 16 to March 31. Long-term maintenance or modifications to the facilities that requires them to be out of service is done during this period. During the fish passage season, the facilities are inspected on a daily basis to insure that they are operating correctly.

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 and survival. Unscheduled maintenance of facilities such as submersible traveling screens, which sometimes break down during the fish passage season, will be carried out according to procedures 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 the CBFWA (through the FPC) and NOAA Fisheries on a case-by-case basis by CENWW-OD-T. Then 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. Submersible Traveling Screens (STS). The STSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If an STS is found to be damaged it will be removed and either replaced with the spare STS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning STS or without a full compliment of STSs. If an STS 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, additional water may be spilled until the effected STS can be removed and repaired or replaced.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12" orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated. To minimize blockage from debris, orifices are cycled and back flushed at least once per day, and more frequently if required by heavy debris loads. If an air valve fails or is blocked with debris, the valve should be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, 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 in accordance with the project dewatering and fish-handling plan.

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 is discharged into the adult fish facility auxiliary water supply system and is also used as the water supply for the sampling facilities. The dewatering structure contains a trash sweep for cleaning the rectangular portion of the inclined screen, and an air blow back system for cleaning the transition (trapezoidal) section of the screen. The dewatering screen has a set of differential pressure sensors for determining head differential across the screen. If the sensors detect a 0.15 foot differential it initiates continuous screen cleaning. If the sensors detect a differential of .30 foot it closes all but 3 orifices (unit 1 orifices remain open) in the juvenile collection channel. Both conditions trigger an alarm at the control panel and in the control room. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen or other component of the structure is damaged, the orifices may need be closed and the collection channel dewatered to allow repairs to be made. If the orifices are closed and the collection channel unwatered, the traveling screens will remain in operation. Fish will be allowed to accumulate in the gatewells for up to 2 days. If repairs are expected to take longer than 2 days, a salvage program will be initiated to remove fish from gatewells, with a gatewell dip basket, until repairs can be made and the system watered up again. While the collection channel is out of service, project personnel shall monitor gatewells for signs of fish problems or mortality. Spill may be provided as an alternative avenue for fish passage during the collection channel outage.

3.1.2.4. Bypass Flume/Pipe. The bypass flume/pipe transports fish to the sampling facilities and to the tailrace below the project. If there is a problem with the flume/pipe that requires it to be unwatered, procedures will be taken similar to paragraph 3.1.2.3.

3.1.2.5. Sampling Facilities. Under normal operation, juvenile fish are routed around the sampling facilities, except when sampling is being conducted. If there is a problem with the sampling facilities when it is in operation, the drop gate will be lowered to keep all juvenile fish in the bypass flume/pipe to bypass them directly to the river below the project. All fish in the sampling facility will then be released back to the river prior to sampling if there are any problems with holding them in the sample tank until they can be sampled.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not have a significant effect on fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage past the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal criteria, unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with NOAA Fisheries and FPOM. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. 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 and may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain fixed weirs, counting stations with picket leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picket leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater 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. North Shore Auxiliary Water Supply System. The north shore facilities contain three electric pumps that provide auxiliary water to the diffusers at the bottom of the ladder and at the entrances. During normal operation two pumps are required to provide the necessary auxiliary water. If a pump fails during two-pump operation, the pump on standby will be operated to provide the necessary flows. If two or all three pumps fail, the NEW1 weir will be maintained at a level of 6' below tailwater until repairs are made.

3.2.2.3. South Shore Auxiliary Water Supply System. The south shore auxiliary water is supplied by eight electric pumps and 150 to 180 cfs of excess water from the juvenile fish passage facilities. Fluctuating tailwater levels require from six to eight pumps to be operated to provide the auxiliary water. If one pump fails, a standby pump will be started to keep the fishway within criteria. If more pumps fail, this procedure will continue until all the standby pumps are in operation. If criteria cannot be met, the floating orifices should be closed in the following order: OG-12, OG-10, OG-8, and OG-6. If the required head differential of 1' to 2' cannot be reached when the floating orifices are closed, SSE 1 and NFE 2 will be closed equally at 1' intervals until it is reached or until the weirs are 5' below tailwater. Then the remaining floating orifices should be closed in the following order: OG-4, OG-1, and OG-2. If there is still not enough auxiliary water to maintain the head differential on the two main entrances, NFE 2 will be closed, the transportation channel bulkheaded off at the junction pool, and SSE 1 operated as deep as possible to maintain the head differential. If it cannot be maintained at a depth of 6' or greater, the weir will remain at 6' regardless of the head.

3.2.2.4. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction, the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure, which prevents the entrance from being operated manually, an alternate entrance will be opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and the entrance bulkheaded off until the floating orifice is repaired.

3.2.2.5. Diffuser Gratings: Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passageway and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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 paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During these dates turbine units will be operated as needed to meet generation requirements in the priority order shown in table IHR-3. Model studies of Ice Harbor Dam show that spilling at lower river flows can cause eddying in front of the powerhouse. To provide the best fish passage conditions during periods of spill, it is extremely important that the turbine units operate in a specific operating order to minimize eddying conditions. Results from the model studies and preferred operations to reduce eddying are reflected in Table IHR-3.

Table IHR-3. Turbine unit operating priority for Ice Harbor Dam.

Season	Time of Day	Unit Priority*
March 1 – November 30 (Project NOT Spilling)	24 hours	1, 3, 4, then 5 and 6 (any order), 2
March 1 – November 30 (Project IS Spilling)	Daytime (0500 to 1800 hours)	1, 3, 6, 4, 5, and 2
	Nighttime (1800 to 0500 hours)	3, 1, 6, 4, 5, and 2
December 1 – February 28	24 hours	Any Order

Note: If unit 3 is out of service, operate unit 4 in place of unit 3. Unit 2 will be operated on a last on/first off basis until an oil leakage problem can be corrected.

The hours of operations may be coordinated and adjusted in-season by CENWW-OD-T (through coordination with TMT) if fish passage or other conditions at the project require it. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Turbine units will be operated within 1% of best efficiency from April 1 through October 31 (as specified in BPA's load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines, or 2) be in compliance with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% turbine 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% turbine efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Ranges for operation of the turbine units within 1% of best turbine efficiency at various heads are shown in Tables IHR-4 through IHR-7. The 1% turbine efficiency ranges for units 1-3 were calculated using results from 1994 index testing of turbine unit 3. Maximum generation of units 1 through 3 at 115% overload is 103 MW. The 1% best efficiency ranges for units 4-6 were calculated using results from January 1994 index testing on unit 6 and are with submersible traveling screens installed. Maximum generation of units 4 through 6 at 115% overload is 127 MW.

Table IHR-4. The 1% best efficiency ranges for turbine units 1-3 with standard length submersible traveling screens installed.

Head (Ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	51	8,029	88	13,850
86	52	8,055	89	13,845
87	53	8,079	90	13,840
88	53	8,103	91	13,834
89	54	8,127	92	13,829
90	55	8,149	93	13,824
91	56	8,155	94	13,846
92	56	8,161	96	13,869
93	57	8,166	97	13,890
94	58	8,172	98	13,912
95	58	8,177	99	13,932
96	59	8,194	100	13,925
97	60	8,212	101	13,918
98	61	8,228	102	13,911
99	61	8,245	103	13,904
100	62	8,261	104	13,897
101	63	8,308	105	13,853
102	64	8,354	106	13,809
103	65	8,400	107	13,766
104	66	8,444	107	13,723
105	67	8,488	108	13,682

Table IHR-5. The 1% best efficiency ranges for turbine units 1-3 without standard length submersible traveling screens installed.

Head (Ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	51	7,907	79	12,331
86	51	7,932	80	12,326
87	52	7,956	81	12,322
88	53	7,980	82	12,317
89	54	8,003	83	12,313
90	55	8,025	84	12,308
91	55	8,031	85	12,328
92	56	8,037	86	12,348
93	56	8,042	87	12,367
94	57	8,047	88	12,386
95	58	8,052	89	12,405
96	59	8,070	90	12,398
97	59	8,087	91	12,392
98	60	8,103	92	12,386
99	61	8,119	93	12,380
100	62	8,135	94	12,374
101	62	8,182	94	12,334
102	63	8,227	95	12,295
103	64	8,272	95	12,256
104	65	8,316	96	12,219
105	66	8,359	97	12,182

Table IHR-6. The 1% best efficiency ranges for turbine units 4-6 with standard length submersible traveling screens installed.

Head (Ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	58	9,065	108	16,787
86	59	9,076	110	16,804
87	60	9,086	111	16,820
88	61	9,096	113	16,835
89	62	9,105	114	16,850
90	63	9,114	116	16,864
91	63	9,112	117	16,875
92	64	9,110	119	16,886
93	65	9,107	120	16,896
94	65	9,105	121	16,906
95	66	9,102	123	16,916
96	67	9,112	124	16,884
97	68	9,121	125	16,852
98	69	9,130	126	16,821
99	69	9,138	127	16,790
100	70	9,146	129	16,760
101	71	9,141	131	16,937
102	71	9,137	134	17,112
103	72	9,132	136	17,283
104	73	9,127	139	17,452
105	73	9,123	142	17,617

Table IHR-7. The 1% best efficiency ranges for turbine units 4-6 without standard length submersible traveling screens installed.

Head (Ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	61	9,350	103	15,934
86	62	9,361	105	15,950
87	62	9,371	106	15,966
88	63	9,381	108	15,980
89	64	9,391	109	15,994
90	65	9,400	111	16,007
91	66	9,398	112	16,018
92	66	9,396	113	16,029
93	67	9,393	115	16,039
94	68	9,391	116	16,048
95	69	9,389	117	16,057
96	70	9,398	119	16,027
97	70	9,408	120	15,997
98	71	9,417	121	15,967
99	72	9,426	122	15,938
100	73	9,434	123	15,909
101	74	9,429	125	16,078
102	74	9,424	128	16,244
103	75	9,419	130	16,407
104	76	9,414	133	16,566
105	76	9,410	135	16,723

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 reservoirs 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 is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Ice Harbor Dam, this special operation may take place when river flows are above 100 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.

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 slowly 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 Reservoir Control Center (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 spill bay stop setting (about 1.7 kcfs) above passing inflow to slowly lower the level of Ice Harbor 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 be stopped. (At Snake River projects, this should allow about one normal work day 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 spill bay 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.

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 spill bay stop setting above passing inflows.

4.3. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance that may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the 1% turbine efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. 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 before hand.

5. Forebay Debris Removal. Debris at projects can impact fish passage conditions. Debris can plug or block trash racks, 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 the debris.

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 work days 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 and NOAA Fisheries. 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.

Table IHR-8. Ice Harbor daytime adult fish passage spill pattern with deflectors in all spill bays.

Spill Bay										Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10		
1										1	1.7
1									1.5	2.5	4.3
1	1								1.5	3.5	6.1
1	1							1	1.5	4.5	7.8
1	1	1						1	1.5	5.5	9.5
1	1	1					1	1	1.5	6.5	11.2
1	1	1	1				1	1	1.5	7.5	13.0
1	1	1	1			1	1	1	1.5	8.5	14.7
1	1	1	1	1		1	1	1	1.5	9.5	16.4
1	1	1	1	1	1	1	1	1	1.5	10.5	18.2
1	1	1	1	1	1	1	1	1	2	11	19.0
1.5	1.5	1	1	1	1	1	1	1	2	12	20.7
1.5	1.5	1	1.5	1	1	1.5	1	1	2	13	22.5
1.5	1.5	1	1.5	1	1	1.5	1.5	1.5	2	14	24.2
1.5	1.5	1.5	1.5	1.5	1	1.5	1.5	1.5	2	15	25.9
1.5	1.5	1.5	1.5	2	1.5	1.5	1.5	1.5	2	16	27.6
2	1.5	1.5	1.5	2	2	1.5	1.5	1.5	2	17	29.3
2	1.5	1.5	2	2	2	1.5	2	1.5	2	18	31.1
2	1.5	1.5	2	2	2	2	2	2	2	19	32.8
2	2	2	2	2	2	2	2	2	2	20	34.5
2	2	2.5	2	2	2	2	2	2	2.5	21	36.2
2	2	2.5	2	2.5	2	2.5	2	2	2.5	22	37.9
2	2.5	2.5	2.5	2.5	2	2.5	2	2	2.5	23	39.6
2	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	24	41.3
2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	25	43.0
2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	3	2.5	26	44.7
2.5	3	2.5	2.5	2.5	2.5	3	3	3	2.5	27	46.4
2.5	3	3	2.5	2.5	3	3	3	3	2.5	28	48.1
2.5	3	3	3	3	3	3	3	3	2.5	29	49.8
3	3	3	3	3	3	3	3	3	3	30	51.5
3	3.5	3.5	3	3	3	3	3	3	3	31	53.2
3	3.5	3.5	3.5	3.5	3	3	3	3	3	32	54.9
3	3.5	3.5	3.5	3.5	3.5	3.5	3	3	3	33	56.6
3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	34	58.3
3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	35	60.0
3	4	4	3.5	3.5	3.5	3.5	3.5	3.5	4	36	61.7
3	4	4	4	4	3.5	3.5	3.5	3.5	4	37	63.4
3	4	4	4	4	4	4	3.5	3.5	4	38	65.1
3	4	4	4	4	4	4	4	4	4	39	66.8
4	4	4	4	4	4	4	4	4	4	40	68.5

Table IHR-8. Ice Harbor daytime adult fish passage spill pattern with deflectors in all spill bays (continued).

Spill Bay										Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10		
4	5	4	4	4	4	4	4	4	4	41	70.2
4	5	5	4	4	4	4	4	4	4	42	71.9
4	5	5	5	4	4	4	4	4	4	43	73.5
4	5	5	5	5	4	4	4	4	4	44	75.2
4	5	5	5	5	5	4	4	4	4	45	76.9
4	5	5	5	5	5	5	4	4	4	46	78.6
4	5	5	5	5	5	5	5	4	4	47	80.3
4	5	5	5	5	5	5	5	5	4	48	81.9
4	6	5	5	5	5	5	5	5	4	49	83.6
4	6	6	5	5	5	5	5	5	4	50	85.3
4	6	6	6	5	5	5	5	5	4	51	87.0
4	6	6	6	6	5	5	5	5	4	52	88.6
4	6	6	6	6	6	5	5	5	4	53	90.3
4	6	6	6	6	6	6	5	5	4	54	92.0
4	6	6	6	6	6	6	6	5	4	55	93.6
4	6	6	6	6	6	6	6	6	4	56	95.3
4	7	6	6	6	6	6	6	6	4	57	96.9
4	7	7	6	6	6	6	6	6	4	58	98.5
4	7	7	7	6	6	6	6	6	4	59	100.1
4	7	7	7	7	6	6	6	6	4	60	101.7
4	7	7	7	7	7	6	6	6	4	61	103.3
4	7	7	7	7	7	7	6	6	4	62	104.9
4	7	7	7	7	7	7	7	6	4	63	106.5
4	7	7	7	7	7	7	7	7	4	64	108.1
4	8	7	7	7	7	7	7	7	4	65	109.8
4	8	8	7	7	7	7	7	7	4	66	111.5
4	8	8	8	7	7	7	7	7	4	67	113.2
4	8	8	8	8	7	7	7	7	4	68	114.9
4	8	8	8	8	8	7	7	7	4	69	116.6
4	8	8	8	8	8	8	7	7	4	70	118.3
4	8	8	8	8	8	8	8	7	4	71	120.0
4	8	8	8	8	8	8	8	8	4	72	121.7
4	9	8	8	8	8	8	8	8	4	73	123.3
4	9	9	8	8	8	8	8	8	4	74	124.9
4	9	9	9	8	8	8	8	8	4	75	126.5
4	9	9	9	9	8	8	8	8	4	76	128.1
4	9	9	9	9	9	8	8	8	4	77	129.7
4	9	9	9	9	9	9	8	8	4	78	131.3
4	9	9	9	9	9	9	9	8	4	79	132.9
4	9	9	9	9	9	9	9	9	4	80	134.5

Table IHR-8. Ice Harbor daytime adult fish passage spill pattern with deflectors in all spill bays (continued).

Spill Bay										Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10		
4	10	9	9	9	9	9	9	9	4	81	136.1
4	10	10	9	9	9	9	9	9	4	82	137.7
4	10	10	10	9	9	9	9	9	4	83	139.3
4	10	10	10	10	9	9	9	9	4	84	140.9
4	10	10	10	10	10	9	9	9	4	85	142.5
4	10	10	10	10	10	10	9	9	4	86	144.1
4	10	10	10	10	10	10	10	9	4	87	145.7
4	10	10	10	10	10	10	10	10	4	88	147.3
4	11	10	10	10	10	10	10	10	4	89	149.0
4	11	11	10	10	10	10	10	10	4	90	150.7
4	11	11	11	10	10	10	10	10	4	91	152.4
4	11	11	11	11	10	10	10	10	4	92	154.1
4	11	11	11	11	11	10	10	10	4	93	155.8
4	11	11	11	11	11	11	10	10	4	94	157.5
4	11	11	11	11	11	11	11	10	4	95	159.2
4	11	11	11	11	11	11	11	11	4	96	160.9
4	12	11	11	11	11	11	11	11	4	97	162.5
4	12	12	11	11	11	11	11	11	4	98	164.1
4	12	12	12	11	11	11	11	11	4	99	165.7
4	12	12	12	12	11	11	11	11	4	100	167.3
4	12	12	12	12	12	11	11	11	4	101	168.9
4	12	12	12	12	12	12	11	11	4	102	170.5
4	12	12	12	12	12	12	12	11	4	103	172.1
4	12	12	12	12	12	12	12	12	4	104	173.7
4	13	12	12	12	12	12	12	12	4	105	175.3

SECTION 7

LOWER MONUMENTAL DAM

Lower Monumental Dam

1. Fish Passage Information. The locations of fish passage facilities at Lower Monumental Lock and Dam are shown on Figure LMN-1. Dates of project operations for fish purposes and special operations are listed in Table LMN-2.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The Lower Monumental juvenile facilities consist of standard length submersible traveling screens (STS), vertical barrier screens (VBS), 12" orifices, collection gallery, dewatering structure, and bypass flume to the tailrace below the project. Transportation facilities consist of a separator to sort juvenile fish by size and to separate them from adult fish, sampling facilities, raceways, office and sampling building, truck and barge loading facilities, and PIT tag detection and deflector systems.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at Lower Monumental Dam is indicated in Table LMN-1. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities which may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

Table LMN-1. Juvenile migration timing at Lower Monumental Dam based on juvenile fish collection numbers.

% Collection	1999	2000	2001	2002	2003
Yearling Hatchery Chinook					
10%	4/24	4/15	4/16	*	4/12
90%	5/25	5/22	5/25	*	5/27
Yearling Wild Chinook					
10%	4/21	4/21	4/30	*	4/23
90%	5/31	5/29	5/30	*	6/2
Subyearling Chinook					
10%	6/24	6/14	6/5	*	6/5
90%	8/4	8/14	8/11	*	7/20
Hatchery Steelhead					
10%	5/2	4/25	5/4	*	5/1
90%	5/29	5/27	7/4	*	5/30
Wild Steelhead					
10%	4/28	4/21	5/4	*	5/1
90%	5/29	5/29	7/3	*	5/31

*Extensive primary bypass makes these calculations inappropriate.

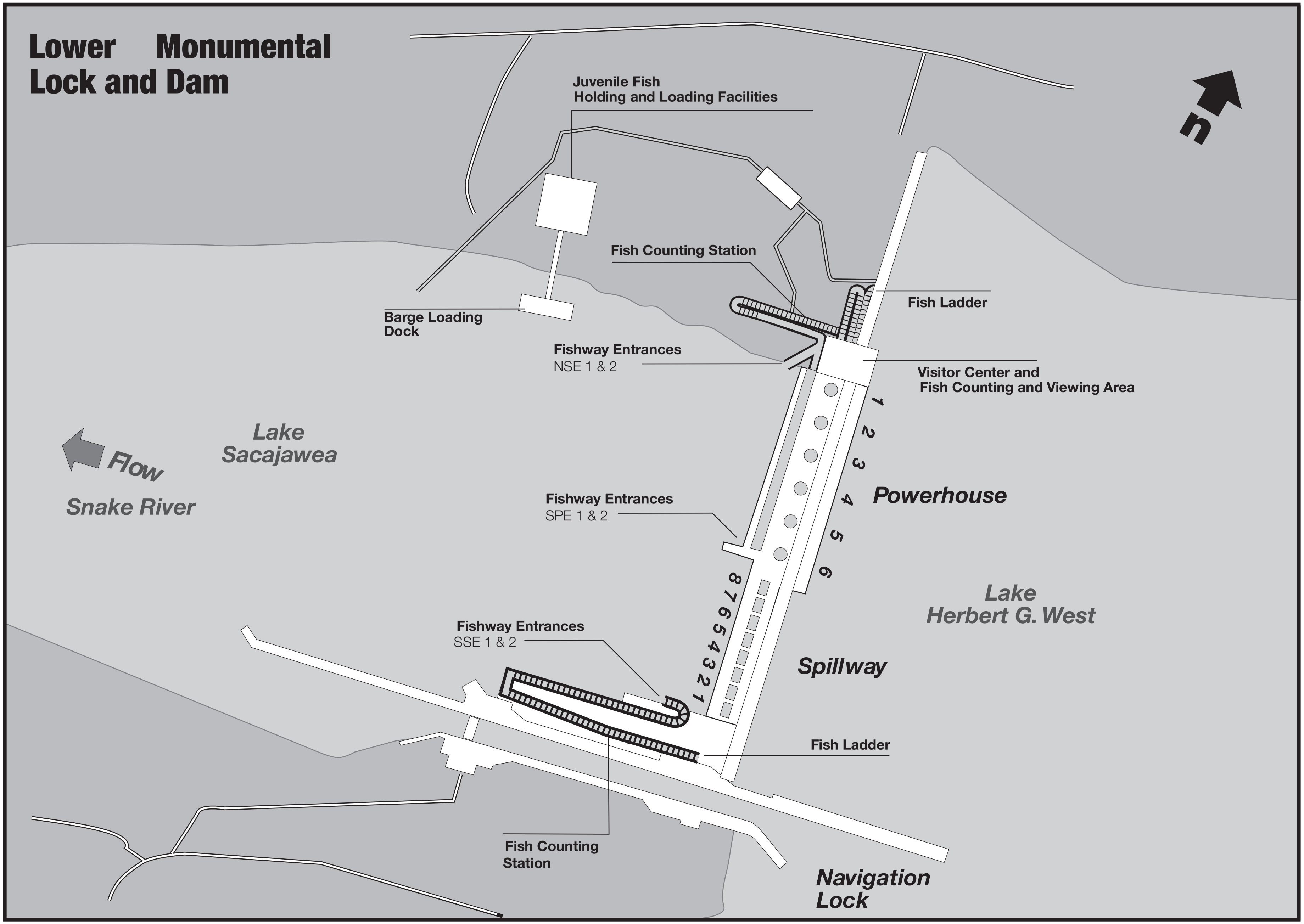
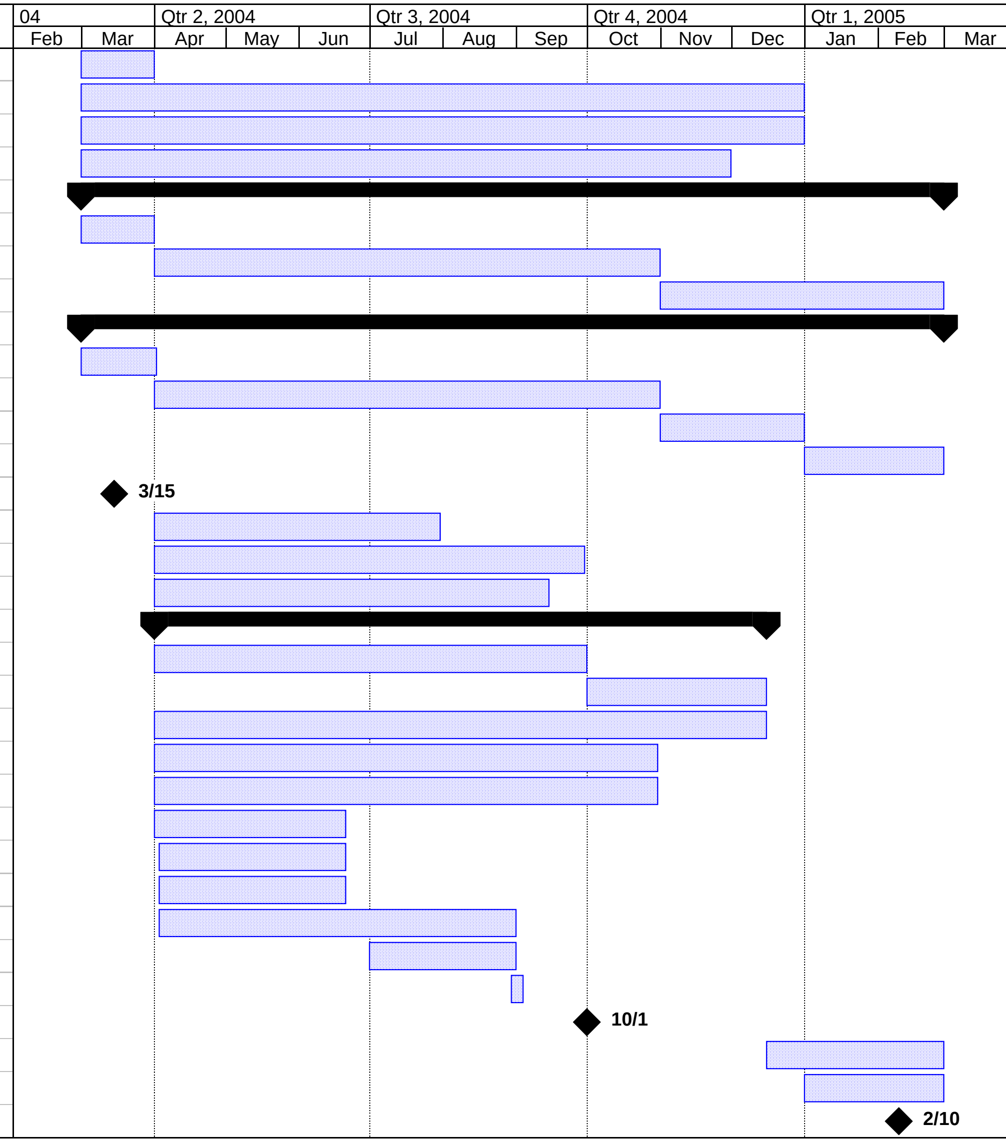


Figure LMN-1 Lower Monumental Lock and Dam general site plan.

Table LMN-1. Dates of project operations for fish purposes at Lower Monumental, 2004

Task Name	Start	Finish	FPP Reference
Winter Maintenance Period Juvenile	3/1/04	3/31/04	Lmn 2.3.1.1.
Adult Fish Passage Period	3/1/04	12/31/04	Lmn 2.3.2.2
Weekly Reports	3/1/04	12/31/04	Lmn 2.3.3
Operate Turbines for Fish Passage	3/1/04	11/30/04	Lmn 4.1
1% limitations	**3/1/04**	**2/28/05**	**Lmn 4.1**
1% Soft	3/1/04	3/31/04	Lmn 4.1
1% Hard	4/1/04	10/31/04	Lmn 4.1
1% Soft	11/1/04	2/28/05	Lmn 4.1
Adult Fish Counting	**3/1/04**	**2/28/05**	**Lmn 1.2.2**
Fish Counting (Video 0800 - 1600)	3/1/04	4/1/04	Lmn 1.2.2
Fish Counting (Visual 0400 - 2000)	4/1/04	10/31/04	Lmn 1.2.2
Fish Counting (Video 0600 - 1600)	11/1/04	12/31/04	Lmn 1.2.2
Fish Counting (Video 0800 - 1600)	1/1/05	2/28/05	Lmn 1.2.2
Final Report	3/15/04	3/15/04	Lmn 2.3.3
Backflush orifices once per shift	4/1/04	7/31/04	Lmn 2.3.1.2.c.4
Juvenile Fish Transportation	4/1/04	9/30/04	App B 3
TDG Monitoring	4/1/04	9/15/04	App D Phase 2
Operate juvenile facilities	**4/1/04**	**12/15/04**	**Lmn 2.3.1**
Operate for Juvenile Fish passage	4/1/04	9/30/04	Lmn 2.3.1
Operate for Adult Fallback	10/1/04	12/15/04	Lmn 2.3.1
Juvenile Passage Period	4/1/04	12/15/04	Lmn 2.3.1.2
Adult Salmon Migration Study	4/1/04	10/31/04	App A Lmn 2.4
Adult Fishway Evaluation	4/1/04	10/31/04	App A Lmn 2.5
Near Field TDG Exchange Study	4/1/04	6/20/04	App A Lmn 2.3
Spill for Fish	4/3/04	6/20/04	Lmn 2.1
Spillway Survival Study	4/3/04	6/20/04	App A Lmn 2.1
Ihr Spillway Survival Study	4/3/04	8/31/04	App A Lmn 2.2
Spillway Stilling Basin Survey	7/1/04	8/31/04	App A Lmn 1.4
Doble Test T1 & T2	8/30/04	9/3/04	App A Lmn 1.5
1/2 STS May Be Pulled	10/1/04	10/1/04	Lmn 2.3.1.2.b.6
Winter Maintenance Period Juvenile	12/16/04	2/28/05	Lmn 2.3.1.1.
Maintenance of Adult Facilities	1/1/05	2/28/05	Lmn 1.2.2
Draft Final Report	2/10/05	2/10/05	Lmn 2.3.3



1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Lower Monumental are comprised of north and south shore fish ladders and collection systems with a common auxiliary water supply. The north shore fish ladder connects to two north shore entrances and the powerhouse collection system. The powerhouse collection system has two downstream entrances and one side entrance into the spillway basin at the south end of the powerhouse, and a common transportation channel. Two north shore entrances, two downstream south powerhouse entrances, and none of the floating orifices will be used during the 2004 fish passage season. The south shore fish ladder has two downstream entrances and a side entrance into the spillway basin. The two downstream entrances are used during normal operation. The auxiliary water is supplied by three turbine-driven pumps located in the powerhouse on the north side of the river. The water is pumped into a supply conduit that travels under the powerhouse collection channel, distributing water to the powerhouse diffusers, and then under the spillway to the diffusers in the south shore collection system. Excess water from the juvenile fish bypass system (approximately 200-240 cfs) is added to the auxiliary water supply system for the powerhouse collection system.

1.2.2. Adult Migration Timing. Upstream migrants are present at Lower Monumental Dam all year. Maintenance of adult fish facilities is scheduled in January and February to minimize impacts to adult migrants. Facilities are usually shut down one shore at a time for maintenance to minimize impacts on adult fish passage. Table LMN-3 shows the primary passage periods by species and shows the latest and earliest recorded dates of peak passage from fish count records compiled by the Corps. Adult fish (salmon, steelhead, bull trout, and lamprey) are normally counted 16-hours per day (0400 to 2000 Pacific Standard Time) from April 1 through October 31. Adult fish counting is done visually by fish counters. Due to a requirement in the 2000 U.S. Fish and Wildlife Service BiOp on operations of the FCRPS, fish counting will continue year round through 2004. Video counting will take place from 0800 to 1600 hours PST in January, February, and March, and from 0600 to 1600 hours PST in November and December.

Table LMN-3. Adult migration timing at Lower Monumental Dam from 1969-2003 based on fish counts.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
Spring Chinook	4/1 - 6/13	4/20	5/27
Summer Chinook	6/14 - 8/13	6/14	7/12
Fall Chinook	8/14 - 10/31	9/13	9/30
Steelhead	4/1 - 10/31	9/15	10/13
Sockeye	4/1 - 10/31	6/24	7/25

2. Project Operation.

2.1. Spill Management. Involuntary spill at Lower Monumental 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 Lower Monumental shall be distributed in accordance with the spill pattern included at the end of this section, Table LMN-9. Special spills for juvenile fish passage will be provided as detailed in Appendix A (Special Project Operations and Research). Spills for juvenile fish passage normally take place during the spring, 24 hours per day, from approximately April 3 through June 20.

To improve tailrace juvenile egress conditions and minimize eddying, it is recommended that the Lower Monumental project be operated as shown below while voluntarily spilling for fish passage. If possible, involuntary spill under the flow levels shown should follow these project operations also.

River Flow Range	Voluntary Spill Level	Turbine Unit Priority
Less than 75 kcfs	50% Spill	1 and 5
75 to 100 kcfs	45% Spill	1, 5, 2, and 3
Over 100 kcfs	50% or to Gas Cap	1, 5, 2, 3, 4, and 6

2.2. Total Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at Lower Monumental are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels are monitored in the Lower Monumental Dam forebay and tailrace from April 1 through September 15. Data will be collected every half-hour and transmitted via computer every hour. Implementation of spill management requests will be based upon TDG monitoring and juvenile migration data. Requests for spill will be coordinated through the TMT.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through September 30 for juvenile fish bypass, collection and transportation, and from October 1 through December 15 for bypassing adult fallbacks. Operate the juvenile facilities according to the criteria listed below and in Appendix B for 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 trash racks just prior to the operating season.

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

b. Submersible Traveling Screens and Vertical Barrier Screens.

1. Maintenance completed on all screens.

2. Inspect STSs prior to installation and operate one trial run (dogged off on deck) to ensure proper operation.

3. Log results of trial run.

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

c. Collection Gallery.

1. Water-up valve operating correctly.

2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

d. Dewatering Structure and Flume.

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

2. Screen cleaning system (brush and air flush) maintained and operating correctly.

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

4. All valves should be operating correctly.

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

e. Transportation Facilities.

1. Primary bypass flume switch gate maintained and in good operating condition.

2. Flume interior smooth with no rough edges.

3. Perforated plate edges smooth with no rough edges.

4. Wet separator and fish distribution system should be 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 should be free of debris, cracks, or blockages. Truck and barge loading hose couplings should have no rough edges and barge loading boom should be maintained and tested.

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

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.

g. Maintenance Records. Record all maintenance and inspections.

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

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Log gatewell 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. Coordinate turbine unit outages with other project work activities, if possible, to minimize turbine unit outages during the spring.

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 surfaces 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 cannot 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. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow 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 unwatering bulkhead slot.

b. Submersible Traveling Screens (STS), Vertical Barrier Screens (VBS), and Operating Gates.

1. Operate STSs in cycling mode when average fork length of subyearling or sockeye is greater than 120 mm.

2. Operate STSs in continuous operational mode when average fork length of subyearling chinook or sockeye is less than 120 mm or if fish condition deteriorates.

3. Inspect each STS once per month by means of underwater video. Spot check VBSs at the same time.

4. Record STS amp readings daily.

5. If an STS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of STSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged STS.

6. Half of the STSs may be pulled after October 1 for maintenance as long as unscreened turbine units are not operated.

7. Make formal determination at end of season as to adequacy of STS mesh and replacement if necessary.

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

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

c. Collection Gallery Checks.

1. Orifices clean and operating. Operate at least one 12" orifice per slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain a full collection channel.

2. Orifice lights operational and operating on open orifices.

3. Operate with bypass gallery full to ensure orifice jets are hitting in the middle of the channel.

4. 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 shift or more frequently as determined by the project biologist, to keep orifices clean.

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

d. Dewatering Structure.

1. Trash sweep operating correctly. The frequency of the sweep should be set as necessary to maintain a clean screen, with a minimum operation of at least once per hour. Operate the air flush as specified by the project biologist 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.

e. Transportation Facilities.

1. All screens should be inspected to make sure there are no holes or sharp edges.

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. Operate wet separator and fish distribution system as designed.

5. Truck and barge loading facilities in good operating condition.

f. Avian Predation Areas (Forebay and Tailrace).

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

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

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

g. Inspection and Record Keeping.

1. Inspect fish facilities at least once every 8 hours. Inspect all facilities according to fish facilities monitoring program.

2. Record all maintenance and inspections.

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

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

a. Inspect all staff gauges and water level indicators, repair and/or clean where necessary.

b. Dewater all ladders 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. Fish ladder exit trashracks must have smooth surfaces where fish pass, and must have downstream edges that are adequately rounded or padded. Spare trashracks should be on hand for use as necessary. Inspect all diffuser gratings and chambers annually by dewatering and physically inspecting the gratings and chambers 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. Prior to the fish passage season, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly.

d. Calibrate all mechanical and electronic 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 debris cleaned out of turbine unit wicket gates.

2.3.2.2. Fish Passage Period (March 1 through December 31).

Note: Ice Harbor pool may be operated at minimum operating pool (MOP), between elevations 437' and 438' msl, as part of the Corps' efforts for improving migration conditions for juvenile salmonids. This may result in some of the adult fishway entrances at Lower Monumental Dam 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 Ladders. Water depth over weirs: 1' to 1.3'.

b. Head on all Entrances. Head range: 1' to 2'

c. North Shore Entrances (NSE 1 & 2). Elevation of top of gate when on sill = 429'.

1. Operate both gates.

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

d. Powerhouse Collection System. No floating orifice gates will be operated in 2004.

e. South Powerhouse Entrances (SPE 1 & 2). Elevation of top of gate when on sill = 432'.

1. Operate both downstream gates.

2. Weir depth: 8' or greater below tailwater. At tailwaters below elevation 440', weirs should be on sill.

f. South Shore Entrances (SSE 1 & 2). Elevation of top of gate when on sill = 431'.

1. Operate both downstream gates.

2. Weir depth: SSE 1 operate 8' or greater below tailwater. SSE 2 raised 6' above sill. At tailwaters below elevation 439', SSE 1 weir should be on sill.

g. Transportation Velocity. 1.5' to 4' per second.

h. Head on Trashracks.

1. Maximum head of 0.5' on ladder exits.

2. Maximum head on south shore picketed leads shall be 0.3'. Maximum head on north shore picketed leads shall be 0.4'.

3. Trashracks and picketed leads installed correctly.

i. Staff Gages and Water Level Indicators. Gages shall be readable at all water levels encountered during fish passage period.

j. 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 biologist shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Picketed leads shall be inspected during all inspections to ensure they are clean and in the correct position (all the way down).

4. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration.

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

6. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. 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. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities that occurred at the project that may affect fish passage. 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. 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. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologist 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 plans. **When the river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T**. Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modifications to the 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 and/or survival. Unscheduled maintenance of facilities such as submersible traveling screens, which sometimes break down during the fish passage season, will be carried out according to procedures 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 effect on fish passage will be coordinated with NOAA Fisheries and FPOM on a case-by-case basis by CENWW-OD-T. The 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. Submersible Traveling Screens. The STSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged it will be removed and either replaced with the spare STS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning STS or without a full compliment of STSs. If an STS 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 STS can be removed and repaired or replaced.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12" orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated. To minimize blockage from debris, orifices are cycled and backflushed at least once per day, and more frequently if required by heavy debris loads. If an air-valve fails, the valve should be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, 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. During any closure event of orifices in an operating turbine unit, gatewells will be checked hourly. During times of high fish passage or if there is evidence of any difficulty in holding fish in gatewells, fish are to be dipped from the gatewells at a more frequent interval.

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 is discharged into the adult fish facility auxiliary water supply system and is also used as the water supply for the transportation facilities. The dewatering structure contains a trash sweep and air burst system for cleaning the inclined screen of impinged debris. If the cleaning systems break and interfere 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 will be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upstream end of the inclined screen. The emergency bypass is then opened and the bypass system operated with 6 gatewell orifices open. Orifices will then need to be routinely rotated, every three hours, in order to let juveniles emigrate from all of the gatewells. While the facilities are in emergency bypass operation, project personnel shall monitor gatewells for signs of fish problems or mortality. Spill may be provided 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 (primary bypass). If there is a problem with the flume that interferes with its operation, the 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 the emergency bypass pipe while repairs are made.

3.1.2.5. Transportation Facilities. The transportation facilities can be operated to collect and hold juveniles for the transportation program or to bypass them back to the river (secondary bypass). If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed to the river via the primary bypass pipe.

3.2. Adult fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility that must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not have a significant effect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July, and annual maintenance requires a two-week outage per pump during the winter maintenance period. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with NOAA Fisheries and FPOM. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. 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 and may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain fixed weirs, counting stations with picket leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picket leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether 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. The auxiliary water for the fish ladders and the collection systems is supplied by three turbine-driven pumps on the north shore, with all three pumps being required for normal operation. If one, two, or all three pumps fail, the fishway will be adjusted in the following manner until repairs can be made: SPE 2 and SSE 2 will be closed and SPE 1 raised to provide the required 1' to 2' head differential in the system. If the desired head differential cannot be reached by the time SPE 1 reaches 5' below tailwater, SPE 1 should be closed, the collection channel bulkheaded off at the junction pool, and NSE 1 and 2 and SSE 1 operated as deep as possible to maintain the head. If it cannot be maintained at a depth greater than 6', the weirs should be maintained at 6' regardless of the head differential.

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

3.2.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passageway and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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 paragraph

3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units at Lower Monumental will be operated to enhance adult fish passage from March 1 through November 30. During this time period, turbine units will be operated as needed to meet generation requirements in the order shown in Table LMN-4. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. If a turbine unit is taken out of service for maintenance or repair, the next unit on the priority list shall be operated.

Table LMN-4. Turbine unit operating priority for Lower Monumental Dam.

Season	Time of Day	Unit Priority
March 1 – November 30	While Spilling	1, 2, 3, then 4 through 6 (any order)
	No Spill	1, 2, 3, 4, 5, then 6
December 1 – February 28	24 hours	Any Order

If unit 1 is out of service, unit 2 should replace it. If unit 5 is out of service, unit 4 should replace it.

Turbine units will be operated within 1% of best efficiency from April 1 through October 31 (as specified in BPA's load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy, statutory requirements and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% turbine 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% turbine efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within the 1% range at various heads are shown in Tables LMN-5 through LMN-8. These 1% turbine efficiency ranges were calculated using results from 1994 index testing of turbine unit 3 at Little Goose Dam. Maximum generation of turbine units at 115% overload is 155 MW.

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 is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Lower Monumental, 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.

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 slowly 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 Reservoir Control Center (RCC) by the same time period and inform them of the intended work.

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

Table LMN-5. Lower Monumental 1% operating efficiency range for turbine units 1-3 with standard length submersible traveling screens installed.

Head Ft	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	62.2	10,817	114.4	19,891
81	63.5	10,892	117.2	20,106
82	64.8	10,964	120.0	20,314
83	66.1	11,035	122.8	20,517
84	67.3	11,103	125.6	20,714
85	68.6	11,169	128.5	20,905
86	69.4	11,154	131.0	21,056
87	70.2	11,140	133.5	21,204
88	70.9	11,125	136.1	21,348
89	71.7	11,111	138.6	21,488
90	72.4	11,097	141.2	21,625
91	73.3	11,088	141.6	21,418
92	74.1	11,079	142.0	21,216
93	75.0	11,071	142.4	21,018
94	75.8	11,061	142.8	20,824
95	76.7	11,052	143.2	20,634
96	77.7	11,071	143.3	20,416
97	78.8	11,088	143.5	20,203
98	79.8	11,105	143.6	19,994
99	80.8	11,121	143.8	19,789
100	81.8	11,137	144.0	19,589
101	82.7	11,138	145.9	19,641
102	83.6	11,140	147.8	19,692
103	84.5	11,141	149.7	19,741
104	85.4	11,142	151.6	19,789
105	86.2	11,143	153.5	19,837
106	86.9	11,122	154.9	19,822
107	87.6	11,101	156.4	19,807
108	88.4	11,081	157.8	19,792
109	89.1	11,061	159.2	19,777
110	89.8	11,041	160.7	19,762

NOTE: The turbine efficiency tables were revised to reflect new information using a 2002 index test and original 1975 turbine model test. Table is based on information provided by HDC in letter to NWW dated August 20, 2003.

Table LMN-6. Lower Monumental 1% operating efficiency range for turbine units 1-3 without standard length submersible traveling screens.

Head Ft	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	62.8	10,772	112.1	19,234
81	64.1	10,846	114.8	19,442
82	65.4	10,919	117.6	19,644
83	66.6	10,989	120.3	19,840
84	67.9	11,057	123.1	20,031
85	69.2	11,123	125.8	20,216
86	70.0	11,109	128.3	20,363
87	70.8	11,094	130.8	20,506
88	71.6	11,080	133.3	20,645
89	72.3	11,066	135.8	20,781
90	73.1	11,052	138.3	20,913
91	74.0	11,043	138.7	20,714
92	74.8	11,035	139.1	20,518
93	75.7	11,026	139.5	20,327
94	76.5	11,017	139.9	20,140
95	77.4	11,009	140.3	19,956
96	78.4	11,027	140.4	19,746
97	79.5	11,044	140.6	19,540
98	80.5	11,061	140.7	19,338
99	81.5	11,078	140.9	19,141
100	82.6	11,093	141.0	18,947
101	83.5	11,095	142.9	18,998
102	84.3	11,096	144.8	19,047
103	85.2	11,098	146.7	19,095
104	86.1	11,099	148.5	19,142
105	87.0	11,100	150.4	19,188
106	87.7	11,079	151.8	19,173
107	88.4	11,059	153.2	19,159
108	89.1	11,038	154.6	19,145
109	89.9	11,019	156.0	19,131
110	90.6	10,999	157.4	19,116

NOTE: The turbine efficiency tables were revised to reflect new information using a 2002 index test and original 1975 turbine model test. Table is based on information provided by HDC in letter to NWW dated August 20, 2003.

Table LMN-7. Lower Monumental 1% operating efficiency range for turbine units 4-6 with standard length submersible traveling screens installed.

Head Ft	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	84.3	14,189	115.1	19,364
81	85.4	14,181	116.8	19,392
82	86.5	14,174	118.5	19,419
83	87.6	14,166	120.3	19,445
84	88.7	14,158	122.0	19,469
85	89.8	14,150	123.8	19,493
86	91.0	14,160	125.5	19,519
87	92.2	14,169	127.2	19,545
88	93.4	14,178	128.9	19,569
89	94.6	14,187	130.6	19,593
90	95.7	14,195	132.3	19,616
91	96.9	14,196	133.9	19,613
92	98.0	14,197	135.4	19,610
93	99.2	14,197	136.9	19,607
94	100.3	14,198	138.5	19,603
95	101.4	14,198	140.0	19,600
96	102.3	14,170	140.5	19,456
97	103.2	14,142	141.0	19,315
98	104.1	14,114	141.5	19,177
99	105.1	14,087	142.0	19,042
100	106.0	14,061	142.5	18,909
101	107.3	14,091	143.9	18,909
102	108.5	14,120	145.4	18,909
103	109.8	14,149	146.8	18,909
104	111.1	14,177	148.2	18,909
105	112.4	14,204	149.6	18,909
106	113.5	14,203	151.6	18,981
107	114.5	14,202	153.6	19,051
108	115.6	14,200	155.6	19,120
109	116.6	14,199	157.6	19,187
110	117.7	14,198	159.6	19,253

NOTE: The turbine efficiency tables were revised to reflect new information using a 2002 index test and original 1975 turbine model test. Table is based on information provided by HDC in letter to NWW dated August 20, 2003.

Table LMN-8. Lower Monumental 1% operating efficiency range for turbine units 4-6 without standard length submersible traveling screens.

Head Ft	Lower Generator Limits		Upper Generator Limits	
	MW	CFS	MW	CFS
80	84.0	13,999	113.9	18,975
81	85.1	13,992	115.6	19,002
82	86.2	13,985	117.3	19,029
83	87.3	13,977	119.1	19,054
84	88.4	13,969	120.8	19,079
85	89.5	13,962	122.5	19,102
86	90.7	13,971	124.2	19,128
87	91.9	13,981	125.9	19,153
88	93.1	13,990	127.6	19,177
89	94.2	13,998	129.3	19,201
90	95.4	14,006	131.0	19,224
91	96.5	14,007	132.5	19,221
92	97.7	14,008	134.0	19,218
93	98.8	14,009	135.5	19,215
94	99.9	14,010	137.1	19,211
95	101.1	14,010	138.6	19,208
96	102.0	13,982	139.1	19,067
97	102.9	13,954	139.6	18,929
98	103.8	13,928	140.1	18,794
99	104.7	13,901	140.5	18,662
100	105.6	13,875	141.0	18,532
101	106.9	13,904	142.5	18,532
102	108.2	13,933	143.9	18,532
103	109.4	13,962	145.3	18,532
104	110.7	13,989	146.7	18,532
105	112.0	14,017	148.1	18,532
106	113.1	14,015	150.1	18,602
107	114.1	14,014	152.0	18,670
108	115.2	14,013	154.0	18,738
109	116.2	14,011	156.0	18,804
110	117.3	14,010	158.0	18,869

NOTE: The turbine efficiency tables were revised to reflect new information using a 2002 index test and original 1975 turbine model test. Table is based on information provided by HDC in letter to NWW dated August 20, 2003.

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 Lower Monumental 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 work day 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.

If the work that needs to be done is of an emergency type 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.

4.3. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance that may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults.

Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent best efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 work days. To conduct the testing, the distribution 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.

Turbine units are to be operated with raised operating gates to improve fish passage conditions when STSs are installed, except as provided below. To facilitate annual maintenance, operating gates are used to unwater 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 work day (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 work day (normally Monday). On the completion of maintenance, the turbine unit can be operated with the operating gates in the standard operating position until 0700 hours of the first regular work day after the maintenance is completed. 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.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. 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 before hand.

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 the debris.

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 work days prior to the day they want the special project operations for spilling to pass debris. The CENWW-OD-T shall coordinate the special operations with RCC and NOAA Fisheries. 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.

Table LMN-9. Lower Monumental Dam spill pattern. (NOTE: Bays 1 and 8 will be restricted to 3 stops maximum in 2004. A new table will be provided before April 1, 2004).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
1								1	1.1
1							1	2	2.2
1	1						1	3	3.3
1	1					1	1	4	4.4
1	1	1				1	1	5	5.5
1	1	1			1	1	1	6	6.6
1	1	1	1		1	1	1	7	7.7
1	1	1	1	1	1	1	1	8	8.8
2	1	1	1	1	1	1	1	9	10.5
2	1	1	1	1	1	1	2	10	12.2
2	2	1	1	1	1	1	2	11	13.9
2	2	1	1	1	1	2	2	12	15.6
2	2	2	1	1	1	2	2	13	17.3
2	2	2	1	1	2	2	2	14	19.0
2	2	2	2	1	2	2	2	15	20.7
2	2	2	2	2	2	2	2	16	22.4
3	2	2	2	2	2	2	2	17	24.2
3	2	2	2	2	2	2	3	18	26.0
3	3	2	2	2	2	2	3	19	27.8
3	3	2	2	2	2	3	3	20	29.6
3	3	3	2	2	2	3	3	21	31.4
3	3	3	2	2	3	3	3	22	33.2
3	3	3	3	2	3	3	3	23	35.0
3	3	3	3	3	3	3	3	24	36.8
4	3	3	3	3	3	3	3	25	38.4
4	3	3	3	3	3	3	4	26	40.0
4	4	3	3	3	3	3	4	27	41.6
4	4	3	3	3	3	4	4	28	43.2
4	4	4	3	3	3	4	4	29	44.8
4	4	4	3	3	4	4	4	30	46.4
4	4	4	4	3	4	4	4	31	48.0
4	4	4	4	4	4	4	4	32	49.6
5	4	4	4	4	4	4	4	33	51.3
5	4	4	4	4	4	4	5	34	53.0
5	5	4	4	4	4	4	5	35	54.7
5	5	4	4	4	4	5	5	36	56.4
5	5	5	4	4	4	5	5	37	58.1
5	5	5	4	4	5	5	5	38	59.8
5	5	5	5	4	5	5	5	39	61.5

Table LMN-9. Lower Monumental Dam spill pattern (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
5	5	5	5	5	5	5	5	40	63.2
6	5	5	5	5	5	5	5	41	64.9
6	5	5	5	5	5	5	6	42	66.6
6	6	5	5	5	5	5	6	43	68.3
6	6	5	5	5	5	6	6	44	70.0
6	6	6	5	5	5	6	6	45	71.7
6	6	6	5	5	6	6	6	46	73.4
6	6	6	6	5	6	6	6	47	75.1
6	6	6	6	6	6	6	6	48	76.8
7	6	6	6	6	6	6	6	49	78.5
7	6	6	6	6	6	6	7	50	80.2
7	7	6	6	6	6	6	7	51	81.9
7	7	6	6	6	6	7	7	52	83.6
7	7	7	6	6	6	7	7	53	85.3
7	7	7	6	6	7	7	7	54	87.0
7	7	7	7	6	7	7	7	55	88.7
7	7	7	7	7	7	7	7	56	90.4
8	7	7	7	7	7	7	7	57	92.2
8	7	7	7	7	7	7	8	58	94.0
8	8	7	7	7	7	7	8	59	95.8
8	8	7	7	7	7	8	8	60	97.6
8	8	8	7	7	7	8	8	61	99.4
8	8	8	7	7	8	8	8	62	101.2
8	8	8	8	7	8	8	8	63	103.0
8	8	8	8	8	8	8	8	64	104.8
9	8	8	8	8	8	8	8	65	106.5
9	8	8	8	8	8	8	9	66	108.2
9	9	8	8	8	8	8	9	67	109.9
9	9	8	8	8	8	9	9	68	111.6
9	9	9	8	8	8	9	9	69	113.3
9	9	9	8	8	9	9	9	70	115.0
9	9	9	9	8	9	9	9	71	116.7
9	9	9	9	9	9	9	9	72	118.4
10	9	9	9	9	9	9	9	73	120.1
10	9	9	9	9	9	9	10	74	121.8
10	10	9	9	9	9	9	10	75	123.5
10	10	9	9	9	9	10	10	76	125.2
10	10	10	9	9	9	10	10	77	126.9
10	10	10	9	9	10	10	10	78	128.6

Table LMN-9. Lower Monumental Dam spill pattern (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
10	10	10	10	9	10	10	10	79	130.3
10	10	10	10	10	10	10	10	80	132.0
11	10	10	10	10	10	10	10	81	133.7
11	10	10	10	10	10	10	11	82	135.4
11	11	10	10	10	10	10	11	83	137.1
11	11	10	10	10	10	11	11	84	138.8
11	11	11	10	10	10	11	11	85	140.5
11	11	11	10	10	11	11	11	86	142.2
11	11	11	11	10	11	11	11	87	143.9
11	11	11	11	11	11	11	11	88	145.6
12	11	11	11	11	11	11	11	89	147.4
12	11	11	11	11	11	11	12	90	149.2
12	12	11	11	11	11	11	12	91	151.0
12	12	11	11	11	11	12	12	92	152.8
12	12	12	11	11	11	12	12	93	154.6
12	12	12	11	11	12	12	12	94	156.4
12	12	12	12	11	12	12	12	95	158.2
12	12	12	12	12	12	12	12	96	160.0

SECTION 8

LITTLE GOOSE DAM

Little Goose Dam

1. Fish Passage Information. The locations of fish passage facilities at Little Goose Lock and Dam are shown in Figure LGS-1. Dates of project operations for fish purposes and special operations are listed in Table LGS-1.

1.1. Juvenile Fish Passage.

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

1.1.2. Juvenile Migration Timing. Juvenile migration timing at Little Goose Dam is indicated in Table LGS-2. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities that may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Little Goose are comprised of one fish ladder on the south shore, two south shore entrances, a powerhouse collection system, north shore entrances with a transportation channel underneath the spillway to the powerhouse collection system, and auxiliary water supply system. The powerhouse collection system is comprised of two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. The two downstream entrances at the north end of the collection system and none of the floating orifices will be used during the 2004 fish passage season. The north shore entrances are made up of

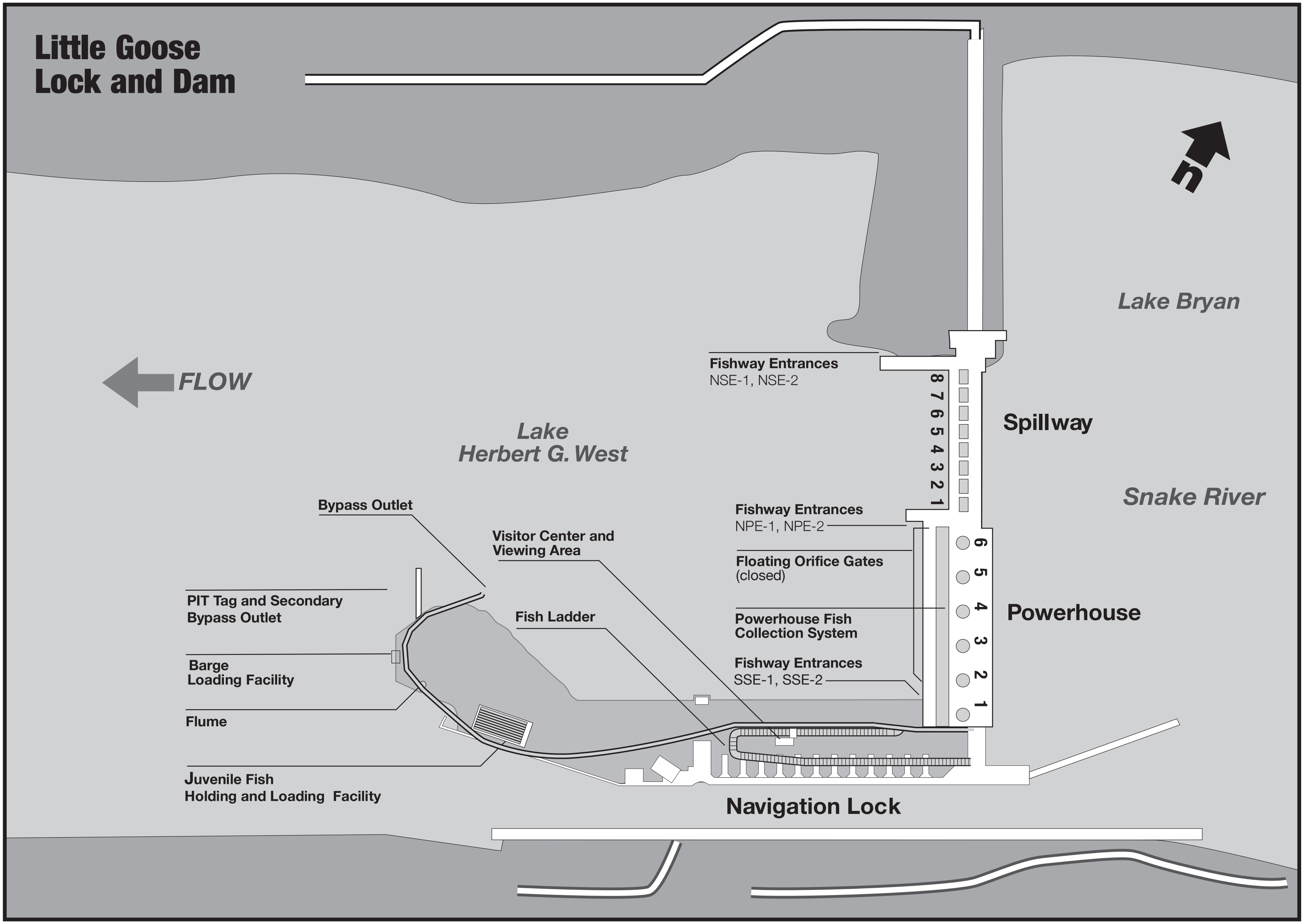


Figure LGS-1 Little Goose Lock and Dam general site plan.

Table LGS-1. Dates of project operations for fish purposes at Little Goose, 2004

Task Name	Start	Finish	FPP Reference
Winter Maintenance Period Juvenile	3/1/04	3/31/04	Lgs 2.3.1.1.
Adult Fish Passage Period	3/1/04	12/31/04	Lgs 2.3.2.2
Weekly Reports	3/1/04	12/31/04	Lgs 2.3.3
Operate Turbines for Fish Passage	3/1/04	11/30/04	Lgs 4.1
1% limitations	**3/1/04**	**2/28/05**	**Lgs 4.1**
1% Soft	3/1/04	3/31/04	Lgs 4.1
1% Hard	4/1/04	10/31/04	Lgs 4.1
1% Soft	11/1/04	2/28/05	Lgs 4.1
Adult Fish Counting	**3/1/04**	**2/28/05**	**Lgs 1.2.2**
Fish Counting (Video 0800 - 1600) PST	3/1/04	3/31/04	Lgs 1.2.2
Fish Counting (Visual 0400 - 2000) PST	4/1/04	10/31/04	Lgs 1.2.2
Fish Counting (Video 0600 - 1600) PST	11/1/04	12/31/04	Lgs 1.2.2
Fish Counting (Video 0800 - 1600) PST	1/1/05	2/28/05	Lgs 1.2.2
Final Report	3/15/04	3/15/04	Lgs 2.3.3
Adult Migration Study	4/1/04	10/31/04	App A. Lgs 2.1
Backflush orifices once per shift	4/1/04	7/31/04	Lgs 2.3.1.2.c.4
TDG Monitoring	4/1/04	9/15/04	App D Phase 2
Operate juvenile facilities	**4/1/04**	**12/15/04**	**Lgs 2.3.1**
Operate for Juvenile Fish Passage	4/1/04	10/31/04	Lgs 2.3.1
Operate for Adult Fallback	11/1/04	12/15/04	Lgs 2.3.1
Juvenile Passage Period	4/1/04	12/15/04	Lgs 2.3.1.2
Juvenile Fish Transportation	4/1/04	10/31/04	App B 3
Adult Fishway Evaluation	4/1/04	10/31/04	App A. Lgs 2.2
Spill for Fish	4/3/04	6/20/04	Lgs 2.1
Spillway Gate Testing	6/1/04	8/31/04	App A. Lgs 1.2
Spillway Stilling Basin Survey	7/1/04	8/31/04	App A. Lgs 1.3
1/2 STS May Be Pulled	10/1/04	10/1/04	Lgs 2.3.1.2 b 5
Winter Maintenance Period Juvenile	12/16/04	2/28/05	Lgs 2.3.1.1.
Maintenance of Adult Facilities	1/1/05	2/28/05	Lgs 1.2.2
Draft Final Report	2/10/05	2/10/05	Lgs 2.3.3

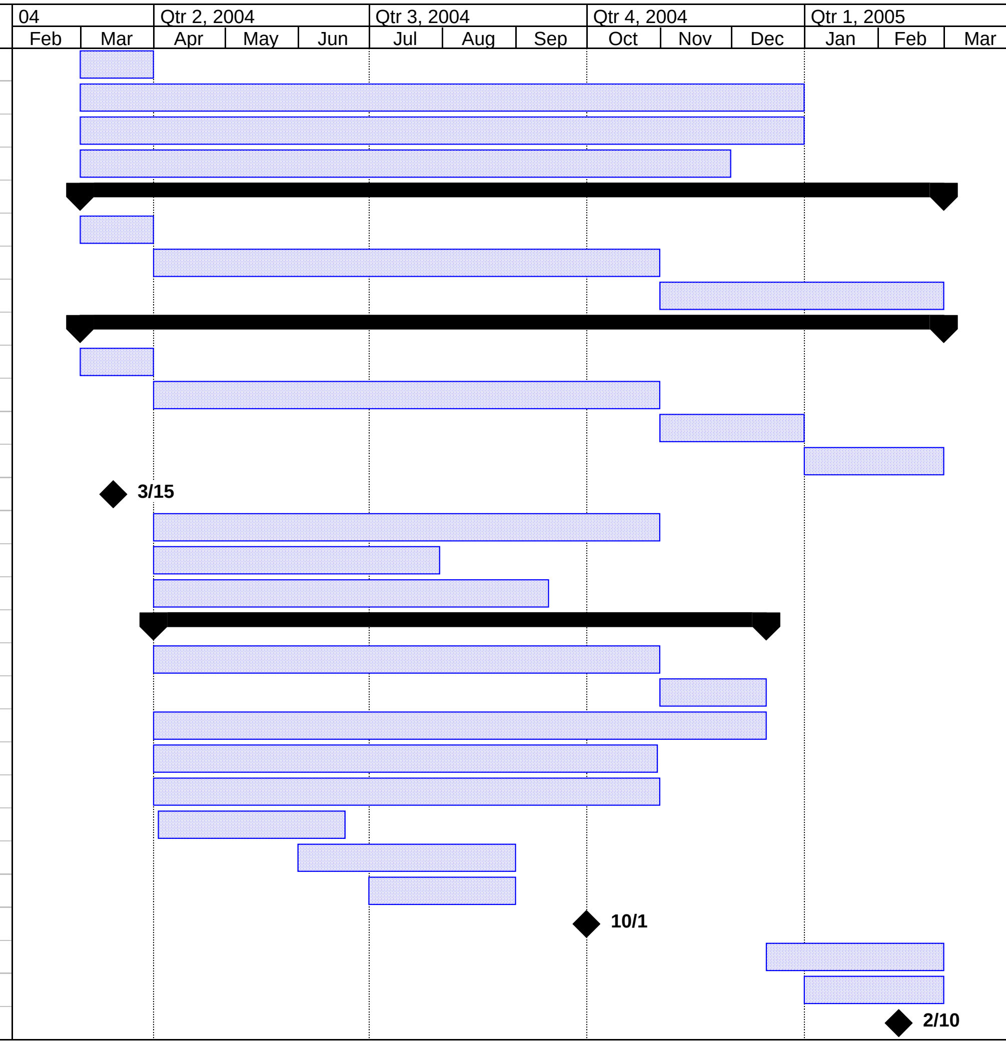


Table LGS-2. Juvenile migration timing at Little Goose Dam based on juvenile fish collection numbers.

% Collection	1999	2000	2001	2002	2003
Yearling Hatchery Chinook					
10%	4/27	4/24	4/30	5/2	4/27
90%	5/25	5/17	5/27	5/23	5/27
Yearling Wild Chinook					
10%	4/20	4/19	4/28	4/27	4/24
90%	5/31	6/9	5/29	5/29	6/11
Subyearling Chinook					
10%	6/21	6/14	6/30	6/18	6/4
90%	8/7	8/4	8/15	7/26	7/24
Hatchery Steelhead					
10%	4/28	4/24	5/2	4/29	4/30
90%	5/29	5/24	6/15	6/1	5/29
Wild Steelhead					
10%	4/25	4/18	5/2	4/22	4/28
90%	5/30	5/24	6/2	6/3	5/30

two downstream facing entrances and a side entrance into the spillway basin with the two downstream entrances operated. The auxiliary water is supplied by three turbine-driven pumps that pump water from the tailrace into the distribution system for the diffusers. Additional water is supplied to the auxiliary water supply system from the juvenile fish facilities primary dewatering structure.

1.2.2. Adult Migration Timing. Upstream migrants are present at Little Goose Dam all year. Maintenance of upstream passage facilities is scheduled for January and February to minimize the impact on upstream migrants. Table LGS-3 lists primary passage periods by species and shows the earliest and latest dates of peak passage that have been recorded from compilation of fish counts by the Corps. Adult fish (salmon, steelhead, bull trout, and lamprey) are normally counted 16 hours per day (0400 to 2000 Pacific Standard Time) from April 1 through October 31. Adult fish counting is done visually by fish counters. Due to a requirement in the 2000 U.S. Fish and Wildlife Service BiOp on operations of the FCRPS, fish counting will continue year round through 2004. Video counting will take place from 0800 to 1600 hours PST in January, February, and March, and from 0600 to 1600 hours PST in November and December.

Table LGS-3. Adult migration timing at Little Goose Dam from 1970-2002 based on fish counts.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
Spring Chinook	4/1 - 6/15	4/20	5/27
Summer Chinook	6/16 - 8/15	6/14	7/12
Fall Chinook	8/16 - 10/31	9/14	9/30
Steelhead	4/1 - 10/31	9/15	10/14
Sockeye	6/15 - 10/31	6/24	7/25

2. Project Operations.

2.1. Spill Management. Involuntary spill at Little Goose is the result of river flow exceeding powerhouse capacity, insufficient generation loads to pass the river flow, turbine unit outages (forced or scheduled), or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Little Goose shall be distributed in accordance with the spill pattern included at the end of this section, Table LGS-9. Special spills for juvenile fish passage will be provided as detailed in Appendix A (Special Project Operations and Research). Spills for juvenile fish passage normally take place during the spring, from approximately April 3 through June 20.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at Little Goose are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels will be monitored in the Little Goose forebay and tailrace from April 1 through September 15. Data will be collected every half-hour and transmitted via computer every hour. Data on spill volume and total project flow will be reported at the same time. Implementation of spill management requests will be based in part upon TDG monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Requests for spill will be coordinated through the Technical Management Team (TMT).

2.3. Operating Criteria.

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

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

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trashracks just prior to the operating season.

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

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

1. Maintenance completed on all screens.

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

3. Log results of trial run.

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

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

c. Collection Gallery.

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

2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

4. Automatic orifice cycling and backflush system maintained and operating correctly.

d. Dewatering Structure.

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. 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.

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.

g. Maintenance Records. Record all maintenance and inspections.

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

a. Forebay Area and Intakes.

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

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

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

4. Inspect gatewell slots daily (preferably early in day shift) for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice, or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be close 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 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. 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 unwatering a bulkhead slot.

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

1. Operate ESBSs with flow vanes attached to screen.

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

3. Inspect each ESBS once per month by means of underwater video. Spot check VBSs at the same time.

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

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

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

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

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

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

c. Collection Gallery Checks.

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 gallery. 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 under 3 hours. Monitor fish conditions in gatewells hourly during orifice closure period.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets hitting no closer than 3' from wall (bypass gallery full).

4. 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 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.

5. If utilizing the automatic orifice backflush system, inspect as determined by the project biologist (but at least once per work 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.

6. Water-up valve operational.

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.

e. Transportation Facilities.

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

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

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

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

f. Avian Predation Areas (Forebay and Tailrace).

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

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

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

g. Inspection and Record Keeping.

1. Inspect fish facilities at least once every 8 hours. Inspect all facilities according to fish facilities monitoring program.

2. Record all maintenance and inspections.

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

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

a. Inspect all staff gauges and water level indicators, repair and/or clean where necessary.

b. Dewater all ladders 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 annually by dewatering and physically inspecting the gratings and chambers 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. Prior to the fish passage season, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly.

d. Calibrate all mechanical and electronic 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.

2.3.2.2. Fish Passage Period (March 1 through December 31).

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

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

b. Counting Window. The counting window and backboard should be clean to allow best video taping of adult fish passing through the counting slot. When possible, the minimum counting slot width should be 18". All equipment should be maintained and in good condition.

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

d. North Shore Entrances (NSE 1 & 2). Elevation of 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). Elevation of 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. Powerhouse Collection System. No floating orifice gates will be operated in 2004. Inspect fish fallout fence for debris buildup.

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

1. Operate both gates.

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

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

i. Tunnel Lights. The 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. Trashracks and picketed leads installed correctly.

k. Staff Gages and Water Level Indicators. Shall be readable at all water levels encountered during fish passage period.

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 biologist 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).

4. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration.

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

6. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. 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. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities which occurred at the project which may affect fish passage. 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. 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. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing zebra 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 plans. **When river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T.** Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities that requires them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to 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 which will impact fish passage and survival. Maintenance of facilities such as ESBSs, which sometimes break down during the fish passage season, will be carried out according to procedures 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 the CBFWA and NOAA Fisheries 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. 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 work day or any time on a weekend. Project personnel will pull and replace the screen the next morning, weekday or weekend inclusive. If the screen can not 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 or damaged, 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 unwatered and stoplogs inserted at the upstream end of the inclined screen. The emergency bypass is then opened and the bypass system operated with 6 gatewell orifices open. Orifices will then need to be routinely rotated, at a minimum of every 2 hours, to allow juveniles to emigrate from all of the gatewells. During any orifice closure, gatewells shall be monitored hourly by project personnel for signs of fish problems or mortality. Orifices shall not be closed for longer than 5 hours in an operating turbine unit with ESBSs in place. During periods of high fish passage, orifice closure times may need to be less than 5 hours depending on fish numbers and condition. If orifices are closed, gatewells shall be monitored hourly. Spill may be used as an alternative avenue for fish passage during a collection channel outage.

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

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

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility that must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not have a significant effect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July or August, and annual maintenance requires a two-week outage per pump during the winter maintenance period. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with the CBFWA and NOAA Fisheries. Coordination procedures for unscheduled maintenance of adult facilities shall be the same as for juvenile facilities. 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 it without unwatering the ladder. Trash racks, picket leads, and counting stations can sometimes be repaired or maintained without unwatering 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 are made up of main entrance weirs with hoists and automatic controls. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually, the weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made.

3.2.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done either by dewatering the fish passage way and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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 paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in 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 (as needed to meet generation requirements) in the priority order shown in Table LGS-4. Unit operating criteria may be coordinated differently to allow for fish research, construction, or project maintenance activities. To minimize mortality to juvenile fish passing through the turbine units from April 1 through October 31 (or as long as there is sufficient river flow and/or generation requests to operate turbine units 4, 5, and 6 within 1 percent of peak efficiency), operating priority during nighttime hours from 2000 to 0400 hours shall favor the north units as shown in Table LGS-4. If the project is spilling for juvenile fish passage nightly with no daytime spill, unit priorities shall change at 1800 and 0600 hours, when spill is started and ended, to minimize starting and stopping of turbine units. If the project is bypassing juvenile fish back to the river through the main bypass flume, nighttime unit operating priority shall be unit 1, then units 4 through 6 (Table LGS-4. 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-4. Turbine unit operating priority for Little Goose Dam.

Season	Time of Day	Unit Priority
March 1 – November 30	24 hours	1, 2, 3, then 4-6 (any order)
April 1 – October 31 (Project IS Spilling)	Nighttime (1800 to 0600 hours)	1, 4-6 , 2, 3
April 1 – October 31 (During juvenile bypass through main flume and no spill)	Nighttime (2000 to 0400 hours)	1, 4-6 (in any order, then 2-3 (as needed)
December 1 – February 28	24 hours	Any Order

Turbine units will be operated within 1% of best efficiency from April 1 through October 31 (as specified in BPA's load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requests will be made in accordance with

BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% turbine 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% turbine efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within the 1% efficiency range at various heads are shown in Tables LGS-5 through LGS-8. The 1% efficiency ranges were calculated using results from 1994 index testing of turbine units 3 and 5 at Little Goose Dam. Maximum generation of units 1 through 6 at 115% overload is 155 MW.

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 is 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.

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 Reservoir Control Center (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.

Table LGS-5. The 1% turbine operating range at Little Goose Dam for units 1-3 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: These tables contain the best information currently available.

Table LGS-6. The 1% turbine operating range at Little Goose Dam for units 1-3 without extended-length submersible bar screens.

Head (ft)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: These tables contain the best information currently available.

Table LGS-7. The 1% turbine operating range at Little Goose Dam for units 4-6 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	83.3	13,505	105.8	17,152
86	84.3	13,488	107.3	17,167
87	85.2	13,470	108.7	17,182
88	86.2	13,453	110.2	17,195
89	87.2	13,435	111.7	17,208
90	88.1	13,418	113.1	17,220
91	89.3	13,437	114.8	17,274
92	90.4	13,455	116.5	17,328
93	91.6	13,473	118.1	17,379
94	92.7	13,490	119.8	17,430
95	93.9	13,507	121.5	17,479
96	94.9	13,504	122.9	17,490
97	95.9	13,501	124.3	17,500
98	96.9	13,498	125.7	17,510
99	97.9	13,495	127.1	17,520
100	98.9	13,492	128.5	17,529
101	100.1	13,510	129.2	17,431
102	101.3	13,527	129.8	17,335
103	102.5	13,544	130.5	17,240
104	103.7	13,560	131.1	17,147
105	104.9	13,576	131.8	17,056

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1975 model test and extended-length submersible bar screens. These tables are based on data from Lower Granite Dam.

Table LGS-8. The 1% turbine operating range at Little Goose Dam for units 4-6 without extended-length submersible bar screens.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits MW)	(CFS)
85	85.1	13,532	113.0	17,972
86	86.1	13,515	114.6	17,988
87	87.1	13,497	115.6	17,914
88	88.1	13,480	116.6	17,842
89	89.1	13,463	117.6	17,771
90	90.0	13,446	120.8	18,045
91	91.2	13,465	122.6	18,102
92	92.4	13,483	124.4	18,158
93	93.6	13,501	126.2	18,212
94	94.7	13,519	128.0	18,265
95	95.9	13,535	129.8	18,317
96	96.9	13,533	131.3	18,329
97	98.0	13,530	132.8	18,340
98	99.0	13,527	134.3	18,350
99	100.0	13,524	135.8	18,360
100	101.1	13,521	137.3	18,370
101	102.3	13,539	138.0	18,268
102	103.5	13,557	138.7	18,167
103	104.7	13,574	139.4	18,068
104	105.9	13,590	140.1	17,971
105	107.1	13,606	140.8	17,876

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1995 model test and extended-length submersible bar screens. These tables are based on data from Lower Granite Dam.

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 work day 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.

If the work that needs to be done is of an emergency type 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.

4.3. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance that may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent best efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 work days. 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.

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 unwater 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 work day (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 work day (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 work day after the maintenance is completed. The project biologist will be notified when the operating gates are set in the standard operating position. The gatewells will be monitored 2 times per day to observe fish condition while the operating gates are in the standard operating position. If turbine maintenance or the raising of the operating gates to the raised operating position is delayed after the time periods stated above, the turbine unit shall be immediately taken out of service until the work can be accomplished. Operation of turbine units with operating gates in the standard operating position shall be restricted to the July 1 through December 15 time period, and shall not occur unless at least 4 other turbine units are available for service. No more than 1 turbine unit at a time shall be operated with operating gates in the standard operating position and the turbine unit will be operated on last on, first off operating priority.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. 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 before hand.

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.

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 work days 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 and NOAA Fisheries. 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.

Table LGS-9. Little Goose Dam spill pattern for adult fish passage and for minimizing total dissolved gas levels (based on pool elevation 637).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
0	1						0	1	1.8
0	1	1					0	2	3.6
0	1	1	1				0	3	5.5
0	1	1	1	1			0	4	7.3
0	1	1	1	1	1		0	5	9.1
0	1	1	1	1	1	1	0	6	10.9
0	2	1	1	1	1	1	0	7	12.9
0	2	2	1	1	1	1	0	8	14.8
0	2	2	2	1	1	1	0	9	16.8
0	2	2	2	2	1	1	0	10	18.8
0	2	2	2	2	2	1	0	11	20.7
0	2	2	2	2	2	2	0	12	22.7
0	3	2	2	2	2	2	0	13	24.7
0	3	3	2	2	2	2	0	14	26.8
0	3	3	3	2	2	2	0	15	28.9
0	3	3	3	3	2	2	0	16	30.9
0	3	3	3	3	3	2	0	17	33.0
0	3	3	3	3	3	3	0	18	35.0
0	4	3	3	3	3	3	0	19	37.0
0	4	4	3	3	3	3	0	20	39.1
0	4	4	4	3	3	3	0	21	41.2
0	4	4	4	4	3	3	0	22	43.2
0	4	4	4	4	4	3	0	23	45.2
0	4	4	4	4	4	4	0	24	47.3
0	5	4	4	4	4	4	0	25	49.3
0	5	5	4	4	4	4	0	26	51.3
0	5	5	5	4	4	4	0	27	53.4
0	5	5	5	5	4	4	0	28	55.4
0	5	5	5	5	5	4	0	29	57.4
0	5	5	5	5	5	5	0	30	59.5
0	6	5	5	5	5	5	0	31	61.5
0	6	6	5	5	5	5	0	32	63.5
0	6	6	6	5	5	5	0	33	65.6
0	6	6	6	6	5	5	0	34	67.6
0	6	6	6	6	6	5	0	35	69.7
0	6	6	6	6	6	6	0	36	71.7
0	7	6	6	6	6	6	0	37	73.7
0	7	7	6	6	6	6	0	38	75.7
0	7	7	7	6	6	6	0	39	77.7

Table LGS-9. Little Goose Dam spill pattern for adult fish passage and for minimizing total dissolved gas levels (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
0	7	7	7	7	6	6	0	40	79.7
0	7	7	7	7	7	6	0	41	81.8
0	7	7	7	7	7	7	0	42	83.9
0	8	7	7	7	7	7	0	43	85.9
0	8	8	7	7	7	7	0	44	87.8
0	8	8	8	7	7	7	0	45	89.9
0	8	8	8	8	7	7	0	46	91.9
0	8	8	8	8	8	7	0	47	94.0
0	8	8	8	8	8	8	0	48	96.0
0	9	8	8	8	8	8	0	49	98.0
0	9	9	8	8	8	8	0	50	100.0
0	9	9	9	8	8	8	0	51	102.0
0	9	9	9	9	8	8	0	52	104.0
0	9	9	9	9	9	8	0	53	106.0
0	9	9	9	9	9	9	0	54	108.1
0	10	9	9	9	9	9	0	55	110.1
0	10	10	9	9	9	9	0	56	112.2
0	10	10	10	9	9	9	0	57	114.3
0	10	10	10	10	9	9	0	58	116.4
0	10	10	10	10	10	9	0	59	118.5
0	10	10	10	10	10	10	0	60	120.5
0	11	10	10	10	10	10	0	61	122.6
0	11	11	10	10	10	10	0	62	124.7
0	11	11	11	10	10	10	0	63	126.8
0	11	11	11	11	10	10	0	64	128.9
0	11	11	11	11	11	10	0	65	131.0
0	11	11	11	11	11	11	0	66	133.0
0	12	11	11	11	11	11	0	67	135.2
0	12	12	11	11	11	11	0	68	137.3
0	12	12	12	11	11	11	0	69	139.4
0	12	12	12	12	11	11	0	70	141.5
0	12	12	12	12	12	11	0	71	143.6
0	12	12	12	12	12	12	0	72	145.7
0	13	12	12	12	12	12	0	73	147.8
0	13	13	12	12	12	12	0	74	149.9
0	13	13	13	12	12	12	0	75	152.0
0	13	13	13	13	12	12	0	76	154.1
0	13	13	13	13	13	12	0	77	156.1

Table LGS-9. Little Goose Dam spill pattern for adult fish passage and for minimizing total dissolved gas levels (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
0	13	13	13	13	13	13	0	78	158.2
0	14	13	13	13	13	13	0	79	160.3
0	14	14	13	13	13	13	0	80	162.4
0	14	14	14	13	13	13	0	81	164.5
0	14	14	14	14	13	13	0	82	166.5
0	14	14	14	14	14	13	0	83	168.6
0	14	14	14	14	14	14	0	84	170.7
0	15	14	14	14	14	14	0	85	172.8
0	15	15	14	14	14	14	0	86	174.8
0	15	15	15	14	14	14	0	87	176.9
0	15	15	15	15	14	14	0	88	178.9
0	15	15	15	15	15	14	0	89	181.0
0	15	15	15	15	15	15	0	90	183.1
0	16	15	15	15	15	15	0	91	185.1
0	16	16	15	15	15	15	0	92	187.2
0	16	16	16	15	15	15	0	93	189.2
0	16	16	16	16	15	15	0	94	191.3
0	16	16	16	16	16	15	0	95	193.4
0	16	16	16	16	16	16	0	96	195.4

SECTION 9

LOWER GRANITE DAM

Lower Granite Dam

1. Fish Passage Information. The locations of fish passage facilities at Lower Granite Lock and Dam are shown on Figure LWG-1. Dates for project operations for fish purposes and special operations are listed in Table LWG-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The Lower Granite juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains extended length submersible bar screens (ESBS) with flow vanes, improved modified balanced flow vertical barrier screens (VBS), gatewell orifices, a bypass channel running the length of the powerhouse, and a bypass pipe to transport the fish to the transportation facilities or to the river. The transportation facilities include an upwell and separator structure to separate the juveniles from the excess water and adult fish, raceways for holding fish, a distribution system for distributing the fish among the raceways or to the barge or back to the river, a sampling and marking building, truck and barge loading facilities, and PIT tag detection and deflection systems.

1.1.2. Juvenile Fish Migration Timing. Juvenile migration timing at Lower Granite Dam is indicated in Table LWG-2. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities that may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Lower Granite are made up 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 an auxiliary water supply system. The powerhouse collection system is comprised of four operating floating orifices, two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. Four of the floating orifices and the two downstream entrances at the north end of the collection system are operated. The north shore entrances are made up of two downstream entrances and a side entrance into the spillway basin with the two downstream entrances normally used. The

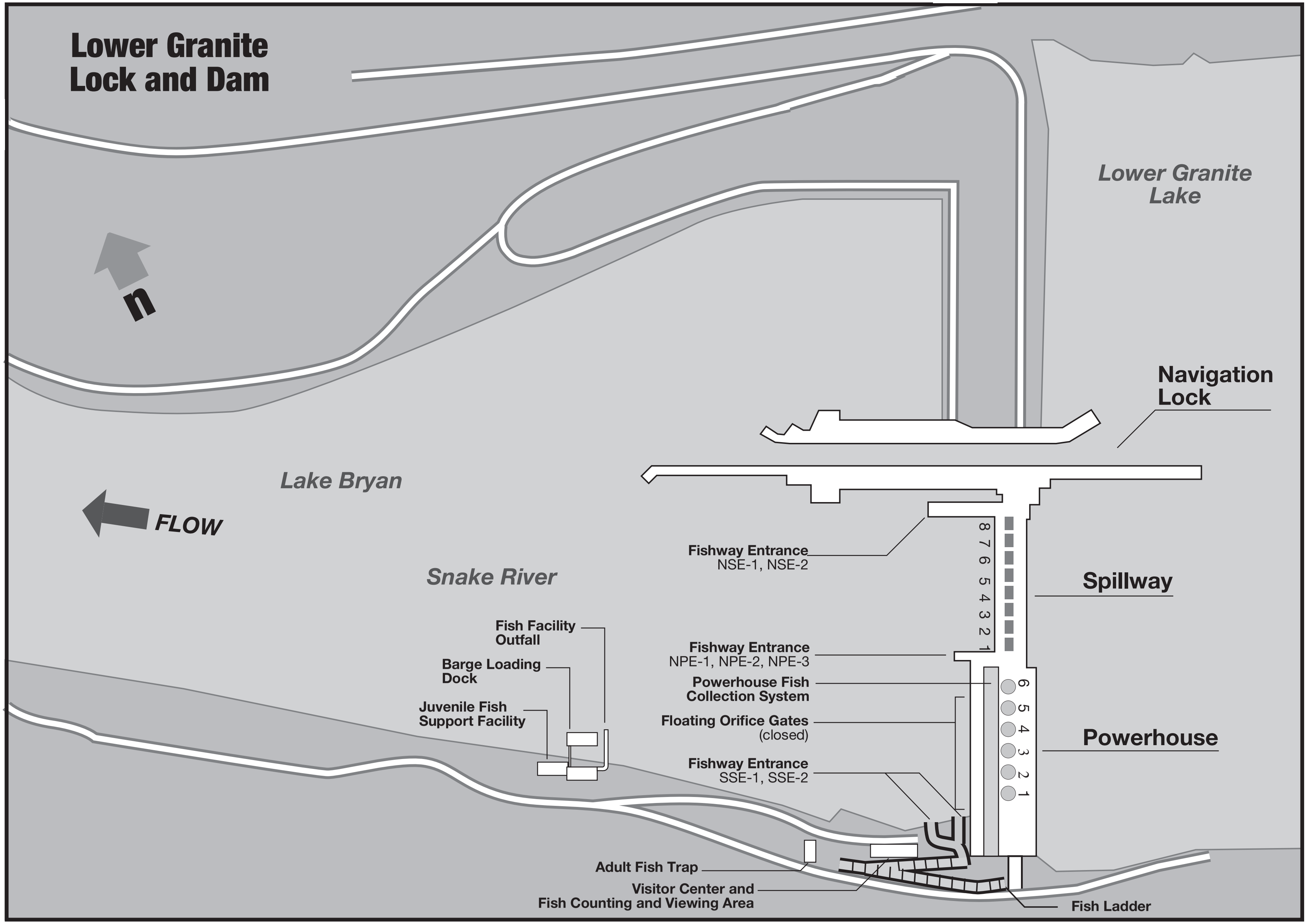


Figure LWG-1 Lower Granite Lock and Dam general site plan.

Table LWG-1. Dates of project operations for fish purposes at Lower Granite, 2004

Task Name	Start	Finish	FPP Reference
Adult Fish Counting	**3/1/04**	**12/31/04**	**Lwg 1.2.2**
Video 0600 - 1600 PST	3/1/04	3/31/04	Lwg 1.2.2
Visual 0400 - 1600 PST	4/1/04	10/31/04	Lwg 1.2.2
Video 2000 - 0400 PST	6/15/04	8/31/04	Lwg 1.2.2
Video 0600 - 1600 PST	11/1/04	12/31/04	Lwg 1.2.2
TDG Monitoring	3/1/04	2/28/05	App D Phase 2
Winter Maintenance Period Juvenile	3/1/04	3/24/04	Lwg 2.3.1.1.
Adult Fish Passage Period	3/1/04	12/31/04	Lwg 2.3.2.2
Weekly Reports	3/1/04	12/31/04	Lwg 2.3.3
Operate Turbines for Fish Passage	3/1/04	12/15/04	Lwg 4.1
Unit 1 Repair	3/1/04	5/1/04	App A Lwg 1.3
Relocation of BGS	3/1/04	3/31/04	App A Lwg 1.6
1% limitations	**3/1/04**	**2/28/05**	**Lwg 4.1**
1% Soft	3/1/04	3/31/04	Lwg 4.1
1% Hard	4/1/04	10/31/04	Lwg 4.1
1% Soft	11/1/04	2/28/05	Lwg 4.1
Index Testing Unit 2	3/1/04	3/12/04	App A Lwg 1.2
Index Testing Unit 4	3/1/04	3/12/04	App A Lwg 1.2
Final Report	3/15/04	3/16/04	Lwg 2.3.3
ESBS Installed in 4 units	3/24/04	3/25/04	Lwg 2.3.1.1.b.6
Transport vs. In-River Study	3/25/04	10/31/04	App A Lwg 2.5
Juvenile Fish Transportation	3/25/04	10/31/04	App B 3
Operate juvenile facilities	**3/25/04**	**12/15/04**	**Lwg 2.3.1**
Operate for Juvenile Fish Passage	3/25/04	10/31/04	Lwg 2.3.1
Operate for Adult Fallback	11/1/04	12/15/04	Lwg 2.3.1
Juvenile Passage Period	3/25/04	12/15/04	Lwg 2.3.1.2
Transport vs. In-River Study	3/25/04	10/31/04	App A Lwg 2.5
Backflush orifices once per shift	4/1/04	8/15/04	Lwg 2.3.1.2.c.5
Adult Fishway Evaluation	4/1/04	10/31/04	App A Lwg 2.5
Measure Head Differentials Weekly	4/1/04	6/30/04	Lwg 2.3.1.2 b 8
Adult Migration Study	4/1/04	10/31/04	App A Lwg 2.1
Spill for fish	4/3/04	6/20/04	Lwg 2.1
Prototype Separator Eval	4/3/04	6/20/04	App A Lwg 2.3
Removable Spillway Weir Operation	**4/15/04**	**7/29/04**	**App A Lwg 2.2**
Removable Spillway Weir Operation	4/15/04	6/10/04	App A Lwg 2.2
Removable Spillway Weir Operation	7/1/04	7/29/04	App A Lwg 2.2

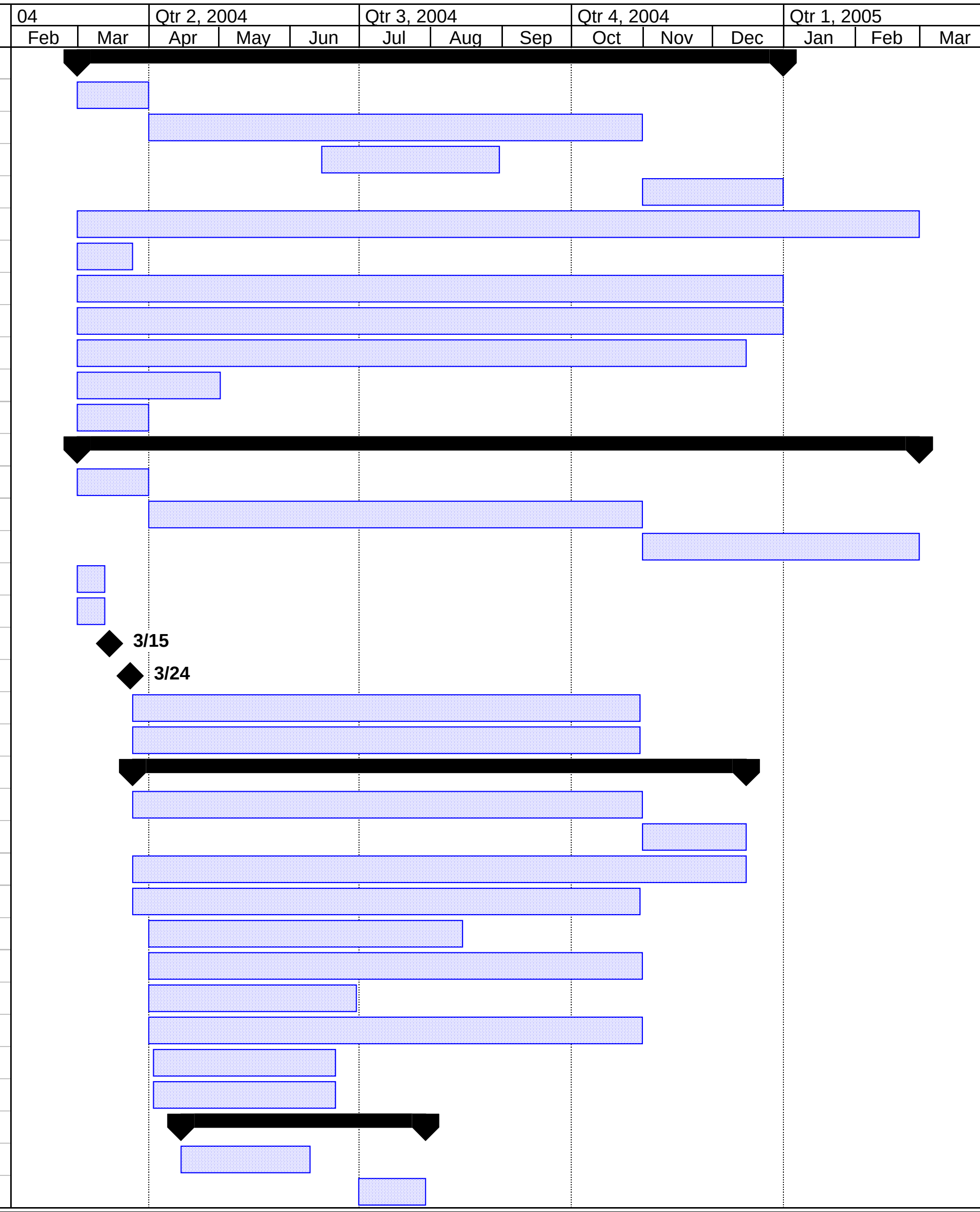


Table LWG-1. Dates of project operations for fish purposes at Lower Granite, 2004

Task Name	Start	Finish	FPP Reference
Spillway Gate Testing	6/1/04	8/31/04	App A Lwg 1.4
Spillway Stilling Basin Survey	7/1/04	8/31/04	App A Lwg 1.5
1/2 ESBS may be pulled	10/1/04	10/2/04	Lwg 2.3.1.2. b.6
Winter Maintenance Period Juvenile	12/16/04	2/28/05	Lwg 2.3.1.1.
Maintenance of Adult Facilities	1/1/05	2/28/05	Lwg 1.2.2
Draft Final Report	2/10/05	2/10/05	Lwg 2.3.3

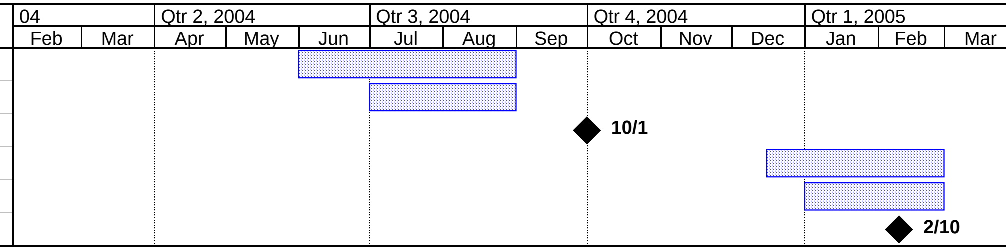


Table LWG-2. Juvenile migration timing at Lower Granite Dam based on juvenile fish collection numbers.

% Collection	1999	2000	2001	2002	2003
Yearling Hatchery Chinook					
10%	4/23	4/22	4/27	4/18	4/23
90%	5/22	5/13	5/17	5/19	5/18
Yearling Wild Chinook					
10%	4/17	4/11	4/24	4/16	4/14
90%	6/2	4/18	5/25	5/24	5/26
Subyearling Chinook					
10%	6/10	6/18	6/11	6/23	6/4
90%	8/23	8/26	8/10	8/9	7/16
Hatchery Steelhead					
10%	4/24	4/23	4/29	4/21	4/25
90%	5/27	5/24	5/27	5/29	5/28
Wild Steelhead					
10%	4/22	4/13	4/29	4/17	4/19
90%	5/30	5/24	5/27	6/1	5/30

auxiliary water is supplied by three electric pumps that pump water from the tailrace. Two pumps are normally used to provide the required flows. Four weirs in the upper end of the ladder were outfitted with PIT tag detectors in early 2003.

1.2.2. Adult Migration Timing. Upstream migrants are present at Lower Granite Dam all year. Maintenance of adult facilities is scheduled for January and February to minimize the impact on upstream migrants. Table LWG-3 lists primary passage periods by species and shows the earliest and latest dates of peak passage that have been recorded from compilation of fish counts by the Corps. Adult fish (salmon, steelhead, bull trout, and lamprey) are normally counted from March 1 through December 15. Fish counters count adult fish by direct observation for 16 hours per day (0400 to 2000 Pacific Standard Time) from April 1 through October 31. Adult fish are counted in March for 10 hours per day (0600 to 1600 Pacific Standard Time) and in November and December for 10 hours per day by video taping of fish passage and later interrogation of the videotapes. Nighttime adult fish passage (2000 to 0400 hours) from June 15 through August 31 is also video taped and interrogated by fish counters for endangered species concerns.

2. Project Operation.

2.1. Spill Management. Involuntary spill at Lower Granite 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

Table LWG-3. Adult migration timing at Lower Granite Dam from 1975-2002 based on fish counts.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
Spring Chinook	3/1 - 6/17	4/26	5/27
Summer Chinook	6/18 - 8/17	6/18	7/17
Fall Chinook	8/18 - 12/15	9/5	10/6
Steelhead	3/1 - 12/15	9/3	10/16
Sockeye	3/1 - 12/15	7/1	7/19

project to spill to provide juvenile fish passage. Spill at Lower Granite shall be distributed in accordance with the spill patterns included at the end of this section, Tables LWG-9 and LWG-10. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research). Spills for juvenile fish passage normally take place during the spring, from approximately April 3 through June 20.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at Lower Granite are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels will be monitored at the Lower Granite forebay and tailrace automated stations year-round. Data will be collected every half-hour and transmitted via computer every hour. Data on spill volume and total project flow will be reported at the same time. Implementation of spill management requests will be based in part upon TDG monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Requests for spill will be coordinated through the Technical Management Team (TMT).

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from March 25 through October 31 for juvenile fish bypass, collection, and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate the juvenile facilities 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 24). 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 trash racks just prior to the operating season.

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

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

1. Maintenance completed on all screens.

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

3. Log results of trial run.

4. Inspect all 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.

6. ESBSs installed in at least 4 turbine units by March 24 (all 6 turbine units if possible). Remaining ESBSs installed prior to April 1.

c. Collection Gallery.

1. Makeup water valves and float control equipment maintained and ready for operation.

2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

4. Automatic orifice cycling and backflush system maintained and operating correctly.

d. Transportation Facilities.

1. 42" and 72" sluice gates maintained and operating correctly.

2. Inclined screen clean and in good condition with no holes in or damage to screen mesh, gaps around screen, or missing silicone.

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 should be 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.

e. Barges.

1. All engines and pumps maintained and in good operating condition.

2. Fish release openings and related equipment in good operating condition.

3. No rough edges or support beams protruding into compartments.

4. No brass or galvanized fittings in circulation lines.

5. All loading hoses properly installed so fish will not hit sides of compartments or support beams when loading.

6. Loading hoses in good shape with rubber gaskets in cam lock fittings.

7. Inside edges of cam lock joints should be beveled to avoid sharp edges.

8. Warning systems tested and operational.

9. Provide net and/or deck covers.

f. Maintenance Records. Record all maintenance and inspections.

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

2.3.1.2. Fish Passage Period (March 25 through December 15).

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily 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 close and backflushed to remove the obstruction. If the obstruction cannot 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.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot 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. 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.

4. Log drawdown differentials in bulkhead slots at least once per week.

5. 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 if fish condition requires it.

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

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

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

1. ESBSs and flow vanes installed in all operating turbine units by March 24.

2. Operate ESBSs with flow vanes attached to screen.

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

4. Inspect each ESBS once per month by means of underwater video. Spot check VBSs at the same time.

5. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs (paragraph 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.

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

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

8. 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. Clean

VBSs as soon as possible after a 1.5' head differential is reached.

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

10. Turbine units are to be operated with *raised* operating gates to improve fish guidance efficiency when ESBSs are installed (March 25 through December 15), except as provided for in Section 4.3., Turbine Unit Maintenance.

c. Collection Gallery Checks.

1. Orifices clean and operating. Operate at least one orifice per bulkhead slot (preferably the north orifice)(18 open). 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 under 3 hours.* Monitor fish condition in gatewells hourly during orifice closure period.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets not hitting back wall, bypass gallery full.

4. Rotate orifices in fish screens slots (6 open).

5. Backflush orifices at least once per day, and more frequently if required. During periods of high fish and debris passage between April 1 and August 15, orifices should be inspected and backflushed once per shift or more frequently as determined by the project biologist, to keep orifices clean.

6. If utilizing the automatic orifice backflush system, inspect as determined by the project biologist (but at least once per 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.

7. Makeup water valves and associated float controls operational and maintaining stable channel flow.

d. Transportation Facilities.

1. 42" and 72" sluice gates operational.

2. Maintain stable water conditions in upwell and separator. No holes, broken wires, or gaps in inclined screen. Operate separator and fish distribution system as designed.

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

4. All valves, slide gates, and switch gates in and around separator and raceways operational.

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

6. 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

e. Avian Predation Areas (Forebay and Tailrace).

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

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

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

f. Removable Spillway Weir (RSW).

1. When the RSW is in operation, the spillgate shall be raised to where it does not touch flow passing down the RSW (about 9 stops)

2. When the NWS forecasts Lower Granite inflows to exceed 200,000 cfs, initiate aggressive forebay debris removal so that RSW operation will not be impeded and coordinate with RCC.

3. Initiate partial RSW stow (rotate down to 30-degree position) when Lower Granite inflows exceed 200,000 and when NWS forecasts inflows to exceed 240,000 cfs.

4. Complete RSW stow (complete rotation to the landing pad) when inflows exceed 260,000 cfs, upstream river gage flows are increasing, and the NWS forecasts Lower Granite inflow to exceed 300,000 cfs.

g. Inspection and Record Keeping.

1. Inspect fish facilities at least once every 8 hours. Inspect facilities according to fish facilities monitoring program.

2. Record all maintenance and inspections.

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

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

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

b. Dewater all ladders 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 annually by dewatering and physically inspecting the gratings and chambers 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. Prior to the fish passage period, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly.

d. Calibrate all mechanical and electronic 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.

2.3.2.2. Fish Passage Period (March 1 through December 31).

Note: Little Goose pool may be operated at minimum operating pool (MOP), between elevations 633' and 634' 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 Lower Granite 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 Widths. Counting windows should be operated as far out as possible while maintaining adequate counting conditions. When possible, the minimum counting slot width should be 18". All equipment should be maintained and in good condition.

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

d. North Shore Entrances (NSE 1 & 2). Elevation of top of gates when on sill = 625'.

1. Operate both downstream gates.

2. Weir depth: 7' or greater below tailwater.

e. North Powerhouse Entrances (NPE 1 & 2). Elevation of top of gates when on sill = 628'.

1. Operate both downstream gates.

2. Weir depth: 8' or greater below tailwater. At tailwaters below elevation 636', weirs should be on sill.

f. Powerhouse Collection System. Operate 4 floating orifices (numbers 1, 4, 7, and 10). Inspect fish fallout fence for debris buildup.

g. South Shore Entrances (SSE 1 & 2). Elevation of top of gates when on sill = 625'.

1. Operate both gates.

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

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

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 exits.

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

3. Trashracks and picketed leads installed correctly.

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

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 biologist shall inspect facilities three times per week. Facilities should be 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).

4. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration. The control system should be calibrated as required to maintain proper readings at all control point locations.

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

6. Record all inspections.

2.3.3. Facility monitoring and reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. 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. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities which occurred at the project which may affect fish passage. 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. 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. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-T on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologists shall 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 plans. When river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-T. Dewatering and fish handling plans were reviewed and revised in 2000 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modifications of facilities that require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to March 24. 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 and survival. Maintenance of facilities such as ESBSs, which sometimes break down during the fish passage season, will be carried out according to procedures 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 the CBFWA (via the FPC) and NOAA Fisheries 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. All ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be 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 110 MWs or less 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 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 turbine intake has 4 orifices, two 10" orifices with air operated valves in the bulkhead slot and two 8" orifices with manually operated slide gates in the fish screen slot, for allowing the fish to exit the slots. Under normal operation, a total of 24 orifices are operated with 18 being bulkhead slot orifices and 6 being fish screen slot orifices. At least 1 orifice is open in each bulkhead slot with the fish screen slot orifices rotated. If an orifice becomes blocked with debris it will normally be cleaned and remain in operation. If an orifice is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, 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. Bypass Pipe. The bypass pipe goes from the end of the powerhouse bypass channel to the transportation facilities downstream of the dam. All juvenile fish in the bypass system must pass through this to the transportation facilities or to the tailrace. If any part of the bypass pipe is damaged, the gatewell orifices will be closed and the bypass system unwatered until repairs can be made. *Turbine units will not be operated for longer than 5 hours with ESBSs in place and orifices closed. If possible, keep to less than 3 hours.* If an outage takes longer than 5 hours, spill will be provided to bypass juvenile fish. During any orifice closure, gatewells shall be monitored by project personnel for signs of fish problems or mortality. During periods of high fish passage, orifice closure times may be less than 5 hours depending on fish numbers and condition.

3.1.2.4. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program, or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities or the entire bypass system unwatered until repairs are made. Spill may be used as an alternative avenue for fish passage during a bypass system outage.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility that must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not have a significant effect on fish passage may be conducted during the rest of the year. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with the fish agencies and tribes. Coordination procedures for unscheduled maintenance of the adult facilities are the same as for juvenile facilities. 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, an adult fish trap located in an offshoot from the ladder, 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 it without unwatering the ladder. Trash racks, picket leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. If the fish trap malfunctions or is damaged, fish may be passed around it until repairs are made. 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 electric pumps supply the auxiliary water for the fish ladder and the powerhouse collection system. During normal operations and most flow conditions, two pumps are capable of providing the required flows. If a pump fails during the two-pump operation, the pump on standby will be operated to make up the flows. If two pumps fail, NSE 2 and NPE 2 will be closed and NPE 1 raised in 1' increments to provide the required 1' to 2' head differential. If the head cannot be maintained by the time the top of the weir reaches 5', the floating orifices should be closed in the following order: OG-4, OG-7, OG-10, and OG-1. If the head in the system still cannot be maintained at this point, SSE 1 and SSE 2 should be raised in 1' increments until 5' below tailwater is reached. If all three pumps fail, NSE 1 and NPE 1 should be closed, the powerhouse collection channel bulkheaded off at the junction pool, and SSE 1 and SSE 2 operated at 6' below tailwater regardless of the head.

3.2.2.3. Fishway Entrances. The fishway entrances consist of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater level. 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. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

3.2.2.5. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passage way and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. 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 to or suspected of having 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 paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units will be operated to enhance adult and juvenile fish passage from March 1 through December 15. During this time period, turbine units will be operated (as needed to meet generation requirements) in the priority order shown in Table LWG-4. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. To minimize mortality to juvenile fish passing through the turbine units from April 1 through October 31 (or as long as there is sufficient river flow and/or generation requests to operate turbine units 4, 5, or 6 within 1% of best turbine efficiency), operating priority during nighttime hours from 2000 to 0400 hours shall be units 4, 5, and 6 (in any order) and then units 1, 2, and 3 as needed (Table LWG-4). If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Table LWG-4. Turbine unit operating priority for Lower Granite Dam.

Season	Time of Day	Unit Priority
March 1 – December 15	24 hours	1, 2, 3, then 4-6 (any order)
April 1 – October 31 (If there is enough flow to run priority units)	Nighttime (2000 to 0400 hours)	4-6 (in any order, then 1-3 (as needed)
December 16 – February 28	24 hours	Any Order

Turbine units will be operated within the 1% turbine efficiency range from April 1 through October 31 (as specified in BPA’s load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requirements will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance 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% turbine efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within the 1% efficiency range at various heads are shown in Tables LWG-5 through LWG-8. The 1% efficiency ranges were calculated using results from 1994 index testing of turbine unit 3 at Little Goose Dam. Maximum generation of units 1 through 6 at 115% overload is 155 MW.

Table LWG-5. The 1% turbine operating range at Lower Granite Dam for units 1-3 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. These tables are based on data from Little Goose Dam.

Table LWG-6. The 1% turbine operating range at Lower Granite Dam for units 1-3 without extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. These tables are based on data from Little Goose Dam.

Table LWG-7. The 1% turbine operating range at Lower Granite Dam for units 4-6 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	83.3	13,505	105.8	17,152
86	84.3	13,488	107.3	17,167
87	85.2	13,470	108.7	17,182
88	86.2	13,453	110.2	17,195
89	87.2	13,435	111.7	17,208
90	88.1	13,418	113.1	17,220
91	89.3	13,437	114.8	17,274
92	90.4	13,455	116.5	17,328
93	91.6	13,473	118.1	17,379
94	92.7	13,490	119.8	17,430
95	93.9	13,507	121.5	17,479
96	94.9	13,504	122.9	17,490
97	95.9	13,501	124.3	17,500
98	96.9	13,498	125.7	17,510
99	97.9	13,495	127.1	17,520
100	98.9	13,492	128.5	17,529
101	100.1	13,510	129.2	17,431
102	101.3	13,527	129.8	17,335
103	102.5	13,544	130.5	17,240
104	103.7	13,560	131.1	17,147
105	104.9	13,576	131.8	17,056

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1975 model test and extended-length submersible bar screens. These tables are based on data from Lower Granite Dam.

Table LWG-8. The 1% turbine operating range at Lower Granite Dam for units 4-6 without extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits (MW)	(CFS)
85	85.1	13,532	113.0	17,972
86	86.1	13,515	114.6	17,988
87	87.1	13,497	115.6	17,914
88	88.1	13,480	116.6	17,842
89	89.1	13,463	117.6	17,771
90	90.0	13,446	120.8	18,045
91	91.2	13,465	122.6	18,102
92	92.4	13,483	124.4	18,158
93	93.6	13,501	126.2	18,212
94	94.7	13,519	128.0	18,265
95	95.9	13,535	129.8	18,317
96	96.9	13,533	131.3	18,329
97	98.0	13,530	132.8	18,340
98	99.0	13,527	134.3	18,350
99	100.0	13,524	135.8	18,360
100	101.1	13,521	137.3	18,370
101	102.3	13,539	138.0	18,268
102	103.5	13,557	138.7	18,167
103	104.7	13,574	139.4	18,068
104	105.9	13,590	140.1	17,971
105	107.1	13,606	140.8	17,876

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1975 model test. These tables are based on data from Lower Granite Dam.

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 work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Lower Granite, 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.

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 Reservoir Control Center (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 lower the level of Lower Granite 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 work day 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.

If the work that needs to be done is of an emergency type 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.

4.3. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance that may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted during mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the 1% turbine 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.

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 unwater 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 work day (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 work day (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 work day 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.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. 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 before hand.

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 a debris problem 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.

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 work days 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 and NOAA Fisheries. 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.

Table LWG-9. Lower Granite spillway pattern for fish passage (with RSW operating at pool elevation 734).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
3.5	0	1	0	1	1	1	1	8.5	15.2
3.5	0	1	1	1	1	1	1	9.5	16.9
3.5	1	1	1	1	1	1	1	10.5	18.6
3.5	1	1	2	1	1	1	1	11.5	20.4
3.5	1	1	2	1	1	1	2	12.5	22.2
3.5	1	1	2	2	1	1	2	13.5	24.0
3.5	1	1	2	2	2	1	2	14.5	25.8
3.5	1	2	2	2	2	1	2	15.5	27.7
3.5	2	2	2	2	2	1	2	16.5	29.5
3.5	2	2	2	2	2	2	2	17.5	31.3
3.5	2	2	3	2	2	2	2	18.5	36.6
3.5	2	2	3	3	2	2	2	19.5	35.0
3.5	2	2	3	3	3	2	2	20.5	36.9
3.5	2	3	3	3	3	2	2	21.5	38.7
3.5	3	3	3	3	3	2	2	22.5	40.6
3.5	3	3	4	3	3	2	2	23.5	42.4
3.5	3	3	4	4	3	2	2	24.5	44.3
3.5	3	3	4	4	4	2	2	25.5	46.2
3.5	3	4	4	4	4	2	2	26.5	48.0
3.5	4	4	4	4	4	2	2	27.5	49.9
3.5	4	4	4	4	4	2	3	28.5	51.7
3.5	4	4	4	4	4	3	3	29.5	53.6
3.5	4	4	5	4	4	3	3	30.5	55.5
3.5	4	4	5	5	4	3	3	31.5	57.3
3.5	4	4	5	5	5	3	3	32.5	59.2
3.5	4	5	5	5	5	3	3	33.5	61.0
3.5	5	5	5	5	5	3	3	34.5	62.9
3.5	5	5	5	5	5	3	4	35.5	64.8
3.5	5	5	5	5	5	4	4	36.5	66.6
3.5	5	5	6	5	5	4	4	37.5	68.5
3.5	5	5	6	6	5	4	4	38.5	70.3
3.5	5	5	6	6	6	4	4	39.5	72.2
3.5	5	6	6	6	6	4	4	40.5	74.1
3.5	6	6	6	6	6	4	4	41.5	75.9

Note: Minimum involuntary spill with RSW operating is 15.2 kcfs.
Note: At approximately 3.5 stops, the tainter gate no longer regulates flow through the RSW. The tainter gate should be raised at least 9 stops so the gate does not interfere with the spillbay flow.

NOTES ARE CONTINUED ON NEXT PAGE

Note: Spillbay discharge at pool elevation 734:

Stops	Discharge (kcfs)
(without RSW in place)	
1	1.7
2	3.5
3	5.4
4	7.2
5	9.1
6	11.0
7	12.8
8	14.7
(with RSW in place)	
RSW 3.5 stops or more	6.7

Table LWG-10. Lower Granite spillway pattern for fish passage (RSW NOT operating, pool elevation 734).

Spillbay Stops								Total Stops	Total Spill (kcfs)
1 (RSW)	2	3	4	5	6	7	8		
Closed	*1*	*1*			*1*	*1*	*2*	*6.0*	*10.3*
Closed	*1*	*1*			*1*	*2*	*2*	*7.0*	*12.1*
Closed	*2*	*1*			*1*	*2*	*2*	*8.0*	*13.9*
Closed	*2*	*2*			*1*	*2*	*2*	*9.0*	*15.7*
Closed	*2*	*2*	*1*		*1*	*2*	*2*	*10.0*	*17.4*
Closed	*2*	*2*	*1*	*1*	*1*	*2*	*2*	*11.0*	*19.1*
Closed	*2*	*2*	*2*	*1*	*1*	*2*	*2*	*12.0*	*20.9*
Closed	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*13.0*	*22.7*
Closed	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*14.0*	*24.5*
Closed	*2*	*2*	*2*	*2*	*2*	*2*	*3*	*15.0*	*26.4*
Closed	*2*	*2*	*2*	*2*	*2*	*3*	*3*	*16.0*	*28.3*
Closed	*3*	*2*	*2*	*2*	*2*	*3*	*3*	*17.0*	*30.2*
Closed	*3*	*3*	*2*	*2*	*2*	*3*	*3*	*18.0*	*32.1*
Closed	*3*	*3*	*3*	*2*	*2*	*3*	*3*	*19.0*	*34.0*
Closed	*3*	*3*	*3*	*2*	*3*	*3*	*3*	*20.0*	*35.9*
Closed	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*21.0*	*37.8*
Closed	3	3	3	3	3	3	4	22.0	39.6
Closed	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**23.0**	**41.4**
Closed	4	3	3	3	3	4	4	24.0	43.2
Closed	4	4	3	3	3	4	4	25.0	45.0
Closed	**4**	**4**	**4**	**3**	**3**	**4**	**4**	**26.0**	**46.8**
Closed	4	4	4	3	4	4	4	27.0	48.6
Closed	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**28.0**	**50.4**
Closed	4	4	4	4	4	4	5	29.0	52.3
Closed	**5**	**4**	**4**	**4**	**4**	**4**	**5**	**30.0**	**54.2**
Closed	5	4	4	4	4	5	5	31.0	56.1
Closed	5	5	4	4	4	5	5	32.0	58.0
Closed	**5**	**5**	**5**	**4**	**4**	**5**	**5**	**33.0**	**59.9**
Closed	*5*	*5*	*5*	*4*	*5*	*5*	*5*	*34.0*	*61.8*
Closed	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*35.0*	*63.7*
Closed	*5*	*5*	*5*	*5*	*5*	*5*	*6*	*36.0*	*65.6*
Closed	*5*	*5*	*5*	*5*	*5*	*6*	*6*	*37.0*	*67.5*

Notes: Patterns in **bold** were evaluated with the Lower Granite 1:80 physical general model at WES. These values match preliminary spill patterns for this test condition that were previously sent to RCC via e-mail message on 4/12/02. *Values shown in **italics** were added to this expanded table on 6/7/02.*

APPENDIX A

SPECIAL PROJECT OPERATIONS AND STUDIES

APPENDIX A: BONNEVILLE

Bonneville Dam[1]

1. Special Project Operations.

1.1. Spring Creek Hatchery Release. The first hatchery release is expected to occur in early March, followed by special operations for juvenile fish passage as coordinated regionally through TMT. Project operations for fish passage will be defined by RCC teletype prior to the release.

1.2. Spill. Spill will be provided continuously from April 10 through August 31 for spring and summer migrants as required in the NMFS Biological Opinion. These are planning dates and may be modified by TMT or through other regional coordination in 2004.

2. Studies.

2.1. Bonneville Rehab Biological Testing (also testing under the Turbine Survival Program. Main unit 1 will need to be commission tested once it returns to service in May 2004. The unit will undergo a series of pre-startup tests. A normal pre-start scenario is to mechanically roll the unit for 1 day. After the unit has been deemed structurally sound, the unit will be HIPOT tested for 2-3 days. After this test series is complete the unit will be subjected to a minimal run load rejection test. Once test are completed the unit will be then advanced to a 72 hour run test, followed by the 100 day commissioning test. Unit 1 is scheduled to return to normal operation by early June 2004. This commissioning test was coordinated with the FFDRWG group and endorsement was gained to complete the test on February 3, 2004.

2.2. Survival Evaluation. As part of the B2 corner collector evaluation, project and route specific survival, and passage distribution will be estimated for spring and summer migrants. We will evaluate survival of spring chinook salmon and steelhead through (1) the B1 ice and trash sluiceway, (specific gates to be evaluate are 2c, 4c, & 6c in the Spring, and 1c, 3c, & 6c in the Summer), (2) through an MGR turbine unit (MU-4), and from upstream releases through the B2 CC, B2 JBS, spillway, and both powerhouses. We will evaluate survival of fall chinook salmon through the B1 ice and trash sluiceway (specific sluice gates to be evaluated are 1c, 3c, & 6c in the Summer), and with upstream releases through the B2 CC, B2 JBS,

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

Spillway and both powerhouses. It is expected that unit 4 that is being used for turbine survival testing will need to be shut down for release pipe/hose installation, and potentially in-season fixes. Due to the potential for changes in operations that could affect presently planned survival research contingency plans are being formulated for discussions with regional fishery managers.

Research at MU-4 MGR likely will occur during the spring passage season only. Unit outages will be required for the installation and removal of monitoring equipment in the sluiceway and MU-4 both Spring and Summer. Further, there will likely be the need for unit outages in order to fix broken or non-functional equipment within the evaluation timeframe (April through July). **Specific project operations required will be maintaining unit 4 as a priority unit for the spring passage season/evaluation.** Powerhouse priority during the MGR testing should keep unit 4 as first on last off with a minimum of unit 2 operating as the same time during testing to maintain good egress conditions of test fish through the test period (April-July 2004).

2.3. Fish Passage Efficiency (FPE) B2 Main Units 11, 12, 17. FPE research will be conducted at all three structures (First Powerhouse, Second Powerhouse, and Spillway) to evaluate FPE for the spring and summer passage seasons. Primary evaluation techniques will be hydroacoustics and radio telemetry. Specific project operations and unit priorities could be needed for this study later in the season if units 11, 12 and 17 are not able to continue to be priority B2 units due to reduced flows. Unit outages will be required for the installation and removal of monitoring equipment. Further, unit outages likely will be needed to fix broken or non-functional equipment within the evaluation timeframe (April through July).

2.4. Evaluation of gatewell modifications at Bonneville Second Powerhouse. As part of the continuing effort to improve FGE at B2 units the Corps plans to install newly designed VBSs in unit 17 in FY04. The Corps plans to measure FGE in this modified unit by installing hydroacoustic transducers in all three slots. In addition, main units 11-14 may have extra hydroacoustics installed prior to the fish passage season to strengthen FGE data sets. This will require the units to be shut down to install transducers on STS as well as trashracks prior to the start of the FPP. In-season repairs may also be needed and planned for. Units 17 and 13 will also be monitored for 3 days each in the spring with the aid of the DIDSON camera to measure gap loss. This will require the sampling unit to be shut down during DIDSON frame installation and removal and when the frame is moved between units.

2.5. Prototype Testing of Fish Guidance Efficiency (FGE) Improvements and Unit Gap Loss at Bonneville Second Powerhouse. In 2004, prototype testing of a newly designed VBS will be conducted with two differing technologies (DIDSON & hydroacoustics). Testing will begin in late April and conclude in late July and will require the test units (15 & 17) to be shut down for short periods for removal and placement of the DIDSON camera frame. The required outage will be for approximately 1-2 hours for each unit per day for two weeks. Additional hydroacoustics transducers have will be installed in units 11, 12, 15, 17 to measure changes in FGE minus Turbine Intake Extensions (TIEs) and the B2CC operating.

Hydroacoustics will be used to estimate FGE (ERDC and PNNL). For the PNNL deployment, transducers will be installed both on the STS and on the trash racks prior to the test start date. Testing will be completed by Mid July. Installation on both the trash racks and STS will require a one-day outage. As always, several outages should be expected throughout the testing season to repair equipment.

It is expected that the test units will be available for normal operation during non-testing periods (unless significant fish injury is seen) to meet project/regional needs.

2.6. Adult Salmon and Steelhead Passage Evaluations. Radio telemetry will be used to monitor adult salmon and steelhead to assess the effect of spill operations and the new corner collector on adult fish passage times and fallback rates. To accomplish these evaluations 650 sp/su Chinook and 350 summer steelhead will be diverted and tagged at the BON AFF and release downstream. Downstream migration of steelhead kelts from fish release at upstream sites will also occur.

2.7. All dates shown are approximate and could be advanced or delayed by a week or so depending on various factors such as river flows, contractor schedules, equipment failures, etc. Some evaluations may not proceed. Therefore, a final description of studies and outages being conducted will be coordinated with the region through AFEP (FFDRWG and SRWG), prior to April 1. All special operation requests or schedule changes will be coordinated with the fisheries agencies and tribes through the AFEP and with RCC and BPA. RCC will coordinate needed changes with the projects and authorize operations in teletype regulations.

3.0. Unit Priorities for spring and summer. Unit priorities will be the same at B2 for the spring and summer in order of first on last off – 11, 17, 12, 13, 18, 14, 15, & 16. These operations are in support of the FGE and survival tests planned. Unit priorities will differ at B1 from spring and summer. Spring priorities at B1 are 4, 2, 3, 5, 6, 7, 10, 8, & 9. Sluice gates at B1 that will be operational in the spring will be 2c, 4c, & 6c. Summer priorities at B1 are 1, 3, 4, 5, 6, 7, 10, 8, & 9. Sluice gates that will be operational in the summer will be 1c, 3c, & 6c.

APPENDIX A: THE DALLES

The Dalles Dam[1]

1. Special Project Operations.

1.1. Spill. Spill will be provided continuously from April 10 through August 31 for spring and summer migrants as required in the NMFS BiOp. These are planning dates and may be modified by TMT or through other regional coordination in 2004. The spillway will be modified during the 2003-'04 winter maintenance period to include a training wall that divides the stilling basin between Bays 6 and 7. A spreadsheet showing new spill patterns has been developed for the modified spillway that will put most of the spill discharge through Bays 1-6.

2. Studies.

Two major research efforts will take place in 2004. The first is a post-construction evaluation of the modified spillway. The second is a forebay behavior study that will provide information on the location and design of a forebay guidance curtain.

2.1. Spillwall Post Construction Evaluation. Survival and injury estimates for spillway passed fish will be generated using balloon tag techniques. Test fish will be passed through bays 2 and 4 and 8 (optional, depending on river flow) via release hoses. Control fish will be released downstream of the end sill via a hose. Two test discharges will be evaluated: one per bay discharge that is between 12 and 18 kcfs, and 21 kcfs. The 21 kcfs treatment may require a forebay restriction at Bonneville, in order to achieve an appropriate tailwater elevation at The Dalles. This will be coordinated with RCC, BPA and regional salmon managers during the study. The balloon-tag study is expected to run from 13 April – 1 May. Each day testing will begin at 0700 hours and conclude around 1900 hours. The balloon-tag study will occur only in the springtime. The start date will be selected prior to the finalization of the FPP. To conduct these evaluations, tailrace BRZ access is required. The hydraulic environment encountered by test fish in the tailrace will be characterized using autonomous sensors released through spillway hoses. Total mortality rates will be estimated using radio telemetry. Radio tagged fish will be released in John Day Dam's tailrace, The Dalles Ice and Trash Sluiceway, and The Dalles tailrace. This

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

study element will start in late April and conclude around July 20.

2.2. FPE and Forebay Approach Behavior Evaluation. Fish passage efficiency will be estimated using fixed hydroacoustic techniques during the spring and summer. Hydroacoustic transducers will be installed in turbine units 1-22 and spillbays 1-10. Also, 3-dimensional approach path and behavior of juvenile salmonids will described using 3-D acoustic telemetry. Yearling chinook, steelhead, sockeye, and subyearling chinook will be tagged with acoustic tags and released upstream of the project. Approximately 80 hydrophones will be deployed in the forebay to monitor the acoustic-tagged fish as they enter the forebay and pass the dam. Surface hydrophones will be mounted on anchored barges in the forebay and fixed to the dam. Bottom hydrophones will be attached to anchors and deployed in the forebay. All equipment will be deployed in March and early-April and will require appropriate unit outages for dive activities. Studies will begin in mid-April and continue through July.

2.3. Sluice Operations Evaluation. An alternative sluiceway operation will be evaluated in 2004. Fixed hydroacoustics, 3-D acoustic telemetry, and radio telemetry will be used to estimate sluice passage. The schedule (Table 1 and Table 2) will include 2 treatments: operation of gates 1-1, 1-2, 1-3 and operation of gates 1-1, 1-2, 1-3, 18-1, 18-2, and 18-3. **Treatments will be switched at 0800 hours daily.** Testing will begin April 19 and end on July 17.

2.4. Adult Salmon and Steelhead Passage Evaluations. Radio telemetry will be used to monitor for adult salmon and steelhead to assess the effect of spillway modifications on adult fish passage times and fallback rates. Addition of new antennae just below the North ladder entrance will be accomplished before the end of March.

2.5. Adult White Sturgeon Passage Evaluations. Combined radio and acoustic telemetry will be used to monitor adult white sturgeon in the vicinity of The Dalles Dam. Fish will be captured and tagged by line fishing in the tailrace and forebay areas of the dam and by using fish removed from turbine units during dewatering for maintenance. Placement of underwater hydrophones at sites along the powerhouse and at exit areas above and below the dam will be accomplished in January and February.

Table 1. TDA spring sluice operations(all 3 gates open for MU1 and MU18).

Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment	Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment
1	1	19-Apr	Mon	MU 1	14	27	15-May	Sat	MU 1, MU 18
1	2	20-Apr	Tue	MU 1, MU 18	14	28	16-May	Sun	MU 1
2	3	21-Apr	Wed	MU 1, MU 18	15	29	17-May	Mon	MU 1
2	4	22-Apr	Thur	MU 1	15	30	18-May	Tue	MU 1, MU 18
3	5	23-Apr	Fri	MU 1, MU 18	16	31	19-May	Wed	MU 1, MU 18
3	6	24-Apr	Sat	MU 1	16	32	20-May	Thur	MU 1
4	7	25-Apr	Sun	MU 1, MU 18	17	33	21-May	Fri	MU 1
4	8	26-Apr	Mon	MU 1	17	34	22-May	Sat	MU 1, MU 18
5	9	27-Apr	Tue	MU 1	18	35	23-May	Sun	MU 1, MU 18
5	10	28-Apr	Wed	MU 1, MU 18	18	36	24-May	Mon	MU 1
6	11	29-Apr	Thur	MU 1, MU 18	19	37	25-May	Tue	MU 1, MU 18
6	12	30-Apr	Fri	MU 1	19	38	26-May	Wed	MU 1
7	13	1-May	Sat	MU 1	20	39	27-May	Thur	MU 1, MU 18
7	14	2-May	Sun	MU 1, MU 18	20	40	28-May	Fri	MU 1
8	15	3-May	Mon	MU 1	21	41	29-May	Sat	MU 1
8	16	4-May	Tue	MU 1, MU 18	21	42	30-May	Sun	MU 1, MU 18
9	17	5-May	Wed	MU 1	22	43	31-May	Mon	MU 1
9	18	6-May	Thur	MU 1, MU 18	22	44	1-Jun	Tue	MU 1, MU 18
10	19	7-May	Fri	MU 1	23	45	2-Jun	Wed	MU 1, MU 18
10	20	8-May	Sat	MU 1, MU 18	23	46	3-Jun	Thur	MU 1
11	21	9-May	Sun	MU 1, MU 18	24	47	4-Jun	Fri	MU 1
11	22	10-May	Mon	MU 1	24	48	5-Jun	Sat	MU 1, MU 18
12	23	11-May	Tue	MU 1, MU 18					
12	24	12-May	Wed	MU 1					
13	25	13-May	Thur	MU 1, MU 18					
13	26	14-May	Fri	MU 1					

2.6. Equipment Installation and Maintenance. Installation of hydroacoustic transducers and radio telemetry equipment will begin in January at The Dalles Dam. Installation of hydroacoustic transducers in turbine unit intakes will be performed by divers and thus require appropriate outages of adjacent units. Additionally, limited pre-season inspection of radio telemetry equipment may be necessary during these dives. Dates for these installations and inspections are pending. In-season outages may also be required to repair or replace damaged equipment.

Equipment will be removed in early August with procedures and outages similar to the installation outages discussed above. If removal cannot be accomplished without manipulating the spill schedule, equipment removal will be delayed until after the spill season to prevent interruptions to other ongoing evaluations.

Table 2. TDA summer sluice operations(all 3 gates open for MU1 and MU18).

Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment	Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment
1	1	6-Jun	Sun	MU 1	12	23	28-Jun	Mon	MU 1, MU 18
1	2	7-Jun	Mon	MU 1, MU 18	12	24	29-Jun	Tue	MU 1
2	3	8-Jun	Tue	MU 1, MU 18	13	25	30-Jun	Wed	MU 1, MU 18
2	4	9-Jun	Wed	MU 1	13	26	1-Jul	Thur	MU 1
3	5	10-Jun	Thur	MU 1, MU 18	14	27	2-Jul	Fri	MU 1, MU 18
3	6	11-Jun	Fri	MU 1	14	28	3-Jul	Sat	MU 1
4	7	12-Jun	Sat	MU 1, MU 18	15	29	4-Jul	Sun	MU 1
4	8	13-Jun	Sun	MU 1	15	30	5-Jul	Mon	MU 1, MU 18
5	9	14-Jun	Mon	MU 1	16	31	6-Jul	Tue	MU 1, MU 18
5	10	15-Jun	Tue	MU 1, MU 18	16	32	7-Jul	Wed	MU 1
6	11	16-Jun	Wed	MU 1, MU 18	17	33	8-Jul	Thur	MU 1
6	12	17-Jun	Thur	MU 1	17	34	9-Jul	Fri	MU 1, MU 18
7	13	18-Jun	Fri	MU 1	18	35	10-Jul	Sat	MU 1, MU 18
7	14	19-Jun	Sat	MU 1, MU 18	18	36	11-Jul	Sun	MU 1
8	15	20-Jun	Sun	MU 1	19	37	12-Jul	Mon	MU 1, MU 18
8	16	21-Jun	Mon	MU 1, MU 18	19	38	13-Jul	Tue	MU 1
9	17	22-Jun	Tue	MU 1	20	39	14-Jul	Wed	MU 1, MU 18
9	18	23-Jun	Wed	MU 1, MU 18	20	40	15-Jul	Thur	MU 1
10	19	24-Jun	Thur	MU 1	21	41	16-Jul	Fri	MU 1
10	20	25-Jun	Fri	MU 1, MU 18	21	42	17-Jul	Sat	MU 1, MU 18
11	21	26-Jun	Sat	MU 1, MU 18					
11	22	27-Jun	Sun	MU 1					

2.7. All dates shown are approximate and could be advanced or delayed by a week or so depending on various factors such as river flows, contractor schedules equipment failures, etc. Some evaluations may not proceed. Therefore, a final description of studies and outages being conducted will be coordinated with the region through AFEP (FFDRWG and SRWG) prior to April 1. All special operation requests or schedule changes will be coordinated with the fisheries agencies and tribes through the AFEP and with RCC and BPA. RCC will coordinate needed changes with the projects and authorize operations in teletype regulations.

APPENDIX A: JOHN DAY

John Day Dam[1]

1. Special Project Operations.

1.1. Spill. Spill will be provided from April 10 through August 31 for spring and summer migrants as required in the NMFS Biological Opinion. These are planning dates and may be modified by TMT or through other regional coordination in 2004. Between May 15 and July 20, spill will occur from 1900 to 0600 hours (11 hours total). Before that time period, spill will be for 12 hours nightly, from 1800 to 0600 hours. From April 10 to July 20, spill discharges will be 60% of instantaneous project flow at project flows up to 300,000 cfs. Above 300,000 cfs project flow, spill discharges will be 180,000 cfs (up to the hydraulic limit of the powerhouse). From July 21 through August 31, spill will be 30% of instantaneous project flow 24-hours per day. Spill will be provided in a manner consistent with TDG management to avoid excessive gas supersaturation conditions.

2. Studies.

2.1. Modified Extended Length Bar Screen Evaluations (ESBS). In 2004, ESBS evaluations will focus on the evaluating smolt condition after passage through the modified gatewell. Pending repair of the existing vertical barrier screens, periodic smolt condition tests will be conducted in unit 7 from approximately April 14 to June 20. PIT-tagged fish will be captured at the smolt monitoring facility and examined for descaling and injury.

2.2. Adult Salmon and Steelhead Passage Evaluations. Downstream migration of post-spawn steelhead (kelts) will be evaluated using PIT tags and radio telemetry at John Day Dam.

2.3. All dates shown are approximate and could be advanced or delayed by a week or so depending on various factors such as river flows, contractor schedules, equipment failures, etc. Some evaluations may not proceed. Therefore, a final description of studies and outages being conducted will be coordinated with the region through AFEP (FFDRWG and SRWG), prior to April 1. All special operation requests or schedule changes will be coordinated with the fisheries agencies and tribes through the AFEP and with RCC and BPA.

---

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

APPENDIX A: MCNARY

McNary Dam[1]

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season in accordance with spill specifications in the NOAA Fisheries BiOp (Appendix E) as updated in 2004 through the TMT Water Management Plan. Alternative spill patterns to control dissolved gas levels or change fish passage conditions should be coordinated through the FPOM.

1.2. Doble Tests. Two transformer banks and their respective turbine units will be taken out of service for Doble testing and circuit breaker replacement in 2004: T4, units 7 and 8 and T6, units 11 and 12. Sometime between September 1 and December 31 units 1 and 2, and 13 and 14, will also be taken off line for circuit breaker replacement. Each pair of breakers will require a 4-week outage. The exact schedule is yet to be determined.

1.3. Upgrade of Fish Ladder Tilting Weirs. The control and electrical systems for the tilting weir exit section in the Oregon shore fish ladder will be upgraded in 2004. This requires a ladder outage from January 5 to February 2. To ensure that the weirs operate properly after the new systems are installed, the forebay will be briefly fluctuated through its full operating range (335 to 340 feet msl) in March. Similar work was done in the Washington shore ladder in 2003.

1.4. Inspection of Levee System. The Corps will inspect the levee system in the Tri-cities area in 2004, requiring a low McNary pool. Tentative dates for the inspection are May 11 or 12. Further coordination with the RCC, fishery agencies, and others will take place as needed.

1.5. Rehabilitation of Spillway Gates. Four spillway gates will be rehabbed beginning in February 2004. This involves resurfacing wheels, installing low-friction seals, and painting. Work will be completed by April 15, allowing for the use of 22 spillway bays. One or more additional gates may be rehabbed if funding is available.

1.6. Operation of Turbine Units Outside of 1% best Operating Range. An operation of turbine units at McNary Dam outside of the normal 1% best efficiency operating range, up to 115% of

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

overload (approximately 80 MWs), is proposed for the spring of 2004. A plan for monitoring this operation is being prepared and coordinated with the region.

2. Studies.

2.1. Evaluation of Juvenile Fish Transportation Versus In-River Survival. Juvenile fish transportation will be evaluated at McNary Dam in 2004. Juvenile spring chinook and steelhead will be PIT tagged at mid-Columbia River hatcheries and either transported by barge or bypassed at McNary Dam. In the spring and early summer, the juvenile bypass facility operations will be alternated between full flow primary bypass and transportation modes by switching the primary bypass gate on an every-other-day schedule. During the transport mode of operation, only designated PIT tagged research fish will be transported while all remaining PIT tagged and run-of-river fish will be bypassed to the river. A potential summer study on fall chinook transportation may be conducted under the routine Bi-Op operations.

2.2. Evaluation of Adult Salmon and Steelhead Migration Past the Snake and Columbia River Dams. The Idaho Cooperative Fisheries Research Unit will continue to monitor the passage of adult salmonids through the hydrosystem. The study requires the installation of radio receivers and data loggers throughout the fishways and at various locations on the dam. The installation of equipment will take place prior to the fish season and is not anticipated to require special project operations.

2.3. McNary Turbine Upgrade Study. Studies related to upgrading the turbine units at McNary Dam will continue in 2004. Prototype VBSs will be evaluated in the A-slot gatewells of turbine units 2, 3, and 4. The VBSs will include a traveling VBS and 2 variations of bar screen VBSs. Testing will include a hydroacoustic evaluation of fish guidance efficiency of all turbine intake slots of the 3 test units at high and low turbine operations. PIT tagged fish will be released in the A-slot gatewells of the 3 test units, along with the A-slots of turbine units 5 and 9, equipped with standard VBSs. PIT tagged fish will be released during the spring and summer on days when the transportation facilities are operating in collection mode so test fish can be collected and evaluated for fish condition. Radar sensors will also be installed in all gatewells of the 3 test units for measuring water surface elevations in the bulkhead and operating gate slots.

2.4. Survival Studies. Survival studies will be conducted at McNary Dam in both spring and summer. Juvenile fish will be radio tagged, released upstream of the project, and monitored as they pass the project. The study is designed to determine overall project survival, spillway survival, bypass survival, and overall powerhouse (bypass and turbine together) survival. These tests will not require any special operations.

APPENDIX A: ICE HARBOR

Ice Harbor Dam[1]

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring and summer outmigration seasons in accordance with spill specifications in the NOAA Fisheries BiOp (Appendix E) as updated in 2004 through the TMT Water Management Plan. Alternative spill patterns to control dissolved gas levels or change fish passage conditions should be coordinated through the FPOM.

1.2. Doble Tests. To complete Doble testing in 2004, line 1 and turbine units 1 and 2 will be taken out of service from September 8 to 9.

1.3. AWS Pump Maintenance (North Shore). The three new AWS pumps installed in early 2003 were found to have various problems associated with the gearboxes (vibration, oil contamination, defective oil seals and bearings). To fix the problems one pump at a time will be taken out of service for one month from December 2003 to February 2004, and for shorter periods in (tentatively) November and December 2004. Two pumps will remain on line except during the two-week ladder outage in the January-February time frame.

1.4. AWS Pump and Mud Valve Maintenance (South Shore). Two of the eight AWS pumps for the south shore ladder will have their butterfly valves rehabbed, and mud valves in the fish pumps and collection channel will be repaired. All pumps will be out of service from January 2 to February 26, at which time six pumps will resume operation. All eight pumps will be operating by March 31.

1.5. Testing of Spillway Gates. Trunnion friction will be evaluated on two spillway gates during the June-August time frame. Stop logs will be installed upstream from the test gate and, for safety purposes, both adjacent spillway gates will be closed and tagged out. After mounting strain gauges, the test gate will be briefly opened to three stops and then closed (a dry test). Stop logs will be in place for about three or four days. A similar wet test will follow. Further coordination with the fishery agencies and others will take place as needed.

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

1.6. Inspection for Shoreline Erosion. The Corps will inspect for shoreline erosion throughout the Ice Harbor Project in 2004, requiring a low Ice Harbor pool. The tentative date for the inspection is April 6. Further coordination with the RCC, fishery agencies, and others will take place as needed.

1.7. Test of Spillway Emergency Generators. The Corps will test the spillway emergency generators by briefly opening the spillway gates about one stop, as many at one time as possible. The test will take place on April 6, or up to 30 days before that. Further coordination with the RCC, fishery agencies, and others will take place as needed.

1.8. Survey of Spillway Stilling Basin. The Corps plans to survey the spillway stilling basin at Ice Harbor in September 2004. This involves hydroacoustic sounding from a boat over a one or two day period. Relatively still water is needed for the work and it may be necessary to change turbine unit or fish passage operations. The purpose is to detect erosion damage caused by spill. Further coordination with the RCC, fishery agencies, and others will take place as needed.

2. Studies.

2.1. Spillway Survival Study. Radio telemetry, PIT, and balloon tag studies will estimate the survival rates of test fish passing over the spillway. Project operations (spill levels and possibly patterns) will change according to a randomized block schedule. Details of the schedule and operations are not available at this time, but will be developed through the SRWG and FFDRWG. Spill operation will involve two distinct operations including one “bulk” spill pattern and one small gate opening pattern. Specifics will be coordinated with the fishery agencies and others as needed.

2.2. Prototype Separator Evaluation. Separation efficiencies will be evaluated for different densities of juvenile fish passing through the prototype separator. This will be conducted using run of river fish at Ice Harbor and with fish collected from the gatewells at Lower Granite. Fish from Lower Granite will be transported by truck, and held at Ice Harbor for release into the collection channel. This study will require operation of the switch gate to the prototype separator during the test periods. A schedule of operation will be provided prior to the field season.

2.3. Evaluation of Adult Salmon and Steelhead Migration Past the Snake and Columbia River Dams. The Idaho Cooperative Fisheries Research Unit will continue to monitor the passage of adult salmonids through the hydrosystem. The study requires the installation of radio receivers and data loggers throughout the fishway and at various locations on the dam. The installation of equipment will take place prior to the fish passage season and is not anticipated to require special project operations. As part of this study, the fish trap in the south ladder will be operated from late June through late October. Trapping and tagging would occur four mornings per week and be completed by noon each day.

2.4. Adult Fishway Evaluation. The Walla Walla District will evaluate operational characteristics of the adult fishways in 2004. The purpose is to analyze existing operating conditions and investigate alternatives to improve fish passage, especially during times of low tailwater. This will involve adjusting diffuser gates and entrance weirs. Efforts will be made to stay within criteria, although occasional deviations will likely occur.

APPENDIX A: LOWER MONUMENTAL

Lower Monumental Dam[1]

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season in accordance with spill specifications in the NOAA Fisheries BiOp (Appendix E) as updated in 2004 through the TMT Water Management Plan. Alternative spill patterns to control dissolved gas levels or change fish passage conditions should be coordinated through the FPOM (but see 1.2. below). During periods of high river flow, spill volumes and the elevation of Lower Monumental reservoir may need to be manipulated on a daily or every-other-day basis to provide safe conditions for loading the fish barge at the juvenile fish facility below the dam.

1.2. Spill Patterns. New spillway deflectors for bays 1 and 8 were constructed in late 2002 and early 2003. As a result, new spill patterns were implemented in 2003 (see Table LMN-9 in the 2003 FPP). However, it was determined that opening bays 1 and 8 beyond three stops resulted in fish being ejected from the river. A temporary restriction was then placed on the two bays, requiring that they be operated at three stops or less and the remaining stops be distributed among the other six spillway bays. This restriction will continue through 2004 (see Table LMN-9 in this 2004 FPP). Parapet walls for keeping fish in the river are scheduled to be constructed before the 2005 migration season, at which time the restriction can be lifted.

1.3. Rehabilitation of AWS Pump. AWS pump 1 will be rehabbed (turbine, gearbox, and the pump itself). This requires an extended outage for that pump from December 15, 2003 to February 28, 2004. Pumps 2 and 3 will be out of service briefly beginning December 15 to allow for the installation of bulkheads in pump 1, and will be returned to service through December 31. Pumps 2 and 3 will then need routine maintenance, requiring concurrent outages for most of January.

1.4. Survey of Spillway Stilling Basin. The Corps plans to survey the spillway stilling basin at Lower Monumental in July or August 2004. This involves hydroacoustic sounding from a boat over a one or two day period. Relatively still water is needed for the work and it may be necessary to change turbine unit or fish passage operations. The purpose is to detect erosion damage

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

caused by spill. Further coordination with the RCC, fishery agencies, and others will take place as needed.

1.5. Doble Tests. Transformer banks T1 and T2 will be Doble tested in 2004. This will involve all generation of all six units. The plant will be off line from 0600–1700 hours each day from August 30 – September 3.

2. Studies.

2.1. Lower Monumental Spillway Survival Study. Survival studies will be conducted using radio-telemetry in 2004. Two spill patterns will be tested in a 2-day blocked design. The two patterns will be determined through discussions within the region and physical model testing at ERDC in Mississippi.

2.2. Ice Harbor Spillway Survival Study. Juvenile fish will be removed from the Lower Monumental Dam daily sample and tagged with radio tags and PIT tags for a spillway survival study at Ice Harbor Dam.

2.3. Near-field Study of Total Dissolved Gas Exchange and Evaluation of Added Spillway Deflector Performance. As part of the COE Fastrack Gas Abatement Program, total dissolved gas abatement alternatives are being developed to reduce the TDG exchange associated with spill operations and to provide greater flexibility in scheduling spillway operations. Additional spillway deflectors for bays 1 and 8 were constructed in late 2002 and early 2003, and now all spillway bays are so equipped. A field study is proposed to address the TDG exchange associated with the modified spillway and associated operations under a wide range of operating conditions. The proposed long-term monitoring program will be initiated in April 2004 prior to the spill season and continue through the end of spill, typically in June.

This three month sampling period will provide for the widest range of operating and environmental conditions. This study will primarily focus on determining the total dissolved gas exchange characteristics associated with spillway operation for discharges up to the design spill for a 7-day, 10-year frequency flood. The incorporation of specific operations could significantly enhance study findings. These special operations could include scheduled spill outage to maintain TDG instruments, alternative spill patterns including bulk spill, management of tailwater stage through storage in Lake Sacagawea, and constant spill with and without powerhouse flows. Circulation patterns below the dam will also be described through a variety of sampling devices. This information will support the interpretation of study TDG data and related issues concerning fish passage through this river reach.

2.4. Evaluation of Adult Salmon and Steelhead Migration Past the Snake and Columbia River Dams. The Idaho Cooperative Fisheries Research Unit will continue to monitor the passage of adult salmonids through the hydrosystem. Installation of radio receivers and data loggers throughout the fishway and various locations on the dam will be required. The installation of equipment will take place prior to the fish passage season and is not anticipated to require special project operations.

2.5. Adult Fishway Evaluation. The Walla Walla District will evaluate operational characteristics of the adult fishway in 2004. The purpose is to analyze existing operating conditions and investigate alternatives to improve fish passage. This will involve adjusting diffuser gates and entrance weirs. Efforts will be made to stay within criteria, although occasional deviations will likely occur.

APPENDIX A: LITTLE GOOSE

Little Goose Dam[1]

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season in accordance with spill specifications in the NOAA Fisheries BiOp (Appendix E) as updated in 2004 through the TMT Water Management Plan. Alternative spill patterns to control dissolved gas levels or change fish passage conditions should be coordinated through the FPOM.

1.2. Testing of Spillway Gates. Trunnion friction will be evaluated on two spillway gates during the June-August time frame. Stop logs will be installed upstream from the test gate and, for safety purposes, both adjacent spillway gates will be closed and tagged out. After mounting strain gauges, the test gate will be briefly opened to three stops and then closed (a dry test). Stop logs will be in place for about three or four days. A similar wet test will follow. Further coordination with the fishery agencies and others will take place as needed.

1.3. Survey of Spillway Stilling Basin. The Corps plans to survey the spillway stilling basin at Little Goose in July or August 2004. This involves hydroacoustic sounding from a boat over a one or two day period. Relatively still water is needed for the work and it may be necessary to change turbine unit or fish passage operations. The purpose is to detect erosion damage caused by spill. Further coordination with the RCC, fishery agencies, and others will take place as needed.

2. Studies.

2.1. Evaluation of Adult Salmon and Steelhead Migration Past the Snake and Columbia River Dams. The Idaho Cooperative Fisheries Research Unit will continue to monitor the passage of adult salmonids through the hydrosystem. Installation of radio receivers and data loggers throughout the fishway and various locations on the dam will be required. The installation of equipment will take place prior to the fish season and are not anticipated to require special project operations.

2.2. Adult Fishway Evaluation. The Walla Walla District will evaluate operational characteristics of the adult fishway in 2004. The purpose is to analyze existing operating conditions

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

and investigate alternatives to improve fish passage, especially during times of low tailwater. This will involve adjusting diffuser gates and entrance weirs. Efforts will be made to stay within criteria, although occasional deviations will likely occur.

APPENDIX A: LOWER GRANITE

Lower Granite Dam[1]

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season in accordance with spill specifications in the NOAA Fisheries BiOp (Appendix E) as updated in 2004 through the TMT Water Management Plan. Alternative spill patterns to control dissolved gas levels or change fish passage conditions should be coordinated through the FPOM. During periods of high river flow, spill volumes and the elevation of Lower Granite reservoir may need to be manipulated on a daily or every-other-day basis to provide safe conditions for loading the fish barge at the juvenile fish facility below the dam.

1.2. Index Testing. Index testing of two turbine units will take place in 2004. Unit 2 will be tested from March 15 to 26, and unit 4 from (tentatively) December 6 to 17. Units 1 to 3 are in one "family", and units 4 to 6 in another. The purpose of the index testing is to determine turbine unit performance so that the unit can be operated at peak efficiency.

1.3. Repair of Turbine Unit 1. Turbine unit 1 has been out of service since December 2002. Repair work, including generator rewind and cavitation repair, is scheduled for completion by May 2004.

1.4. Testing of Spillway Gates. Trunnion friction will be evaluated on two spillway gates during the June-August time frame. Stop logs will be installed upstream from the test gate and, for safety purposes, both adjacent spillway gates will be closed and tagged out. After mounting strain gauges, the test gate will be briefly opened to three stops and then closed (a dry test). Stop logs will be in place for about three or four days. A similar wet test will follow. Further coordination with the fishery agencies and others will take place as needed.

1.5. Survey of Spillway Stilling Basin. The Corps plans to survey the spillway stilling basin at Lower Granite in July or August 2004. This involves hydroacoustic sounding from a boat over a one or two day period. Relatively still water is needed for the work and it may be necessary to change turbine unit or fish passage operations. The purpose is to detect erosion damage

---

[1] The purpose of this section is to notify regional interests of planned activities that will or may affect fish passage. Further coordination may occur as needed.

caused by spill. Further coordination with the RCC, fishery agencies, and others will take place as needed.

1.6. Relocation of Behavioral Guidance Structure (BGS). The attachment point of the BGS to the dam will be moved from between units 3 and 4 to between units 5 and 6. The depth of the BGS will also be reduced near the dam. Currently, the structure is about 80 feet deep near the dam, tapering to about 55 feet deep at the upstream end. Part of the bottom of several of the sections will be removed, so the maximum depth at any point of the structure will be about 60 feet. This work is anticipated to take about six weeks and will likely take place in February and March. Preliminary unit outage schedules call for units 2, 3 and 4 to be out of service for approximately one week in early February and units 4, 5 and 6 to be out of service for approximately two weeks in mid and late February.

2. Studies.

2.1. Evaluation of Adult Salmon and Steelhead Migration Past the Snake and Columbia River Dams. The Idaho Cooperative Fisheries Research Unit will continue to monitor the passage of adult salmonids through the hydrosystem. The study requires the installation of radio receivers and data loggers throughout the fishway and at various locations on the dam. The installation of equipment will take place prior to the fish passage season and is not anticipated to require special project operations. As part of this study, the fish trap in the ladder will be operated from early July through late October to recapture fish outfitted with DST tags at the Ice Harbor trap.

2.2. Removable Spillway Weir Operation. The Removable Spillway Weir (RSW) was installed in the summer of 2001. It underwent extensive biological testing in spring 2002 and 2003. During February and March 2004, the Behavioral Guidance Structure will be moved to the north two units and the depth decreased along part of its length. The 2004 biological test will likely take place between mid-April and early June. The expected forebay elevation during testing will be between 734 and 735 feet, providing approximately 6,700 to 7,700 cfs over the RSW. A specific study design has not been finalized at this time, but will likely involve 24 hour per day operation of the RSW, along with some level of “training spill”. Monitoring will likely consist of radio-telemetry. Monitoring will focus on RSW efficiency and effectiveness, and fish behavior in the vicinity of the RSW and relocated BGS. The evaluation may involve periodic removal of the BGS, which would likely result in short-term (1 – 3 hours) outages at units 5 and 6. A summer test of the RSW and BGS may also take place in 2004. This would occur sometime between mid-June and late July and would most likely run for 3 or 4 weeks. Radio-telemetry would again be used to assess RSW performance. Project operations would most likely include the RSW (between 6,000 and 7,700 cfs) and some level of training spill, 24 hours per day.

2.3. Prototype Separator Evaluation. Separation efficiencies will be evaluated for different densities of juvenile fish passing through the prototype separator located at Ice Harbor. This will be conducted using run of river fish at Ice Harbor and with fish collected from the gatewells at Lower Granite. Fish from Lower Granite will be transported by truck, and held at Ice Harbor for release into the collection channel. This study will require operation of the switch gate to the prototype separator during the test periods. A schedule of operation will be provided prior to the field season.

2.4. Adult Fishway Evaluation. The Walla Walla District will evaluate operational characteristics of the adult fishway in 2004. The purpose is to analyze existing operating conditions and investigate alternatives to improve fish passage, especially during times of low tailwater. This will involve adjusting diffuser gates and entrance weirs. Efforts will be made to stay within criteria, although occasional deviations will likely occur.

2.5. Evaluation of Juvenile Fish Transportation Versus In-River Survival. Juvenile spring/summer chinook and steelhead will be PIT tagged at the juvenile fish facility and then released into the river below the project for either in-river migration or collection and transportation at Little Goose Dam. Most fish will be tagged out of the east bank of raceways in NOAA Fisheries’ temporary tagging facilities. Tagging of fish from the raceways will be independent of any other facility sampling operations and will reduce the number of fish direct loaded into fish barges. At the beginning and end of the tagging operation, when fish numbers are low, fish may be tagged in the facility sampling room. This will require an increase in the normal facility sampling rate in order to get the required number of fish on marking days. The adult fish trap will also be operated in 2004 to monitor adult returns of study fish tagged in previous years.

APPENDIX B

CORPS OF ENGINEERS JUVENILE

FISH TRANSPORTATION PLAN

Corps of Engineers' Juvenile Fish Transportation Plan

1. Introduction:

a. The Juvenile Fish Transportation Plan describes operations and establishes criteria for the transportation of juvenile salmon and steelhead from Lower Granite, Little Goose, Lower Monumental, and McNary dams (collector dams) to release areas below Bonneville Dam. This work plan supplements normal operating criteria presented Sections 5,6,8, and 9 of the Fish Passage Plan for the collector dams.

b. Collection and transportation is accomplished by the Walla District, Corps of Engineers (CENWW), under an Endangered Species Act (ESA) permit from the National Marine Fisheries Service (NOAA Fisheries). On-site biological assistance is provided by fishery agencies through a contract with Pacific States Marine Fisheries Commission and subcontracts with Washington Department of Fish and Wildlife (WDFW) and Oregon Department of Fish and Wildlife (ODFW). On-site biological assistance is provided by WDFW at Lower Granite, Lower Monumental, and McNary dams and ODFW at Little Goose Dam.

c. The transport program will be coordinated with other fishery monitoring, research, and management activities by CENWW. Coordination will be achieved with the fishery agencies and tribes through NOAA Fisheries, the Fish Passage Center (FPC), Fish Passage Operations and Maintenance Coordination Team (FPOM), the Technical Management Team (TMT), and other agencies as required.

2. Objective: The objective of CENWW and the transportation program is to maximize survival of juvenile fish collected and transported by:

a. Providing safe and efficient collection and barge or truck transport of juvenile salmon and steelhead from collector dams to release areas below Bonneville Dam;

b. Identifying and recommending programs or facility changes that would benefit fish collection and transportation or bypass operations;

c. Assuring that collection, transport, and release site facilities are ready for operation prior to the beginning of transport operations;

d. Assuring that collection, transport, and release site facilities are properly maintained throughout the transport season;

e. Establishing operating criteria for facilities, barges, and trucks including fish holding and transport densities, sampling rates, and facility operations and maintenance;

f. Coordinating changes needed to accommodate fluctuations in the outmigration with projects, NOAA Fisheries, FPC, FPOM, and TMT personnel;

g. Coordinating transport evaluation and other research with the transportation program;

h. Providing the training of new personnel associated with collection and transport facilities and equipment;

i. Providing all parties involved a list of emergency points of contact and appropriate telephone numbers so that any emergency can be coordinated and corrected efficiently;

j. Preparing an annual report detailing transportation activities and results for the previous year, and identifying maintenance, replacement, or modifications needed for the next transport season.

3. Program Duration:

a. Starting Operations: Transport operations will start on March 25 at Lower Granite Dam. Collection of juvenile fish for transportation at Little Goose and Lower Monumental dams will begin on April 1. McNary Dam will begin sampling for PIT tags, monitoring facility operations, and the Smolt Monitoring Program on April 1. Transport operations at McNary Dam will not begin until conditions specified under paragraph 4.a.(2) are met.

b. Summer Transport Operations: At McNary Dam, summer operations will begin when in-river migration conditions are no longer spring-like (see 4.a.(2) below). At Lower Granite, Little Goose, and Lower Monumental dams, summer operations will begin on June 21. Fish collected during summer operations will be held in shaded raceways or holding tanks. Sampling may convert to 100% when fish numbers at Snake River projects are below 500 fish per day or lower (per FPC sampling guidelines) and smaller pickup mounted transport tanks may be used. Steelhead, which state biologists determine are in poor condition or are reverting to the parr stage, may be bypassed to the river.

c. Ending Operations: Transport operations are anticipated to continue through approximately October 31 at Lower Granite and Little Goose, and through September 30 at Lower Monumental and McNary dams.

d. Emergency Notification Criteria: Project Biologists will report to the CENWW Transportation Coordinator when high water temperatures or other factors increase collection mortality to 6 percent of daily collection for 3 consecutive days or if daily collection mortality exceeds 10,000 fish. The Transportation Coordinator will evaluate the situation and shall notify NOAA Fisheries and may arrange a conference call, if needed, with FPC and/or TMT to discuss the options of continuing collection and transportation or to bypass fish. In the event of a fish loss exceeding conditions set forth in the ESA Section 10 Permit for the transportation program, the Corps shall notify NOAA Fisheries and reopen consultation as needed. If icing conditions threaten facility integrity or present unsafe conditions on the transport route, transport operations may be terminated early by the Project Manager. Emergency termination or modification of the transportation program will be coordinated by the CENWW Transportation Coordinator with NOAA Fisheries and FPC.

4. Operating Criteria:

a. Collection and Transportation: Juvenile fish shall be transported in accordance with the ESA Section 10 permit, the Biological Opinion prepared under ESA Section 7 consultation with NOAA Fisheries, and transportation program criteria. During transport operations, collected juvenile fish will be bypassed back to the river if the number of collected fish exceeds facility and barge holding capacities. Holding for transportation will resume when adequate capacities are available to hold and transport fish according to transportation program criteria. Maximum holding time and loading criteria will not be exceeded without CENWW review and approval. Marked or PIT tagged fish will be released to the river if they are part of an approved research study or smolt monitoring program travel time evaluation. Specifics of the transportation program may be altered during the transportation season based on recommendations from the TMT.

(1) At Lower Granite, Little Goose, and Lower Monumental dams, all juvenile fish collected shall be transported. Barging operations will begin on April 9 and continue through approximately August 15.

(2) At McNary Dam, fish collected during the spring shall be bypassed back to the river either through the main bypass pipe and full flow PIT tag detection system or through the transportation facilities in order to collect fish for transport research, fish condition information, and to obtain PIT tag data. The preferred operation when not collecting spring fish for transport research is full flow bypass to the river. Full flow

bypass may be alternated with every other day bypass through the transportation facilities to allow sampling of fish under the Smolt Monitoring Program. Transportation operations at McNary Dam for subyearling chinook shall not begin until inriver migratory conditions are deteriorating (i.e., no longer spring-like), usually not until around June 20. Spring-like conditions are defined as favorable flow and water temperatures; i.e., river flows are at or above the spring flow target of 220 to 260 kcfs, and ambient water temperatures are below 62^{o}F. When transport operations begin, fish will be collected and held for transportation with all fish collected being transported. During the spring, juvenile fish may be periodically sampled for the Smolt Monitoring Program and for monitoring facility operations.

b. Peak Migration Periods: For the purpose of transport operations, the peak migration period is defined as beginning when total collection at an individual project reaches 20,000 fish per day (actual peak days may range from 250,000 to 830,000 fish per day). Normally, truck transportation will be used before and after the peak, and barge transportation will be used during the peak. Peak migration generally occurs between April 15 and June 10 at Lower Granite, Little Goose, Lower Monumental, and McNary dams. At McNary Dam, a summer peak of subyearling chinook salmon also occurs from late June through mid-August with a smaller peak occurring during this time period at Snake River projects

c. Collection Facility Operations:

(1) Once transport operations begin, collection facilities will be staffed 24 hours per day until transport operations cease.

(2) Flows and fish passage at juvenile fish separators will be monitored at least every 15 minutes throughout separator operations.

(3) When collection systems are not providing safe fish passage or meeting operating criteria, project managers and biologists will make operational changes that are in the best interests of the fish, then notify CENWW as soon as possible. The CENWW Transportation Coordinator will coordinate changes with NOAA Fisheries, FPC, and TMT.

d. Sampling Procedures:

(1) When sampling is being conducted, it will normally be accomplished in accordance with smolt monitoring program sampling guidelines recommended by the FPC. Sampling guidelines may occasionally be altered if transportation program or fish

research activities require it. Normal alterations of sampling guidelines are to adjust the number of fish sampled to meet approved research needs, to minimize the handling of fish during warm water temperature periods, or to meet deadlines for loading fish transport vehicles.

(2) Fish that are sampled will be counted by electronic counting tunnels and the counts verified and adjusted by hand counts. All fish number estimates, raceway, truck, and barge loading densities and rates will be based on a sample of fish collected. Samples will be taken hourly 24 hours per day. Sample rates will be coordinated with smolt monitoring program personnel and set by project biologists.

(3) Species composition and weight samples will be taken to determine loading densities for raceways, barges, and trucks. Project personnel will keep a running total of hourly estimates of fish numbers, raceway totals, and direct loading totals for barges based on these estimates. Daily samples for monitoring descaling will include a minimum of 100 fish of the dominant group(s) for which descaling information is recorded. During periods of low fish passage, descaling will be monitored daily for facility operations. Full sample descaling may be conducted instead of 100 fish subsamples as long as it does not impact other facility operations. During extended transport operations (after August 15 at Snake River projects), samples may be evaluated every other day to minimize handling stress and to allow all collected fish to be held in the sample holding tanks.

(4) Where smolt monitoring program activities are conducted at collector dams, project biologists may utilize daily total information gathered by those personnel.

e. Loading Criteria:

(1) Raceways: Maximum raceway holding capacity will be 0.5 lbs. of fish per gallon of water. Inflow to raceways is approximately 1,200 gallons per minute (gpm) at Lower Granite and Little Goose dams, and 2,400 gpm at Lower Monumental and McNary dams. Individual raceway volume is approximately 12,000 gallons of water at Lower Granite and Little Goose, and 24,000 gallons at Lower Monumental and McNary.

(2) The 0.5 pounds per gallon criterion is not to be exceeded without CENWW review and approval. Such decisions will be coordinated with NOAA Fisheries, FPC, and TMT and a joint decision whether to exceed criteria or bypass fish to the river will be made based on: (1) species composition; (2) total anticipated collection during the critical holding period; (3) in-river fish passage conditions; and (4) fish condition.

Project biologists will provide information to the CENWW Transportation Coordinator upon which to base these decisions.

(3) Distribution Among Raceways: Collected fish should be spread among raceways to minimize crowding and stress, and to reduce the risk of disease transmission. Additional groups should be added to each raceway at the discretion of the project biologist until holding capacity is reached. Whenever possible, small fish will be held in raceways separate from large fish.

(4) Holding Time: Maximum holding time in raceways will be 2 days.

(5) Truck and Barge Capacities: Loading criteria are 5 pounds of fish per gpm inflow for barges and 0.5 pounds of fish per gallon of water for trucks. Capacities per vehicle are shown in Table B-1.

Table B-1. Capacities for fish transport vehicles.

Barge	Capacity (gal)	Inflow(gpm)	Fish Capacity (lbs)
SOCKEYE (2127)	85,000	4,600	23,000
BLUEBACK (2817)	85,000	4,600	23,000
STEELHEAD (4382)	100,000	10,000	50,000
COHO (4394)	100,000	10,000	50,000
CHINOOK (8105)	150,000	15,000	75,000
KING SALMON (8106)	150,000	15,000	75,000
8107	150,000	15,000	75,000
8108	150,000	15,000	75,000
Truck	3,500		1,750
Midi-tank	300		150
Mini-tank	150		75

f. Summer (Extended) Transport Operations:

(1) During the summer, all fish collected at the projects will be routed to the raceways with the most effective shading for holding. Sampling efforts should be minimized, if possible, to limit handling stress on fish. Facility samples may be processed every other day if possible.

(2) At Snake River projects, all collected fish may be routed to the sample tanks when fish numbers drop to an acceptable handling level. At that time all fish collected will be handled as part of the daily sample per smolt monitoring program sampling guidelines. To minimize handling stress, facility samples may be processed every other day. When large trucks are used, fish may be loaded from either the raceways or labs. When mini or midi-tankers are used, Corps and agency

project biologists will select the best method of transferring fish from the lab to the tankers.

(3) During summer months at McNary Dam, from June 15 through August 31, water temperatures will be measured along the face of the powerhouse, in B-slot gatewells, and within the collection channel on a daily basis. These temperature measurements will be used for management of project operations per criteria contained in the Fish Passage Plan. During warm water periods, collected fish may be transported by truck or barge on a daily basis to minimize stress and mortality from warm water conditions. Other special operations may be required at McNary Dam during summer months to minimize impacts of project operations on juvenile fish collection during warm water temperature periods.

(4) During the summer trucking season, if fish collection numbers begin increasing to where it appears the project will have have difficulty transporting the fish with available equipment, the project shall notify the CENWW Transportation Coordinator immediately. The Transportation Coordinator will arrange for additional transport vehicle if possible or prioritize transport/bypass operations between the projects.

(5) When water temperatures are above 68^{0}F, all personnel handling fish shall take extra care to minimize stress and other impacts on fish.

g. Facility and Equipment Logbooks and Records: To document collection and transportation activities, the following items will be logged at each dam by either project personnel or state biologists:

(1) Juvenile fish facilities: Records will be maintained recording fish counts by hour, by day, and by species, numbers and species of fish trucked or barged, number and species of fish sampled, descaling rates, and mortality rates. Records will be transmitted daily to CENWW for consolidation and transmittal to CENWD. Facility personnel will follow standard operating procedures (SOP's), and will note in facility logbooks accomplishment of SOP's at various stations at the collection facilities. General observations of fish condition and juvenile fish passage will be documented in facility logbooks by state biologists.

(2) Truck and Barge Logbooks: Each truck and barge shall have a logbook for recording fish loading rates, fish condition, estimated mortalities, area of release, equipment malfunctions, and accomplishment of scheduled work under the

SOPs. When consecutive loading of trucks or barges occurs at downstream projects, truck drivers or barge riders will record numbers and condition of fish loaded. Towboat captains will keep logbooks on towboat activities. Barge riders will be authorized as inspectors by the Contracting Officer's Representative to initial entries noting towboat passage, loading, or fish release activities, and comments on barging operations. State biologists will report truck and barge mortality information in their weekly reports.

(3) Weekly Reports: State biologists shall prepare weekly reports documenting daily and weekly collection and transportation numbers, sampling information, facility and sampling mortality, descaling rates, and adult fallbacks. The weekly reports will be used by CENWW for any weekly reports required in the ESA Section 10 permit issued by NOAA Fisheries. State biologists shall distribute the weekly reports to other regionally interested parties as directed by the CENWW Transportation Coordinator.

5. Transport Operations:

a. Truck Operations: Eight fish transport trailers and four tractors, three midi-tanks, and three mini-tanks are available for hauling fish. One midi-tank and one mini-tank will be provided at each Snake River project. Mini-tanks are small units that can be mounted onto pickup trucks. Normally during the early spring trucking, transport trucks/trailers will be distributed two at Lower Granite Dam, one at Little Goose Dam, one at Lower Monumental Dam. During late summer trucking, one truck/trailer will be stationed at each dam. Spare trailers will be kept at McNary Dam. Trucks may be redistributed to meet transport demands and when smaller transport vehicles begin operating in late summer.

(1) Truck Release Sites: The normal early spring release site for trucked fish will be at Dalton Point. From August 15 through the end of the transport season, trucks and mini-tanks will be transported by barge from a boat ramp located somewhere downstream of Bonneville dam to a mid-river release area. Mid-river releasing of trucked fish will continue as long as river levels allow safe loading of trucks onto the barge. Dalton point will be utilized as an alternate release site in the case of an emergency or unsafe river conditions for performing the mid-river barge release.

(2) Operation of Truck Life Support Systems: Truck drivers will be trained by project biologists and maintenance personnel on the operation of truck life support systems, the requirements of fish to be met, and signs of stress for which to

watch. Routine checks will be made on support systems and fish condition at check points identified by project biologists. Life support system data and information on fish condition will be entered into the truck driver's logbook at each check point and at the release point. The truck driver's logbook will be reviewed by the project biologist upon the truck driver's return after each trip.

(3) If required to maintain transport schedules, transport trucks, midi-tanks, and mini-tanks leaving Lower Granite may take on additional fish at Little Goose Dam, or trucks leaving Little Goose may take on additional fish at Lower Monumental Dam. Loading schedules will be coordinated so that fish will be kept separated by size as much as possible.

b. Barge Operations: Eight fish barges and four towboats will be available for use.

(1) Barge Scheduling: Barges with 75,000 pound capacity will operate from Lower Granite Dam. It takes approximately 79 hours to make a trip from Lower Granite Dam to the release area near the Skamania light buoy below Bonneville Dam and return. One barge will leave Lower Granite Dam every-other-day beginning on about April 8. When fish numbers increase, barging operations will switch to one barge leaving Lower Granite daily. When fish numbers decline in late spring, operations will change back to every-other-day barging from Lower Granite Dam, with barging operations continuing through August 15. During spring operations, barges will take on additional fish at Little Goose, and Lower Monumental dams as barge capacity allows. The two medium and two small barges may also be used from Lower Granite Dam for additional barging capacity or they will be used for direct loading of fish at Little Goose Dam. When daily collection exceeds barge capacity, juvenile fish will be bypassed to the river until collection numbers drop to where juvenile fish can be barged within barge carrying capacity criteria. During the summer, barges traveling from the Snake River projects will stop at McNary Dam to load fish collected there. Barging from McNary Dam may continue after Snake River barging ceases, past August 15, on an every-other-day basis if fish numbers warrant it. Summer barge operations at McNary after August 15 will continue while collection exceeds 3,500 pounds of fish per day (the capacity of two trucks) or trends indicate numbers will exceed the 3,500 pound trigger number.

(2) Barge Loading: Whenever possible, small and large fish will be loaded in separate compartments in barges.

(3) Barge Riders: Project barge riders will accompany each barge trip, supervising all loading and release

operations, and barge operations en-route. Barge riders will be trained on barge operation, maintenance, and emergency procedures by project biologists and maintenance personnel. Barge riders will also be cross-trained in facility operations, and may rotate with facility operators as decided by project management. Barge riders shall be responsible for monitoring fish condition, barge equipment operations, and water quality (temperature and dissolved oxygen levels) at regular intervals during downriver trips. Barge riders shall maintain logbooks recording loading activities and times, loading densities by barge compartment, information on equipment operations, and release locations. Standard operational procedure forms shall be filled out during routine monitoring of equipment operation and shall include fish mortality and water quality data. At each subsequent dam where fish are loaded onto the barge, the barge rider shall make appropriate notations in the logbook. The barge rider shall also serve as an inspector for the towboat contract, and record information required by the Contracting Officer's Representative, and shall initial the towboat captain's logbook confirming operational information and lockage times. Any unresolved differences between barge riders and towboat crews shall be reported immediately to the Contracting Officer's Representative.

(4) Barge Release Area: The barge schedule is based on release at the Skamania light buoy (approximately RM 140) with arrival at that point pre-determined to occur during night-time hours to minimize predation impacts. Barge travel time is affected by weather and river flows. As allowed by arrival time at Bonneville Dam, barge riders will randomly select barge release sites from Skamania light buoy upstream to Warrendale (approximately RM 144) to further decrease the ability of predators to prey on fish released from the barge. Project biologists will provide maps designating specific release sights to ensure that fish will not be released in the same area on consecutive trips.

6. Emergency Procedures:

a. Emergency procedures will be followed at any time an emergency occurs, 24 hours per day, 7 days per week during the transport season. Emergencies will be reported to the CENWW Transportation Coordinator as soon as possible.

b. In the event of an emergency (equipment failure at a facility or on a truck or barge, emergency lock outage, chemical spill in the river, etc.), facility workers, truck drivers, and barge riders will be expected to take immediate appropriate actions to protect fish. If time allows, the worker, driver, or rider should consult with his/her supervisor by phone or radio to jointly make emergency decisions. If time does not allow consultation, the worker, driver, or rider must take appropriate action on his/her own initiative, then report to his/her supervisor as soon as possible after the action has been completed.

c. A complete listing of persons to be notified in case of emergencies and their business and home telephone numbers will be provided to each person involved in the transport program. Facility operators, truck drivers, and barge riders will be trained on emergency notification procedures by project biologists and CENWW. For the purpose of reporting an emergency, the person involved will immediately notify his/her supervisor, or the next person up the line until the emergency has been properly reported and corrective action has been initiated. In addition to telephone reporting, barge riders will report emergencies by the towboat radio to the nearest Corps dam. The operator on duty will relay the message to the person or persons identified by the barge rider.

7. Fishery Agency Roles:

a. The fishery agencies provide biological assistance at transportation dams. CENWW contracts for state fish biologists to work at each collector facility.

b. Contracts specify that state agency personnel at collector dams accomplish specific tasks for the Corps including:

(1) Reviewing or conducting handling, inspection, and recording of data from fish sampled at the collection facility;

(2) Evaluating and recording fish condition, and recommending operational changes or inspection of facilities if fish condition indicates a problem;

(3) Providing hand counts of sampled fish, assisting the project biologist in adjusting electronic fish counts, checking hourly and daily fish counts for accuracy, and coordinating facility counts with counts of FPC smolt monitoring program personnel where appropriate;

(4) Conducting quality control inspections of collection facilities and transport equipment including visits to other collection facilities when work schedules can be so arranged;

(5) Monitoring the effects of smolt monitoring and research projects on fish condition and transportation activities and reporting impacts, including numbers of fish handled for

research purposes and the disposition of those fish, to the project biologist;

(6) Participating in gatewell dipping as required to monitor fish condition;

(7) Preparing weekly reports summarizing fish numbers and transport activities, and;

(8) Preparing text and tabular information in the correct format for project annual reports.

8. Dissemination of Information:

a. Project biologists or agency biologists at each collector dam will be responsible for entering all pertinent information into the computer database and for transmitting daily reports to CENWW. Weekday information will be transmitted by 1500 hours on the day collected. Weekend information will be transmitted to CENWW by 1200 hours on the following Monday.

b. Agency biologists will provide weekly reports detailing fish collection and transportation numbers, descaling estimates, and facility and transportation mortality estimates. The reports will also contain a narrative on project activities and compliance with operating criteria. If research or smolt monitoring activities are occurring at the project, the weekly reports will include information on the number of fish sampled and sacrificed also. Agency biologists shall provide the reports to interested parties within the region.

9. Project Requirements for Fishery Agency Activities and Research:

a. Coordination: Agencies and tribes expecting to work at Corps dams will provide early coordination including work proposals, evidence of approval by CBFWA, copies of ESA permits, and project needs and requirements through written correspondence to the Chief, Operations Division, of CENWW, and shall not start work until written approval has been received. The Corps also expects the FPC to coordinate Smolt Monitoring Program sampling guidelines with the Corps on an annual basis.

b. Protocol: To maintain good working relationships and safe working conditions, fishery agencies, tribes, and research organizations will be required to follow courtesy, security, and safety protocols as follows.

(1) Have agency picture identification and present it to project security on arrival;

(2) Check in with the Operations Manager upon first arrival at the project to receive information on who will be the project point of contact, and what courtesy and safety requirements must be followed;

(3) Notify the point of contact whenever arriving or departing from the project so they will know where personnel will be working and when they will be on the project;

(4) Adhere to project clearance, safety, security, and work procedures, including preparing an Activity Hazard Analysis as specified in the Corps Safety Manual, 385-1-1.;

(5) Notify the Operations Manager or his/her representative of unscheduled or non-routine work and activities, and;

(6) Notify the point of contact of expected guests or changes in personnel and assure that these individuals are aware of safety and work procedures.

APPENDIX C

BONNEVILLE POWER ADMINISTRATION'S

SYSTEM LOAD SHAPING GUIDELINES

REGARDING TURBINE OPERATION

AND BEST EFFICIENCY

Bonneville Power Administration's System Load Shaping Guidelines Regarding Turbine Operation and Best Efficiency

1. Background: Outmigrating juvenile salmonids have several potential routes of passage past hydroelectric dams on the mainstem Columbia and Snake Rivers, including turbines, mechanical bypass, sluiceways, and spillways. Fish passage survival varies depending on the route of passage. As a result of reported higher mortality rates for fish passage through turbines (Iwamoto and Williams 1993), regional efforts have been focused on providing non-turbine passage routes for juvenile fish as a means to improve fish survival through the FCRPS. Nevertheless, substantial numbers of juvenile fish will continue to pass through turbines; therefore, effort to minimize turbine-related mortality is a priority of the fishery agencies and Indian Tribes, National Oceanic And Atmospheric Administration Fisheries (NOAA Fisheries, formerly National Marine Fisheries Service [NMFS]), U.S. Army Corps of Engineers (Corps), and Bonneville Power Administration (BPA).

Turbine operating efficiency has a relatively direct effect on fish passage survival; the relationship between survival of juvenile fish passing through Kaplan turbines is positively correlated and roughly linear to the efficiency at which the turbines are operated. Bell (1981) recommended making every effort to operate turbines at best efficiency at a given head during periods of peak fish passage to minimize fish mortality.

2. Turbine Efficiency: For the purposes of this document, best turbine efficiency operation shall be based on efficiency tables provided by the Corps for each project in the Fish Passage Plan (FPP). The Corps shall ensure that these efficiency ranges are based on the best available information, and that updates are coordinated with BPA, the Fish Passage Operation and Maintenance Coordination Team, and operating agencies. The tables will be distributed to all operating agencies prior to implementation, allowing at least two working days after receipt of the tables for implementation.

Operating efficiency of turbines is a result of wicket gate opening and blade angle for a given head (Bell 1981). As a result, there is a family of turbine efficiency curves for each project (or turbine design) for various head differentials. Operational decisions affecting turbine operations are based on efficiency curves for incremental changes in head, as provided by turbine manufacturers or empirical testing.

3. Guidelines:

a. Objective: To reduce the mortality of outmigrating juvenile salmonids, BPA will provide the Corps' hydrosystem projects with generation requests that allow turbines at the Lower Snake (LSN) and Lower Columbia (LCOL) projects to operate within 1% of best efficiency, or as otherwise specified, during the Best Efficiency Operating Period, within the guidelines outlined below.

b. Best Efficiency Operating Period: This period is defined as 24 hours per day from April 1 through October 31 for all LCOL river and LSN river projects. BPA will maintain generation requests that allow turbines to operate within 1 percent of best efficiency in accordance with these guidelines however, operation may occur outside 1% of best efficiency subject to the limitations listed in paragraphs 4 and 5.

Reporting generation requests outside the 1% best efficiency range relative to the applicable best efficiency limitations during the Best Efficiency Operating Period will be provided as outlined in paragraph 6.

c. Unit Priorities: The Corps should make every effort to adhere to unit priorities. The Corps shall follow a unit priority list that specifies which units at each LSN and LCOL project should be operated within the range of best efficiency, to minimize impact to salmon stocks. Likewise, the Corps will also indicate the priority for operating units outside the 1% best efficiency minimum or maximum ranges. The list will be based on the best available fish passage and turbine efficiency information and will be included in the FPP.

d. Project Priorities: If units must be operated out of the 1% best efficiency range, then BPA will make every effort to assure that generation requests to the Corps projects adhere to project priorities. Project priority may be developed weekly, based on in-season fish passage information, by the Technical Management Team (TMT).

e. Coordination: Coordination will occur through existing interagency coordinating mechanisms, such as the Corps, BOR, BPA and NOAA Fisheries in-season management process described in the NMFS 2000 BiOp.

Coordination is also intended to minimize frequent disruption of FCRPS by allowing the action agencies sufficient lead time to include system operational changes in their planning activities. Sufficient time is defined as a minimum of two working days before implementation, unless an emergency situation exists. In the event of an emergency, implementation will begin as soon as practical given concurrent operations, hydraulic situations and loads.

Reasonable and prudent operation outside of best efficiency for limitations listed in paragraphs 4.a and 4.b is at the discretion of the BPA and Corps. BPA and the Corps will coordinate with NOAA Fisheries when operation of turbines outside of the best efficiency range may be appropriate under provisions in paragraphs 4.c through 4.i. Coordination will occur during the bi-weekly TMT meetings.

Emergency situations, described in paragraphs 4.a and 4.b, that require an immediate change in FCRPS operation to avoid excessive take of listed salmonids may be directly coordinated at any time between NOAA Fisheries and the action agencies. Coordination of an emergency change in FCRPS operation shall normally be completed immediately, with information supplied to the TMT described above as soon as practical. Implementation of the change(s) will occur as soon as practical given operational, hydraulic and load conditions. The action agencies shall provide points of contact to allow such emergency coordination to occur.

4. Limitations for the period April 1 through October 31. Conditions that may affect BPA's ability to operate in such a manner include:

a. System Reliability: BPA's ability to operate the power system in a manner that enables the Corps to maximize operation of turbines within best range will be constrained by requirements to maintain system reliability (including requirements necessary for transient and voltage stability of the transmission system), and the ability to meet system response criteria. Additionally, it is necessary to maintain a margin of resource generation on line to fulfill Northwest Power Pool (NWPP), Western Electricity Coordinating Council (WECC), and the North American Electric Reliability Council (NERC) reliability requirements.

BPA's Reliability Criteria for Operations[1], the Northwest Power Pool Operating Manual[2], the Western Systems Coordinating Council Operations Committee Handbook[3], and the North American Electric Reliability Council Operating Manual[4] define system response criteria and margin of resource generation.

Predictable instances of deviation from within the best range as a consequence of prudent utility operation for control of short-term system dynamics include:

1) Routine responses to loss of generation, load or transmission within the interconnection including delivery of Operating Reserve Obligation to NWPP members upon request. The duration of these deviations is minimal, but dependent upon recovery by the interconnection member with the problem.

2) Routine starting and stopping of generation units. These deviations are unavoidable, but very short in duration.

3) Deliberate dropping of generation, i.e., instantaneous interruption of output, to preserve system integrity. This dropping could cause a brief excursion.

b. Firm and Direct Service Industry (DSI) Load: The LCOL and LSN projects will be operated within 1% of best efficiency to the extent that the ability to meet firm loads is not jeopardized. According to the Regional Act, the Power Sales Contract[5] with the DSIs and House Report 96-976[6], dated September 16, 1980," the total DSI load will be considered firm for purposes of resource operation."

c. Total Dissolved Gas Supersaturation (TDG): The TDG levels will be monitored at each project during the fish passage season. Signs of gas bubble disease will be monitored at all Smolt Monitoring Program sampling sites and selected in-river sites. Best turbine efficiency operation may be modified if representative monitoring data indicate that TDG is affecting fish survival. Necessary operational modifications will be coordinated through the process outlined in paragraph 3.e.

---

[1]Section 4.
[2]Minimum Operating Reliability Criteria Sections I and II. 1.-3. and 8.
[3]Minimum Operating Reliability Criteria Section II 1.-4. and 8., and Section III 1.1 and 1.2.
[4]The entire manual has relevance. However, particularly concise portions are - Guide II.A. and the Reliability Criteria for Interconnected Systems Operation, especially the Preamble, Section I.A., B., and C., Section II.A. and B., and Section III.A.
[5]Section 8.(a).(1)
[6]Part II, page 48

d. Coordinated Fishery Operations: In the event that coordinated fishery operations and approved fishery research are not in accord with operating turbines at best efficiency, operational modifications will be coordinated through the process outlined in paragraph 3.e.

e. Grand Coulee (GCL) and Chief Joseph (CHJ) Flexibility: Within system reliability and firm load limitations, flexibility at GCL and CHJ will be fully used, whenever possible, before generation requests to LCOL and LSN projects are outside the best efficiency range.

f. Flow Augmentation Operations: Flow augmentation requests for LCOL flows at McNary (MCN) are primarily met by water releases from GCL. The decision on whether to use GCL flexibility to provide inflows to MCN at the level necessary to meet the week's LCOL flow request when fish collection is maximized for transport during the flow augmentation period shall be made through the coordination process outlined in paragraph 3.e.

The TMT flow augmentation requests may exceed the 1% best efficient operation range at LCOL/LSN projects. Meeting this flow request will take precedent over best efficient operations. Coordination of the implementation of the flow requests will occur through the process outlined in paragraph 3.e.

g. Transport Projects: Resolution of the conflict between spill management and turbine operation within 1% of best efficiency at transport projects during the transport season shall be determined through the coordination process outlined in 3.e., and in accordance with fish transportation guidelines, based on in-season flow and fish passage information. Care should be taken during transition periods close to the upper flow boundary to avoid frequent switching of priorities between spill and generation.

h. Routine Maintenance and Testing: All units at all projects must undergo maintenance and associated testing. The testing necessitates deviation from the 1% best efficiency band for periods of from 15 minutes to 8 hours. Scheduling of maintenance testing will be coordinated through the process outlined in 3.e., to ensure that it is conducted during times of low fish passage within a day to minimize impacts on fish.

i. Flood Control: The FCRPS provides multiple benefits to the region. Flood control is the primary function of many of the projects on the Columbia River. In the event that river flow conditions require flood control operations, operation of turbines within the 1% best efficiency range may be modified or suspended based on the Corps' direction. Allowing excursions from 1% best efficiency for flood control operations would facilitate transportation, reduce excessive dissolved gas levels, and lower the risk of gas bubble disease in fish. Coordination of flood control operations will occur as outlined in paragraph 3.e. See also paragraphs 4.c and 4.e.

During flood control operation, compliance reporting will follow procedures outlined in paragraph E.

j. Other: In the event that the excursion was not explainable or caused by human error.

5. Limitations for the period September 1 through October 31: Conditions that may affect BPA's ability to operate in such a manner include all limitations in 4.a. through 4.j., plus the requirement for prudent use of the FCRPS storage capability necessary to import energy into the FCRPS for fish storage and firm load requirements.

6. Quality Control: Significant deviations from 1% will be reported to the TMT. Data on unit status will be kept by BPA during the 1% operating season. Documentation as to why the excursions occurred will be kept in project logs at each dam.

Upon request of the TMT, a case-by-case brief explanation of the reason(s) for unit operation outside the best efficiency range, the date, and the associated period of time will be provided by the appropriate parties.

A brief explanation of the reason(s) for unit operation outside the best efficiency range, the date, and the associated period of time will also be provided for documented excursions. Other excursions (e.g., excursions for unknown reasons) will also be reported.

APPENDIX D

CORPS OF ENGINEERS PLAN OF ACTION

FOR DISSOLVED GAS MONITORING

IN 2004

CORPS OF ENGINEERS PLAN OF ACTION FOR DISSOLVED GAS MONITORING IN 2004

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CORPS OF ENGINEERS PLAN OF ACTION FOR DISSOLVED GAS MONITORING IN 2004

1.0 INTRODUCTION

This Plan of Action for 2004 summarizes the role and responsibilities of the Corps of Engineers as they relate to dissolved gas monitoring, and identifies channels of communication with other cooperating agencies and interested parties. The Plan summarizes what to measure, how, where, and when to take the measurements and how to analyze and interpret the resulting data. It also provides for periodic review and alteration or redirection of efforts when monitoring results and/or new information from other sources justifies a change. Some information on the complementary activities of other participating agencies is provided at the end of this document.

2.0 GENERAL APPROACH

The total dissolved gas (TDG) monitoring program consists of a range of activities designed to provide management information about dissolved gas and spill conditions. These activities include time-series measurements, data analysis, synthesis and interpretation, and calibration of numerical models. Four broad categories of objectives are involved:

1) data acquisition, to provide decision-makers with synthesized and relevant information to control dissolved gas supersaturation on a real-time basis,
2) real-time monitoring, to ascertain how project releases affect water quality relative to ESA Biological Opinion measures and existing state and tribal dissolved gas standards;
3) trend monitoring, to identify long-term changes in basin wide dissolved gas saturation levels resulting from water management decisions; and
4) model refinement, to enhance predictive capability of existing models used to evaluate management objectives.

Portland, Seattle and Walla Walla Districts have direct responsibilities for TDG monitoring at their respective projects, including data collection, transmission, and analysis and reporting. The Division's Reservoir Control Center (RCC) will coordinate this activity with the Districts and other State and Federal agencies and private parties as needed to insure the information received meet all real-time operational and regulatory requirements. Districts and Division roles and functions are described in more detail in later sections of this document.

The Corps considers TDG monitoring a high priority activity with considerable potential for adversely affecting reservoir operations and ongoing regional efforts to protect aquatic biota. It will make all reasonable efforts toward achieving at least a data quality and reliability level comparable to that provided in previous years.

Furthermore, the Corps believes it is important to maintain a two-way communication between those conducting the monitoring and the users of monitoring information. These interactions give decision-makers and managers an understanding of the limitations of monitoring and, at the same time, provide the technical staff with an understanding of what questions should be answered. Therefore, comments and recommendations received from users were and continue to be very useful in establishing monitoring program priorities and defining areas requiring special attention.

3.0 DISTRICTS/DIVISION RESPONSIBILITIES

3.1 Portland, Seattle and Walla Walla Districts Functions

Portland, Seattle and Walla Walla Districts will perform all the activities required at their TDG monitoring sites. Data will be collected and transmitted from those sites systematically and without interruption to the Corps Water Management System (CWMS). CWMS is a comprehensive water management system incorporating the acquisition, transformation, verification, storage, display, analysis, and dissemination of information using a relational database (ORACLE) to store the data. Some of the gauges will record year round while other will be seasonal (see Table 4 at the end of this appendix). At most gauges, normal seasonal monitoring will be from 1 April through 15 September. However, the Chelan County gauges will operate from 1 April through 31 August and the Hungry Horse gauge will operate from 1 April through 30 September. Should spill occur in association with the Spring Creek hatchery release, monitoring stations downstream of Bonneville Dam will be activated. Activation of these monitoring stations will be coordinated with the Portland District.

District responsibilities include but are not limited the following tasks:

- preparing annual monitoring plan of action and schedule, as described in RPA 131 of the National Marine Fisheries Service 2000 Biological Opinion
- procuring data collection/transmission instruments
- preparing and awarding equipment and service contracts
- performing initial instrument installation and testing
- setting up and removal of permanent monitoring installations, if requested
- evaluate existing stations, as described in RPA 132 of the National Marine Fisheries Service 2000 Biological Opinion
- collecting and transmitting TDG data to CWMS
- reviewing data for early detection of instrument malfunction
- making periodic calibration, service and maintenance calls once every 2 weeks
- providing emergency service calls as needed and/or when so notified
- performing special TDG measurements, if needed
- keeping records of instrument calibration and/or adjustments
- retrieving, servicing, and storing instruments at the end of the season
- providing final data corrections to the Division office
- performing data analysis to establish/strengthen spill vs. TDG relationship
- preparing an annual activity report
- document and report QA/QC performance

All three Districts will also be responsible for (1) preparing an annual report on instrument performances, and (2) providing the necessary material including test and data analyses, charts, maps, etc. for incorporation in the Corps' Annual TDG Report, which will be finalized by the Division. Additional monitoring at selected locations may be required on an "as needed" and depending upon available funding. Dissemination of data to outside users will remain a Division responsibility to avoid duplication and uncoordinated service.

3.2 Division's Functions

The Division will be responsible for overall coordination of the TDG monitoring program with the Districts, other State and Federal agencies and cooperating parties. The Leader of the Water Quality Team, CENWD-CM-WR-N, is the designated TDG Division Program Coordinator reporting through the chain of command through Chief, Reservoir Control Center and Chief, Water Management Division to the Director of Programs.

The Division TDG Program Coordinator will provide overall guidance to District counterparts to ensure that the monitoring program is carried out in accordance with the plan outlined in this document, including close adherence to a general schedule and operating QA/QC protocols. The individual will be the main point of contact for all technical issues related to the TDG monitoring at Corps projects. The coordinator will refer problems of common regional interest to relevant forums such as the Water Quality Team (WQT) for peer review and open discussion. The individual will facilitate final decision-making on technical issues based on all relevant input from interested parties.

The Division TDG Program Coordinator will meet with District counterparts in late January or early February to discuss and firm up detailed implementation plan and schedule for the current year. Discussion will cover monitoring sites, equipment, data collection and transmission procedures, service and maintenance, budget, communication needs, etc. A set of specific performance measures will be jointly prepared as a basis for reviewing and monitoring District performances. A post-season review meeting will be held annually to provide a critique of the operations and identify areas needing changes and/or improvements.

4.0 2004 ACTION PLAN

The 2004 Action Plan consists of the following eight phases observed in previous years, plus winter monitoring. These phases are as follows:

(1) Program start-up;
(2) Instrument Installation;
(3) In-season Monitoring and Problem Fixing;
(4) Instrument Removal and Storage;
(5) Winter Monitoring;
(6) Data Compilation, Analysis and Storage;
(7) Program Evaluation and Report; and
(8) Special Field Studies

The Plan of Action for all three Districts is similar to the one in 2003, with the exception of some fixed monitoring station changes.

A NOAA Fisheries Forum Water Quality Team Subcommittee has meet every year since 2001 in the fall to consider actions concerning RPA 132 of the Biological Opinion. RPA 132 calls the action agencies to develop a plan and conduct a systematic review and evaluation of the TDG fixed monitoring stations in the forebays of all the mainstem Columbia and Snake River dams, in coordination with the Water Quality Team. The Fixed Monitoring Station (FMS) Subgroup of the Water Quality Team (WQT) met on December 9th, 2003 to complete the review of the FMS system for the Federal Columbia River Power System (FCRPS). After consideration of the discussions at this meeting, the following recommendations (Table 1) for changes to the FMS have been established:

Table 1

Fixed Monitoring Station Subgroup Recommendations for 2004 Spill Season

Fixed Monitoring Station	**Recommendation/Comments**
Camas/ Washougal	Recommend no change in this site at this time. However, the WQT is currently reviewing the purpose, representativeness, and value as a TDG management tool of this station. Until these issues are addressed, this station will remain in service during the 2004 spill season (see discussion below).

Warrendale	The site is inconsistent with other tailwater sites in the system due to considerable mixing with powerhouse waters. The WQT is currently reviewing use of this station along with Camas/Washougal and the new BON Tailrace monitor on Bradford Island. Until all issues are addressed, this station will remain in service during the 2004 spill season and will be used as the Bonneville tailrace monitor for spill management purposes (see discussion below).
BON Tailrace	Install real-time monitor on Bradford Island in the spill water channel just downstream of the aerated zone (near "Turtle Rock"). Evaluate potential use of this site for spill management at Bonneville Dam. However, this station will not be used for spill management purposes until the issues with respect to Camas/Washougal are addressed.
BON Forebay	Recommend no change in this site.
TDA Tailrace	The station is currently inconsistent with other tailwater sites in the system due to considerable mixing with powerhouse flows. Continue to utilize this site for spill management but recommend additional investigations to identify a more suitable monitor location.
TDA Forebay	Recommend no change to this station.
JDA Tailrace	Recommend no change in this site.
JDA Forebay	Relocate monitor to the upstream end of the navigation lock. Deploy monitor at a depth of 15 meters.
MCN Tailrace	Recommend no change in site location.
MCN Forebay	Maintain exiting station locations, data recording, and applications. Recommend 2004 as a transition year to evaluate alternative stations as follows: Locate one monitor near upstream end of navigation lock guide wall and deployed at a depth of 15 meters. Locate a second monitor on a float at the Boat Restricted Zone (BRZ) on the Oregon side of the forebay. Both instruments should be remote logging devices. Data are to be made available monthly for review by the WQT.
Pasco	Recommend no change in this site.
IHR Tailrace	Recommend no change in this site.
IHR Forebay	Maintain existing station locations, data recording, and applications. Recommend 2004 as a transition year to evaluate alternative stations as follows: Locate monitor near the upstream end of the navigation lock guide wall and deployed at a depth of 15 meters. Instrument should be remote logging device. Data are to be made available monthly for review by the WQT.
LMN Tailrace	Recommend no change in this site.
LMN Forebay	Maintain existing station locations, data recording, and applications. Recommend 2004 as a transition year to evaluate alternative stations as follows: Locate monitor near the upstream end of the navigation lock guide wall and deployed at a depth of 15 meters. Instrument should be remote logging device. Data are to be made available monthly for review by the WQT.
LGS Tailrace	Recommend no change in this site.
LGS	Maintain existing station locations, data recording, and applications. Recommend

Forebay	2004 as a transition year to evaluate alternative stations as follows: Locate monitor near the upstream end of the navigation lock guide wall and deployed at a depth of 15 meters. Instrument should be remote logging device. Data are to be made available monthly for review by the WQT.
LWG Tailrace	Recommend no change in this site.
LWG Forebay	Maintain existing station locations, data recording, and applications. Recommend 2004 as a transition year to evaluate alternative station as follows: Locate monitor near the existing monitor on the navigation lock guide wall and deployed at a depth of 15 meters. Instrument should be remote logging device. Data are to be made available monthly for review by the WQT.
DWR Tailrace	Recommend no change in this site.
Peck	Recommend no change in this site.
Lewiston	Recommend no change in this site.
Anatone	Recommend no change in this site.
Pasco	Recommend no change in this site.
Albeni Falls Tailrace	Install monitor. No monitor has been operated at this site previously.
Albani Falls Forebay	Install monitor. No monitor has been operated at this site previously.
Libby Tailwater	Recommend no change in this site.
Chief Joseph Tailwater	Recommend no change in this site.
Chief Joseph Forebay	Recommend no change in this site.

At the December 9th and January 13th meetings Water Quality Team meeting, discussion of the fixed monitoring sites downstream of Bonneville dam took place. At these meetings, the Corps presented a recommendation to eliminate the Warrendale FMS and begin monitoring Bonneville tailwater TDG levels from Bradford Island at a location just downstream of the aerated zone (near "Turtle Rock"). The fish and wildlife agencies (NOAA Fisheries, Fish Passage Center, and the U.S. Fish and Wildlife Service) all supported this relocation contingent upon the discontinued use of the gauge at Camas/Washougal to manage spill at Bonneville Dam. Water quality agencies from the States of Oregon and Washington indicated support for the relocation because it would be consistent with the preferred location for tailwater TDG gauges as specified in the "Total Maximum Daily Load (TMDL) for Lower Columbia River Total Dissolved Gas." The State of Washington has deleted specific reference to the Camas/Washougal site for compliance determination in its water quality regulations adopted in 2003. EPA must still approve the new standards (anticipated sometime in 2004) before they are fully in effect, so some revision of the rule is still possible. The State of Oregon has required the use of the Camas/Washougal site for compliance monitoring in the Order issued by its Environmental Quality Commission. However, the State water quality agency stated a willingness to amend this order should a decision be made to change the monitoring site. As a result, the Corps is recommending no specific changes in the locations of TDG gauging stations downstream of Bonneville dam for spill management. Due to structural changes at Bonneville dam, the Corps is planning on continued TDG monitoring at the Bradford Island site in the future to determine how use of these new facilities affect TDG entrainment in the tailwaters. The data from the Bradford Island site will not be used for spill management for the 2004 spill season.

4.1 Phase 1: Program Start-Up

Responsible parties (See Table 3 at the end of this appendix) will be invited to a TDG-FMS Coordination meeting some time in late January or early February for final discussions on the plan of action. This will ensure a good mutual understanding of the most current objectives of the dissolved gas monitoring program, including data to be collected, instrument location, procedures to be used, special requirements, etc. The draft plan will be presented for peer review at a February meeting of the WQT.

All three Districts will ensure that adequate funding is available for 2004 monitoring activities. Portland District, having decided to continue to use the service of the USGS (Portland Office) in 2004, will prepare the necessary contracts to secure those services and provide for rental and associated maintenance of the USGS's Sutron data collection platforms. Walla Walla District, which will begin using the services of the USGS (Pasco Office) in 2004, will also prepare the necessary contracts to secure those services. Seattle will renew or develop new contractual arrangements as needed for the operation of the Chief Joseph and Libby stations, and the installation and maintenance of the new monitors at Albeni Falls. All maintenance and service contracts should be completed at least two weeks before the instruments are installed in the field. Where applicable, the Districts will ensure that real estate agreements and right of entry are finalized between the landowners and the Corps. All paper work for outside contracting will be completed no later than 31 January.

To date, the districts have been initiating the necessary contracts to continue operation and maintenance of the FMS's through the 2003-2004 winter monitoring season and the 2004-monitoring season. Districts and division have finalized the current QA/QC protocols. Temperature loggers have been placed in Dworshak Reservoir for winter monitoring. All districts will continue GOES satellite transmission.

Discussions between districts, division and contractors are expected to continue through February, at which time a final plan of action will be produced. It is also understood that the following entities will continue to operate their monitoring instruments in 2004:

- U.S. Bureau of Reclamation, below Hungry Horse, at the International Boundary and above and below Grand Coulee Dam;
- Mid-Columbia PUDs (Douglas, Chelan and Grant Counties), above and below all five PUD dams on the Columbia River; and
- Idaho Power Company, in the Hells Canyon area (as part of its Federal Energy Regulatory Commission's license renewal requirement).

4.2 Phase 2: Instrument Installation

Instruments to be installed and their assigned locations are listed in Table 4 and shown in Figure 2. Some of them are already in place for the 2003-2004 winter monitoring. The Corps network will essentially remain the same as in 2003. However, unlike previous years, the station below Libby Dam will be active through the entire 2004 spill season. In previous years, the Libby tailwater gauge was only operational at times when spill was occurring.

Forebay and tailwater gauges will be installed at Albeni Falls sometime this winter and are expected to be fully operational during the entire 2004 spill season.

All instruments are scheduled to been in place and duly connected to their Sutron, Zeno, or Geomation DCP's no later than 1 April for all stations except the stations downstream of Bonneville dam which may need to be activated earlier should spill occur in conjunction with the Spring Creek hatchery release. Otherwise, the stations below Bonneville will be activated by 1 April like all other monitoring sites.

Corps stations that remain in service during the 2002-2003 winter will continue their operation with minimum interruption into the spring, following the necessary instrument service and maintenance check-up and site equipment (piping) upgrades. These stations include the following: Dworshak tailwater, Pasco (temperature), Anatone (temperature), Lower Granite forebay and tailwater, Ice Harbor forebay and tailwater, McNary forebay (Oregon and Washington sides) and tailwater, Bonneville forebay, and Warrendale. The Anatone gauge is operated seasonally for temperature and TDG. The Walla Walla District currently provides funding to the USGS to collect temperature data year-round at their gauging station located in the same reach. The Pasco gauge is operated for TDG and temperature seasonally (1 April through 15 September) but only operated as a QC/QA station for the remainder of the year. An assessment of monitoring site integrity will be conducted; any damages that may have occurred over the winter will be fixed before proceeding on to calibration and testing. Selected project personnel may be requested to assist on this task as needed.

4.3 Phase 3: In-season Monitoring and Problem Fixing

Actual data collection and transmission will begin no later than 10 March at the monitoring stations below Bonneville dam if spill at Bonneville is performed as part of the Spring Creek Hatchery release. Otherwise, the data collection and transmission will begin no later than 1 April for the entire monitoring network.. The exact starting date will be coordinated with the Corps' Reservoir Control Center (CENWD-CM-WR-N), project biologists and cooperating agencies, based on run-off, spill, and fish migration conditions.

The following data will be collected approximately every hour:

- Water Temperature (°C)
- Barometric Pressure (mm of Hg)
- Total Dissolved Gas Pressure (mm of Hg)
- Gage depth (feet)

Data will be collected at least hourly and transmitted at least every four hours. If feasible, the previous 12 hours of data will also be sent to improve the capability of retrieving any data that may have been lost during the preceding transmission. For Portland, Seattle, and Walla Walla Districts, data transmission will be done via the GOES Satellite, to the Corps' ground-receive station in Portland. After decoding, all data will be stored in the CWMS database. Per their contract with Portland District, the USGS is planning to have the satellite data going into CWMS and ADAPS (internal to the USGS) simultaneously to allow for some pre-screening. Data transmission at Libby and Albeni Falls (gauges operated by the Seattle District) will also be done via radio to the NWS HEC-DSS database to provide back-up data in case of GOES transmission failure.

Given their direct relevance to fish mortality, the first three parameters (Temperature, Barometric Pressure, and TDG) will be collected on a first priority basis.

Daily reports summarizing TDG and related information will be posted on the Technical Management Team's (TMT) home page. To the extent feasible, the measured TDG data will be compared with SYSTDG model predicted values so that suspicious values can be flagged. Data filtering through other methods will also be made. Information provided on the homepage will include the following data:

- Station Identifier
- Date and Time of the Probe Readings
- Water Temperature, °C

- Barometric Pressure, mm of Hg
- TDG Pressure, mm of Hg
- Calculated TDG Saturation Percent (%)
- Project Hourly Spill, Kcfs (QS)
- Project Total Hourly Outflow (Total River Flow), Kcfs (QR)
- Number of Spillway Gates Open
- Probe depth, ft
- Calculated Compensation Depth, ft

Spill bay stop settings, if different from the numbers provided in the Fish Passage Plan, also will be reported to and coordinated with the TMT. Stop-settings, however, will not be part of the water quality data set available on the TMT home page.

The Reservoir Control Center staff will perform reconciliation of data received to CWMS based on input from the field before the data are permanently stored in the Corps' Water Quality Data Base. Additional data posting in the TMT home page will continue.

4.3.1 Data Quality Process

The NMFS 2000 Biological Opinion RPA 131 stipulates that the "Action Agencies shall monitor the effects of TDG." Further explanation of the RPA includes a discussion of Quality Control and Quality Assurance including redundant and backup monitoring, bi-weekly calibration, and spot-checking of monitoring equipment. In an effort to address these concerns the US Army Corps of Engineers has established Data Quality Criteria for the fixed monitoring stations at its projects. These Data Quality Criteria describe the accuracy, precision and completeness of the data needed at each station. The fixed monitoring stations will be assessed at the end of the monitoring season against these criteria and a performance report will be created. Adjustments will be made to the individual fixed monitoring stations that do not perform to the objectives described.

As a general overview, the Data Quality criteria for fixed monitoring stations (FMS) include having two dedicated TDG probes (hydrolab) for each site, which provides redundancy instead of redundant stations. The "extra" TDG probes (hydrolab) for each site is lab calibrated before its bi-monthly rotation into the field. Once it is deployed, it is again calibrated and/or checked. The data from the FMS operated by the Portland and Walla Walla Districts is sent to USGS and USACE-NWD. The USGS reviews this data and performs corrections. The Seattle District reviews and corrects their data. There is a goal of 95% data completeness. The Data Quality Criteria was presented to the WQT in February 2003. The WQT discussed and approved the approach at the March 2003 WQT meeting.

4.3.1.1 Data Quality Criteria

The proposed data quality criteria for fixed monitoring station cover three main parts:

A. **Calibration Protocols:** laboratory and field calibrations
B. **Reviewing Data Quality:** data quality checks and dealing with suspect data
C. **Completeness of Data**

The items are described as following:

A. Calibration Protocols

There are two general types of calibrations performed on Fixed monitoring stations (FMS): lab calibrations and field calibration.

1. Laboratory Calibration
   There are four data quality criteria associated with laboratory calibration, including *i)* calibration of the secondary TDG standard, *ii)* the secondary barometric pressure standard, *iii*) the field instrument TDG sensor, and *iv*) secondary standard thermistor. Each is described as follows:

i. Calibration of Secondary TDG Standard
Calibrate the TDG sensor at two points using the primary National Institute of Standards and Technology (NIST) standard. The TDG pressure must be +/- 2 mm Hg at both pressures; otherwise the secondary standard is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements. For an index of primary and secondary standards (see Table 2).

Table 2
Primary and Secondary Standards

PARAMETER	PRIMARY STANDARD	SECONDARY STANDARD
Temperature	NIST traceable thermometer	Lab Hydrolab
Barometer Pressure	NIST traceable barometer or digital pressure gauge.	Hand held barometer
Total Gas Pressure	Digital pressure gauge calibrated to NIST	TDG Probe

ii. Calibration of Secondary Barometric Pressure Standard
Calibrate the secondary standard barometer at ambient barometric pressure to the NIST standard. The barometer must be +/- 1 mm Hg of the primary standard (NIST certified instrument) otherwise the secondary standard is recalibrated.

iii. Calibration of Field Instrument TDG sensor
The two point TDG sensor calibration must agree within +/- 2 mmHg at both pressures, otherwise the sensor is recalibrated. Pressures at which the sensor is calibrated must bracket the expected range of field measurements.

iv. Calibration of Secondary Standard Thermistor
The instrument's thermistor must agree within +/- 0.2°C with the primary NIST standard. This variance will be monitored and if the probe performs outside this range, it will be returned to the manufacturer for maintenance. A check or verification still constitutes a calibration and should be documented in records.

2. Field Calibration
   There are two data quality criteria associated with field calibration: Calibrations and Performance checks. Calibrations include two fixed points and two point TDG sensor calibration.

i. Calibrations
- Two Fixed Points: In order to reduce TDG calibration variability, two fixed points should be chosen and incorporated in the TDG calibration protocol. For example, calibrate the first point to ambient barometric pressure, and the second point to 200 mmHg over barometric pressure. The calibrated range for this example brackets 100-126 % TDG saturation. This ensures the same calibration curve is established each time for every instrument.
- Two Point TDG Sensor Calibration: Following a two-week deployment, a two point TDG sensor calibration must agree within +/- 4 mmHg at both pressures. Pressures at which the sensor is calibrated must bracket the expected range of field measurements. If the pressure

- is not +/- 4 mmHg of the standard, the data will considered "suspect" and handled as described in "Reviewing Data Quality".

ii. Performance checks

There are four data quality criteria associated with performance checks: TDG pressure compared to secondary standard; standby probes deployed; thermistor compared to secondary standard; and field barometer compared to secondary standard. Each is described as follows:

- TDG Pressure Compared to Secondary Standard: After the deployment period, prior to removal of the field instrument, the TDG pressure will be compared to the secondary standard. The actual decision point regarding adjusting the data would be in the lab following the two point TDG sensor calibration described in field instrument post calibration. The field comparison actually involves sampling precision and should not be used as a decision point for shifting data.

- Standby Probe Deployed: During initial deployment of a new TDG probe, after sufficient time for equilibration (up to one hour), the TDG pressure must be +/- 10 mmHg of the secondary standard otherwise another (standby) probe is deployed.

- Thermistor Compared to Secondary Standard: During initial deployment of the new instrument, the thermistor will be +/- 0.4°C of the secondary standard, corrected for calibration, or the instrument will be replaced with a standby.
- Field Barometer Compared to Secondary Standard: At each visit the field barometer reading should the same as the secondary standard or the field barometer will be calibrated.

The sensor must be deployed to a depth where the compensation depth is sufficient to accommodate the change in pressure relative to the atmosphere, otherwise the TDG measurements may be underestimated. If the site does not accommodate maintaining the probe at greater than the compensation depth for more than 95% of the measuring cycle, investigations will begin to re-locate the fixed monitoring station.

The Corps, or their contractors, will have an adequate inventory of spare instruments that will be maintained to ensure that at least one backup monitor will be made available for deployment as necessary. A malfunctioning instrument will be repaired within 24 to 48 hours, depending on the remoteness of the instrument location and TDG conditions (weekends may require a longer response time). High priority will be placed on fixing a faulty instrument when TDG are or expected to be in excess of the current state standards.

Corps staff and/or contractors will maintain TDG instruments. Instruments needing repairs that are beyond the staff's capability will be shipped to the manufacturer. In-house water quality and information management will do repairs of communication network staff. USGS Stennis Center (MS) staff will handle Service and repairs of the Sutron DCPs. Service and repairs of the Zeno DCPs will be performed by a contractor.

To better understand the physical process of dissolved gas distribution across the reservoirs and its dissipation along the various pools, selected transects studies will continue to be conducted on an as-time-permits basis. An additional objective for this activity is to be able to define how representative readings from current monitoring sites really are with respect to the entire river reach.

To help reduce response time in determining whether an emergency field visit is needed, the following decision-making procedure was developed by the WQT:

- No emergency trips are made for the parameter of temperature or oxygen.

- For gas and barometric pressure, if more than 25% of the hourly values are missing, then an emergency trip is needed.

- If the difference in values between two consecutive stations is larger than 20 mm Hg for gas pressure, or 14 mm Hg for barometric pressure, then an emergency trip is triggered. Criterion 3 does not apply if:
    a. there is a transient "spike" for a parameter.
    b. if the higher-than-expected gas pressure value is associated with spill operations.

- If gas parameters at a station do not fall within any of the Corps Engineering Research and Development Laboratory (ERDC) generated/RCC generated gas production curves, are not caused from operational or structural changes, and these data persist for over 48 hours, then an emergency visit is triggered.

- If there is uncertainty with an abnormal reading at a gas monitoring station that persists for more than 48 hours, the COE will notify WQT members as soon as possible via email. The WQT should develop a recommendation to TMT, and to IT if necessary. If the COE plans to change fish passage actions <u>because</u> of the uncertainty, it should notify both the TMT & WQT members of the proposed change. TMT members will determine whether or not a meeting or conference call is needed and advise the COE of this need. The COE will then convene a TMT meeting, if requested to do so. If an abnormal reading at the gas monitoring station persists for more than 48 hours, the Corps will adopt the 2000 Plan of Action language on the subject. According to the May 2, 2000 letter from the Corps to NMFS, "If the WQT chairs determine a water quality issue exists, the issue will be framed by the WQT and forwarded from the chairs of the WQT to the chair of TMT or IT, as appropriate. Each state's fishery and water quality agencies and tribes will work together prior to any TMT meeting on this issue to balance and assure consistency of the proposed actions with fishery management requirements and state water quality standards."

B. <u>Reviewing Data Quality</u>

The data from the fixed monitoring stations will be sent to the USACE-NWD's CWMS database which stores the raw data. At the same time, data from the FMS operated by the Portland and Walla Walla Districts is sent to the USGS's ADAP database. The USGS performs the review, correction and deletion process described below on ADAP's data, thus storing corrected data.

1. <u>Reviewing Data</u>

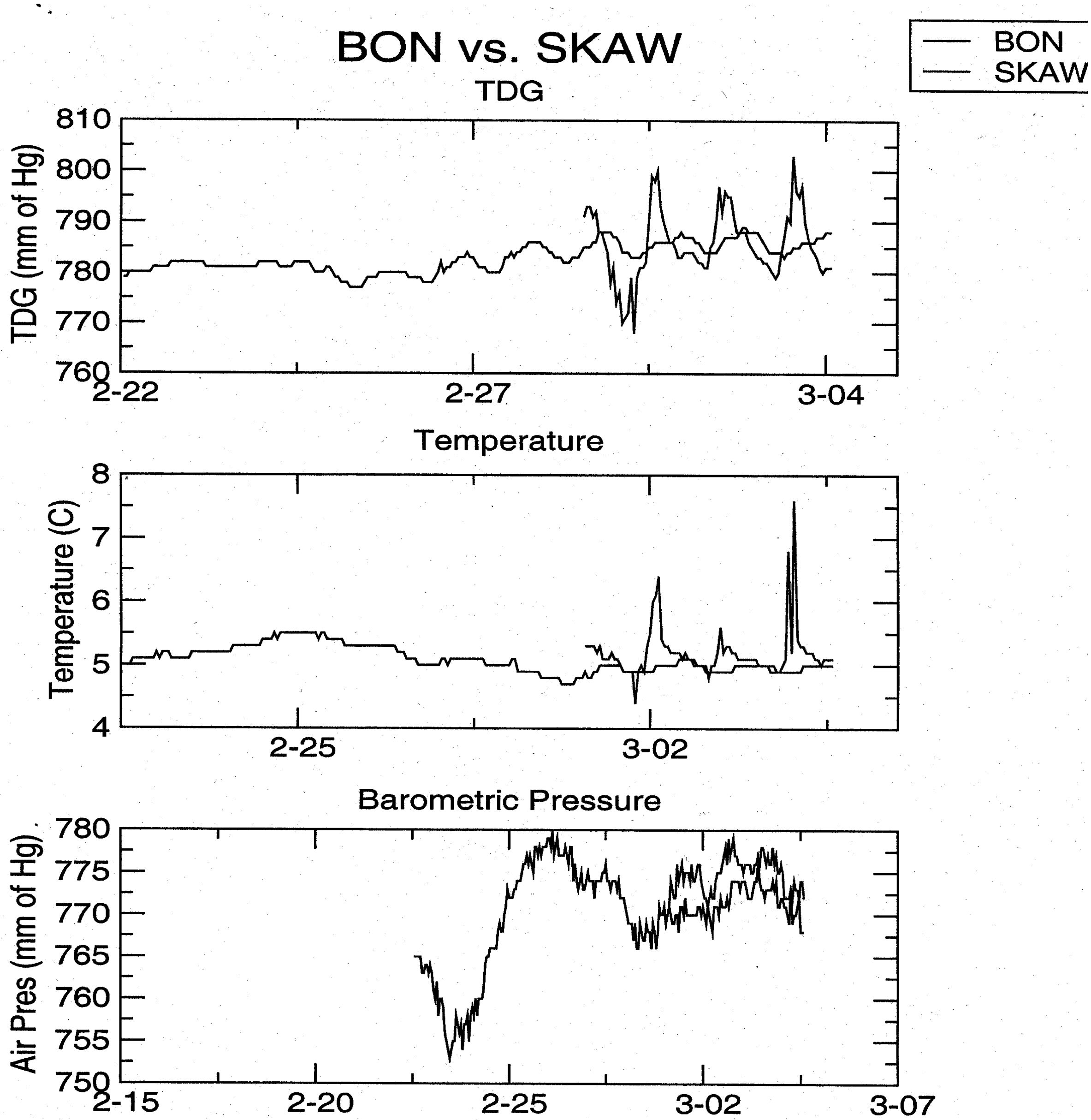
Once data are received, one or more of the following review processes occur:

- **Visually look at the tables of data**: There are certain signs in the data that may indicate mechanical problems. An instance, when the TDG pressure rises to 1,000 mmHg suddenly, and remains at that level, there may be a membrane tear. If there are extreme changes in any parameter, this shows that the data is erroneous.

- **A data checklist is completed.** The data quality checklist shown below provides an example of questions that can be used to assist in identifying problems with data.

- **Review graphs of the data.** Creating graphs of the data can show unusual spikes in a parameter and draw your attention to the data quickly. Spikes in graphed data can suggest further investigation may be necessary. For instance, a sudden rise of 5 ^{o}C in one hour stands out and is suspect. The graph shown below is an example of what is currently used.

• **Figure 1:** Graphs for Data Review



2. Dealing with Suspect Data

Once suspect data are identified, one of the following actions can be taken:

- **Correct the data:** If there is a constant amount of shift or a continual drift, the data can be corrected using the USGS NWIS software. This is not usually the case. Sensor drift can be handled using a linearly prorated correction.
- **Delete the data:** If there appears to be no means of correcting the data, then it is deleted from the USGS ADAPS database and they inform the Corps of the erroneous data. The Corps can then decide what to do with the erroneous data.

If data recorded by the fixed sensors are different from those recorded during the calibration procedure, appropriate correction will be made to the current as well as past data already stored in CWMS as soon as possible. Data corrections will be provided to the USACE-NWD on an on-going basis so that they can be incorporated into the database.

C. Completeness of Data:

Completeness of data includes how completeness is calculated and the data quality criteria goal.

1. Completeness Calculation

The calculation of data set completeness is based on temperature and %TDG, which encompasses barometric pressure and TDG pressure. Data completeness is not based on the completeness of one parameter but of an entire suite.

2. Completeness Goal

Data collected at each site will be 95% of the data that could have been collected during the defined monitoring period.

4.4 Phase 4: Instrument Removal and Storage

Water quality monitors will be removed shortly after the end of the monitoring season (15 September) by Corps staff or the USGS, except for those that are slated for continued winter monitoring. Those removed will be serviced by the maintenance and service contractors and stored at a convenient location until the beginning of the next monitoring season. A selected number of monitors and spare DCPs will be available for off-season special monitoring activities upon request. Seattle District owns its Sutron and Geomation DCPs, and maintains and stores them as needed.

4.5 Phase 5: Winter Monitoring.

The same few stations that were selected for winter operation in 2002-2003 will be retained for compliance monitoring in the following 2003-2004 winter (see Table 4 at the end of this appendix).

4.6 Phase 6: Data Compilation, Analysis and Storage

Time and resource permitting, Corps staff and contractors will fill data gaps, perform statistical analyses, and develop trends and relationships between spill and TDG saturation. Efforts will be made to use the SYSTDG model, and finding ways to facilitate and/or improve user access to the TDG and TDG-related database. The SYSTDG model (developed by ERDC) will be available for in-season gas production predictions and screening. Data collected at and transmitted from all network stations will be ultimately stored at CENWD-CM-WR-N, where they can be accessed through a data management system such as HEC-DSS or download the information from the TMT website.

4.7 Phase 7: Program Evaluation and Summary Report

An annual report will be prepared after the end of the normal (spring and summer) monitoring season to summarize the yearly highlights of the TDG monitoring program. Preparation for the annual report will begin with a post-season review, with participation by the Northwest Division Office, the three Corps districts, the Bureau of Reclamation, the Mid-Columbia PUD's, and the NMFS forum WQT. The report will include a general program evaluation of the adequacy and timeliness of the information received from the field, and how that information is used to help control TDG supersaturation and high water temperature in the Columbia River basin. Information on the performance of the instruments (including accuracy, precision and bias associated with each parameter) and the nature and extent of instrument failures will be documented. This summary should include statistics on data confidence limits. Division staff will prepare the Annual TDG Monitoring Report based on field input, other material provided by each District, and recommendations by the WQT. This report will also contain suggestions and recommendations to improve the quality of the data during the FY2005 monitoring program.

4.8 Phase 8: Special Field Studies

As provided for in Phase 3, additional monitoring of dissolved gas saturation will be conducted on an as-needed basis. The current plan for additional monitoring includes:

Bonneville Tailwaters: The Corps plans on operating a TDG FMS at the Turtle Rock site on Bradford Island with the intent of evaluating the influence of newly constructed fish passage facilities on TDG levels. Additional spot monitoring during use of the new facilities may occur on an as-needed basis.

The Dalles Tailwaters: The current location of the TDG FMS is inconsistent with other tailwater sites in the system and is inconsistent with the site specified in the Lower Columbia River TDG TMDL. The Corps will investigate alternative sites for TDG monitoring during the 2004 spill season.

McNary Forebay: The Corps plans on operating two additional monitors in the McNary Forebay. One will be located near the upstream end of the navigation lock guide wall at a depth of 15 meters. The second will be locate a second monitor on a float at the Boat Restricted Zone (BRZ) on the Oregon side of the forebay. Data from these sites will be compared to data from the existing TDG FMS to determine whether site relocation is recommended.

Lower Snake River Projects: A second TDG gauge will be operated in the forebays of all four of the Lower Snake River projects at a depth of 15 meters. The extra monitor at Lower Granite will be at the same site as the current FMS but just at a lower depth. The extra monitors at the other three projects will be at a different location.

5.0 COOPERATION WITH PARTICIPATING AGENCIES

The Bureau of Reclamation, Douglas County PUD, Chelan County PUD, and Grant County PUDs currently monitor for total dissolved gases at their mainstem projects and have maintained a cooperative effort with the Corps in collecting and reporting total dissolved gas and related water quality parameters. It is expected that this cooperation will extend through the 2004 spill season. Idaho Power Company is believed to have been collecting some TDG information in the Hells Canyon Complex for use in numerical modeling for FERC re-licensing efforts. However, this information has not been as widely disseminated as the data from the rest of the TDG monitoring network. Following are the action plans for the cooperating agencies.

Bureau of Reclamation. Bureau of Reclamation TDG monitoring will continue at International Boundary and the Grand Coulee forebay and tailrace, and the Hungry Horse sites in 2004. Hourly data transmission to CWMS will continue via the GOES satellite.

Douglas County PUD. TDG monitoring will continue at the forebay and tailrace of Wells Dam in 2004. Hourly data from both of these stations will continue to be sent to the Corps.

Chelan County PUD. The physical monitoring of TDG to be conducted in 2004 will be very similar to the monitoring conducted from 2000 to 2003. Chelan will continue to monitor TDG in the forebay and tailrace of both Rocky Reach and Rock Island Dams. The PUD will continue to use Common Sensing monitors in the forebay and Hydrolab Datasonde 4s in the tailrace. Data will continue to arrive to the Corps hourly, and efforts will be made to repair malfunctioning probes within 48 hours. Monitoring instruments will be calibrated every three to four weeks or as necessary. Chelan will also continue to conduct weekly transects in the tailraces of both projects to validate the locations of the tailrace monitors and may institute some forebay transects to verify that forebay readings are representative of the conditions in the river at large.

Public Utility District No. 2 of Grant County (Grant PUD). Grant PUD currently operates and maintains four-fixed site water quality stations that continuously monitor (24 hours - year-round) total dissolved gas (TDG), temperature (°C), dissolved oxygen (DO; mg/l), pH (units), and turbidity (NTUs). Fixed site monitors are located midway across the river channel in the forebay and tailrace of each dam. Grant PUD also maintains a fixed site monitoring station located in the Rock Island Dam tailrace from September 1 through April 1 (of each year). The Public Utility District No.1 of Chelan County operates and monitors this site the remaining part of the year (during spring and summer spill seasons) as part of their water quality data collection requirements.

Each fixed site water quality monitoring station is equipped with a Hydro-Lab Corporation Model DS4A®, DS4® or Minisonde® multi-probe enclosed in a submerged conduit. Multi-probes are connected to an automated system that allows Grant PUD to monitor TDG, temperature, DO, pH and turbidity on an hourly basis (year-round). A barometer is located at each fixed site and provides the atmospheric pressure readings necessary to correct the partial pressure readings taken by the Hydro-Lab multi-probes.

All locations are connected to an automated system that allows Grant PUD to monitor water quality data on an hourly basis. Data is collected and recorded onto a Sutron 8210 data collection platform (DCP) at the top of hour. A PCBase2 operating system transmits hourly water quality data via radio/antenna links to a PC at each dam. Data is transferred from the PC to an Access database from which daily reports can be generated and distributed.

Multi-probe calibration and maintenance for fixed monitoring sites follow established guidelines by USGS (Personnel communication, D. Tanner) and Hydro-Lab Corporation. Fixed site multi-probes are exchanged bi-weekly with a previously calibrated (12-72 Hours) probe. Calibration is conducted in a controlled laboratory environment using certified equipment and recommended standard solutions. A secondary probe (QA) is deployed at each site for quality control/analysis assurance during maintenance and calibration. The QA probe is used to monitor probe sensor deviation and suggest future deployment or re-calibration maintenance.

Grant PUD currently posts total dissolved gas, temperature, discharge (kcfs), spill (kcfs) and spill percentage (%) data to its web-site (www.gcpud.org/stewardship/waterquality.htm) on a daily basis. The data presented is generally posted by 12:00 pm each day and is from the previous day (1-day lag during week - 3-day lag over weekends). The one-day lag-time is necessary to conduct a QA/QC on all water quality data. Specific details of Grant PUDs fixed site water quality monitors, maintenance and calibration procedures, and quality assurance methods can be reviewed in Grant PUDs Final License Application, License Technical Appendix E-3.F (Duvall and Dresser 2003).

Table 3. List of Contact Persons in 2004

Project	Name	Position	Phone #	E-Mail
Internat'l Bndry., Hungry Horse, Grand Coulee	Dr. Sharon Churchill	FMS Oversight	((509) 754-0254	schurchill@ pn.usbr.gov
	Dave Zimmer	Water Quality Regional Coord.	(208) 378-5088	dzimmer@ pn.usbr.gov
	Jim Doty	Hydromet Data Transmission	(208) 378-5272	jdoty@ pn.usbr.gov
Chief Joseph, Libby	Marian Valentine	Coordinator	(206) 764-3543	marian.valentine@ usace.army.mil
	Kent Easthouse	Oversight	(206) 764-6926	Kent.b.easthouse@ usace.army.mil
	Ray Strode	Trouble-shooting	(206) 764-3529	ray.strode@ usace.army.mil
Wells (Douglas)	Rick Klinge	Coordinator	(509) 884-7191	rklinge@dcpud.org
Rocky Reach, Rock Isl.(Chelan)	Waikele (Kelee) Hampton	Coordinator	(509) 663-8121 x 4627	waikele@chelanpud. org
	Mike Blalock	Data Manager	(509) 669-1732	
Wanapum, Priest Rapids (Grant)	Cliff Sears	Coordinator	(509) 754-6612	csears@ gcpud.org
	Tom Dresser	Data Management, QA/QC, Maintenance and Calibration	(509) 754-5088 Ext. 2312	tdresse@ gcpud.org
Dworshak, Low. Granite, Little Goose, Low. Monumental, Ice Harbor, McNary, Pasco, Anatone	Dave Reese	Coordinator	(509) 527-7283	david.l.reese@ usace.army.mil
	Steve Juul	Oversight	(509) 527-7281	steve.t.juul@ usace.army.mil
	Russ Heaton	Oversight	(509) 527-7282	russ.d.heaton@ usace.army.mil
John Day, The Dalles, Bonne-ville, Warrendale, Skamania,Camas	Jim Britton	Coordinator	(503) 808-4888	james.l.britton@usac e.army.mil
	Joe Rinella	USGS/Contract Coordinator	(503) 251-3278	jrinella@ usgs.gov
	Dwight Tanner	USGS/Oversight	(503) 251-3289	dqtanner@ usgs.gov
COE Northwest Division Program Coordination	Jim Adams	Coordinator	(503) 808-3938	james.r.adams@ usace.army.mil
	Laura Hamilton	Oversight	(503) 808-3939	laura.j.hamilton@us ace.army.mil

Table 4. 2004 Dissolved Gas Monitoring Network

STATION CODE	STATION NAME	OWNERS	DATES OF OPERATION
CIBW	US/Can Boundary	USBR	Year Round
HGHW	Below Hungry Horse	USBR	April 1 – September 30
FDRW	Grand Coulee Forebay	USBR	Year Round
GCGW	Grand Coulee Tailwater	USBR	Year Round
ALFI	Albeni Falls Forebay	COE – NWS	April 1 – September 15
ALDI	Albeni Falls Tailwater	COE – NWS	April 1 – September 15
LBQM	Libby Tailwater	COE – NWS	April 1 – September 15
CHJ	Chief Joseph Forebay	COE – NWS	April 1 – September 15
CHQW	Chief Joseph Tailwater	COE – NWS	April 1 – September 15
WEL	Wells Forebay	DOUGLAS CO.	April 1 – September 15
WELW	Wells Tailwater	DOUGLAS CO	April 1 – September 15
RRH	Rocky Reach Forebay	CHELAN CO.	April 1 – August 31
RRDW	Rock Reach Tailwater	CHELAN CO.	April 1 – August 31
RIS	Rock Island Forebay	CHELAN CO.	April 1 – August 31
RIGW	Rock Island Tailwater	CHELAN CO.	April 1 – August 31‡
WAN	Wanapum Forebay	GRANT CO.	Year Round †
WANW	Wanapum Tailwater	GRANT CO.	Year Round †
PRD	Priest Rapids Forebay	GRANT CO.	Year Round †
PRXW	Priest Rapids Tailwater	GRANT CO.	Year Round †
PAQW	Columb. R. Above Snake	COE – NWW	April 1 – September 15
DWQI	Dworshak Tailwater	COE – NWW	Year Round
PEKI	Peck/Clearwater	COE – NWW	April 1 – September 15
LEWI	Lewiston/Clearwater	COE – NWW	April 1 – September 15
ANQW	Upper Snake at Anatone	COE – NWW	April 1 – September 15
LWG	Lower Granite Forebay	COE – NWW	Year Round
LGNW	Lower Granite Tailwater	COE – NWW	Year Round
LGS	Little Goose Forebay	COE – NWW	April 1 – September 15
LGSW	Little Goose Tailwater	COE – NWW	April 1 – September 15
LMN	Lower Monum. Forebay	COE – NWW	April 1 – September 15
LMNW	Lower Monum. Tailwater	COE – NWW	April 1 – September 15
IHR	Ice Harbor Forebay	COE – NWW	Year Round
IDSW	Ice Harbor Tailwater	COE – NWW	Year Round
MCQW	McNary Forebay – WA	COE – NWW	Year Round
MCQO	McNary Forebay – OR	COE – NWW	Year Round
MCPW	McNary Tailwater	COE – NWW	Year Round
JDA	John Day Forebay	COE – NWP	April 1 – September 15
JHAW	John Day Tailwater	COE – NWP	April 1 – September 15
TDA	The Dalles Forebay	COE – NWP	April 1 – September 15
TDDO	The Dalles Tailwater	COE – NWP	April 1 – September 15
BON	Bonneville Forebay	COE – NWP	Year Round
WRNO	Warrendale	COE – NWP	Year Round
CWMW	Camas/Washougal	COE – NWP	March 10 – September 15

‡Data for 1 Sep to Mar 31 available at tbe Grant Co. Website http://www.gcpud.org/stewardship/waterquality.htm

† Data located at Grant Co. Website.

All other data located at http://www.nwd-wc.usace.army.mil/tmt/

USBR= U.S. Bureau of Reclamation

COE = Corps of Engineers, NWP= Portland District, NWS= Seattle District, NWW= Walla Walla District

Figure 2: 2004 Dissolved Gas Monitoring Network

APPENDIX E

MEASURES RELATED TO PROJECT SPILL FOR FISH PASSAGE, FROM THE NMFS 2000 BIOLOGICAL OPINION ON FCRPS OPERATION

(SECTIONS 9.6.1.4.3 AND 9.6.1.4.4, PAGES 9-88 TO 9-92)

9.6.1.4.3 Current and Near-term Actions

Spill Program

Action 54: The Corps and BPA shall implement an annual spill program, consistent with the spill volumes and TDG limits identified in Table 9.6-3, at all mainstem Snake and Columbia River FCRPS projects as part of the annual planning effort to achieve the juvenile salmon and steelhead performance standards.

The annual spill program will be based on the best available monitoring and evaluation data concerning project passage, spill, and system survival research. The Action Agencies, in consultation with the Technical Management Team and with the approval of NMFS, will conduct a preseason determination of the specific annual spill levels and dates at each project. The planning dates for the annual spill program are April 3 to June 20 and June 21 to August 31 for the spring and summer migration periods, respectively, in the Snake River, and April 10 to June 30 and July 1 to August 31 for the spring and summer migration periods, respectively, in the lower Columbia River. Initial estimates of project spill levels, and the basis for each estimate, are shown in Table 9.6-3.

The specific spill volumes listed in Table 9.6-3 must be viewed as approximate because the TDG levels measured at the monitoring site below each project, at a given spill level, can vary with such factors as river flow, forebay dissolved gas level, spill patterns, and water temperature changes. Spill levels at some projects may change as spill patterns are refined or if deflector optimization measures are implemented. There are also project-specific limitations on spill levels for reasons other than TDG, including adult passage, navigation, and research activities. These limitations are typically of short duration, but they can affect spill for fish passage to a limited degree.

Interruptions or adjustments in spill may occur due to unforeseeable power system, flood control, or other emergencies. The Action Agencies should view such emergency actions as last resorts, and they should not be used in place of the long-term investments necessary to allow full, uninterrupted implementation of the required spill levels while maintaining other project purposes, such as an adequate and reliable power system.

Discussion of emergencies with effects of exceptional magnitude or duration should include involvement of regional executives. Section 9.4.2.2 provides for the development of more specific process modifications to address these needs in the water management plans.

9.6.1.4.4 Project-by-project Spill Requirements

Lower Granite Dam. To achieve the desired fish passage efficiencies, the 1995 FCRPS Biological Opinion set the Lower Granite spill level at 80% of total instantaneous discharge for

12 hours per day. Under most conditions, however, this level of spill could not be implemented because the gas cap was reached at spillway flows of 40 kcfs (1998 Supplemental FCRPS Biological Opinion). More recent information suggests that the gas cap will be reached at about 60 kcfs; this level is the appropriate current spill limit. Based on radio-tracking studies with adult chinook, performed at Lower Granite Dam during 1996 and 1997, a spill level of 60 kcfs does not appear to affect adult passage adversely (Bjornn 1998, Bjornn 2000). It may be necessary to reduce spill to accommodate safety concerns when juveniles are being loaded directly onto barges for transportation downstream, and the barges must be docked for extended periods. Spill operations must also consider research needs critical to the ongoing evaluation of the surface bypass prototype (e.g., project operations in 2000 have been modified to spill for 24 hours per day instead of only at night, and powerhouse operations have been modified to provide the required hydraulic conditions in the immediate forebay).

Table 9.6-3. Estimated spill levels and gas caps for FCRPS projects during spring (all) and summer (nontransport projects).

Project[1]	**Estimated Spill Level**[2]	**Hours**	**Limiting Factor**
Lower Granite	60 kcfs	6 p.m. - 6 a.m.	gas cap
Little Goose	45 kcfs	6 p.m. - 6 a.m.	gas cap
Lower Monumental	40 kcfs	24 hours	gas cap
Ice Harbor	100 kcfs (night) 45 kcfs (day)	24 hours	nighttime - gas cap daytime - adult passage
McNary	120-150 kcfs	6 p.m. - 6 a.m.	gas cap
John Day	85-160 kcfs/60% [3] (night)	6 p.m. - 6 a.m.[4]	gas cap/percentage
The Dalles	40% of instant flow	24 hours	tailrace flow pattern and survival concerns (ongoing studies)
Bonneville	90-150 kcfs (night) 75 kcfs (day)	24 hours	nighttime - gas cap daytime - adult fallback

[1] Summer spill is curtailed beginning on or about June 20 at the four transport projects (Lower Granite, Little Goose, Lower Monumental, and McNary dams) due to concerns about low inriver survival rates.
[2] Estimated spill levels shown in the table will increase for some projects as spillway deflector optimization measures are implemented.
[3] The TDG cap at John Day Dam is estimated at 85 to 160 kcfs, and the spill cap for tailrace hydraulics is 60%. At project flows up to 300 kcfs, spill discharges will be 60% of instantaneous project flow. Above 300 kcfs project flow, spill discharges will be at the gas cap (up to the hydraulic limit of the powerhouse).
[4] Spill at John Day Dam will be 7:00 p.m. to 6:00 a.m. (night) and 6:00 a.m. to 7:00 p.m. (day) between May 15 and July 31.

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

<u>Little Goose Dam</u>. The 1995 FCRPS Biological Opinion set the Little Goose Dam spill level at 80% of total instantaneous discharge 12 hours per day (NMFS 1998). As at Lower Granite Dam, the Action Agencies could not usually implement this level because the gas cap was reached at spillway flows of approximately 35 kcfs. More recent information suggests that the gas cap will be reached at about 45 kcfs; this level is the appropriate current limit at Little Goose Dam. Based on radio-tracking studies with adult chinook performed during 1997, a spill level of 60 kcfs did not appear to affect adult passage adversely (Peery 1998).

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

<u>Lower Monumental Dam</u>. The 1995 FCRPS Biological Opinion set the Lower Monumental Dam spill level at 81% of total instantaneous discharge for 12 hours per day (NMFS 1998). Again, this level of spill was not provided voluntarily, because the gas cap was reached at spillway flows of approximately 40 kcfs. The estimate of spill at the gas cap has not changed. Spill levels to the gas cap will now, however, be provided for 24 hours per day. Based on radio-tracking studies with adult chinook performed during 1997, a spill level of 45 kcfs did not appear to affect adult passage adversely (Peery 1998, Bjornn 2000). Because the gas cap is currently reached at approximately 40 kcfs, no reduction in spill is necessary for adult passage.

Accelerated erosion in the spillway stilling basin apron has recently been noted as a concern by the Corps. NMFS is concerned that the Corps may decide, for safety reasons, to limit fish passage spill until the noted erosion is corrected. To ensure that 24-hour fish passage spill, as described above, is not limited, the Corps and BPA will respond to the problem by initiating timely corrective measures.

BPA has specified 11.5 kcfs as a minimum powerhouse flow for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

<u>Ice Harbor Dam</u>. The 1995 FCRPS Biological Opinion prescribed spill levels at Ice Harbor Dam of 27% in the spring and 70% in the summer, each for 24 hours per day. The 27% spring objective was often reached, even though the gas cap limited voluntary spill to flows of 25 kcfs. The summer target of 70% was also reached at the lower flow levels (NMFS 1998). Due to the installation of spillway flow deflectors, more recent information suggests that the gas cap will be reached at 100 kcfs. Based on research performed during the early 1980s, adult passage would become a concern at daytime (5:00 a.m. to 8:00 p.m.) spill in excess of 45 kcfs. Recent information from radio-tracking studies performed from 1996 to 1998 suggests that spill levels

from 55 to 70 kcfs did not appear to affect adult passage adversely (Peery 1998, Bjornn 2000). The 45-kcfs, adult-passage daytime cap may have to be reconsidered once the final study results are available. No change is now proposed, however, and the daytime limit remains 45 kcfs.

BPA has specified 7.5 to 9.5 kcfs as minimum powerhouse flows for system reliability. Because this minimum depends on the status of generation at other projects, it may not be necessary at all times.

McNary Dam. The 1995 FCRPS Biological Opinion set the McNary Dam spill level at 50% of total instantaneous discharge for 12 hours per day (NMFS 1998). Due to limited powerhouse capacity, and because the gas cap was reached at spillway flows of 120 kcfs, these spill levels were reached under most conditions. More recent information suggests that the gas cap will be reached at about 135 kcfs.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

John Day Dam. The 1998 FCRPS Supplemental Biological Opinion set the John Day Dam spill level at 60% of total instantaneous discharge up to the gas cap during the nighttime hours. At project flows up to 300 kcfs, spill discharges will be 60% of instantaneous project flow during 12 hours per day. Above 300 kcfs, spill discharges will be the gas cap (up to the hydraulic limit of the powerhouse). With the completion of spillway deflectors and new spill patterns, gas cap spill flow has ranged up to170 kcfs. Spill limits of 25% minimum and 60% maximum are imposed to ensure adequate juvenile egress conditions from the spillway at low spill flows and from the juvenile bypass system during high spill flows. General physical model studies have indicated that spill percentages below 25% create poor egress conditions (eddies and slack water) in the spillway tailrace, and spill levels above 60% tend to create a large eddy in the tailrace below the powerhouse that can actually cause flow from the bypass to move upstream.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

The Dalles Dam. The 1995 FCRPS Biological Opinion prescribed a spill level at The Dalles Dam of 64% for 24 hours (NMFS 1998). Spill survival studies NMFS conducted in 1997, 1998, and 1999 indicated that the 64% spill level can result in relatively low spillway survival compared to fish released below the project. These studies also indicated that a 30% spill level spillway survival was always as good or higher than the 64% level. Companion studies using radio-tagged fish and hydroacoustic monitoring indicated that reducing the spill percentage from 64% to 30% caused more fish to pass through the powerhouse sluiceway and turbines. Turbine survival has not been measured at this project, but it is assumed to be no better than that observed at other projects. Details of these studies and references can be found in NMFS 2000a.

Based on the available information, the ISAB recommended an evaluation of 24-hour spill levels at The Dalles in the 30% to 50% range (ISAB 2000). NMFS recommends an evaluation of 24-hour spill at the 40% level and expects to improve juvenile fish survival with this interim spill operation (see Section 9.6.1.4.5). Additionally, because reduced juvenile survival at higher spill levels may have been related to the daylight adult spill pattern, there is potential for higher than 40% nighttime spill with a juvenile passage pattern after The Dalles survival tests are concluded, and the results are evaluated. Upon completion of these tests, modified spill levels and patterns should be evaluated for adult passage and fallback.

BPA has specified a minimum powerhouse flow of 50 kcfs to maintain power transmission system stability.

Bonneville Dam. The 1998 FCRPS Supplement established a nighttime spill level at the TDG cap generally between 90 and 150 kcfs for the duration listed in the current Corps' Fish Passage Plan. The minimum spill level will be no less than 50 kcfs of the total river flow to provide good tailrace egress of juvenile migrants. Daytime spill levels are limited to 75 kcfs at Bonneville Dam due to concerns for adult salmonid fallback through the spillway. Recent evidence from adult radio-tracking studies conducted in 1996, 1997, and 1998 indicates that increases in adult fallback associated with increased daytime spill flows from 75 to120 kcfs range are relatively small. Juvenile passage benefits from the increased spill level would likely outweigh small adult losses that may be associated with the higher spill level. Further, spillway deflector optimization improvements may result in more uniform spill gate openings, which could reduce adult fallback rates. NMFS believes this issue warrants further investigation. Planned studies are described below.

BPA has specified a minimum powerhouse flow of 30 kcfs.

APPENDIX F

GUIDELINES FOR DEWATERING AND

FISH HANDLING PLANS

Guidelines for Dewatering and Fish Handling (Salvage) Plans

Each Corps of Engineers mainstem project on the Columbia and Snake Rivers has dewatering and fish handling plans which cover the dewatering of various project facilities which may contain fish at the time of dewatering. The plans contain procedures for any handling or salvaging of fish within a facility or project area when it is dewatered. All dewatering and fish handling plans should be reviewed and revised where appropriate to reflect any new information and guidelines listed below. The plans shall be reviewed by the Fish Passage O&M Coordination Team.

Coordination: The dewatering and fish handling (salvage) plan for each project shall include coordination procedures for planned and emergency fish salvage activities. The project fishery biologist shall coordinate all fish salvage activities with project and District personnel.

Fish Salvage Briefing: The plans shall include a requirement that a fish salvage briefing for **all participants** involved in a dewatering activity be held prior to each dewatering activity. The briefings should lay out responsibilities for each participant in the dewatering activity. All emergency fish salvage operations will be coordinated and overseen by the project fishery biologist or fisheries staff if possible.

Personnel: The dewatering plans shall specify the number and specialization of personnel required for each type of dewatering activity. Personnel for fish salvage include the project fishery biologist, fisheries staff, crane operators, riggers, winch operators, forklift operators, and maintenance workers. To minimize fish stress and mortality, adequate personnel must be available for fish salvage activities.

Facilities and Dewatering Procedures: The salvage plans shall be project specific and shall contain step by step dewatering and fish salvaging procedures for all facilities and project features which may contain fish. The most common areas include adult fish ladders and collection channels, juvenile bypass systems, juvenile fish sampling facilities, turbines scroll cases and draft tubes, gatewell slots, and navigation locks. Individual projects may have other facilities or features that contain fish. The plans shall specify how the facility is to be dewatered and where and how fish are to be salvaged. Each project shall have designated release sites for the various types of fish expected to be encountered during each dewatering activity.

Fish Handling Equipment: The plans shall specify all fish handling equipment required for handling fish during each type of dewatering activity. Typical fish salvage equipment includes gloves, hand held fish nets, seines, fish buckets, gatewell dip baskets, and fish transportation tanks and vehicles. All equipment should be in good condition and pre-positioned before dewatering begins.

Support Equipment: The plans shall include a detailed listing of all support equipment required for each dewatering activity. This should include items such as hard-hats, boots, safety harnesses, flashlights, portable radios, ladders, cranes, man-baskets, pumps, forklifts, and any other equipment required for a dewatering activity. The plans shall specify where equipment is required for use during a dewatering, where certain equipment should be pre-positioned before work begins, and the heavy equipment needed for fish salvage activities.

Fish Safety Pools: The fish salvage plans shall identify the areas in each facility which pond enough water to hold fish temporarily. The plan shall specify whether the safety pools are usually maintained by leakage or a controlled water flow. The plans shall specify how long and under what conditions each safety pool can be used to hold fish safely. If the there is the potential for the safety pools to freeze over or loose their water source, the fish should be evacuated as soon as possible.

Fish Handling Procedures/Practices: The plans shall include procedures to minimize fish mortality and stress. The primary fish handling objective will be to collect and transport fish to release sites with minimal stress and without injury or mortality to any fish. Plans shall specify the details of all fish handling activities including how to crown and handle fish within each facility, specifics on the number of fish which can be hauled or transported in containers or transport tanks at varying water temperatures, and how and where to release fish at each project.

Fish Handling Guidelines: General fish handling guidelines which should be reflected in fish handling/salvage plans are detailed here. Adult salmonids and other large adult fish should be salvaged first. Netting of fish should be minimized whenever possible. Fish should not be crowded in the holding containers. Fish will be less stressed in larger containers (300 gallons or larger preferred), in colder water, and with supplemental oxygen or aeration. If fish are transported in warmer water (>65^{o} F), fewer fish should be transported in a container and holding times should be shorter. All fish will be returned to the river as soon as possible at specified, predetermined release sites. Fish should not be held in holding tanks or containers for more than two hours under any circumstances. Fish should be released from the holding tanks into the river as soon as the fish salvage operation stops for any reason. Fish should be carefully released into the tailwater or forebay with a short vertical drop to the river. Fish release slides are desirable. The water temperature in the transport tank should be monitored. The water temperature in the transport or holding tanks will not be more than 2^{o} F different from the river water. Fish should be removed prior to debris removal if possible.

Fish Salvage Report: The fish salvage plan should include a report form for the fish salvage operations. These forms should be completed for all fish salvage activities and kept permanently on file at each project.

APPENDIX G

PROTOCOLS FOR ADULT FISH TRAPPING OPERATIONS AT BONNEVILLE, ICE HARBOR, AND LOWER GRANITE DAMS

Protocols for Adult Fish Trapping Operations at Bonneville Dam

1. **General.** The following protocols will be implemented by agencies conducting research in the Bonneville Dam second powerhouse Adult Fish Collection and Monitoring Facility (AFC&MF). Trapping will not occur when fish ladder water temperatures exceed 74°F as measured at the top of the return ladder. These protocols were coordinated with fish agencies and tribes through the Fish Passage Operation and Maintenance Coordination Team (FPOM).

2. **General requirements for AFC&MF users.** All personnel conducting research in the AFC&MF will implement the following requirements.
    - **a.** Users must have appropriate documentation for conducting research at the dam. (See Guide for Researchers at Bonneville Dam).
    - **b.** Users must have a valid ESA Section 10 Permit that covers all listed species passing the project during the trapping period and users shall comply with all fish handling conditions in the permit. **Note: If Section 10 conditions are more restrictive than the following protocols, users must follow Section 10 conditions.**
    - **c.** Hard hats are to be worn at all times. A headpiece with magnifying glass for monitoring GBT is also acceptable.
    - **d.** Long pants or raingear are to be worn at all times. Shorts or sweats will not be permitted in the lab.
    - **e.** Steel-toed shoes or steel-toed rubber boots are to be worn at all times. No tennis shoes or sandals will be permitted.
    - **f.** Users will notify project biologists when they arrive on site and when they depart (x4551, x7984, or x4552). If users supply the project biologists with a season schedule, it will not be necessary to notify project biologists upon arrival and departure. If users are on site during non-business hours (1700-0630), Monday through Friday or anytime on the weekends, they are required to contact the control room (x221 or x222) when they arrive and when they depart.
    - **g.** Users will lower the main ladder picket leads and downstream exit bulkhead when they arrive, if necessary, and raise the picket leads and downstream exit bulkhead when they are completed for the day unless other arrangements are made.
    - **h.** Users will be permitted to operate valves 9 and 10 to control flow down the flumes at their discretion and the raw water booster pump. It is recommended that valves 9 and 10 remain open 55% and 40%, respectively. Users will not be permitted to operate any other valves or the overhead crane unless permitted to do so through the project biologists.
    - **i.** Users will record the times picket leads are lowered and raised, which agency they are representing and water temperatures when they arrive, at 1200 and 1500 hours, each day they are using the AFC&MF. Temperatures will be recorded from the temperature probe at the top of the return ladder. A spreadsheet will be provided by project biologists and located by valves 9 and 10.
    - **j.** Users must use a cotton mesh net, which is large enough to safely handle the largest fish passing the project during the trapping period.

3. **Trapping protocols during the fish passage season (from March 15 through November 30) when fish ladder water temperatures are <70°F.** Personnel conducting research during this time are required to be present in the AFC&MF to divert desired fish into the

anesthetic tank using the flume swing gates. Undesired fish will be bypassed to the return pool. No diversion into or holding of fish in the brail pool will be allowed. The purpose of these protocols is to provide precautionary measures to limit delayed mortality resulting from stress when handling fish.

- **a.** There will be no time restriction for trapping operations.
- **b.** There will be no more than 4 chinook, or 6 steelhead, or 6 sockeye, or a combination of 6 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.
- **c.** There will be no more than 6 adult salmonids allowed in the recovery tank at any one time.
- **d.** Water in the anesthetic tank will be replaced at least two times per day. Water temperatures in the anesthetic tank will be maintained within 1°C of the fish ladder water temperature. **Note: If anesthetic tank water temperature exceeds 70°F, criteria in section 4 will go into effect.**
- **e.** Water in the recovery tank will be running continuously allowing a constant exchange of water through the tank.
- **f.** Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it takes no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.
- **g.** Personnel shall ensure that fish are fully recovered from anesthetization prior to release into the return ladder.
- **h.** When trapping is completed for the day, users will raise the main ladder picket leads and the downstream exit bulkhead.

4. **Trapping protocols during the fish passage season (from March 15 through November 30) when fish ladder water temperatures are between 70 and 74°F.** Personnel conducting research during this time period are required to be present in the AFC&MF to divert desired fish into the anesthetic tank using the flume swing gates. Undesired fish will be bypassed to the return pool. No diversion of fish into or holding of fish in the brail pool will be allowed. The purpose of these protocols is to provide precautionary measures to limit delayed mortality resulting from stress when handling fish during warm water conditions. If ladder water temperatures exceed 74°F during any time of the day when the AFC&MF is operating, trapping will be suspended immediately. The Corps reserves the right to terminate trapping operations at any time.

From 70 to 72°F

- **a.** Trapping will be allowed every other day or a maximum of 4-days per week and work will be accomplished between 0600-1200 hours each day. The morning operations are to take advantage of the water-cooling that occurs overnight.
- **b.** There will be no more than 3 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.
- **c.** There will be no more than 3 adult salmonids allowed in the recovery tank at any one time.
- **d.** Assure oxygen levels are maintained at saturation in the anesthetic and recovery tanks. Provide aeration as necessary to maintain oxygen levels the same as in the fish ladder water. In other words, there will be no depression in oxygen levels in the anesthetic or recovery tanks regardless of numbers of fish in and through the tank. To assure this, water in the anesthetic tank will be replaced at least every three hours.
- **e.** Water in the recovery tank will be running continuously allowing a constant exchange of water through the tank.

- **f.** Maintain the anesthetic and recovery tank water temperatures 1-2°F lower than the ladder water temperature. If ice is used to cool the anesthetic or recovery tank water, the ice should be from river water or, at least, from an un-chlorinated water source. Do not exceed a 3°F difference between the anesthetic or recovery tank water and fish ladder water.
- **g.** Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it takes no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.
- **h.** Personnel shall ensure fish are fully recovered from anesthetization prior to release into the return ladder.
- **i.** When trapping is completed for the day, users will raise the main ladder picket leads and the downstream exit bulkhead.

From 72 to 74°F

- **a.** Sampling will be permitted 1-day per week when water temperatures exceed 72°F to allow for WDFW steelhead sampling. All other research entities will also be allowed to sample during that time frame.
- **b.** Protocol from subsection b to i remains the same as for water temperatures from 70-72°F.

5. **Winter trapping protocols, from December 1 through March 14.** Personnel conducting research during this time are not required to be present in the AFC&MF. Users are allowed to activate the flume swing gates to divert all fish into the brail pool. The purpose of these protocols is to provide precautionary measures to limit passage delay, and stress from overcrowding in the brail pool.
    - **a.** Sampling will occur on a daily basis.
    - **b.** Fish will not be permitted to remain in the brail pool longer than 24 hours. It is recommended that handling of fish occurs daily by 1800 hours. This assures that if fish are sampled at the end of the day, most of the fish captured are only held from the morning until afternoon since passage at night is minimal, reducing delay.
    - **c.** During sampling, the brail pool should be raised and one adult salmonid netted via a sanctuary net and placed into the anesthetic tank at a time. After removing fish from the brail pool into the anesthetic tank, the brail pool will be lowered back to its full depth.
    - **d.** There will be no more than 3 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.
    - **e.** There will be no more than 3 adult salmonids allowed in the recovery tank at any one time.
    - **f.** Water in the recovery tank will be running continuously allowing a constant exchange of water through the tank.
    - **g.** Personnel shall ensure fish are sampled as quickly as possible. It is recommended that it takes no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.
    - **h.** Personnel shall ensure fish are fully recovered from anesthetization prior to release into the ladder.
    - **i.** If daily sampling cannot occur on weekends, the main ladder picket leads and downstream exit gate will be raised following completion of sampling on Friday. The flume swing gates are to be deactivated to allow fish to pass freely into the return pool.

Protocols for Adult Fish Trapping Operations at Ice Harbor Dam

1. **General.** Personnel conducting research at the adult fish trapping facility at Ice Harbor Dam will implement the following protocols. These protocols were coordinated with fisheries agencies and tribes through the Fish Passage Operations and Maintenance Coordination Team (FPOM).

2. **Administrative requirements.** All personnel conducting research at the facility will adhere to the following requirements.
   - **a.** The facility will not be operated unless there is an approved Corps-funded research project that requires its use, or the user has a letter from the Corps that permits use of the facility.
   - **b.** Users must have a valid ESA Section 10 Permit that covers all listed species passing the project during the trapping period and users shall comply with all fish handling conditions in the permit. **Note: If Section 10 conditions are more restrictive than the following protocols, users must follow Section 10 conditions.** A copy of the Section 10 Permit must be provided to the Corps' project biologist.
   - **c.** Hard hats will be worn if so required by the Corps' Operations Manager at Ice Harbor (509-543-3256).
   - **d.** Long pants are to be worn at all times.
   - **e.** Steel-toed shoes or steel-toed rubber boots are to be worn at all times.
   - **f.** <u>Notification Required For Work During Regular Business Hours (Monday through Thursday, 0630 to 1700 hours)</u>. Users will notify the project biologist when they arrive on site and when they depart (509-543-3208). If users supply the project biologist with a season schedule, it will not be necessary to notify project biologist upon arrival and departure.
   - **g.** <u>Notification Required For Work During All Other Hours (Monday through Thursday, 1700 to 0630 hours, or anytime from Friday through Sunday)</u>. If users are on site during times other than regular business hours, specific notification procedures must be worked out with the Operations Manager at Ice Harbor <u>in advance</u>. Users <u>may</u> be required to contact the control room (509-543-3231) upon arrival and departure.
   - **h.** Users must present a safety plan to the project biologist, who can provide guidance for developing the plan.

3. **Trapping protocols during the fish passage season (March 1 through December 15) when fish ladder water temperatures are less than 70°F.** Since the trap is operated manually, personnel conducting research are required to be present at the facility to divert desired fish.
   - **a.** The trap will be tested for proper operation before trapping begins. After each day's use the trap will be promptly removed from the water by suspending it in its guides, or by completely removing it from the fish ladder.
   - **b.** Trapping operations can take place between 0600 and 1200 hours, for up to 4 hours per day or until the designated number of desired fish are obtained, whichever occurs first. During the summer months, the period from 0600 to 1000 hours is preferred. The trap shall not be in the water for more than 4 hours.

- **c.** Netting of fish is not recommended. If transfer of fish is necessary, fish should stay in water at all times through the use of a water-filled bag, sanctuary net, or other means. The device used should be large enough to safely handle the largest fish.
- **d.** Non-target fish will be released to the ladder.
- **e.** **Oxygen levels** in fish handling tanks will be maintained at saturation by replacing the water and providing aeration as necessary.
- **f.** **Water temperatures** in fish handling tanks will be maintained within 2°F of the fish ladder water temperature but less than 70°F.
- **g.** Personnel shall sample fish as quickly as possible. It should require no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the ladder or transportation tank.
- **h.** Fish must be adequately recovered from anesthetization prior to the next step in the handling process, whether placed in the ladder or transported.

4. **Trapping protocols during the fish passage season (March 1 through December 15) when fish ladder water temperatures are 70°F to 72°F.** The trap may be operated when water temperatures are within the range of 70°F to 72°F, provided that researchers closely adhere to the restrictions below. Researchers must have the <u>proper ESA documentation.</u> **Trapping operations will not be allowed, and trapping must cease immediately, if fish ladder water temperatures exceed 72°F.** Due to the narrow temperature range involved, researchers must use reliable digital thermometers.
    - **a.** Researchers must notify the Corps project biologist in advance when trapping is to occur in this temperature range. The project biologist will occasionally monitor trapping operations.
    - **b.** The trap will be tested for proper operation before trapping begins. After each day's use the trap will be promptly removed from the water by suspending it in its guides, or by completely removing it from the fish ladder.
    - **c.** Trapping operations can take place between 0600 and 1200 hours, for up to 4 hours per day or until the designated number of desired fish are obtained, whichever occurs first. During the summer months, the period from 0600 to 1000 hours is preferred. The trap shall not be in the water for more than 4 hours.
    - **d.** Trapping operations may take place up to 4 days per week.
    - **e.** Netting of fish is not recommended. If transfer of fish is necessary, fish should stay in water at all times through the use of a water-filled bag, sanctuary net, or other means. The device used should be large enough to safely handle the largest fish.
    - **f.** Non-target fish will be released to ladder.
    - **g.** **Oxygen levels** in fish handling tanks will be maintained at saturation by replacing the water and providing aeration as necessary.
    - **h.** **Water temperature** in the anesthetic tank will be maintained 1-2°F lower than the ladder water temperature. If ice is used, the ice should be from river water or from an un-chlorinated water source. If practical, water temperature in the recovery tank should also be maintained 1-2°F lower than the ladder water temperature; otherwise flow-through water should be running continuously.
    - **i.** Personnel shall sample fish as quickly as possible. It should require no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the ladder or transportation tank.
    - **j.** Fish must be adequately recovered from anesthetization prior to the next step in the handling process, whether placed in the ladder or transported.

Protocols for Adult Fish Trapping Operations at Lower Granite Dam

1. **General.** Personnel conducting research at the adult fish trapping facility at Lower Granite Dam will implement the following protocols. These protocols were coordinated with fisheries agencies and tribes through the Fish Passage Operations and Maintenance Coordination Team (FPOM).

2. **Administrative requirements.** NOAA Fisheries is the primary user of the facility and employs personnel that are permanently based there. These and all other personnel conducting research at the facility will adhere to the following requirements.
   - **a.** The facility will not be operated unless there is an approved Corps-funded research project that requires its use, or the user has a letter from the Corps that permits use of the facility.
   - **b.** Users must have a valid ESA Section 10 Permit that covers all listed species passing the project during the trapping period and users shall comply with all fish handling conditions in the permit. **Note: If Section 10 conditions are more restrictive than the following protocols, users must follow Section 10 conditions.** A copy of the Section 10 Permit must be provided to the Corps' project biologist.
   - **c.** Hard hats will be worn if so required by the Corps' Operations Manager at Lower Granite (509-843-1493 x258).
   - **d.** Long pants are to be worn at all times.
   - **e.** Steel-toed shoes or steel-toed rubber boots are to be worn at all times.
   - **f.** <u>Notification Required For Work During Regular Business Hours (Monday through Thursday, 0630 to 1700 hours)</u>. Users will notify the project biologist when they arrive on site and when they depart (509-843-1493 x263 or x264). If users supply the project biologist with a season schedule, it will not be necessary to notify project biologist upon arrival and departure.
   - **g.** <u>Notification Required For Work During All Other Hours (Monday through Thursday, 1700 to 0630 hours, or anytime from Friday through Sunday)</u>. If users are on site during times other than regular business hours, specific notification procedures must be worked out with the Operations Manager at Lower Granite <u>in advance</u>. Users <u>may</u> be required to contact the control room (509-843-1493 x231) upon arrival and departure.
   - **h.** Users must present a safety plan to the project biologist, who can provide guidance for developing the plan.

3. **Trapping protocols during the fish passage season (March 1 through December 15) when fish ladder water temperatures are less than 70°F.** During the years just prior to 2003 the trap was operated automatically, 24 hours per day, during much of the fish passage season. Personnel conducting research during this time were therefore not always required to be present at the facility to divert desired fish. Automatic operation and the temporary absence of on-site personnel can continue as required. However, PIT tag detectors were installed in the upper end of the fish ladder in early 2003. As a result, the new detectors will collect PIT tag data normally collected at the trap. It is therefore anticipated that trap operation will be minimized in future years.
   - **a.** During lengthy periods of non-use (two days or more), the facility shall be dewatered or the water supply will be shut down. Since the facility obtains water from the fish

ladder, this action will avoid out-of-criteria water flows in the ladder. If freezing weather may cause damage during such a non-use period, the facility will be dewatered.

b. There will be no time-of-day restrictions for trapping operations.

c. Adult fish generally do not need to be netted due to the layout of the facility. Netting of fish is not recommended. If transfer of fish is necessary, fish should stay in water at all times through the use of a water-filled bag, sanctuary net, or other means. The device used should be large enough to safely handle the largest fish.

d. Non-target fish will be released to the return pool.

e. There will be no more than 12 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.

f. There will be no more than 12 adult salmonids allowed in the recovery tank at any one time.

g. **Oxygen levels** in fish handling tanks will be maintained at saturation by replacing the water and providing aeration as necessary.

h. **Water temperatures** in fish handling tanks will be maintained within 2°F of the fish ladder water temperature but less than 70°F.

i. Personnel shall sample fish as quickly as possible. It should require no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.

j. Fish must be adequately recovered from anesthetization prior to the next step in the handling process, whether placed in the return ladder or transported. In the case of the return ladder, full recovery is not desirable because fish may jump onto a grating.

4. Trapping protocols during the fish passage season (March 1 through December 15) when fish ladder water temperatures are 70°F to 72°F. The trap may be operated when water temperatures are within the range of 70°F to 72°F, provided that researchers closely adhere to the restrictions below. Researchers must have the <u>proper ESA documentation.</u> **Trapping operations will not be allowed, and trapping must cease immediately, if fish ladder water temperatures exceed 72°F.** Due to the narrow temperature range involved, researchers must use reliable digital thermometers.

a. Researchers must notify the Corps project biologist in advance when trapping is to occur in this temperature range. The project biologist will occasionally monitor trapping operations.

b. During lengthy periods of non-use (two days or more), the facility shall be dewatered or the water supply will be shut down. Since the facility obtains water from the fish ladder, this action will avoid out-of-criteria water flows in the ladder.

c. Trapping operations can take place between 0600 and 1200 hours, for up to 4 hours per day or until the designated number of desired fish are obtained, whichever occurs first. During the summer months, the period from 0600 to 1000 hours is preferred.

d. Trapping operations may take place up to 4 days per week.

e. Adult fish generally do not need to be netted due to the layout of the facility. Netting of fish is not recommended. If transfer of fish is necessary, fish should stay in water at all times through the use of a water-filled bag, sanctuary net, or other means. The device used should be large enough to safely handle the largest fish.

f. Non-target fish will be released to the return pool.

g. There will be no more than 3 adult salmonids allowed in the anesthetic tank at any one time. This assumes that users can effectively track the length of time fish stay in the anesthetic tank.

h. There will be no more than 3 adult salmonids allowed in the recovery tank at any one time.

i. **Oxygen levels** in fish handling tanks will be maintained at saturation by replacing the water and providing aeration as necessary.

j. **Water temperature** in the anesthetic tank will be maintained 1-2°F lower than the ladder water temperature. If ice is used, the ice should be from river water or from an un-chlorinated water source. If practical, water temperature in the recovery tank should also be maintained 1-2°F lower than the ladder water temperature; otherwise flow-through water should be running continuously.

k. Personnel shall sample fish as quickly as possible. It should require no longer than 25 minutes to transition the fish from entry into the anesthetic tank to release back into the return ladder or transportation tank.

l. Fish must be adequately recovered from anesthetization prior to the next step in the handling process, whether placed in the return ladder or transported. In the case of the return ladder, full recovery is not desirable because fish may jump onto a grating.

APPENDIX H

TURBINE DEWATERING PROCEDURE

FOR CHIEF JOSEPH DAM

DEPARTMENT OF THE ARMY
CHIEF JOSEPH DAM PROJECT OFFICE, CORPS OF ENGINEERS

SEATTLE DISTRICT
BRIDGEPORT, WASHINGTON 98813

CENWS-OD-CJ 13 Aug 02

EFFECTIVE UNTIL SUPERSEDED OR RESCINDED

PROJECT STANDING OPERATING PROCEDURE NO. 406

CHIEF JOSEPH DAM

SUBJECT: Fish Protection Procedures for Turbine Maintenance

To: Operations, Maintenance, and Resource Management Sections

Purpose: Outline key criteria and operational constraints intended to protect, and provide for the recovery of, any fish, which may become trapped in generator draft tubes at the Chief Joseph Dam Project.

1. This procedure provides a general outline of the dewatering process itself, and includes details for only those constraints specifically intended to promote fish survival. It is not intended to address the details of personnel safety policy or procedures, or any detailed operational instructions for the actual dewatering process. Personnel safety provisions are detailed in the appropriate activity hazard analyses. Details of the operational steps for dewatering are covered by separate Operating Procedures and, to some extent, may be dictated by circumstances unique to each dewatering. However, all dewatering efforts will adhere to the fish protection provisions outlined in this procedure.

2. Hydroelectric turbines and water passages must be inspected and serviced periodically. This requires draining the water passages between the intake bulkhead gates and the tailrace stoplogs. After the water reaches tail water level, the remaining water is drained to an dewatering sump and then pumped out into the river. Any fish trapped in the draft tube area must be removed before being stranded or lost through drains. It is therefore desirable to minimize numbers of fish involved in the draining process and then to quickly salvage any fish that may have been trapped.

3. Natural Resource Management section personnel will carry out fish protection and recovery operations with the help of maintenance personnel. During the dewatering process they will be present at the draft tube entry door, and will direct and monitor it through the final stages of the draft tube dewatering.

4. The Project's Natural Resource Management personnel will direct and coordinate the fish protection procedures and the recovery and release process. The Maintenance and Operations

Sections will provide Natural Resource Management advance notice of planned unit dewatering as soon as possible prior to the date of dewatering. Natural Resource Management personnel will conduct meetings and briefings as necessary to ensure all dewatering team members are familiar with the required fish recovery process.

5. Natural Resource Management personnel will coordinate with the National Marine Fisheries Service, Hydro Program Office, 503-231-6855, gary.fredricks@noaa.gov, to provide notification at least two weeks, if possible, in advance of any maintenance requiring dewatering or otherwise potentially affecting fish. In addition, the Fish Passage Operations and Maintenance Group will be notified with an annual schedule, contact USACE Portland District Office, Operations Div., 503-808-4304.

6. Several hours before the unit is to be dewatered the Operations Section will contact BPA to get final approval for the outage and make sure all the clearance tags are ready to be placed. Early on the day of the dewatering, the mechanics and operators will coordinate to lower the intake service gate and/or install the intake bulkhead. This will isolate the intake water passage from the forebay.

7. Operators will prepare to drain the water out of the penstock down to tailrace water elevation while mechanics prepare to install the intake bulkhead and tailrace stoplogs. The mechanics will place the tailrace stoplogs as soon as possible after the unit is flushed out. This entire process from flushing remaining water out of the penstock through complete installation of bulkheads and stoplogs should be completed within 3 hours, barring complications.

8. Operators will open the draft tube dewatering valve and start draining the draft tube to the dewatering sump. At the same time the sump dewatering pump or pumps will be started but the dewatering sump will not be allowed to go below an elevation of 733 feet above sea level. The draft tube is drained by gravity to this dewatering sump, so by restricting the dewatering sump to a minimum elevation of 733 feet, the draft tube is also restricted to this minimum elevation. The bottom of the draft tube is at an elevation of 725 feet above sea level, so this leaves a large area of water eight feet deep for any trapped fish. The water level in the draft tube will be monitored remotely from this dewatering sump. At no time will the water level in the dewatering sump drop below 733 feet without all aspects of the fish recovery plan in place including recovery devices, insulated transport device, etc. Project personnel will have the dip net, lifting sling, insulated fish carrying tank, and all required safety equipment at the unit during the final dewatering process. Fish can survive four days in the draft tube at a water level of 733 feet and above.

9. For safety reasons, the draft tube entry door will not be opened until confirmation that the tailrace stoplogs are sealed, i.e.: the water level is verified to be below the draft tube man door petcock and a maximum of one dewatering pump is maintaining the water level in the sump. Once Operations has declared a satisfactory seal has been achieved, the mechanics will then open the draft tube access door. General Maintenance personnel will either install safety gear at this time for access to the bottom of the draft tube, or, if the suspended work platform is to be

required during this unit outage, it will be installed first. Once the draft tube door is open, the work platform can be installed when necessary and the water level in the draft tube can be monitored from the draft tube man door.

10. When satisfied all fish recovery preparations are in place, the designated Natural Resource Management Section person will authorize the Maintenance Section clearance holder to request the water level in the draft tube be lowered below the 733-foot elevation to a level that allows for safe entry into the draft tube. Upon authorization, the Maintenance Section clearance holder will request the Chief Operator lower the water level in the sump/draft tube below an elevation of 733 feet. Upon receiving the clearance holder's request to go below 733 feet, the Chief Operator shall contact the designated Natural Resource Management Section person to confirm that all fish recovery preparations are complete, and lowering the water level below 733 feet is authorized. After receiving this confirmation, the Chief Operator will authorize journeymen operators to operate the sump as required to control the water level in the draft tube as requested by the designated Natural Resource Management Section person. Once the level in the sump drops below 733 feet, the designated Natural Resource Management Section person will visually monitor the draft tube water level.

11. When the water is down to a level where entry is safe, approximately two to four feet in depth, personnel will enter the draft tube through the draft tube access door at 747-foot level to inspect for trapped fish. Any live fish will be netted out with a dip net and placed in a rubber-lifting sling that is sized to hold the fish and water. The sling will then be lifted vertically to the 747-foot level and then to the 785-foot level generator floor through a series of hatches and stairways. This should take less than five minutes, during which time the fish will be in water. They will be placed in a large insulated fish carrying tank full of river water located on a cart which will be transported to the freight elevator, from which it will be loaded into a truck for eventual release of fish at the downstream boat ramp, using a flume if necessary. The fish will be handled only once during the netting process. At all other times the fish will be kept in water.

12. When the designated Natural Resource Management Section person has determined that either there are no fish in the draft tube or that all the fish have been safely removed, he will notify the Chief Operator that all fish recovery operations are complete. He will also notify the clearance holder that all fish protection restrictions on water levels in the draft tube and dewatering sump have been released.

13. Other considerations for fish protection include the following:

a. Tailrace logs have structural cross-members that form shelves, which may trap fish. These will be screened off as the bulkheads are removed for maintenance in 2002, but will be inspected for fish as applicable prior to screen installation.

b. Work windows intended to minimize likelihood of trapping endangered species will be investigated, although BPA power demands somewhat limit the timing of unit outages. Initially, avoidance of the month of October is suggested; adjustments may be considered according to experience.

c. Units 1 through 16 have floor drains with a grate with 2.5 inch spacing. It is possible for fish smaller than about ten inches to slip through these draft tube floor drains before they can be salvaged. Units 17 through 27 have side drains with small grate spacing. If necessary, smaller-mesh grating will be added or substituted on the floor drains to prevent entrapment of fish.

14. Equipment required for performing this procedure:

a. Two water hoses to supply water to gallery tank as well as transport tank..

b. Waders.

d. Two 5 gallon buckets to fill water tanks.

e. Large dip nets.

f. Fish bags/large fish stretcher.

g. Rope access ladder and anchors.

h. Rope to assist in hauling fish up ladder.

i. Life vests.

j. Safety belts, 1 per person; also anchored rope or cable for attachment to safety belt during entry and exit.

k. Dollies, one for gallery fish tank and one for transport tank used to take fish up the elevator.

l. Truck with fish transport tank (and possibly flume), to be procured as necessary.

15. Personnel required for performing this procedure:

a. Biologist or other trained personnel to advise on fish handling.

b. Personnel to net and transport fish in draft tube. Fish removal from draft tube requires a minimum of two people, however, three are preferred.

MARK C. JENSON, P. E.
Operations Project Manager

APPENDIX I

LIST OF ACRONYMS

List of Acronyms

ADCP	Acoustic Doppler Current Profiler	MU	Main Unit
ADV	Acoustic Doppler Velocimeter	MW	Megawatts
AFC&MF	Adult Fish Collection & Monitoring Facility	N	North
AWS	Auxiliary Water Supply	NDE	North Downstream Entrance
BGS	Behavioral Guidance Structure	NE	North Entrance
BI	Bradford Island	NFE	North Fishway Entrance
BON	Bonneville Lock and Dam	NFH	National Fish Hatchery
BPA	Bonneville Power Administration	NMFS	National Marine Fisheries Service
BRZ	Boat Restricted Zone	NPE	North Powerhouse Entrance
CBFWA	Columbia Basin Fish and Wildlife Authority	NSE	North Shore Entrance
CBTT	Columbia Basin Teletype	NUE	North Upstream Entrance
CENWP	Portland District	O&M	Operations and Maintenance
CENWW	Walla Walla District	OFC	Outlet Flow Control
CFS	Cubic Feet per Second	OG	Orifice Gate
CI	Cascades Island	OOS	Out of Service
COE	Corps of Engineers	OPE	Orifice Passage Efficiency
DSM	Downstream Migrant (channel)	PDS	Primary Dewatering Structure
E	East	PIES	Project Improvements for Endangered Species
EPA	Environmental Protection Agency	PIT	Passive Integrated Transponder
ERG	Emergency Relief Gate	PLC	Program Logic Controller
ESA	Endangered Species Act	PSMFC	Pacific States Marine Fisheries Commission
ESBS	Extended-Length Submersible Bar Screen	PST	Pacific Standard Time
EW	East Weir	PUD	Public Utility District
FDS	Fish/Debris Separator	RCC	Reservoir Control Center
FERL	Fish Engineering Research Laboratory	S	South
FFDRWG	Fish Facilities Design Review Work Group	SBC	Surface Bypass Collector
FFU	Fisheries Field Unit	SDE	South Downstream Entrance
FG	Fish Gate	SE	South Entrance
FGE	Fish Guidance Efficiency	SFE	South fishway Entrance
FPC	Fish Passage Center	SG	Sluice Gate
FPE	Fish Passage Efficiency	SMF	Smolt Monitoring Facility
FPOM	Fish Passage O & M (Coordination Team)	SO	Sluice Oregon
FPP	Fish Passage Plan	SPE	South Powerhouse Entrance
fps	Feet Per Second	SPO	Special Project Operations
FV	Fish Valve	SSE	South Shore Entrance
IHR	Ice Harbor Lock and Dam	STS	Submersible Traveling Screen
ISO	International Standardization Organization	SUE	South Upstream Entrance
JBS	Juvenile Bypass System	SW	Sluice Washington
JDA	John Day Lock and Dam	SWI	Simulated Wells Intake
JFTP	Juvenile Fish Transportation Plan	TDA	The Dalles Lock and Dam
JMF	Juvenile Monitoring Facility	TDG	Total Dissolved Gas
JP	Junction Pool	TIE	Turbine Intake Extension
Kcfs	Thousand cfs	TMT	Technical Management Team
LCRAS	Lower Columbia River Adult Study	UMT	Upstream Migrant Transportation (channel)
LGS	Little Goose Lock and Dam	VBS	Vertical Barrier Screen
LWG	Lower Granite Lock and Dam	W	West
LMN	Lower Monumental Lock and Dam	WDFW	Washington Department of Fish and Wildlife
MCN	McNary Lock and Dam	WECC	Western Electricity Coordinating Council
MOP	Minimum Operating Pool	WES	Waterways Experiment Station