US Army Corps
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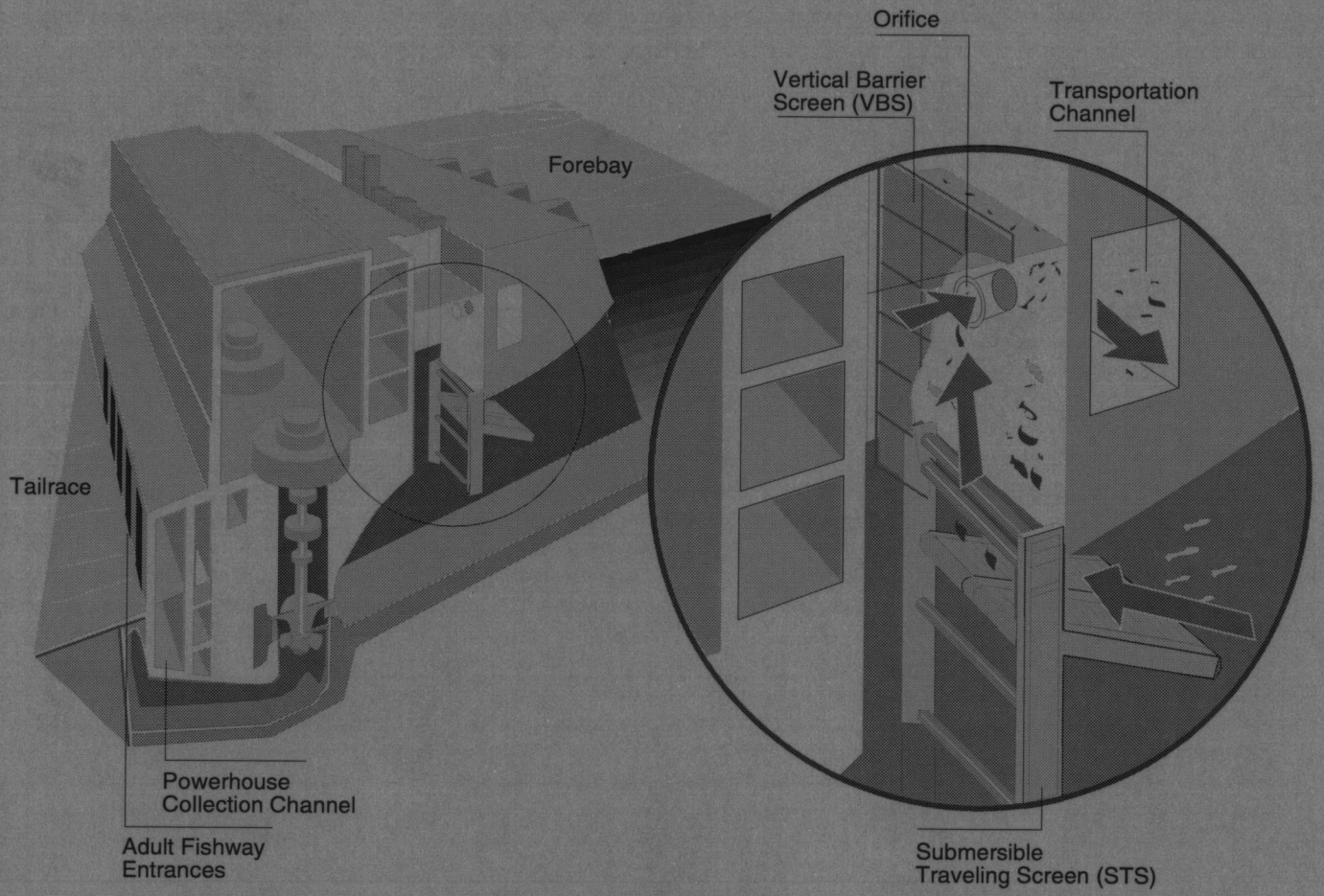
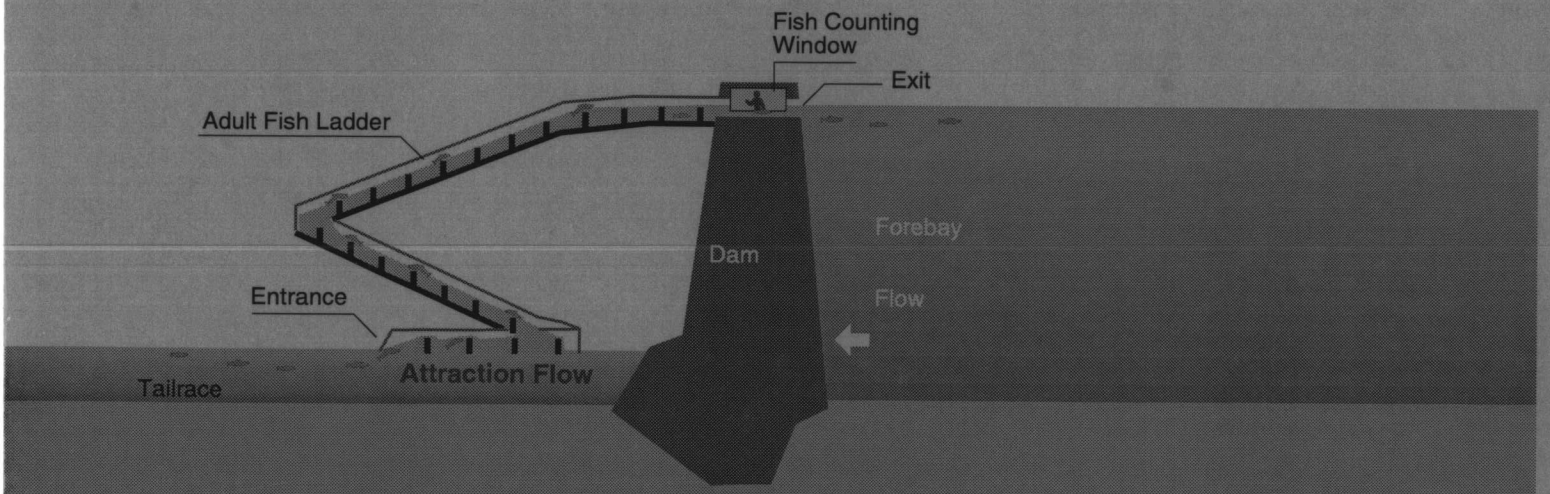
Northwestern Division

Fish Passage Plan
Corps of Engineers Projects





March 1998

FISH PASSAGE PLAN

FOR

CORPS OF ENGINEERS PROJECTS

U.S. ARMY CORPS OF ENGINEERS

NORTH PACIFIC DIVISION

PORTLAND, OREGON

MARCH 1998

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OVERVIEW

1. Fish Passage Plan

1.1. Overview

The Fish Passage Plan (FPP) is developed by the US Army Corps of Engineers (COE) in coordination with the region's fisheries agencies, Indian tribes, Bonneville Power Administration (BPA), and other participants through the Corps' Fish Passage O&M Coordination Team. The FPP describes year-round project operations necessary to protect and enhance ESA-listed salmon species as well as other anadromous fish species. The FPP guides Corps actions in regard to providing fish protection and passage at the eight Corps mainstem Columbia and Snake river projects. 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 Marine Fisheries Service (NMFS) as part of the Endangered Species Act (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 NMFS' Biological Opinion issued 2 March 1995 (Reinitiation of Consultation on 1994 - 1998 Operation of the Federal Columbia River Power System and Juvenile Transportation Program in 1995 and Future Years) and in the Corps' Record of Decision signed 10 March 1995 (U.S. Army Corps of Engineers North Pacific Division Record of Decision, Reservoir Regulation and Project Operations, 1995 and Future Years). Additional changes may be needed as a result of ongoing consultation with NMFS on listed steelhead in the Columbia River basin. When revising the FPP, the Corps considers the amended Northwest Power Planning Council (NPPC) Columbia River Basin Fish and Wildlife Program to the fullest extent practicable.

Comments on the FPP are welcome. They may be directed either to the Fish Passage O&M Coordination Team or the Reservoir Control Center (RCC) [North Pacific Division, COE] office in Portland, Oregon. Unresolved differences between FPP criteria and prior recommendations of the fisheries agencies and tribes are highlighted within Sections 2 through 9.

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 fisheries 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 after the fact.

1.3 Technical Management Team. Decisions on river operations to achieve fish passage efficiency (FPE) or survival goals for spring and summer outmigrants will be made in coordination with the Technical Management Team (TMT). Coordination of special operations identified in the FPP will occur through the TMT and they 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% best efficiency range, zero nighttime flow, and implementation of the juvenile fish transportation program.

1.4 Spill at Corps Mainstem Projects. Corps mainstem projects will provide spill for juvenile fish passage according to the NMFS Biological Opinion (specifications in Appendix E) to protect ESA-listed salmon species. Target spill levels were developed through consultation with NMFS and may be adjusted during the fish migration season as recommended by the TMT. Continuous spill is provided at Bonneville, The Dalles, and Ice Harbor Dams for spring and summer outmigrants to meet Biological Opinion requirements. Nightly spill is also provided at John Day and McNary Dams (spring season only at McNary), and may be provided in the spring at the Snake River collector dams (Lower Monumental, Little Goose, and Lower Granite) under certain conditions (see Appendix E). It should be noted that the Corps is in consultation with NMFS concerning ESA-listed steelhead and that this may result in changes to the spill program at collector projects. Spill may also be provided under special circumstances for non-listed fish species, if recommended by the fisheries agencies and tribes and if the recommendations are consistent with regional operational agreements (i.e., Spring Creek Hatchery release in March).

1.5 Total Dissolved Gas Monitoring. Total dissolved gas (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 and EPA is 110% of saturation at ambient temperature and pressure. The Corps policy is to operate each mainstem projects to meet state standards insofar as physically possible unless other overriding reasons cause temporary deviations. The NMFS Biological Opinion calls for fish spill to be provided at levels that create higher TDG levels (Appendix E). Also, implementation of fish spill requests from fish agencies and Indian tribes have in the past resulted in TDG levels of 120% or greater. Therefore, fish spill implementation will be subject to further

coordination with appropriate entities if excessive TDG levels occur or if evidence of gas bubble disease is observed in fish. Any spill requests that will cause exceedance of the state TDG standard must include prior coordination with state water quality agencies, including waivers of state water quality standards obtained in advance by the requester (see Appendix F, NPD Policy on Spill and Total Dissolved Gas).

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 turbine units within 1% of best operating efficiency.

1.7. Juvenile Fish Transportation Plan (JFTP). Juvenile fish will be transported in accordance with the NMFS Biological Opinion and Section 10 permit. Transportation 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. 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 NMFS (ESA).

1.8. Project Fish Passage Facilities Inspection and Reporting Criteria.

1.8.1 General. Sections 2 through 9 contain the 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 NMFS Hydropower Program office 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 calibrating will not routinely be included in the weekly report. The Corps also provides an annual report to NMFS which summarizes project operations and maintenance and fish passage facility inspections and monitoring.

1.8.2 Criteria for Reporting Excursions Outside the 1% Best Turbine Operating Efficiency Range. Excursions outside the 1% best turbine operating efficiency range will be reported

by BPA annually. These reports will describe instances where lower Columbia and lower Snake river turbines were operated outside 1% best efficiency ranges for significant periods, as defined under the guidelines in Appendix C. BPA will prepare the reports by consolidating data provided by Corps project operators at LCOL and LSN projects. Reports will be sent to NMFS by BPA. The intent of excursion reporting is to provide a means for quality assurance for project operations, as specified in Appendix C.

1.9. Implementation of the Fish Passage Plan.

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

Daily RCC briefings are held at 1300 hours, Monday through Friday, in the U.S. Custom House, Portland, Oregon. RCC also participates in weekly meetings of the Federal interagency TMT which recommends river operations to implement the Biological Opinion and other recommendations from fish interests. Corps representatives are available at these meetings to discuss the latest weather and runoff forecasts, as well as fish, hydrologic, water quality, and power information to assist in the planning of operations for fish passage for the following days. Fish operation recommendations are evaluated by the Corps to determine impact on overall system operations. The Corps also coordinates with NMFS and U.S. Fish and Wildlife Service (FWS) to meet ESA requirements for endangered species.

1.9.1 Agency Responsibilities.

1.9.1.1. U.S. Army Corps of Engineers.

- Coordinate with NMFS and FWS on operational actions that might impact threatened, endangered, or candidate species.
- Prepare a Water Management Plan for in-season management, in coordination with TMT members, which implements the Corps Record of Decision.
- In cooperation with the fish agencies and tribes, provide fish passage monitoring, surveillance, and reporting at Corps projects throughout the migration period.

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

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

- Conduct the Dissolved Gas Monitoring Program as described in Appendix D.

1.9.1.2. Fish agencies and Indian tribes.

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

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

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

- 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 run past key projects.

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

- 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.

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

- Recommend viable methods and procedures to reduce mortality to resident and migratory fish. This may include such operations as collection and transportation

of migrants, use of alternate bypass strategies, or other methods to reduce fish mortality.

1.9.1.3. Bonneville Power Administration.

- 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.

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

- 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.

- Adjust system generation to provide adequate water to meet fish operations requirements in accordance with the NMFS Biological Opinion on hydrosystem operations.

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

- Provide information on unit operation within 1% of best efficiency, as indicated in Appendix C.

1.9.1.4. 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.

1.9.2. Coordination Procedures.

1.9.2.1. Coordination of the FPP.

The FPP is effective year-round and revisions are coordinated with the Fish Passage O&M Coordination Team, which includes NMFS, other Federal and state fisheries agencies, Indian tribes, and other interested parties. Different parts of the FPP may be revised at different times. Suggested revisions should be submitted to the Committee 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 will be included in the Water Management Plan.

1.9.2.2. 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 operations 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, the full reservoir operating range is assumed to be available. It should be noted that the Corps is consulting with NMFS on ESA-listed steelhead and this may result in some change in MOP operation.

b. Fish spill management. The Corps will implement fish spill provisions contained in Section VIII.A.2. of the NMFS Biological Opinion, consistent with state water quality standards including applicable TDG waivers which are in effect at the time. The TDG and gas bubble trauma signs in fish will be monitored and evaluated during the spill season by the Corps, NMFS, other fisheries agencies, tribes, BPA, and water quality agencies. Recommendations on adjusting spill levels based on physical and biological monitoring results will be forwarded to the TMT for discussion at their weekly meetings.

c. Special operation 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. Sufficient lead time will be given on a planned operation, whenever practical, to allow coordination with the TMT and NMFS (ESA). 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 effects on other project O&M requirements. Coordination of special

operations with NMFS, 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 Operations Protocol adopted by the TMT, will be followed.

SECTION 2

THE DALLES 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 (p. BON-2 through BON-4). Dates for project operations for fishery 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-inch gatewell orifices, fish bypass channel, excess water elimination facility, fish sampler, and a 24-inch fish transport pipe to the tailrace. All 10 main turbine units have STSs. A small unit (unit 0) 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 & 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 comprise turbine intake extensions (TIEs), streamlined trash racks, STSs, VBSs, two 12-inch orifices per gatewell (with only one operating per gatewell) flowing into a fish bypass channel, an excess water elimination facility, and a 36-inch fish transport pipe which connects the bypass channel to the tailrace. 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.

1.1.3. Juvenile Migration Timing. The juvenile fish migration season occurs from March 1 through November 30. Table BON-2 shows 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. Maintenance activities will be coordinated to minimize potential impacts on juvenile migrants that may be present during this time period.

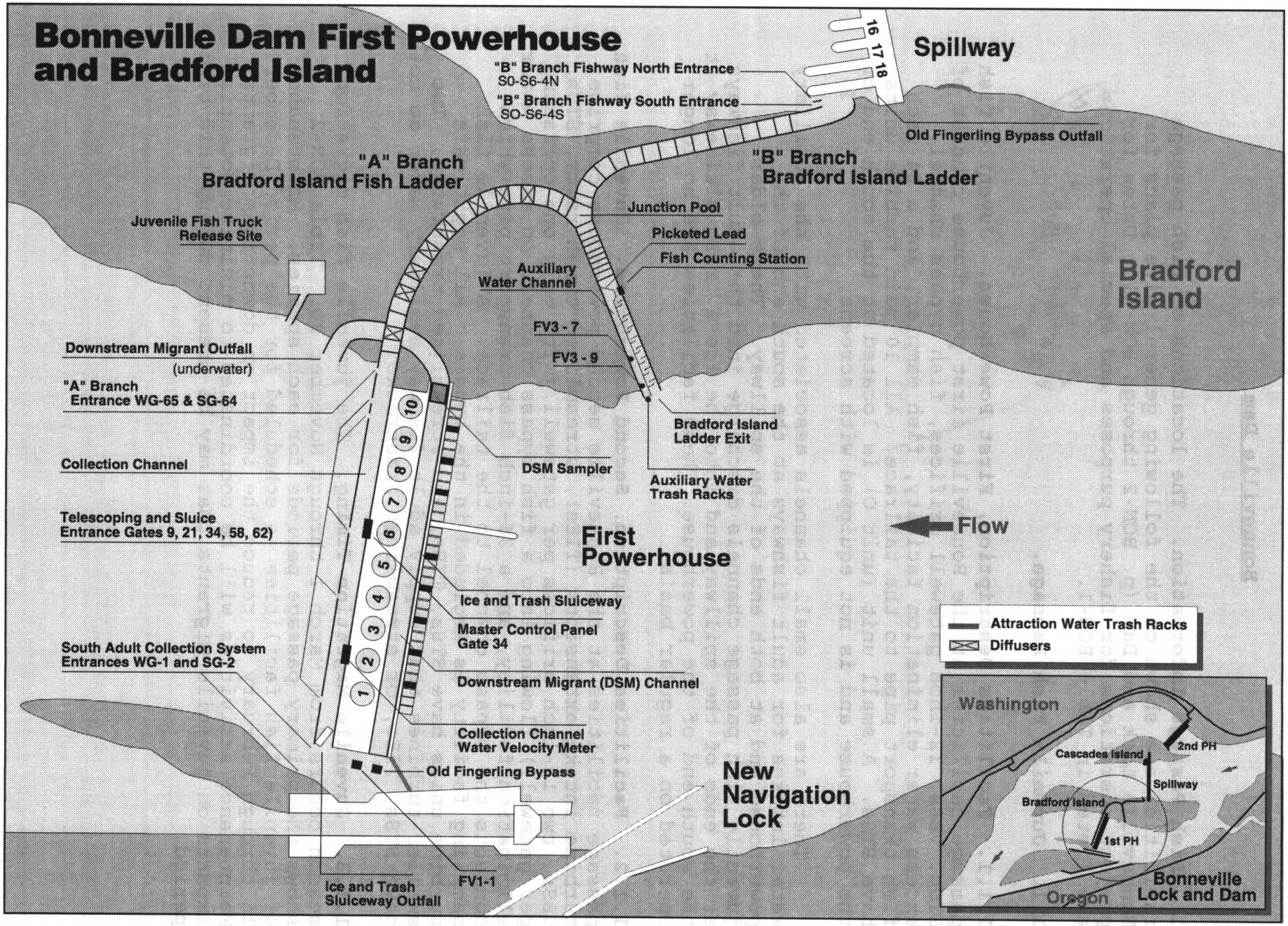

Figure 1 Bonneville Dam First Powerhouse and Bradford Island Fish Ladder

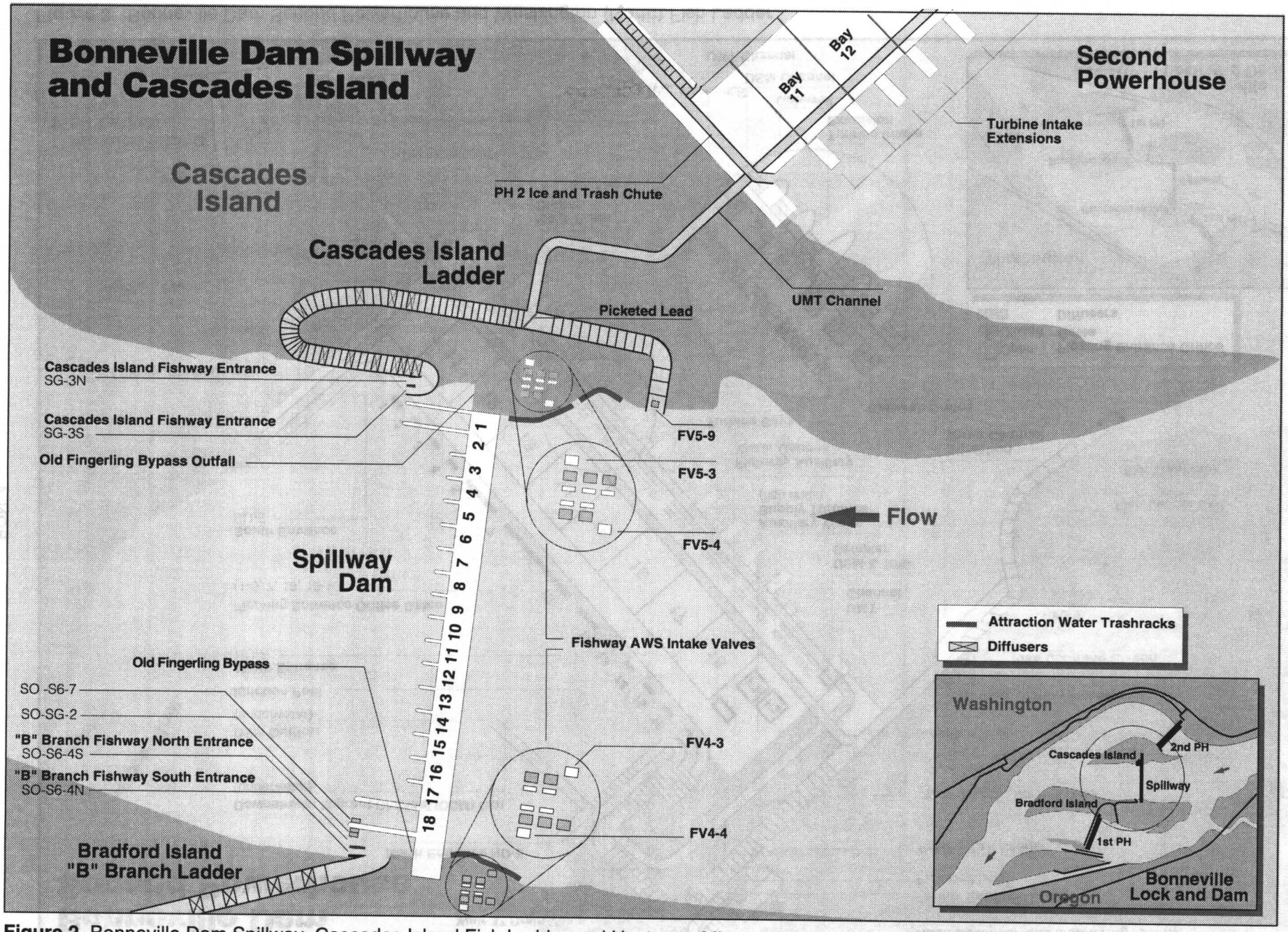

Figure 2 Bonneville Dam Spillway, Cascades Island Fish Ladder and Upstream Migrant Transportation Channel (UMT)

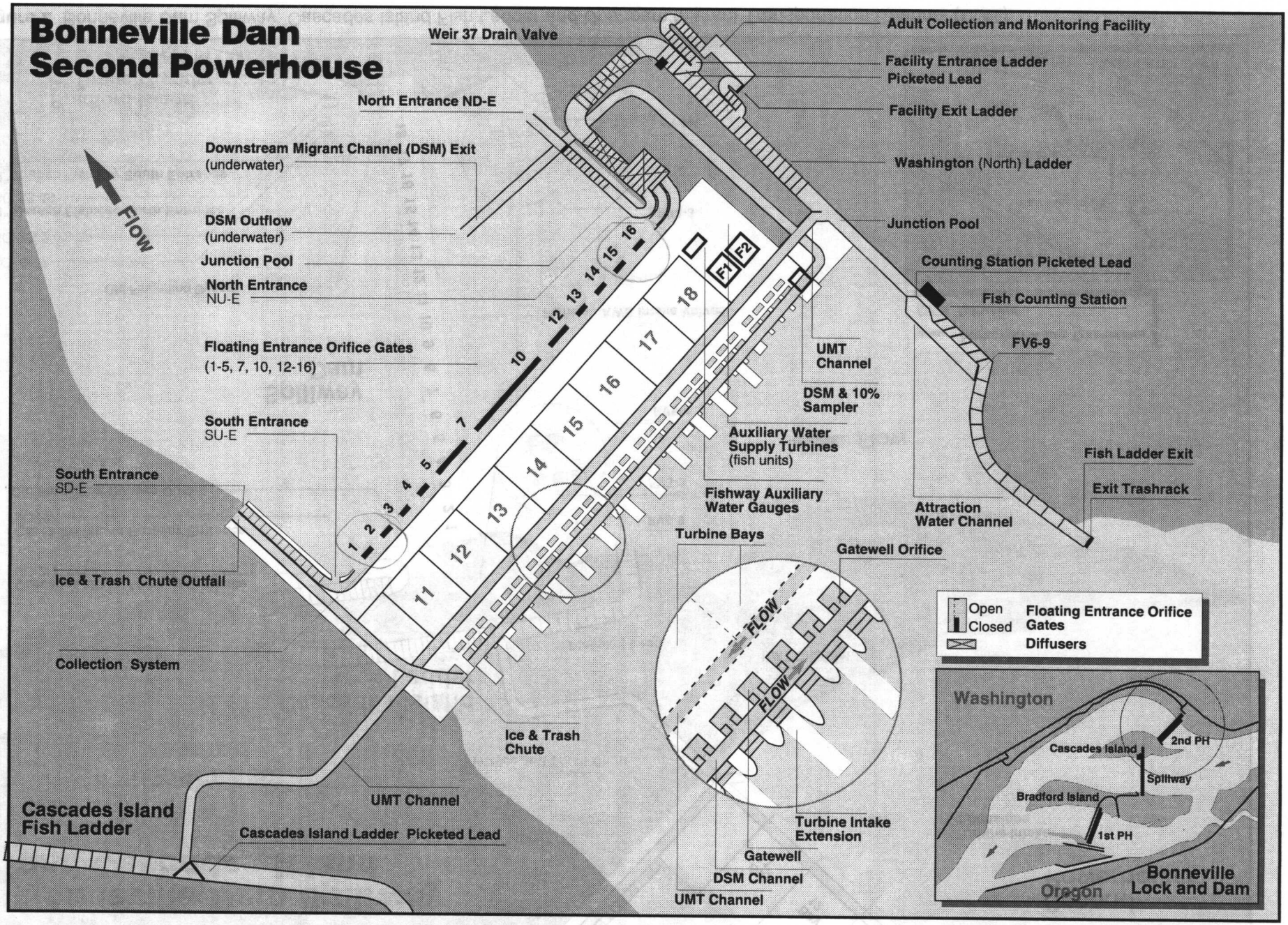

Figure 3 Bonneville Dam Second Powerhouse and Washington (North) Fish Ladder.

Table BON-1. Dates of project operations for fishery purposes at Bonneville Dam, 1998.

Name	Start	Finish	Notes
Spring Creek National Fish Hatchery Release	3/13/98	3/23/98	Spill Days May Vary (Normally 7 - 10 Days)
Juvenile Fish Passage Period	3/1/98	11/30/98	
Spill For Juvenile Fish Passage	4/20/98	8/31/98	Spill Amounts Vary - See Appendix A
Dissolved Gas Monitoring	3/10/98	9/15/98	See Appendix D
Bypass Facility Maintenance	12/16/98	2/28/99	
Special day time spill hours for sockeye	6/1/98	8/15/98	See Paragraph 2.2.3.1
Turbine 1% Operation - Hard Constraint	3/15/98	10/31/98	See Appendix C
Turbine 1% Operation - Soft Constraint	11/1/98	3/14/99	See Appendix C
Adult Passage Period	3/1/98	11/30/98	See Appendix A
Adult Facility Maintenance	12/1/98	2/28/99	
Adult Fish Counting	3/1/98	2/28/99	See Appendix A
STS and Bypass Operation for Adult and Juvenile Fish	3/1/98	12/15/98	STS Operation 12/1 Through 12/15 To Prevent Adult Fall Back
In-water Work Period	12/1/98	2/28/99	Also Known As Winter Operating Period
Weekly Reporting	3/1/98	2/28/99	See Paragraph 2.6
Annual Report	1/31/99	1/31/99	See Paragraph 2.6
Spill to achieve 70 % FPE	4/15/98	4/19/98	See Appendix A
Powerhouse Operating Priorities	3/1/98	11/30/98	See Appendix A
Smolt Passage Studies	3/1/98	11/30/98	See Appendix A
Squawfish Radio Tracking Study	3/1/98	11/30/98	See Appendix A
Lower Columbia River Adult Study	4/1/98	9/30/98	See Appendix A
BON PH2 Sluice Chute Weir Test	4/12/98	7/10/98	See Appendix A

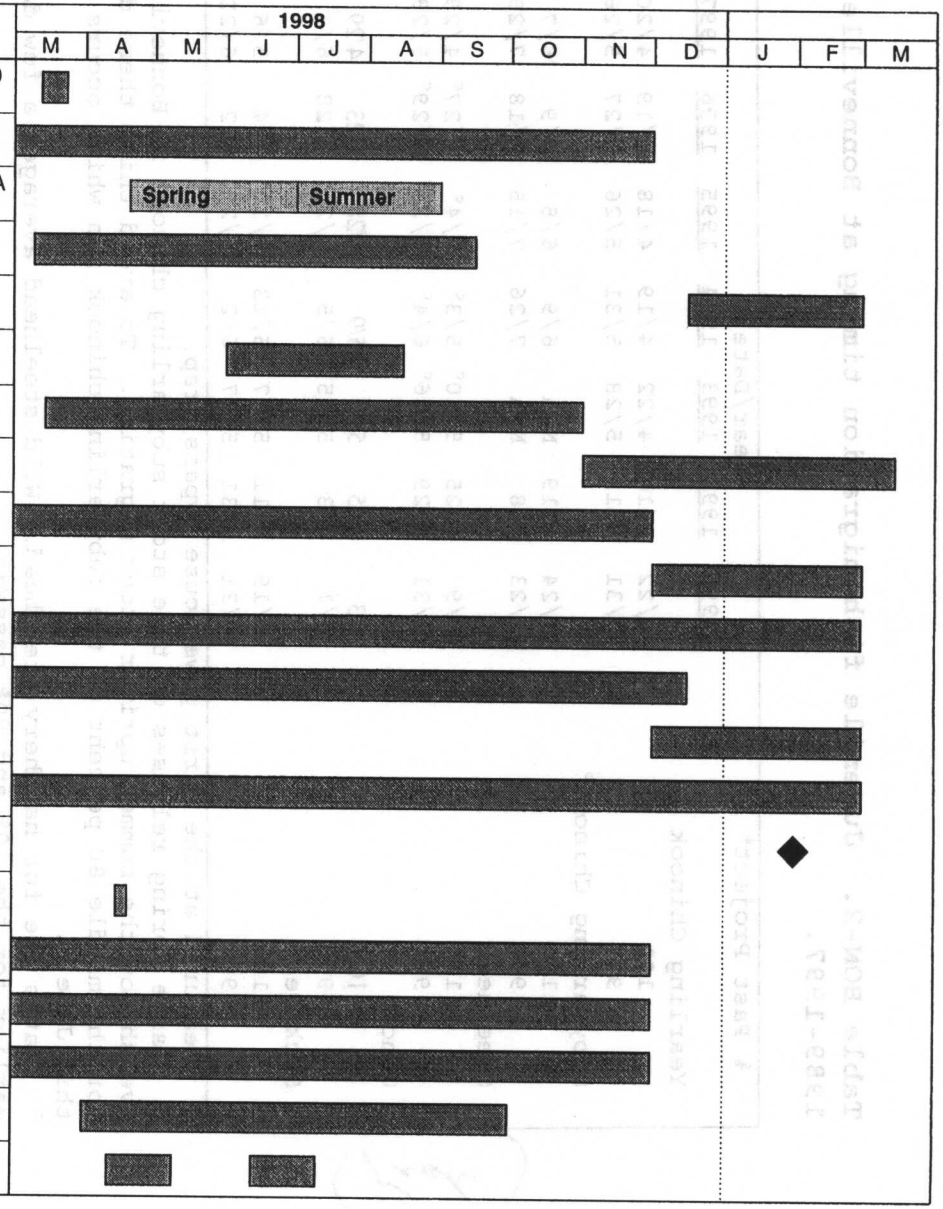

Table BON-2. Juvenile fish migration timing at Bonneville Dam, 1989-1997.

% Past Project[a]	Year/Date						
	1991	1992	1993	1994	1995	1996	1997
Yearling Chinook							
10%	4/22	4/16	4/22	4/19	4/18	4/19	4/20
90%	5/31	5/15	5/28	5/31	5/26	5/27	5/26
Subyearling Chinook[b]							
10%	3/24	4/19	N/A	6/9	6/5	6/9	6/7
90%	7/23	7/8	N/A	7/26	7/15	7/18	7/29
Steelhead							
10%	5/9	4/25	5/10[c]	5/3[c]	5/4[c]	4/27[c]	4/29[c]
90%	5/31	5/29	5/26[c]	6/4[c]	5/29[c]	5/29[c]	5/28[c]
Coho							
10%	5/3	4/25	5/5	5/9	4/28	4/23	4/29
90%	6/1	6/3	5/25	6/5	5/29	5/28	6/4
Sockeye							
10%	5/19	5/11	5/17	5/13	5/10	5/4	5/6
90%	5/31	5/31	5/27	6/2	5/27	6/2	6/22

[a] Measured at the first powerhouse bypass trap.

[b] Large spring releases of tule stock subyearling chinook in Bonneville pool overshadow the summer upriver stock migration. To avoid this, these dates are for the middle 80 percent of the subyearling chinook run which occurs after this June 1.

[c] Dates are for hatchery steelhead. Wild steelhead averaged a few days earlier for the 10% and 90% passage.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. Adult fish passage facilities at Bonneville Dam are composed 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) from November 1 through March 31, primarily to monitor winter steelhead passage. The fish counting schedule appears in Appendix A. 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.

Adult migration count data for Bonneville Dam have been collected since 1938. Table BON-3 summarizes adult fish passage timing through 1995. 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.

Table BON-3. Adult migration timing from fish counts, 1938-1997.

Species	Count Period	Earliest Peak	Latest Peak
Spring chinook	3/14 - 5/31	4/15	5/27
Summer Chinook	6/1 - 7/31	6/5	7/31
Fall Chinook	8/1 - 11/15	8/31	9/17
Steelhead	3/15 - 11/15	7/16	9/12
Coho	7/15 - 11/15	8/29	9/20
Sockeye	6/1 - 8/15	6/22	7/13

2. Project Operation.

2.1. General.

2.1.1. Guidance for spring and summer general flow distribution between powerhouses and spill is provided in the main text of the Fish Passage Plan and in appendix A. 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 Project indicate that fish survival rates for passage through various routes differ between spring and summer. For this reason, distribution of flow between powerhouses and spill will change (see description in the main text of this plan and in Appendix A).

2.1.2. Research, non-routine maintenance, and other fishery related activities will not be conducted within 100' of any fishway entrance or exit, or directly in, above, or adjacent to any fishway, unless concurred with by regional fisheries managers through ESA and other fish passage issues. Alternate actions will be considered by district and project biologists in coordination with the fishery 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.

2.2. Spill Management.

2.2.1. General. Regardless of time of day, only one spill schedule will be used at Bonneville Dam (See Table BON-7, Spill Schedule). 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. The hours of nighttime spill are the daily complements of the periods of daytime spill (see section 2.2.3.~~1.~~, below). However, changing spill gate positions takes some time, particularly for the gates which can't yet be operated remotely. So, 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 will be provided according to guidance described in Appendices A and E. The second powerhouse ice and trash chute will be operated for ice and trash removal and for emergency auxiliary adult transportation channel water supply only as outlined in section 3.3.2.1.c. Second Powerhouse, (second paragraph).

2.2.3. Adult Fish. During the adult fish passage period, daytime spill will be limited to 75 kcfs whenever possible. Normally, this restriction will be from one hour before sunrise to one half hour before sunset. However, during the sockeye passage season, beginning 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 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 an early Spring Creek NFH fish release, but not later than March 10, for stations below Bonneville and on April 1 for the station at Bonneville and those further upriver. TDG data collection will continue until Labor Day. Spill volume and total project flow will be reported at the same time. 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 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 February 28).

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 are functional.

c. Inspect each STS and operate on a trial run (dogged off at deck level). Install STSs in each intake of operational turbine units by the end of February. However, see section 2.4.1.2. Juvenile Fish Passage Season about accommodations for an early fish release from Spring Creek NFH.

d. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting 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 outfall conduit walls and floor.

g. 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 in areas where avian lines are not practical. Avian abatement measures shall be operable by March 1.

Suggest written w/ th checklist

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

2.4.1.2. Juvenile Fish Passage Season. (March 1 through November 30). Juvenile fish protection devices (STSs, etc.) will be in place for an early fish release from Spring Creek NFH, if scheduled to occur before March 1. Screens will remain in operation through December 15 to protect adult fallbacks.

a. 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 feet of total drawdown in gatewells, as indicated by fish condition (e.g., higher than expected descaling), or as determined by the project biologist. STSs in units being raked will be run in continuous mode during raking operations. Gatewell orifices of the unit being raked must be closed during the procedure.

b. Operate STSs at an angle of 55 degrees from vertical.

c. Inspect each STS once per month and each VBS a minimum of once every two months (video is acceptable). Frequency of monthly inspections may be based on individual turbine unit run time. Inspect STSs and VBSs within a time frame to minimize damage to screens following the arrival of heavy debris at the dam. Summaries of STS and VBS inspections will be included in weekly operation monitoring reports. All 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 condition, increased debris load in the bypass system, and other indications of STS or VBS malfunctions or failure. Records of inspections or summary of such records will be made available to the Fish Passage Center (FPC) by January 31.

CBFWA recommends that VBS inspections be conducted once per month through the fish passage season.

d. Operate all gatewell orifice systems. Inspect each daily to assure that the orifice valves and lights are operating correctly. Back-flush at least every day or more often if indicated by debris accumulations. Replace all burned out orifice lights within 24 hours.

e. In the DSM downwell area (Standards listed are for normal operation. During smolt sampling, depth of water over the inclined screen and elevation of the water surface in the downwell are lowered):

1. Maintain between 0.9 and 1.3' of depth, 1.0' preferred, over the end of the DSM inclined dewatering screen.

2. Maintain differential between forebay and DSM channel water surface between 4.0 and 5.2'.

3. Maintain drop from dewatering screen to water surface in downwell between 3.0 and 4.5'.

f Insert under PIT tag goals

4. Operate dewatering screen trash sweep one revolution at 20-minute intervals. The interval between operations may be doubled when the amount of debris passing is light.

f. Observe each STS watt and/or amp gauge reading at least once each day and record readings 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 fishery measures, and then only on a last on/first off basis. The first powerhouse gatewell orifices will be closed during the debarking operation. After debarking a gatewell, back-flush the orifice in that gatewell. 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 consultation with FPC and NMFS. 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.

k. Turbine units without full complements of STSs will not operate, except to be in compliance with other coordinated fishery measures.

l. During the juvenile fish passage season, open ice & trash sluiceway chain gate 7A to elevation 72' above msl, and set gate 10C to full open. However, if 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[1]. ([1]Evaluation of Ice and Trash Sluiceway at Bonneville Dam as a Bypass System for Juvenile Salmonids, 1981. Calculated from hydraulic equation to achieve approximately 475 cfs (3.7 feet of head). The ice and

trash sluiceway may be closed for a two month period beginning October 1, if it is determined, through regional coordination, that migrating juvenile salmonid numbers are low enough that closure will not adversely affect fish migration or fish condition. This closure is subject to annual regional evaluation, and may be terminated at any time if problems arise that negatively impact salmonid migration or fish condition. Whenever the old juvenile fish bypass located at the south end of the powerhouse operates, some flow must be maintained through the ice & trash sluiceway, since the bypass flows into the sluiceway. However, the old fingerling bypass is no longer operated as a juvenile fish passage system.

m. Inspect juvenile fish passage facilities twice per day, except where other guidance is provided elsewhere within this plan for specific facilities.

2.4.1.3. Winter Maintenance Season. (December 16 through February). The end of the season may be shortened for an early fish release from Spring Creek NFH.

a. All STSs removed.

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 screen 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 orifices should be closed and the DSM channel drained.

2.4.2. Operating Criteria, Second Powerhouse.

2.4.2.1. Prior to the Juvenile Fish Passage Season (December 1 through February 28).

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, or protrusions (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. However, see section 2.4.2.2. Juvenile Fish Passage Season, about accommodations when there is an early fish release from Spring Creek NFH.

d. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting 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. 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 in areas where avian lines are not practical. Avian abatement measures shall be operable by March 1.

h. The results of all inspections and the readiness of the facilities for operation will be verbally 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 30). Juvenile fish protection devices (STSs, TIES, etc.) will be in place for an early fish release from Spring Creek NFH, if scheduled to occur before March 1. Screens will remain in operation through December 15 to protect adult fallbacks.

a. Main unit gatewell drawdown will be measured a minimum of once per week. Remove debris from the forebay and trash racks as required to maintain less than 1.5' of drawdown in gatewell or as indicated by fish condition (e.g., higher than expected descaling) or as determined by the project biologist. 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 work day 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 will develop operational guidelines on an as-needed basis.

c. Operate STSs at angle of 60° from vertical.

d. Inspect each STS once per month and each VBS a minimum of once every two months (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.

CBFWA recommends that VBS inspections be conducted once per month through the fish passage season.

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 the FPC by January 31, upon request.

e. Operate all gatewell orifice systems. Inspect each twice daily to assure that the orifice valves and lights are operating correctly. Orifices with less than a clear flow jet will be cleaned. Replace all burned out orifice lights within 24 hours. Electrical modifications were made in 1995 which allow central, automatic lighting control in the second powerhouse DSM. The DSM is now darkened on a schedule as determined through coordination with the FPOM in 1994. The DSM lights should be left off, per this guidance, except when people are in the gallery. Investigation has shown that darkening the channel results in faster fish evacuation.

f. Inspect 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 before gatewell 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 fishery measures, and then only on a last on/first off basis. The second powerhouse gatewell orifices will be closed during the cleaning operation. After cleaning a gatewell, inspect and if necessary, clean the orifice in that gatewell. 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 consultation with FPC and NMFS. 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.

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

will be deter

l. Maintain DSM water surface between elevations 64.7' and 65.2' as measured at the south end of the channel.

m. Maintain the water surface on the dewatering screen between elevations 60.8' and 61.2'.

n. When juvenile fish sampling is in progress, maintain the water surface elevation in the PH2 downwell between 53 and 55'. It is necessary to keep the elevation this low to prevent flooding through the sampling system outlet. When sampling is not in progress, plug the sampler outlet and raise the water elevation to as close to 58' as possible.

o. Inspect facilities twice per day. At least three inspections per week will be performed by project fishery biologists.

gone

p. Operation of the Emergency Relief Gate (ERG) may strand juvenile fish that are near the dewatering screen when the water recedes. Training and maintenance operation of the ERG during the juvenile fish passage season should be minimized. As much as practical, all operation of the ERG should be coordinated through the project biologist. To ensure that the ERG is operable when needed, operation should be tested at the beginning of the juvenile fish passage season and once mid-season. Tests will be done at such a time as to create the least impact to migrating fish.

q. 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. See p. SPO-BON-1 for the TIE removal schedule in place for the second powerhouse ice/trash chute surrogate surface corner collector testing in spring/summer, 1998.

2.4.2.3. Winter Maintenance Season. (December 16 through February 28). The end of the season may be shortened for an early fish release from Spring Creek NFH.

To reduce adult fallback mortality, the juvenile bypass system, or DSM channel will operate from November 30 through December 15. STSs in priority units will be left in place during this period. 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 project fishery biologists.

2.4.3. Operating Criteria, Spillway.

2.4.3.1. Prior to Juvenile Fish Passage Season (December 1 through February 28).

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 verbally 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 30).

Bonneville Dam uses a single spill schedule for use both day and night (See sections 2.2. Spill Management and 2.2.2. Juvenile Fish for guidance).

2.4.3.3. Winter Maintenance Season. (December 16 through February 28). 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 Adult Passage Period (December 1 through February 28).

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

b. Unless specially coordinated, unwater all ladders and inspect all unwatered 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 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 verbally reported at the FPOM meeting immediately prior to the passage season.

2.5.1.2. Adult Fish Passage Period. (March 1 through November 30).

a. All Adult Facilities.

1. Maintain water depth over fish ladder weirs: 1.0' +/- 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). Measure these water depths 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 Cascade Island ladder just downstream of the entrance to the UMT.

2. Water temperature will be measured in an adult fishway at ~~each project~~. Powerhouse.

3. Head on all entrances: 1.0 to 2.0' (1.5' preferred). A head of approximately 1.0' to 2.0' 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 3.4.1. Adult Fish Passage Facilities, Scheduled Maintenance, when unable to achieve head criterion.

4. A transportation velocity of 1.5 to 4.0 fps (2.0 fps preferred) shall be maintained for the full length of the

powerhouse collection channel, and the lower ends of the fish ladders which are below the tailwater. Water velocities will be measured directly, and monitored during fishway inspections to verify channels are operating between 1.5 and 4.0 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 1.0' head will be allowed on the first powerhouse attraction water intakes and trash racks at all the ladder exits, with 4-inch maximum head on all picketed 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. 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 24 hours per day year around. 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 15/8 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 twice per day. At least three inspections per week will be performed by project fishery biologists.

9. Upstream light banks in both count stations shall remain off in an attempt 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.

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

Adult Lab operation picklite open - Repeated IW weekly Report.

b. Spillway Ladders.

1. Spillway gates 1 and 18 shall be open 4 inches to attract adult migrating fish to the adjacent fishway entrances, throughout the adult fish passage season.

2. Side entrances SW-SG-5 and SO-SG-7 and 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 5 orifice 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, orifice gates, sluice gates, A branch diffusion gates, and fish valves FV1-1 and FV3-7.

2. Weir Gates and Bulkheads: Differential/ Submergence Requirements. Weir gates 1 and 2 are operated to maintain a differential of 1.4' to 1.6' between collection channel and tailwater. When the differential falls outside this desired range, weir gates 1 and 2 are moved for 7 seconds, which corresponds to a 0.2' gate movement, and then remain inoperable for the remainder of 1.5 minutes. – maintain 8 ft depth??

Weir gates 64 and 65 are operated to maintain an 8.0' or greater submergence below tailwater. When weir gates 64 and 65 fall outside this desired range, they are simply moved to 8' submergence. However, when tailwater is below 13.5', the available auxiliary water is less than that required to maintain the 8' submergence and 1.5' differential requirements simultaneously. Therefore, when tailwater is below 13.5', weir gate 64 is operated to maintain a 1.5' differential.

3. Gate Pairing. The 4 weir gates are operated as 2 pairs. Only one gate pair is allowed to operate for a given tailwater. Weir gates 1 and 65 are operated together as the active pair for tailwater greater than 23' msl, while weir gates 2 and 64 are operated together as the active pair for tailwater less than 24.5' msl. For tailwater inside this range, the previous active gate pair will remain active. If a weir gate is

active, its entrance is opened, the weir gate is operated to meet the appropriate requirements and, in the case of entrances 2 or 64, its respective bulkhead is also fully raised. If a weir gate is inactive, its entrance is closed, the weir gate is fully raised and, in the case of entrances 2 or 64, its respective bulkhead is also fully lowered. A transition occurs when control is passed from one active pair to the other.

4. Transition Positioning. During a transition, the former active pair entrance is closed and the new active pair entrance is opened. Of the two gates which are active, the active gate which maintains differential is initially positioned according to tailwater, while the active gate which maintains submergence is initially positioned to 8' below tailwater. Once each of the active gates is in its respective position, there is a 5 minute delay in which the gate may not be operated (by the PLC program). This delay is instituted to allow the conditions in the collection channel to settle before resuming normal gate operation.

5. Operate powerhouse entrance gates 9, 21, 34, 58, and 62.

Orifice A (lower sluice gate) operates (opens) from tailwater elevation 7.0' to 16.0' on a rising tailwater and elevation 15.0' to 7.0' on a falling tailwater.

Orifice B (upper telescoping gate) operates (opens) from tailwater elevation 16.0' to 38.0' on a rising tailwater and elevation 38.0' to 15.0' on a falling tailwater.

6. First powerhouse collection channel diffusers are open according to the schedule in Table BON-4.

Table BON-4. Bonneville Dam first powerhouse adult fish collection diffusion system valves.

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	FG2-21*....open
FG2-12....open	FG2-21B....open

* Gate has manual electric operation. No automatic controls.

d. Second Powerhouse.

1. Operate all north (NUE and NDE) and south (SUE and SDE) entrances. Operate weir crests at elevation 1.0' (fully lowered) for tailwater elevations up to 14.0'. For tailwater elevations greater than 14.0', operate weir crest 13.0' or greater below tailwater.

2. Operate all 12 powerhouse floating gate fishway entrances.

e. Spillway Operations.

Bonneville Dam uses a single spill schedule (Table BON-7) for both day and night. See sections 2.2. Spill Management, and 2.2.3. Adult Fish for guidance.

2.5.2. Winter Operating Period, or In-water Work Period, (December 1 through February 28).

2.5.2.1. 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. Adult facilities will be inspected once per day to assure operation as per criteria above. These inspections are to be performed at least three times per week by project fishery biologists. 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. The units in the powerhouse with the fully operating fish facility will be first on/last off to meet power demand, except when the first powerhouse collection facility is out of service, units 1, 2 and 10 will continue to operate. One of the two ladders servicing the spill channel will be in full operation at all times unless specially coordinated. Outage periods will be minimized to the extent practicable.

2.5.2.2. Spill bays 1 and 18 may be on seal throughout the winter operating period.

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

2.6. Facility Monitoring and Reporting. Fish passage facilities will be inspected at least once a day to assure operation according to established criteria. More frequent inspections of some facility components that may be required will occur as noted throughout the text. At a minimum, project biologists shall

perform adult and juvenile fishway inspections at least 3 days weekly. Additional fishway inspections may be performed by FFU, project operations, and/or fishery 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 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 Project Manager shall send them to CENWP-CO as soon as possible the following week, with a copy to RCC, Attention: Jim Athearn. 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 will be provided to CENWP-CO in time for distribution to FPOM members at the February meeting.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Scheduled 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. These organisms have become a serious problem elsewhere in the country and may become introduced into the Columbia River basin.

3.1.1.3. 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.

3.2. Juvenile Fish Passage Facilities.

3.2.1. Scheduled 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 Bonneville juvenile bypass facilities will receive preventive maintenance at all times of 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 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. Modifications and general maintenance to the channels are also to 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 raking of trash racks may be necessary when a storm brings large quantities of debris down river to the project. Gatewell orifices of the unit being raked will be closed during the procedure (applies only to the first powerhouse).

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 up to two months (see section 5. Dewatering Plans). The maintenance schedules for these turbines and spillways will be coordinated with the fisheries agencies through the FPOM. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the areas of 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 weighting given to fish, power, and water management and will be coordinated with the appropriate resource agencies.

Some types of maintenance on turbines 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. Unscheduled Maintenance.

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.

a. Bonneville Project's juvenile bypass systems are controlled by automatic systems. 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 cleaned out (first powerhouse is automatic; second powerhouse is manual).

b. Inspect all STS gatewells daily. 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 fishery measures. This is to maintain clean orifices and minimize fish injury. The first powerhouse gatewell orifices will be closed during the cleaning operation. ~~After cleaning a gatewell, back-flush the orifice in that gatewell~~. Check gatewell drawdown.

c. **Bonneville First Powerhouse.** If any part of the dewatering screen, downwell, or juvenile release conduit fails, making this portion of the system unsafe for juvenile fish, the juveniles will be diverted to the ice and trash sluiceway. This operating mode will require the gate at the south end of the DSM channel to be removed and a stop-log installed at the north end so migrants will flow down into the ice and trash sluiceway channel. Assure that sluiceway gate 7A is opened to 72.0' msl, gate 10C is opened fully, and the ice and trash sluiceway end gate is open to provide safe transportation flows for juveniles. Forebay elevation will be kept above 74.0' msl to the extent practicable. The bypass will then continue operating while repairs are completed. In either operating mode, the orifices will be cleaned with the air pressure system at least once per day, when plugged orifices are indicated, or after trash rack raking and gatewell debarking.

d. **Bonneville Second Powerhouse.** If the bypass system fails in the dewatering section, downwell, 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.

e. During fishway inspection the VBSs may be found plugged or damaged. 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.

3.2.2.3. Turbines and Spillways.

If a spill gate becomes inoperable, the operator will 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.

3.3. Adult Fish Passage Facilities.

3.3.1. Scheduled Maintenance.

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. If not practicable, the time of the maintance and type will be recorded in the Weekly Report.

3.3.1.2. Powerhouse and Spillway Adult Fish Collection Systems. Preventive maintenance and repair occurs throughout the year. During the 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 unwatering, such as diffusion gratings, leads, and entrance gates, will be scheduled once per year during the winter maintenance season while the system is unwatered, 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.

If change is needed
Here is response . . .
24 hour limit between adj. gates

The project biologist or alternate Corps fisheries personnel will attend all dewatering activities potentially involving fish, as well as inspections, to provide fishery input (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. 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 exceeded. When practicable, rake trash racks during the time of day when fish passage is 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.

CBFWA recommends that trash rack raking be performed after dark.

3.3.2. Unscheduled Maintenance.

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 operation according to standards. This will allow the fish facility to operate according to 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 close powerhouse entrances 9, 21, 34, 58, and 62, one at a time, starting with gate 9 and proceed north.

If closing the orifice gate fails to achieve a minimum fishway head of 1.0' when tailwater is greater than 17.0' msl, then operation of newly modified gate 1 and gate 65 weirs becomes

necessary. Operational guidelines of these gates appear in section 2.5.1.2.c. First Powerhouse, 1 through 5.

When tailwater elevation is less than 17.0' and the gate 65 weir crest is at least 6.0' below tailwater, then operation of newly modified gates 1, 2, 64, and 65 becomes necessary. Operational guidelines of these gates is referenced in the paragraph above.

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 1.0' 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 6.0' below the tailwater surface is reached. At this point maintain the gate positions until the auxiliary water system is repaired.

c. Second Powerhouse. If either or both of the fishway auxiliary water turbines are unable to provide water sufficient to meet full criteria between April 1 and August 31, raise the NUE in 1.0' increments until the weir crest is 6.0' below the tailwater or a fishway head of at least 1.0' is achieved. If this fails to achieve the above criteria then apply the same procedure, until the criteria are achieved, using in addition the NDE, then the SUE, and finally the SDE. The weir crests for these entrances will not be raised above 6.0' below tailwater. If the correct fishway head is still not achieved after this procedure, then fully close NUE and operate in this configuration until repairs can be made to the system.

If one of the fishway water supply turbine units fails between September 1 and March 31, during a time when tailwater is high enough that normal operation can't be maintained using the remaining fish unit, and repairs can't be made within 24 hours, then the ice and trash sluiceway will be used to supplement discharge to allow operation of the fishway according to the above standards. Between September 1 and 15, and March 1 and March 31, the juvenile and adult runs will be evaluated to decide if the sluice chute should be operated when one fish unit is out of service. Care will be taken to keep the trash chute screen free of debris. If a barrier rack is used at the entrance to the ice & trash chute to exclude adult salmonids, the downstream end gate will be raised briefly at least once weekly to flush trapped fish and debris out of the chute. If the rack is not used, the chute will be flushed twice weekly, on Monday and Thursday.

If both of the fishway auxiliary water turbines fail between September 1 and March 31, and March 1 and March 31, and repairs

can't be made within 8 hours, then the ice and trash chute will be started up. The adult facility will be operated as follows:

1. Close NDE, SUE, and NUE.

2. Operate the SDE weir crest at 8.0' below tailwater.

3. Operate the floating orifice gates. However, if the backup fishway auxiliary water system must be used for a period exceeding 30 days, then block off as many of the center floating orifice gates as possible and open NDE with a weir depth of 8.0' fet below the tailwater surface. While under this configuration, power generation at the second powerhouse will be minimized to reduce fish attraction into this area.

If all auxiliary water systems fail or malfunction, then close SUE, NDE, and NUE and raise SDE weir crest to 6.0' below tailwater elevation 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.

Powerhouse 2 adult fishway diffusion system valves A3 and A4 have been found damaged and were 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 not been observed to exceed 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 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. The Bonneville first powerhouse ladder was completed in 1937 and the Bonneville 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. Picketed leads can cause problems. Pickets with excessive spacing (greater than 1 inch), erosion of concrete around the leads, or missing pickets can allow fish into areas where escape is difficult. In some instances of picketed 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 picketed 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.

4. Turbine Unit Operation and Maintenance.

4.1. Unit operating priority during the fish passage seasons (March 1 through December 1).

4.2. During the winter maintenance season, when powerhouse fish collection systems are operating, the operating priority sequence is unit 1, 10, 2, 18, and 11. Additional units will be selected in any sequence at the discretion of the powerhouse operators. Generally, when a unit in this

Table BON-5. Bonneville Dam Fish Passage Season Unit Operating Priority.

First Powerhouse Unit Operating Priority	Times	Second Powerhouse Unit Operating Priority
1,10,9,2,3,(5-8),4	0500 - 2000	18,**11,17**,12,16,13,14,15
	~~2000 - 0500~~	~~18,17,11,12,16,13,14,15~~

- Flow distribution between powerhouses will be determined by CENPD-ET-WM.
- Unit 16 will follow unit 17 in priority if unit 18 is out of service.
- If unit 1 is out of service, replace it with unit 2 to maintain station service.

list is not available, then an adjacent unit will be operated. When a fish collection channel is out of service the unit operating sequence will change accordingly, within the limitations of the project's power distribution requirements.

4.3. Guidelines for operation of the turbine units within 1% of peak efficiency and within cavitation limits at various head ranges are provided in Bonneville Dam Peak Turbine Efficiency Ranges. The project will operate the turbine units according to the table for Bonneville Dam Peak Turbine Efficiency Ranges.

4.4. To the extent technically feasible, turbines will be operated within +/-1% of peak turbine efficiency, unless operation outside of that range is necessary to meet load requirements of the BPA administrator, whose load

Table BON-6. Turbine operating ranges within 1% of best efficiency for Bonneville first and second powerhouses.

Head (feet)	First Powerhouse (units 1-10)				Second Powerhouse (units 11-18)			
	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)	Lower Limit (MW)	Lower Limit (cfs)	Upper Limit (MW)	Upper Limit (cfs)
34	14	6,116	26	11,258	29	12,047	39	16,478
35	14	6,114	27	11,278	29	12,055	40	16,578
36	15	6,112	28	11,297	30	12,063	41	16,578
37	16	6,158	29	11,328	31	12,070	43	16,627
38	16	6,205	30	11,360	32	12,078	44	16,677
39	17	6,251	31	11,391	33	12,086	45	16,727
40	17	6,318	32	11,422	34	12,044	47	16,777
41	18	6,371	33	11,464	35	12,022	49	16,826
42	19	6,424	34	11,506	36	11,960	51	16,876
43	19	6,476	35	11,547	37	11,918	53	16,926
44	20	6,529	36	11,589	38	11,881	55	17,008
45	21	6,582	37	11,631	39	11,844	56	17,090
46	22	6,646	38	11,646	39	11,807	58	17,173
47	22	6,711	39	11,661	40	11,770	59	17,255
48	23	6,775	40	11,677	41	11,733	61	17,337
49	24	6,839	41	11,692	42	11,747	63	17,338
50	25	6,904	41	11,707	43	11,760	65	17,338
51	25	6,968	42	11,722	44	11,774	66	17,339
52	26	7,030	43	11,738	45	11,787	68	17,339
53	27	7,091	44	11,752	46	11,801	70	17,340
54	28	7,153	45	11,768	47	11,842	72	17,340
55	29	7,214	46	11,783	48	11,884	73	17,341
56	29	7,276	46	11,798	49	11,925	75	17,342
57	30	7,337	47	11,813	51	11,967	76	17,342
58	31	7,399	48	11,828	52	12,008	77	17,343
59	32	7,427	49	11,844	53	12,050	77	17,343
60	32	7,455	50	11,859	54	12,091	77	17,344
61	33	7,482	51	11,874	55	12,103	77	16,967
62	33	7,510	52	11,889	56	12,115	77	16,590
63	34	7,538	53	11,904	57	12,128	77	16,214
64	34	7,566	54	11,919	58	12,140	77	15,837
65	35	7,593	55	11,935	59	12,152	77	15,460
66	36	7,621	56	11,950	60	12,164	77	15,083
67	36	7,649	58	11,965	61	12,176	77	14,706
68	37	7,677	58	11,951	62	12,189	77	14,330
69	38	7,704	59	11,937	63	12,201	77	13,953
70	39	7,732	59	11,923	64	12,213	77	13,576

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

requests will be consistent with BPA's System Load Shaping Guidelines (Appendix C), avoid excess daytime spill (during the time of year when the 75 kcfs spill cap applies), or to comply with other coordinated fishery measures. The guidelines apply between March 15 and October 31. However, during the rest of the year, the project will continue to operate units within the peak turbine efficiency range, except as specifically requested by BPA to do otherwise as power requirements demand.

CBFWA recommends operation of all units within 1% of peak turbine efficiency unless otherwise agreed.

4.5. If it is necessary to operate outside the +/- 1% peak efficiency range, then units which pass the least fish should be selected first. Assuming a preference to pass fish through the juvenile bypass system, units which pass the least fish will be selected first. Therefore, when units must be selected to operate outside the peak efficiency range, they will be chosen according to the following prioritized list, where not constrained by specific project limitations: (5-8), 3, 9, 10, 2, 1, 15, 14, 13, 16, 12, 17, 11, 18.

4.6. The project turbine unit maintenance schedules will be reviewed by Project and Operations Division biologists for fishery 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.

4.6.1. Unit 10 provides important attraction flow for adult fish and helps move juvenile fish out of an area of high predation in the tailrace. Therefore, long-term outages will be avoided after the beginning of the juvenile fish passage season, particularly the first Spring Creek NFH fish release, until after the adult fall chinook and coho runs at the end of October.

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

4.6.3. In the event of long-term outages at Bonneville powerhouses, out of service (OOS) 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. This may be performed at night, daytime, or whenever unit cycling will have the least effect on fish passage.

4.7. Until problems with the PH2 hydraulic head gate operating system are corrected, the gates at units 11 through 18 will be set onto the latches. 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.

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

5.3. The fisheries agencies and tribes will be will be invited to assist in any dewatering, and at a minimum, will be represented at all ladder dewaterings by the WDFW fish counting program supervisor or an alternate.

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

5.4.1. A project biologist or biological technician will attend all activities which involve dropping the JBS water surface below the end of the dewatering screen. Refer to the project Fish Salvage Plans for descriptions of JBS dewaterings.

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

5.4.3. The trash sweeps will be turned off of automatic control.

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 Plans.

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. Scheduled 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.

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

5.5.1.3. 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. Nets repaired

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

5.5.1.5. The project biologist or alternate Corps fisheries personnel will oversee fish rescue when the ladders are dewatered. The project biologist will invite fishery agency and/or tribal biologists' participation in the dewatering. Rescue personnel will walk the inside of the ladder from the head gates down to tailwater, salvaging all fish either by moving fish to tailwater within the ladder flow, or capturing and placing the fish in a large water filled tank, which is then transported to the forebay or tailrace depending on the fish life stage (adults to forebay, juveniles to tailrace) for release.

5.5.1.6. 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 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 check list maintained by the project biologist.

5.5.2. Unscheduled Maintenance.

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

5.5.2.2. Follow steps 5.5.1.3. through 5.5.1.5. above.

5.6. Powerhouse Fish Collection System.

5.6.1. Scheduled Maintenance.

5.6.1.1. 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 to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.6.1.2. The project biologist will assure that rescue equipment is available if needed.

5.6.1.3. The project biologist will provide technical guidance for fish safety and will assist directly as needed in rescue operations.

5.7. Turbines.

5.7.1. Immediately before setting the head gates, remove juvenile fish from the gatewell(s) which 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 turbine unit is shut down if draft tube is to be dewatered.

5.7.4. 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.

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

5.7.6. 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 and/or alternate Corps fisheries personnel will provide technical guidance for fish safety and will directly participate in fish salvage.

5.7.7. The project biologist will invite FPOM fishery biologists to participate in the dewatering, and will assure that rescue equipment is available if needed.

5.7.8. 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-CO at least two work days prior to the day the special operation is required. Using information provided by the project, CENWP-CO will coordinate with RCC and NMFS. Once the coordination is complete, RCC will issue a teletype detailing the specifics of the special operations.

Table BON-7. Spill patterns for Bonneville Dam.

Bay Number																		Total Dogs	kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
4"	1																4"	1	3.1
4"	1															1	4"	2	6.2
4"	1	1														1	4"	3	9.3
4"	1	1													1	1	4"	4	12.4
4"	1	1	1												1	1	4"	5	15.5
4"	1	1	1											1	1	1	4"	6	18.6
4"	1	1	1	1										1	1	1	4"	7	21.7
4"	1	1	1	1									1	1	1	1	4"	8	24.8
4"	1	2	1	1									1	1	1	1	4"	9	28.5
4"	3	2									2				1	2	4"	10	33.6
4"	3	2									2				2	2	4"	11	37.2
4"	3	2			1						2				2	2	4"	12	40.3
4"	3	2			2						2				2	2	4"	13	43.9
4"	3	2	1		2						2				2	2	4"	14	47.0
4"	3	2	1		2						2			1	2	2	4"	15	50.1
4"	3	2	1		2				1		2			1	2	2	4"	16	53.2
4"	3	2	1		2				2		2			1	2	2	4"	17	56.9
4"	3	2	2		2				2		2			1	2	2	4"	18	60.5
4"	3	2	2		2		1		2		2			1	2	2	4"	19	63.6
4"	3	2	2		2		2		2		2			1	2	2	4"	20	67.2
4"	3	2	2		2		2		2		2		1	1	2	2	4"	21	70.3
4"	3	2	2		2		2		2		2		2	1	2	2	4"	22	74.0
4"	3	2	2		2		2		2		2		2	1	2	3	4"	23	77.5
4"	3	2	2		2		2		2		2		2	2	2	3	4"	24	81.1
4"	3	3	2		2		2		2		2		2	2	2	3	4"	25	84.6
4"	3	3	2		2		2	1	2		2		2	2	2	3	4"	26	87.7
4"	3	3	2		2		2	2	2		2		2	2	2	3	4"	27	91.4
4"	4	3	2		2		2	2	2		2		2	2	2	3	4"	28	94.9
4"	4	3	2		2		2	2	2		2		2	2	3	3	4"	29	98.4
4"	4	3	2		2		2	2	2		2		2	2	3	4	4"	30	102
4"	4	3	3		2		2	2	2		2		2	2	3	4	4"	31	105
4"	4	3	3	1	2		2	2	2		2		2	2	3	4	4"	32	109
4"	4	3	3	2	2		2	2	2		2		2	2	3	4	4"	33	112
4"	4	3	3	2	2		2	2	2		2	1	2	2	3	4	4"	34	115
4"	4	3	3	2	2		2	2	2		2	2	2	2	3	4	4"	35	119
4"	4	3	3	2	2	1	2	2	2		2	2	2	2	3	4	4"	36	122
4"	4	3	3	2	2	2	2	2	2		2	2	2	2	3	4	4"	37	126
4"	4	3	3	2	2	2	2	2	2	1	2	2	2	2	3	4	4"	38	129
4"	4	3	3	2	2	2	2	2	2	2	2	2	2	2	3	4	4"	39	132
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	2	3	4	4"	40	136
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	3	3	4	4"	41	139
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	3	4	4	4"	42	143
4"	4	4	3	3	2	2	2	2	2	2	2	2	2	3	4	4	4"	43	146
4"	4	4	3	3	2	2	2	2	2	2	3	2	2	3	4	4	4"	44	150
4"	4	4	3	3	2	2	2	2	2	2	3	2	3	3	4	4	4"	45	153

Table BON-7 (cont). Spill patterns for Bonneville Dam.

Bay Number																		Total Dogs	kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
4"	4	4	3	3	2	3	2	2	2	2	3	2	3	3	4	4	4"	46	157
4"	4	4	3	3	2	3	2	2	3	2	3	2	3	3	4	4	4"	47	160
4"	4	4	3	3	2	3	2	3	3	2	3	2	3	3	4	4	4"	48	164
4"	5	4	3	3	2	3	2	3	3	2	3	2	3	3	4	4	4"	49	167
4"	5	4	3	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	50	171
4"	5	4	4	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	51	174
4"	5	5	4	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	52	178
4"	5	5	4	3	2	3	2	3	3	2	3	2	3	3	5	5	4"	53	181
4"	5	5	4	3	2	3	2	3	3	3	3	2	3	3	5	5	4"	54	185
4"	5	5	4	3	2	3	3	3	3	3	3	2	3	3	5	5	4"	55	188
4"	5	5	4	3	2	3	3	3	3	3	3	2	3	4	5	5	4"	56	192
4"	5	5	4	4	2	3	3	3	3	3	3	2	3	4	5	5	4"	57	195
4"	5	5	4	4	2	3	3	3	3	3	3	2	3	4	5	5	4"	57	195
4"	5	5	5	4	3	3	3	3	3	3	3	2	3	4	5	5	4"	59	202
4"	5	5	5	4	3	3	3	3	3	3	3	3	3	4	5	5	4"	60	206
4"	5	5	5	4	3	4	3	3	3	3	3	3	3	4	5	5	4"	61	209
4"	5	5	5	4	3	4	3	3	3	3	4	3	3	4	5	5	4"	62	213
4"	5	5	5	4	4	4	3	3	3	3	4	3	3	4	5	5	4"	63	216
4"	5	5	5	4	4	4	3	4	3	3	4	3	3	4	5	5	4"	64	220
4"	5	5	5	4	4	4	3	4	3	3	4	3	4	4	5	5	4"	65	223
4"	5	5	5	4	4	4	3	4	4	3	4	3	4	4	5	5	4"	66	227
4"	5	5	5	4	4	4	3	4	4	3	4	3	4	5	5	5	4"	67	230
4"	5	5	5	4	4	4	3	4	4	4	4	3	4	5	5	5	4"	68	234
4"	5	5	5	4	4	4	3	4	4	4	4	4	4	5	5	5	4"	69	237
4"	5	5	5	5	4	4	3	4	4	4	4	4	4	5	5	5	4"	70	241
4"	5	5	6	5	4	4	3	4	4	4	4	4	4	5	5	5	4"	71	244
4"	5	5	6	5	4	4	4	4	4	4	4	4	4	5	5	5	4"	72	248
4"	5	5	6	5	4	4	4	4	4	4	4	4	4	6	5	5	4"	73	251
4"	5	5	6	5	4	5	4	4	4	4	4	4	4	6	5	5	4"	74	255
4"	5	5	6	5	4	5	4	4	4	4	4	4	5	6	5	5	4"	75	258
4"	5	5	6	5	4	5	4	4	4	4	5	4	5	6	5	5	4"	76	262
4"	5	5	6	5	5	5	4	4	4	4	5	4	5	6	5	5	4"	77	265
4"	5	5	6	6	5	5	4	4	4	4	5	4	5	6	5	5	4"	78	268
4"	5	5	6	6	5	5	4	5	4	4	5	4	5	6	5	5	4"	79	272
4"	5	5	6	6	5	5	4	5	4	5	5	4	5	6	5	5	4"	80	275
4"	5	5	6	6	5	5	4	5	5	5	5	4	5	6	5	5	4"	81	279
4"	5	5	6	6	5	5	4	5	5	5	5	5	5	6	5	5	4"	82	282
4"	5	5	6	6	5	5	5	5	5	5	5	5	5	6	5	5	4"	83	286
4"	5	5	6	6	5	6	5	5	5	5	5	5	5	6	5	5	4"	84	289
4"	5	5	6	6	5	6	5	5	5	5	5	5	6	6	5	5	4"	85	292
4"	5	5	6	6	5	6	5	5	5	5	6	5	6	6	5	5	4"	86	296
4"	5	5	6	6	6	6	5	5	5	5	6	5	6	6	5	5	4"	87	299
4"	5	5	6	6	6	6	5	6	5	5	6	5	6	6	5	5	4"	88	302
4"	5	5	6	6	6	6	5	6	6	5	6	5	6	6	5	5	4"	89	306
4"	5	5	6	6	6	6	5	6	6	6	6	5	6	6	5	5	4"	90	309

Table BON-7 (cont). Spill patterns for Bonneville Dam.

Bay Number																		Total Dogs	kcfs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
4"	5	5	6	6	6	6	5	6	6	6	6	6	6	6	5	5	4"	91	312
4"	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4"	92	316
4"	5	5	6	6	6	7	6	6	6	6	6	6	6	6	5	5	4"	93	319
4"	5	5	6	6	6	7	6	6	6	6	6	6	7	6	5	5	4"	94	323
4"	5	5	6	6	6	7	6	6	6	6	7	6	7	6	5	5	4"	95	326
4"	5	5	6	6	7	7	6	6	6	6	7	6	7	6	5	5	4"	96	330
4"	5	5	6	6	7	7	6	7	6	6	7	6	7	6	5	5	4"	97	333