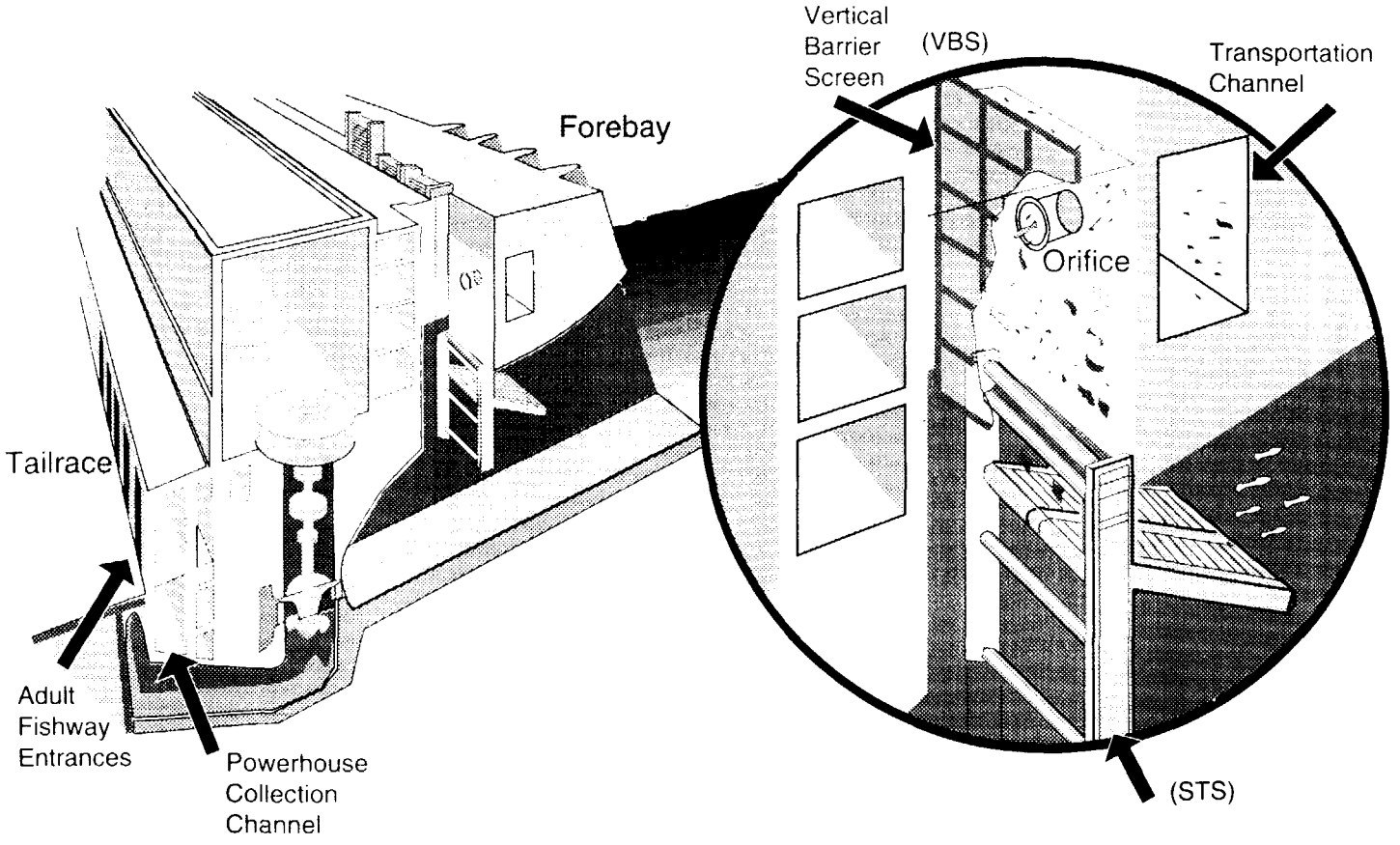
US Army Corps
of Engineers
North Pacific Division

Fish Passage Plan for 1991
Corps of Engineers Projects



CENPD-PE-WM
March 1991

CENPD-PE-WM (1165-2-26a) 10 April 1991

MEMORANDUM FOR See Distribution

SUBJECT: 1991 Fish Passage Plan

1. Enclosed for your information is the Corps' 1991 Fish Passage Plan (FPP), prepared under our project operating authorities to provide acceptable passage conditions for juvenile and adult migratory fish. The fish facilities criteria in the 1991 FPP have been developed jointly among the Corps, fishery agencies, Indian tribes, and BPA. The FPP describes the manner in which Corps projects will operate this year to provide for fish passage.

2. The FPP also contains provisions to implement in 1991, where practicable, those portions of the Northwest Power Planning Council's Fish and Wildlife Program amendments related to project spill operations. The 1991 FPP provisions are consistent with the Corps' decision to continue implementing project spill portions of the Council's amendments this year.

3. Contact Russell George (extension 3745) or Rudd Turner (extension 3744) of the Reservoir Control Center if you have questions or desire more information.

Encl

NICHOLAS A. DODGE, P.E.
Chief, Water Management Division

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FISH PASSAGE PLAN

FOR 1991

FOR CORPS OF ENGINEERS PROJECTS

U.S. ARMY CORPS OF ENGINEERS

NORTH PACIFIC DIVISION

PORTLAND, OREGON

CENPD-PE-WM
MARCH 1991

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PREFACE

The 1991 Corps project operating criteria (Appendix A of this Fish Passage Plan) have been developed jointly between the Corps of Engineers and regional fisheries agencies, Indian tribes, and BPA through the Fish Facilities O&M Subcommittee of the Fish Passage Development and Evaluation Program Technical Coordinating Committee. During this process, many differences between Corps operating criteria and agency recommendations for fish passage were resolved. Unresolved differences have been noted in this year's criteria, and will be addressed further in future Fish Passage Plans.

This coordination effort has resulted in significant progress toward a joint Corps/CBFWA guidance document for Corps mainstem projects on operation for anadromous fish passage, which is the goal of the effort.

Comments on the 1991 Fish Passage Plan are encouraged; they may be directed either to the Subcommittee or the Corps' North Pacific Division Reservoir Control Center (CENPD-PE-WM) in Portland, Oregon.

1991 FISH PASSAGE PLAN

1. General. In developing the 1991 Fish Passage Plan (FPP), the Corps has taken the Northwest Power Planning Council's (NPPC) 1989 action, which was to incorporate the spill terms of the Regional Spill Agreement into their Fish and Wildlife Program, into consideration to the fullest extent practicable. Spill will be provided at Lower Monumental, Ice Harbor, John Day and The Dalles Dams in accordance with the modified amendment (Appendix C) for both spring and summer migrations if such spill does not have nonpower impacts, and BPA agrees to the power loss. Spill operations will begin when the first 10 percent of that migration have passed the dam and will cease when 90 percent of that migration has passed but no later than July 22, 1991 at Lower Monumental and Ice Harbor or later than August 22, 1991 at John Day and The Dalles. At Bonneville Dam the operation plan remains basically unchanged from the Corps' 1990 Fish Passage Plan; details of the plan and research are shown in Section 5a.

The 1991 FPP will guide the Corps' actions in regard to providing fish protection at the Corps' eight mainstem Columbia and Snake River projects. Other Corps documents and agreements related to fish passage at these projects are intended to be in accord with the FPP.

2. Corps Project Operation and Maintenance. Appendix A contains detailed information on the criteria used for the operation and maintenance of fish passage facilities and project operation procedures for fish passage at the Corps projects on the lower Snake and lower Columbia Rivers. These criteria have been developed through consultation with the fish and wildlife agencies and tribes. The Corps has attempted to resolve concerns expressed by the fishery agencies and tribes but some areas of disagreement still exist. These have been noted where they occur in the Appendix A criteria.

3. **Fish Transportation Oversight Team's (FTOT) Annual Work Plan For 1991**. This document describes the annual work plan for juvenile fish collection and transportation operations at Lower Granite, Little Goose, and McNary Dams for the 1991 season. It is included at the end of Appendix A. The 1991 FTOT Plan has been developed jointly with the fish and wildlife agencies and tribes. The Corps believes that the best available scientific information supports maximum transportation of all juvenile fish. The Corps cannot agree to be a signatory to anything less, but will not actively oppose in 1991 the transportation of juvenile fish in accordance with the appended FTOT annual work plan.

4. **Fish Hatchery Release Schedule**. This schedule is provided by the fish and wildlife agencies and tribes, in their weekly Fish Passage Center report. Hatchery releases should be coordinated to coincide, insofar as possible, with Water Budget operation and the natural juvenile fish migration.

5. **Project Operation Criteria**. The following paragraphs list, by project, the project specific operating criteria of the 1991 FPP.

a. **Bonneville Dam**.

The first and second powerhouses at Bonneville both have structural powerhouse juvenile fish bypass systems. Presently juvenile guidance efficiency at the second powerhouse is not satisfactory. Therefore, the units will not be operated at the second powerhouse during the middle 80 percent spring and summer migration period unless units are needed to limit spill to 75,000 cfs during daylight hours (0600 to 2000 hours). Typically, when flows are above the capacity of the first powerhouse units, spill will occur. Units in the second powerhouse may be operated as necessary for fishery research. This restriction on the second powerhouse operations will not apply during periods when the units are being operated for research or after 0600 hours August 16.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities from March 15 through November 15 in accordance with project operating criteria contained in Appendix A.

- No restriction on operation of screened units at the first powerhouse.

- The second powerhouse will not be operated during the nighttime hours (2000 to 0600 hours) except as necessary for fishery research.

- The second powerhouse will be operated during the daytime hours (0600 to 2000 hours) if required to limit spill to less than 75,000 cfs. Unit operating priorities listed in Appendix A will be implemented.

(2) **Research**

- Research activities at the Bonneville second powerhouse will require shutdown of all but units 11 and 12 during late March to late May for approximately four days per week, lasting four hours daily (1000 - 1400 hours).

- FGE and vertical distribution tests will be conducted at the first powerhouse during late April to late May. Units 3, 5, and 8 will be operated on and off nightly for about three hours (2000-2300 hours). Researchers have requested that 1-2 of these units be placed out of service during the four week test period.

- There are no tests planned at Bonneville during the summer of 1991.

(3) Operation for Adult Passage.

- Operate the project throughout the year in accordance with project operating criteria as specified in Appendix A.

b. The Dalles Dam.

Approximately 3,600 to 4,000 cfs flow will be routed through the ice and trash sluiceway during the juvenile passage season in accordance with Appendix A.

(1) Operation for Juvenile Passage.

- Operate juvenile fish passage facilities from April 1 through November 15 in accordance with project operation criteria contained in Appendix A.

- Spill may be requested by the Fish Passage Center (FPC) in accordance with spill criteria of Section III B2 through B13 of the NPPC spill amendment modified for nonpower use (Appendix C). The Corps will implement the spill request if criteria in FPP Section 6.b.2.(b) are met.

(2) Operation for Adult Passage.

- Operate the project throughout the year in accordance with project operating criteria as specified in Appendix A.

c. John Day Dam.

All 16 units are screened and the project has bypass facilities.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities from April 1 through October 31 in accordance with operating criteria in Appendix A.

- Spill is not required for spring passage of juvenile fish as the passage facility provides juvenile survival greater than 94%.

- Spill may be requested by the FPC during the summer passage period in accordance with spill criteria of Section III, B2 through B13 of the spill amendment modified for nonpower uses (Appendix C). The Corps will implement the spill request if criteria in FPP Section 6.b.2(b) are met.

- When spilling at night (2000 to 0600 hours), spill in south end bays up to 80,000 cfs, then spill the next 20,000 cfs in north end bays. Spill in excess of 100,000 cfs should be split 80 percent in the south bays and 20 percent in the north bays.

(2) **Operation for Adult Passage**.

- Operate the project throughout the year in accordance with operating criteria specified in Appendix A.

- From 0400 to 2000 hours, March 1 through November 30, operate unit 1 in the 90 to 110 MW range to provide best ladder entrance condition for adult fish passage, unless additional generation is needed to meet firm load.

d. **McNary Dam**.

All generation units at McNary are screened. The project has facilities to separate juveniles by size, then bypass them either directly to the tailrace or to holding ponds for transport by barge or truck to below Bonneville Dam.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities, from April 1 through October 31, in accordance with operating criteria and FTOT Annual Work Plan shown at the end of Appendix A.

(2) **Operation for Adult Passage**.

- Operate project facilities throughout the year in accordance with operating criteria shown in Appendix A.

- Operate units 1 and 2 during daylight hours from March 1 through December 31 for adult attraction except as noted in the fish facility O&M criteria in Appendix A.

(3) **Research**.

- Tests of experimental screens for the juvenile bypass facility will be conducted during early April through May and late June through July. This will require outage of units 5 and 6 during the test periods (except for about 2-8 hours nightly, for approximately 30 nights in spring and 30 nights in summer, to conduct tests).

e. **Ice Harbor Dam**.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities from April 1 through August 31 in accordance with project operation criteria contained in Appendix A. Approximately 2,700 cfs will be routed through the ice and trash sluiceway for 24 hours per day during the juvenile passage season.

- Spill may be requested by the FPC in accordance with spill criteria of Section III, B2 through B13 of the spill amendment modified for nonpower uses (Appendix C). The Corps will implement the spill request if criteria in FPP Section 6.b.2.(b) are met.

(2) Operation for Adult Passage.

- Operate project facilities throughout the year in accordance with operating criteria shown in Appendix A.

f. Lower Monumental Dam.

Lower Monumental has only a gatewell salvage bypass system. New juvenile bypass facilities will be under construction in 1991.

(1) Operation for Juvenile Passage.

- Operate juvenile fish passage facilities from April 1 through end of bypass season in accordance with project operation criteria contained in Appendix A.

- Spill may be requested by the FPC in accordance with spill criteria of Section III, B2 through B13 of the spill amendment modified for nonpower uses (Appendix C). The Corps will implement the spill request if criteria in FPP Section 6.b.2.(b) are met.

g. Little Goose Dam.

All generation units at Little Goose are screened. The project has facilities to separate juveniles by size, then bypass them either directly to the tailrace or to holding ponds for transport by barge or truck to below Bonneville Dam.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities from April 1 through August 31 in accordance with operating criteria and FTOT Annual Work Plan shown at the end of Appendix A.

(2) **Operation for Adult Passage**.

- Operate project facilities throughout the year in accordance with operating criteria shown in Appendix A.

- Operate unit 1 for adult attraction during daylight hours from March 1 through November 30, or until it is shut down for turbine blade repair.

h. **Lower Granite Dam**.

All generation units at Lower Granite are screened. The project has facilities to bypass either directly to the tailrace or to holding ponds for transport by barge or truck to below Bonneville Dam.

(1) **Operation for Juvenile Passage**.

- Operate juvenile fish passage facilities from April 1 through August 31 in accordance with operating criteria and FTOT Annual Work Plan shown at the end of Appendix A.

(2) **Operation for Adult Passage**.

- Operate project facilities throughout the year in accordance with operating criteria shown in Appendix A.

6. **Implementation of the Fish Passage Plan.**

Implementation of the 1991 Fish Passage Plan (FPP) will require that the Corps coordinate with Bonneville Power Administration (BPA), Indian tribes, and the Federal and state fishery agencies. The Fish Passage Manager will be point of contact for the fishery agencies and tribes. The Corps, North Pacific Division Reservoir Control Center (RCC) will provide coordination for the project operators as required to determine the operation of Corps projects where those operations would effect water management, spill, unit availability, or other project uses. District biologists may coordinate directly with the fishery agencies and tribes on other project-specific operations that do not have system impacts.

RCC daily briefings are held at 1330 hours, Monday through Friday, in the U.S. Custom House. Immediately following these briefings, RCC representatives will be available to meet with the Fish Passage Manager to discuss the latest weather and runoff forecasts, as well as fish, hydrologic, and power information to assist in the planning of operations for fish passage for the next few days. Fishery operations or requests by the Fish Passage Manager can then be evaluated in the next days' forecast runs for overall system operational planning.

a. **Responsibilities of Parties.**

1. **U.S. Army Corps of Engineers.**

(a) Provide timely formulation of runoff volume forecasts in January, February, March, April, May, and June to enable the fishery agencies, tribes, and those in energy production and marketing as much lead time as possible to prepare for operations relative to the impending fish migration.

(b) Provide the FPC with planned reservoir operations to achieve fishery spill requirements during the period of juvenile migration.

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

(d) Discuss project operations with regard to releases and/or transport of hatchery stocks with the Fish Passage Manager.

(e) Discuss project operations with the power and fishery entities to assure that operating flexibility is made available for both fish passage and energy production.

(f) 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 the Fish Passage Manager.

(g) In the event that specific spill requests by the Fish Passage Manager are not implemented or are modified, provide a written explanation.

(h) Carry out routine and emergency fish passage operations and maintenance procedures in accordance with criteria in Appendix A.

(i) Conduct the Dissolved Gas Monitoring Program as described in Appendix B.

2. **Fishery agencies and Indian tribes**.

(a) Request spill in accordance with 1989 amendments to the NPPC Fish and Wildlife Program.

(b) Provide RCC with spill priority list and update as needed.

(c) Provide monitoring and surveillance throughout the migration period at predetermined locations such as Smolt Monitoring Program sample sites.

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

(e) Where biologically feasible, coordinate hatchery releases to ensure they are protected by regulated fishery flows and spills. Provide and update hatchery release schedules in a timely manner.

(f) Provide appraisal to the operating agencies of the amount of flexibility available in fisheries operations while maintaining acceptable conditions for migrants. This information can be used to maximize other project uses, including power generation.

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

(h) Assure that all viable methods and procedures to reduce mortality to migrants are utilized. In addition to spilling water this would include such operations as collection and transportation of migrants, use of ice and trash sluiceways, and others.

(i) Through the Fish Passage Manager, coordinate fisheries input to Corps water management decisions.

3. **Bonneville Power Administration**.

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

(b) Provide the RCC and Fish Passage Manager their estimate of water available for involuntary spill.

(c) Provide the RCC and Fish Passage Manager their estimate of power market impacts of requested spill operation.

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

(e) Adjust system generation to provide adequate water to meet fishery operations requirements in accordance with spill amendment Section III, Para B2 - B13 as modified to provide nonpower uses (Appendix C).

(f) Implementation of spill priorities on a real-time hourly basis.

4. **Mid-Columbia Public Utility Districts**.

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

b. **Coordination Procedures.**

1. **Annual coordination for the FPP**.

Annual revisions to the FPP will be coordinated through the FPDEP-TCC Fish Facilities O&M Subcommittee. Suggested revisions will be submitted to the Subcommittee by December 1 of each year for the next year's FPP. Draft FPP sections will be provided to the Corps Portland and Walla Walla Districts by February 1 of the publication year. The final document will be published by March 15. The FPP will be effective for a one year period, April 1 - March 31.

2. Day to day coordination of river system.

(a) **Water Budget requests.**

Procedures agreed upon in the Corps' 1991 Water Budget Coordinated Plan of Operation (CPO) will be followed in making and implementing Water Budget requests. These include requirements and schedules for coordination meetings, in-season briefings, water use accounting, providing information, and making and implementing requests. In summary, the Fish Passage Manager is responsible for fishery coordination and requests. Requests will be implemented if they conform to the CPO and do not conflict with other non-power requirements. This determination will be made by RCC.

If a Water Budget request is not implementable and modifications are made, these will be documented and an explanation provided to the Fish Passage Manager and the Northwest Power Planning Council fish passage advisor.

(b) **Spill Amendment requests.**

The 1991 FPP fully considers the Northwest Power Planning Council's 1989 action to incorporate the project spill terms of the interagency spill Memorandum of Agreement into their Fish & Wildlife Program. In 1991, CoE will continue to implement the spill amendments' project spill provisions to the fullest extent practicable. In this regard, procedures specified in Section III, paragraphs B2 through B13, of the spill agreement (Appendix C) will be followed by the Fish Passage Manager and RCC in submitting and implementing fish spill requests. The Fish Passage Manager will submit daily spill requests, including reiterations of existing requests if there are no changes in project spill. Requests are to be submitted by the deadlines specified in Appendix C, which require specific lead times for requests prior to implementation.

RCC will coordinate with BPA daily on each project spill request, and will implement a request if the following conditions are met:

1. BPA agrees to the power loss.

2. The request is consistent with dates, hours, and percentage criteria in Appendix C.

3. Spill does not cause adverse nonpower or safety impacts.

(c) Special operations requests (fishery requests and Corps O&M activities).

Requests for special operations for fish needs outside Water Budget and fish spill requests will be received from the Fish Passage Manager for consideration by RCC. Prior coordination of these requests with RCC is strongly encouraged. RCC will consider degree of fisheries need along with extent of impacts on power and nonpower project uses, and project O&M requirements, in making its implementation decision. Modifications to requests will be coordinated with the Fish Passage Manager prior to implementation.

Corps project requests related to O&M activities will be evaluated for impacts on fish migration, including coordination with the Fish Passage Manager. Sufficient lead time will be given on a planned operation whenever practicable, to allow ample consideration of fishery impacts in RCC's decision. As much lead time as possible will be provided for emergency actions.

(d) Other operational requests.

As with Corps O&M requests, all operational requests will be evaluated for impacts on fish migration, including coordination with the Fish Passage Manager. Except for emergency actions, adequate time will be allowed for evaluation of all project impacts, including fisheries, prior to implementation.

APPENDIX A

OPERATION AND MAINTENANCE CRITERIA

FOR FISH PASSAGE FACILITIES

AT CORPS OF ENGINEERS PROJECTS

(INCLUDING FTOT 1991 ANNUAL WORK PLAN)

Bonneville Dam

I. BONNEVILLE DAM

A. Fish Passage Information. The locations of fish passage facilities are shown on the following general site plan for Bonneville Lock and Dam (Figure 1).

1. Juvenile Fish Passage

a. Facilities Description

(1) First Powerhouse.

(a) Facilities Description. Juvenile fish passage facilities at the Bonneville first powerhouse consist of STSs, VBSs, 12" gatewell orifices, fish bypass channel, excess water elimination facility, fish sampler, and a 24" fish transport pipe to the tailrace. All 10 turbine units have STSs.

(2) Second Powerhouse.

(a) Facilities Description. Juvenile facilities at the Bonneville second powerhouse comprise STSs, VBSs, 2-12" orifices per gatewell (with only one operating per gatewell) flowing into a fish bypass channel, an excess water elimination facility, and a 36" 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. Two smaller turbines that supply adult fishway auxiliary water do not have STSs.

b. Juvenile Migration Timing. Maintenance of juvenile fish facilities is scheduled for the period of approximately December 1 through February 28 to reduce the impact on downstream migrants until additional juvenile passage data are obtained. The period required for facility operation will be reviewed based on actual sampling data of fish passing the project.

Bonneville Lock and Dam

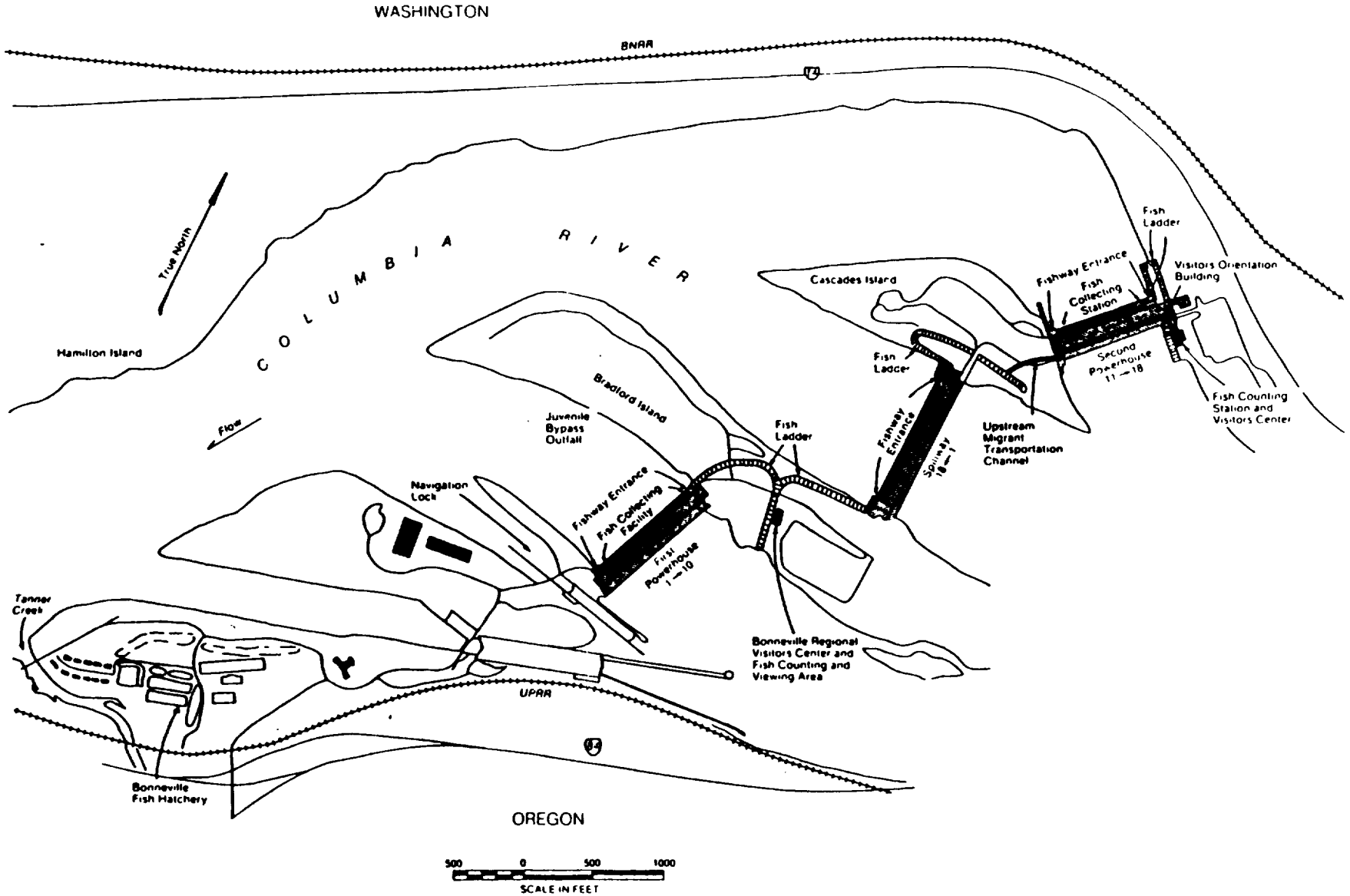

Table 1. Juvenile Migration Timing at Bonneville Dam.

% PAST PROJECT	1986[a]	1987[b]	1988[c]	1989[c]	1990[c]
Yrlg. Chinook					
10%	4/16	4/18	4/19	4/21	4/16
90%	5/29	5/20	5/21	5/21	5/22
Subyrlg. Chinook [d]					
10%	no	no	6/9	6/6	6/7
90%	data	data	7/28	7/29	7/12
Steelhead					
10%	4/24	4/26	4/26	4/22	5/1
90%	6/4	5/27	6/2	5/29	6/4
Coho					
10%	4/3	5/1	5/6	4/21	4/23
90%	6/5	5/27	6/3	5/29	6/9
Sockeye					
10%	5/14	5/11	5/14	5/10	5/8
90%	6/6	6/4	6/2	6/4	6/5

[a] Measured at the second powerhouse bypass trap.

[b] Measured at the first powerhouse by gate-well dipping.

[c] Measured at the first powerhouse bypass trap.

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

2. Adult Fish Passage

a. 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 second powerhouse collection system/ladder and the Cascades Island 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.

b. Adult Migration Timing. Upstream migrants are present at the project year around.

Adult migration count data for Bonneville Dam have been collected since 1938. Table 2 summarizes adult timing through 1990. Primary passage period and the earliest and latest peak of migration recorded are listed for each species, from fish counts compiled by the Corps.

Table 2. Adult Migration Timing from Fish Counts 1938-1990

Species	Passage Period	Earliest Peak	Latest Peak
Spring Chinook	3/14 - 5/31	4/15	5/27
Summer Chinook	6/1 - 7/31	6/5	8/15
Fall Chinook	8/1 - 11/15	9/1	9/17
Steelhead	3/15 - 11/15	7/16	9/12
Coho	7/ - 11/15	8/29	9/18
Sockeye	5/ - 8/	6/22	7/13

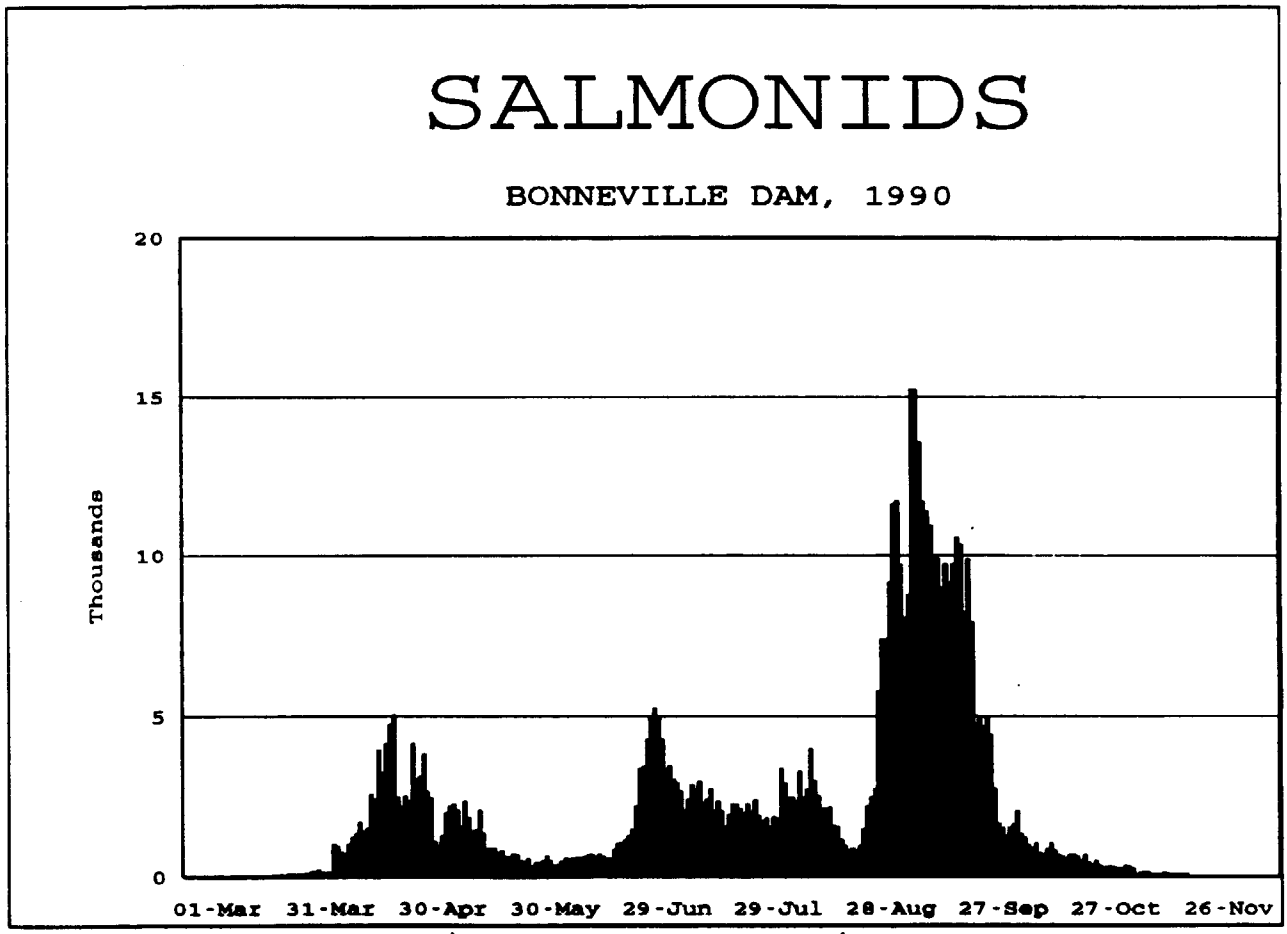

Figure 2. Adult Salmonid Passage at Bonneville Dam.

B. Project Operation

1. Spill Management.

a. Juvenile fish.

(1) Special powerhouse and spill operations will be requested during spring and summer juvenile out migration seasons until the FGE and bypass problems are corrected at the second powerhouse. Spill has not been designated at the outset other than the daytime limits mentioned below to minimize adult fallback. Special operations will end no later than August 15.

(2) Due to poor FGE at the second powerhouse, this powerhouse **will not operate** from the 10th to the 90th percentile of the spring and summer migration except as needed to: 1) conduct approved research, 2) avoid excess daytime spill, 3) be in compliance with other coordinated fishery protective measures, or 4) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements.

These criteria are under review and will likely be changed for 1992. It may be easier to base second powerhouse restriction timing on previous years passage timing (suggested 1 April through 15 August) rather than to predict current year timing.

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(3) The second powerhouse ice and trash sluiceway will be operated only for ice and trash removal and for emergency auxiliary adult transportation channel water supply as outlined under Operating Standards for Adult Passage Facilities.

b. Adult Fish

(1) When spill occurs during the daytime hours (0600-2000 PST), it shall be shaped in accordance with the criteria shown in the following spill schedule (Table III).

(2) Spill requests by CBFWA will be based upon their objective of obtaining 100 percent passage efficiency and avoidance of delays at this project.

(3) During the adult fish passage, daytime spill (0600-2000 PST) will be limited to 75 kcfs whenever possible.

Table 3. Spill Schedule for Flows at Bonneville Dam.

(Gate Opening in Dogs)*

Gate Number																		Total KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Dogs **
4"	1															(1)	4"	
4"	1	1													(1)	1	4"	
4"	1	1	1											(1)	1	1	4"	
4"	1	1	1	1									(1)	1	1	1	4"	
4"	1	2	1	1									1	1	(2)	1	4"	10 35.3
4"	1	2	1	1	1							(1)	1	1	2	1	4"	
4"	1	2	1	1	1	1					(1)	1	1	1	2	1	4"	
4"	1	2	1	1	1	1	1			(1)	1	1	1	1	2	1	4"	
4"	1	2	1	1	1	1	1	1		1	(2)	1	1	1	2	1	4"	
4"	2	2	1	1	1	1	1	1		1	2	1	1	1	2	(2)	4"	20 68.6
4"	2	2	1	1	1	1	(2)	1	1	1	2	1	1	1	2	2	4"	
4"	2	2	1	1	1	1	2	2	(2)	1	2	1	1	1	2	2	4"	
4"	2	2	1	1	1	1	2	3	(3)	1	2	1	1	1	2	2	4"	
4"	2	2	1	1	2	1	2	3	3	1	2	1	1	1	2	(3)	4"	
4"	2	2	1	1	2	1	2	4	(4)	1	2	1	1	1	2	3	4"	30 100.8
4"	2	3	1	1	2	1	2	(5)	4	1	2	1	1	1	2	3	4"	
4"	2	3	1	1	2	1	3	5	(5)	1	2	1	1	1	2	3	4"	
4"	2	3	1	1	2	1	3	(6)	5	1	2	1	1	1	3	3	4"	
4"	2	3	1	1	2	1	3	6	6	1	2	1	1	1	3	(4)	4"	
4"	2	3	1	1	2	1	3	6	(7)	1	2	1	1	1	3	4	4"	40 139.7
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4"	3	4	2	2	3	3	4	7	(8)	3	2	1	2	1	3	4	4"	
4"	3	4	3	2	3	3	4	7	8	3	(3)	1	2	1	3	4	4"	
4"	3	4	3	3	3	3	4	7	8	3	3	(2)	2	1	3	4	4"	
4"	3	4	3	4	3	3	4	7	8	3	3	2	2	(2)	3	4	4"	
4"	3	4	3	4	3	4	4	7	(9)	3	3	2	2	2	3	4	4"	60 211.5

* ( ) values may be one dog less than value shown. For example: (1) means 0 or 1 dog. (2) means 1 or 2 dogs, etc.

** KCFS approximate values were calculated using a forebay elevation of 76.0 feet.

Table 4. Spill Schedule for Flows at Bonneville Dam (continued).

(Gate Opening in Dogs)*

Gate Number																		Total KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Dogs **
4"	3	4	3	4	4	4	4	7	9	(4)	3	2	2	2	3	4	4"	
4"	3	4	4	4	4	4	4	7	(10)	4	3	2	2	2	3	4	4"	
4"	3	4	4	4	4	4	4	8	10	4	(4)	2	2	2	3	4	4"	
4"	3	4	4	4	4	4	4	8	10	5	4	2	(3)	2	3	4	4"	
4"	3	4	4	4	4	4	4	9	10	(6)	4	2	3	2	3	4	4"	70 246.5
4"	3	4	4	4	4	4	5	9	10	6	4	(3)	3	2	3	4	4"	
4"	3	4	4	4	4	4	5	10	10	6	4	3	3	(3)	3	4	4"	
4"	3	4	4	4	4	4	6	10	11	6	4	3	3	3	3	4	4"	
4"	4	4	4	4	4	4	6	10	11	(7)	4	3	3	3	3	4	4"	
4"	4	4	4	4	4	4	6	11	(12)	7	4	3	3	3	3	4	4"	80 281.0
4"	4	4	4	4	4	5	6	11	12	7	(5)	3	3	3	3	4	4"	
4"	4	5	4	4	4	5	6	11	12	(8)	5	3	3	3	3	4	4"	
4"	4	5	4	5	4	5	6	11	12	8	5	(4)	3	3	3	4	4"	
4"	4	5	4	5	4	5	6	12	12	8	5	4	3	3	(4)	4	4"	
4"	4	5	4	5	4	5	7	12	12	8	5	4	3	(4)	4	4	4"	90 316.1
4"	4	5	4	5	5	5	7	12	12	8	5	4	(4)	4	4	4	4"	
4"	4	5	5	5	5	5	7	12	12	8	5	4	4	4	4	(5)	4"	
4"	5	5	5	5	5	5	8	12	12	8	(6)	4	4	4	4	5	4"	
4"	4	5	5	5	5	5	8	12	12	8	6	5	(5)	4	4	5	4"	
4"	4	5	5	5	5	6	8	12	12	8	6	5	5	4	(5)	5	4"	100 351.2

* ( ) values may be one dog less than value shown. For example: (1) means 0 or 1 dog. (2) means 1 or 2 dogs, etc.

** KCFS approximate values were calculated using a forebay elevation of 76.0 feet.

2. Dissolved Gas Management and Control. Spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring during 1991 will be from a station located about six miles below Bonneville Dam (Warrendale). Dissolved gas data will be reported every four hours from the first week of March through September 30. Related data for Bonneville Dam reported at the same time will be spill volume and total project flow.

3. Juvenile Fish Passage Facilities

a. First Powerhouse

(1) Operating Criteria

(a) Prior to the Juvenile Fish Passage Season:

i) Remove debris from forebay, trashracks and gatewell slots.

ii) Inspect VBSs for damage, holes, debris accumulations and protrusions (video inspection acceptable). Clean and repair as necessary.

iii) Inspect each STS and operate on trial run (dogged off at deck level). Install STS in each slot of operational units by the end of the last work day in the work week closest to March 1.

iv) Operate STSs at 55° angle from vertical.

v) Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems.

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

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

viii) Inspect and where necessary repair or install avian predator control lines.

(b) Juvenile Fish Passage Season. The passage season begins on the last work day of the work week closest to March 1 and goes to the start of the first work day of the work week closest to November 30:

i) Remove debris from forebay and trashracks as required to maintain less than 1.5 feet of total drawdown in gatewell, as indicated by fish condition (e.g., higher than expected descaling), or as determined by the Project Biologist. STSs in units being raked should be run in continuous mode during raking operation. Gatewell orifices of the unit being raked must be closed during the procedure.

ii) Inspect each STS and each VBS a minimum of once every three months (video acceptable), less frequent inspections may be allowed by the Project Biologist on STSs which have operated very little since their last inspection. Preferably, inspections will occur immediately prior to peaks in juvenile fish migrations, which begin about May 1, mid-July and September 1. Inspections should be concentrated on the priority units and those others with the longer operating time. More frequent inspections may be required by the Project Biologist or under the following conditions: 1) deterioration of fish condition; 2) increased debris load in bypass system; and 3) other indications of STS or VBS malfunctions or failure.

CBFWA recommends that STS and VBS inspections be conducted once per month.

If STS or VBS damage or plugging is detected, follow procedures in Fish Facilities Maintenance Plan. Records of inspections or summary of such records will be made available to the FPC by January 1.

iii) 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.

iv) In the DSM downwell area:

a) Maintain between 0.9 and 1.3 feet of depth, 1 foot preferred, over the end of the DSM inclined dewatering screen.

b) Maintain differential between forebay and dewatering screen between 5.3 and 5.7 feet.

c) Maintain drop from dewatering screen to water surface in down-well between 3.0 and 4.5 feet.

d) Operate dewatering screen trash sweep 1 revolution at 20 minute intervals. The interval between operations may be doubled when the amount of debris passing is light.

v) Inspect each STS amp gauge readings at least once each shift and record readings once per day. If an STS failure occurs, then follow procedures in Fish Facilities Maintenance Plan.

vi) Inspect all STS gatewells daily. The project will make an effort to clean before gatewell water surface becomes one-half covered with debris. However, the project will begin cleaning the gatewells before they become fully covered unless the gatewell becomes fully covered overnight or on a weekend, at which time cleaning will begin the next work day. Turbines with a gatewell fully covered with debris will be operated on a last on/first off basis to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; 3) Avoid excess daytime spill (greater than 75 kcfs); or 4) provide station service power. The first powerhouse gatewell orifices should be closed during the debarking operation. After debarking a gatewell, back-flush the orifice in that gatewell. Check gatewell drawdown.

CBFWA recommends the gatewells be cleaned before they become half covered by debris.

vii) Coordinate gatewell cleaning efforts with personnel operating downstream migrant sampling facilities.

viii) Turbines will be operated within 1% of peak turbine efficiency unless operation out of that range is necessary to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) avoid excess daytime spill (greater than 75 kcfs); or 3) be in compliance with other coordinated fishery measures.

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

ix) STS cycling operation may begin when the mean length of the juvenile chinook passing the project equals or exceeds 112mm. The timing of this operational change will be determined by the Project Biologist. A cycling time of a maximum 20 minutes off and a minimum of 2 minutes on must be followed. Cycling will be discontinued if warranted by fish condition or debris problems.

x) Inspect and maintain the avian predator control lines strung over the tailrace and juvenile fish release areas.

xi) Turbine units without full complements of STSs may operate only as last on/first off to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; 3) avoid excess daytime spill (greater than 75 kcfs); or 4) provide station service power.

CBFWA recommends no operation of partially or fully unscreened turbines unless otherwise agreed.

xii) During periods of involuntary spill, open sluicegate 7A to a depth of 3.5 feet and 10C to a depth of 2.5 feet below the minimum expected forebay elevation.[1]

CBFWA recommends the sluiceway be operated from 1 June through 15 August in addition to the above criterion.

xiii) Inspect facilities twice per day.

(c) August 16 through the end of the Fish Passage Season.

STSs may be removed from units as designated by the Project Biologist (at least one-half of the units must remain screened) to reduce wear and facilitate early winter maintenance. Enough units will remain screened such that the expected peak daily river flow (as estimated by the RCC in coordination with BPA) for the remainder of the passage season will pass through screened

units. STSs will be removed from lower priority units. Order of operating priority will be; 1) screened, first powerhouse units, 2) screened, second powerhouse units, 3) unscreened, first powerhouse units, and 4) unscreened, second powerhouse units.

CBFWA recommends no operation of partially or fully unscreened turbines unless otherwise agreed.

(d) Winter Maintenance Season begins on the first work day of the work week closest to November 30 and goes through the last work day of the work week closest to March 1.

All STSs removed. DSM channel may be dewatered throughout most of this period if STSs must be stored beneath the intake deck, which places the STSs directly in front of the gatewell orifices (see Dewatering Procedures). Additionally, all units will be operated within 1% of peak turbine efficiency whenever possible.

b. Second Powerhouse

(1) Operating Criteria

(a) Prior to the Juvenile Fish Passage Season

i) Remove debris from forebay, trashracks and gatewell slots.

ii) Inspect VBSs for damage, holes, debris accumulations or protrusions (Video inspection acceptable). Clean and repair as necessary.

iii) 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 the work day in the work week closest to March 1.

iv) Operate STSs at angle of 60° from vertical.

v) Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems.

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

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

viii) Install, inspect and maintain lines in the tailrace area for the purpose of avian predation control, except when fish research precludes the installation.

(b) Juvenile Fish Passage Season. The passage season begins on the last work day of the work week closest to March 1 and goes to the start of the first work day of the work week closest to 30 November:

i) Remove debris from forebay and trashracks as required to maintain less than 1.5 feet 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 should be run on continuous during raking operation. Gatewell orifices of the unit being raked must be closed during the procedure.

ii) Inspect each STS or VBS a minimum of once every three months (video acceptable), less frequent inspections may be allowed by the Project Biologist on STSs which have operated very little since their last inspection. Preferably, inspections will occur immediately prior to peaks in juvenile fish migrations, which occur about May 1, mid-July and September 1. Inspections should be concentrated on the priority units and those others with the longer operating time. More frequent inspections may be required by the Project Biologist or under the following conditions: 1) deterioration of fish conditions; 2) increased debris load in bypass system; and 3) other indications of STS or VBS malfunctions or failure.

CBFWA recommends that STS and VBS inspections be conducted once per month.

If STS or VBS damage or plugging is detected follow procedures in Fish Facilities Maintenance Plan. Records of inspections or summary of such records will be made available to the FPC by January 1 upon request.

iii) Operate all gatewell orifice systems. Inspect each daily to assure that the orifice valves and lights are operating correctly. Orifices with less than a clear flow jet should be cleaned at least once per day. Replace all burned out orifice lights within 24 hours.

iv) Inspect each STS amp gauge at least once each shift and record reading once per day. If an STS failure

occurs, then follow procedures in Fish Facilities Maintenance Plan.

v) Inspect all STS gatewells daily. The Project will make an effort to clean them before they become half covered with debris. However, the Project will begin cleaning the gatewells before they become fully covered unless they become fully covered overnight, or a weekend at which time cleaning will begin the next work day. Turbines with a gatewell fully covered with debris will be operated on a last on/first off basis to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; 3) avoid excess daytime spill; or 4) provide station service power. After debarking a gatewell, inspect and if necessary, clean the orifice in that gate well. Check gatewell drawdown.

CBFWA recommends the gatewells be cleaned before they become half covered.

vi) Coordinate gatewell cleaning efforts with personnel operating downstream migrant sampling facilities.

vii) Turbines will be operated within 1% of peak turbine efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) avoid excess daytime spill; or 3) be in compliance with other coordinated fishery measures.

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

viii) STS cycling may begin when the mean length of the juvenile chinook passing the project equals or exceeds 112mm. This time will be determined by the Project Biologist. A cycling time of a maximum 20 minutes off and a minimum of 2 minutes on must be followed. Cycling will be discontinued if indicated by fish condition or debris problems.

ix) Inspect and maintain lines in the tail-race area for the purpose of avian predation contol, except when ongoing fish research precludes the installation.

x) Turbine units without full complements of STSs may operate only as last on/first off to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; or 3) avoid excess daytime spill.

CBFWA recommends no operation of partially or fully unscreened turbines unless otherwise agreed to.

xi) The second powerhouse operation continues to be limited. Prior to the tenth percentile of the spring out migration, the second powerhouse units will not be operated for a minimum of five days beginning at 0600 the morning following a tule production release from Spring Creek Hatchery. Additional restriction days (up to a grand total of fifteen) will be determined by the Project Biologist in consultation with RCC and the FPC, and will be based upon first powerhouse bypass estimates of Spring Creek tules and other appropriate input.

CBFWA recommends the restricted operation last 10 days.

Second powerhouse units will not operate during the middle 80 percent (production releases prior to April 1 from Spring Creek Hatchery will not be considered in the computation of this percent) of the spring and summer out-migrations unless the units are needed to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; 3) avoid excess daytime spill (greater than 75 kcfs); or 4) operate for approved fish research. These dates will be provided by the FPC to the RCC who will relay to the project. Typically, when flows are above the capacity of the first powerhouse units, spill will occur. This restriction

on the second powerhouse will not apply after August 15. After this date or the 90th percentile of the summer out migration which ever comes first, powerhouse 2 will be available to meet load demands through the end of the passage season. The only research planned this year which will impact second powerhouse operation is continuing studies of fish survival.

xii) Maintain DSM water surface at unit #18 orifices between elevations 64.5 - 65.0.

xiii) Maintain water surface on dewatering screen between elevations 60.8 - 61.2.

xiv) Maintain water surface in downwell as close as possible to 58.0 under the automatic control system.

xv) Inspect facilities twice per day.

(c) August 16 through the end of the Fish Passage Season.

STSs may be removed from units as designated by the Project Biologist (at least one-half of the units must remain screened) to reduce wear and facilitate early winter maintenance. Enough units will remain screened such that the expected peak daily river flow (as estimated by the RCC in coordination with BPA) during the remainder of the passage season will pass through screened units. STSs will be removed from lower priority units. Order of operating priority will be: 1) screened first powerhouse units, 2) screened second powerhouse units, 3) unscreened first powerhouse units, and 4) unscreened second powerhouse units.

CBFWA recommends no operation of fully or partially unscreened turbines unless otherwise agreed.

(d) Winter Maintenance Season. (Begins on the first work day of the work week closest to November 30 and goes through the last work day of the work week closest to March 1.)

All STSs removed. DSM dewatered (see Dewatering Procedures) only when required for maintenance. The period of maintenance should be minimized to the extent practicable. Facilities, when operating are to be inspected at least once per day to assure criteria are being met. Additionally, all units will be operated within 1% of peak turbine efficiency whenever possible.

4. Adult Fish Passage Facilities

a. Operating Criteria

(1) Prior to March 1

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

(b) Unless specially coordinated, dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris or plugged orifices 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.

(2) March 1 through November 30 (Adult Fish Passage Period)

(a) All Adult Facilities

i) **Water depth over fish ladder weirs:** 1.3 (+ or - 0.1) feet.

ii) **Head on all entrances:** 1.0 to 2.0 feet (1.5 feet preferred). Refer to maintenance plan when unable to achieve head criterion.

iii) A transportation velocity of 1.5 to 4 feet per second (2.0 fps preferred) shall be maintained for the full length of the powerhouse collection channel, the lower ends of the fish ladders which are below the tailwater, and the adult transportation channel (UMT).

iv) Maximum of 6" head on the first powerhouse attraction water intakes and trashracks at all the ladder exits, with a 4" maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

v) Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period.

vi) The second powerhouse continues to operate with restrictions during the main part of the juvenile passage period. See second powerhouse juvenile passage standards as it will impact first powerhouse operation and maintenance.

vii) Turbine unit operating priority.

Table 5. Bonneville Dam Unit Operating Priority.

TIMES	UNIT OERATING PRIORTY
0500 - 2000	1, 2, 10, 9, (3-8), 18, **11**, **17**, 12, 16, 13, 14, 15.
2000 - 0500	1, 2, 10, 9, (3-8), 18, **17**, **11**, 12, 16, 13, 14, 15.

Unit 16 will follow unit 17 in priority if unit 18 is out of service.

viii) At the end of each fish counting day, fully open counting station crowders and leave fish passage slot lighted over night.

ix) Inspect facilities twice per day.

(b) Spillway Ladders

i) Spill bay gates 1 and 18 shall be open 4 inches to attract adult migrating fish to the adjacent fishway entrances.

ii) 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 feet, both gates shall be open. When the tailwater is between 9 and 17 feet, the south sluice gate shall close. When the tailwater exceeds 17 feet, both sluice gates shall close.

(c) First Powerhouse

i) Entrance gate 65 operates as an adjustable height submerged weir with crest elevation 8 feet below tailwater for tailwater elevations above 17.0. For tailwater elevations below 17.0, the weir is fully lowered with crest at elevation 8.5.

ii) Entrance gate 64 is a submerged orifice entrance which operates according to tailwater elevation. The

gate fully closes when tailwater exceeds 17'. It fully opens when tailwater is below 8'. Between these elevations, the gate positions to compensate for limited flow through gate 65.

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

Orifice A (lower sluice gate) operates (opens) from tailwater elevation 7 to 16 on a rising tailwater and elevation 15 to 7 on a falling tailwater.

Orifice B (upper telescoping gate) operates from tailwater elevation 16 to 38 on a rising tailwater and 38 to 15 when tailwater drops.

iv) Powerhouse entrance gate 1 operates as an adjustable height submerged weir which acts as the primary control to regulate head between the collection channel and tailrace (head on all entrances). Entrance gate 2 is a submerged orifice entrance which operates only when entrance gate 1 is completely lowered to regulate the head between the collection channel and tailrace at lower tailwater elevations. Gate 1 is fully lowered at tailwaters below 22.0; then gate 2 takes over fishway head regulation.

(d) Second Powerhouse

i) 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 feet below tailwater.

ii) Operate all 12 powerhouse floating gate fishway entrances.

(e) Spillway Operations

Spill schedules (Table 3) shall be followed during the spill period.

b. December 1 through February (Winter Operating Period)

(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 to be inspected once per day to assure operation as per standards above. 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 specially 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 powerhouse 1 collection facility is out of service, units 1, 2 and 10 will continue to operate. One of the two ladders servicing the spill channel should be in full operation at all times unless specially coordinated.

(2) Spill bays 1 and 18 may be on seal.

(3) Adjust crowders at fish counting stations to full open at the end of the counting season.

C. Fish Facilities Maintenance

CBFWA recommends that a biologist be present to provide technical advice at all project activities which may involve handling fish.

1. Juvenile Fish Passage Facilities

a. Scheduled Maintenance

(1) Submersible Traveling Screens. The STS system will receive preventive maintenance or repair at all times of the year including the winter maintenance period when all STSs may be removed from the intakes. 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.

(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 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 trashracks are to be raked just prior to the juvenile fish passage season and whenever trash accumulations are suspected because of increased head across the trashracks (>1.5') or increased juvenile fish descaling. Additional raking of trashracks may be necessary when a storm brings large quantities of debris downriver to the project. Gatewell orifices of the unit being raked should be closed during the procedure (applies only to the first powerhouse).

(3) Turbines and Spillways. The maintenance and routine repair of project turbines and spillways is a regular and

recurring process which requires that units be shut down for up to two months (see Dewatering Plan). The schedule for this maintenance will be reviewed by the Project and Operations biologists and coordinated within NPP, NPD, BPA and FPC. 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. No other fish related restrictions regarding maintenance will be placed on any units at these projects, except as specially coordinated.

b. Unscheduled Maintenance

(1) Submersible Traveling Screens. If an STS or VBS is found to be damaged or inoperative in an operating unit, then refer to Figure 3. During the peak juvenile passage periods (April 15 through August), the day of and four days following a juvenile fish release from Spring Creek National Fish Hatchery or as determined by the Project Biologist in consultation with the Fish Passage Center, a crane crew will be taken off lower priority work or will work overtime to remove and replace (if spare available) a damaged or malfunctioning STS or VBS from any unit needed or likely to be needed for operation within the next 48 hours. Crews will work overtime or as call-outs on weekends as required.

(2) Juvenile Bypass System

(a) The 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. When the orifices become plugged with debris they are either mechanically (Second Powerhouse) or pneumatically (First Powerhouse) cleaned out.

(b) Inspect all STS gatewells daily. The project will make an effort to clean before gatewell water surface becomes one-half covered with debris. However, the project will begin cleaning the gatewells before they become fully covered unless the gatewell becomes covered overnight or on a weekend, at which time cleaning will begin the next work day. Turbines with a gatewell fully covered with debris will be operated on a last on/first off basis to: 1) meet the load requirements of the BPA administrator whom will use the Federal Columbia River Basin

System flexibility to determine plant load requests which minimize fish passage mortality; 2) be in compliance with other coordinated fishery measures; 3) avoid excess daytime spill; or 4) provide station service power. This is to maintain clean orifices and minimize fish injury. The first powerhouse gatewell orifices should be closed during the debarking operation. After debarking 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 downstream migrant (DSM) channel to be removed and a stoplog installed at the north end so migrants will flow down into the ice and trash sluiceway channel. Sluiceway gate 7A will be opened to a depth of 3.5 feet^2, gate 10C to 2.5 feet below the minimum expected forebay, and the ice and trash sluiceway end gate will be opened 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 trashrack 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 consultation with CBFWA. 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 to be plugged or damaged. In these cases refer to Figure 3.

1. If all available units are operating to meet firm energy demand during low debris conditions, continue operating until step 3 can be accomplished, otherwise proceed to step 2.

2. Units 10, 9, 18, and 17 will operate under any load conditions (except when debris is heavy) with failed STS or VBS until step 3 is done. When debris is heavy, units with a failed STS will be shut down. If either unit 1 or 2 is out of service and the other of these two has a malfunctioning screen, that unit must stay in operation. The failed STS or VBS in any of the above units will be repaired or replaced within 24 hours. Turbine units 1 and 2 will replace 9 and 10 in priority when the First Powerhouse bypass channel flows to the south. Any other unit with failed STS or VBS will be shut down until step 3 can be done or it is required to meet firm energy demand, in which case it will be the last on line and the first off.

3. During working hours, assuming the BPA dispatcher will unload Bonneville on request, the unit will be taken out of service and the failed STS or VBS examined. If possible, repairs will be done the same day, and the unit may return to service. During the peak juvenile passage period (15 April - 30 September), and the 5 days following the day of a juvenile fish release from Spring Creek National Fish Hatchery, or as determined by the Project Biologist, an STS fails on a unit required for generation, then a crane crew will work overtime or weekends if necessary to remove and replace (if spare available) the damaged or malfunctioning STS or VBS.

4. If repairs require longer than 1 day, the STS or VBS will be replaced with a spare or one from a long term out of service unit. If all available turbines are required to meet firm energy demands or to control excess spill during daylight hours, unscreened turbines will be operated. The STS or VBS will be replaced with one from Unit 8 then 7 (PH-1) or Unit 15 (PH-2), and the unit will be returned to service. If the unscreened unit must be operated for longer than one week then remove the damaged STS or VBS as advised by the Project Biologist. Order of STS or VBS removal should be slots A-B then C, except at unit 7 where the order of removal should be B, C, A. If the failed STS or VBS is in units 7 or 8 the failed STS or VBS will be removed and repaired.

5. All partially screened or unscreened units will be operated according to Juvenile Operating Standards until a spare or repaired STS or VBS is available for installation.

Figure 3. O & M when STS or VBS Fail at Bonneville Dam.

2. Adult Fish Passage Facilities

a. Scheduled Maintenance

(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.

(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 dewatering, such as diffusion gratings, leads and entrance gates, will be scheduled at least once every ten years with at least one underwater inspection in between unless a channel must be dewatered for fishway modifications or to correct observed problems (See Dewatering Plans). Inspection by 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 unless specially coordinated. Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

The Project Biologist will attempt to attend all dewatering activities potentially involving large numbers of fish, as well as inspections to provide fishery input (See Dewatering Plans). In the absence of the Biologist, the project will proceed, using all due care to ensure that fish are not stranded or injured. In these circumstances, personnel in charge of the activities will provide reports to the Project Biologist summarizing each fish salvage activity. Information will include at least the following: facility involved, timing, numbers of salmonids and sturgeon handled, condition of fish (alive, stressed or dead) and where the fish were released. If an emergency occurs which threatens fish safety, then the Project Biologist or alternate will be contacted for assistance.

(3) Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered (see Dewatering Plan) 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 identi-

fied throughout the passage year that do not affect fish passage as well as those identified during the dewatered period may then be repaired.

b. Unscheduled Maintenance

(1) **Fishway auxiliary water systems.** Most fishway auxiliary water systems are operated automatically. If the automatic system fails, then the system can usually be operated manually by project personnel. 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.

(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 gates fails to achieve a minimum fishway head of 1.0 feet when tailwater is greater than 17 feet, then raise gate 65 weir in one-foot increments up to 6 feet of depth below the tailwater surface until a head of 1.0 feet is achieved. If this fails to achieve the proper fishway head, then raise gate 1 weir in one foot increments to 6 feet below the tailwater surface until a head of 1.0 feet is achieved.

When tailwater elevation is less than 17 feet and the gate 65 weir crest is at least 6 feet below tailwater, close gate 64 in one-foot increments until the proper head is achieved or the gate is fully closed, then raise gate 65 in one-foot increments up to 6 feet below tailwater. If the gate 65 weir crest is less than 6 feet below tailwater, then fully open gate 64 and close gate 65. If this fails to achieve the proper fishway head and the gate 1 weir crest is at least 6 feet below tailwater, then close gate 2 in one-foot increments until fully closed, then raise gate 1 in one foot increments up to 6 feet below tailwater. If the gate 1 weir crest is less than 6 feet below tailwater, then fully open gate 2 and close gate 1. At this point maintain the gates' positions regardless of whether criteria are met or not, until the auxiliary water system is repaired.

(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 sluicegate entrance, if open. This will divert the reduced available water to the entrance slots. If a head of 1.0 foot is still not achieved, stop-logs are to be added to the entrance slots until the desired head or a weir depth of not less than 6 feet 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 North Upstream Entrance (NUE) in one-foot increments until the weir crest is 6 feet below the tailwater or a fishway head of a least 1.0 feet is achieved. If this fails to achieve the above criteria then apply the same procedure, until the criteria are achieved, using in addition the North Downstream Entrance (NDE) then, the South Upstream Entrance (SUE), and finally the South Downstream Entrance (SDE). The weir crests for these three entrances should not be raised above 6 feet 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, then the ice and trash sluiceway will be used to supplement discharge to allow operation of the fishway according to the above standards. Care will be taken to keep the trash chute screen free of debris and the downstream end gate will be raised briefly at least once weekly to flush trapped fish and debris out of the chute.

If both of the fishway auxiliary water turbines fail between September 1 and March 31, then the ice and trash sluiceway, 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 eight feet 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 eight feet 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 six feet 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.

(2) Powerhouse and Spillway Adult Fish Collection Systems. Bonneville Project contains several types of fishway entrances. In most cases, if a failure occurs 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 insure 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 brought back into manual or automatic control at the earliest possible date.

(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 structures of the ladders include picket leads, counting stations, fishway exits and overflow weirs with orifices. Picket leads can cause problems. Pickets with excessive spacing (greater than 1"), erosion of concrete around the leads or missing pickets can allow fish into areas where escape is difficult. In some instances of picket lead failure, spare leads and spare installation slots are available. In these cases the spare leads are installed and the damaged leads are removed and repaired. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problems will be made in consultation with CBFWA.

D. Turbine Unit Operation and Maintenance

1. Priority of unit operation: See Table 5 .

2. The project's 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.

Unit 10 provides important attraction flow for adult fish and helps move juvenile fish out of an area of high predation in the tailrace. Attempt should be made to avoid long-term unit outages after the beginning of the juvenile fish passage season, particularly the first spring creek fish release, until after the fall chinook and coho adult runs diminish at the end of October.

Unit 1 provides attraction flow for adult fish, and when the juvenile bypass system flow is reversed, it helps move juvenile fish downstream, also. When not needed for juvenile fish passage, long-term outages should be avoided between 1 April and the end of the fall chinook and coho adult runs at the end of October. There is also a period of low adult fish passage between about the last week of May and mid-June, during which the impact of a unit outage would be light.

E. Dewatering Plans

CBFWA recommends that a biologist be present to provide technical advice at all project activities which may involve fish handling.

1. Adult Fish Ladder

a. Scheduled Maintenance

(1) When possible operate the ladder to be dewatered at orifice flow for at least 24 hours but no more than 48 hours prior to dewatering.

(2) Discontinue all fishway auxiliary water supply at least 24 hours but no more than 48 hours prior to dewatering.

(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.

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

(5) The Project Biologist will invite fishery agency and/or Indian tribal biologists participation in the dewatering and will try to be available to oversee fish rescue when ladders are dewatered. 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 tailwater, whichever is closest, for release. When rescue is accomplished in the absence of the Project Biologist a brief report will be provided which will include: facility involved, timing, salmonids and sturgeon found, fish condition (live, dead or stressed) and where the fish were moved to.

b. Unscheduled Maintenance

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

(2) Follow steps 3-5 above.

2. Powerhouse Fish Collection System

a. Scheduled Maintenance (see Appendix A for coordination procedures)

(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.

(2) The Project Biologist will assure that rescue equipment is available if needed.

(3) The Project Biologist will provide technical guidance on fish safety and will assist directly as needed in rescue operations. Reports will be provided for fish rescue activities which are not attended by the biologist. Information will include facility involved, timing, numbers of salmonids and sturgeon involved and fish condition (live, dead or stressed) and where the fish were returned to water.

3. Turbines

a. When possible, place head gates and tail logs immediately after turbine unit is shut down if draft tube is to be dewatered.

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

c. Water levels in the draft tube will not be allowed to drop to a level which strands fish.

d. 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 will provide technical guidance on fish safety and will directly participate in fish salvage when possible. Reports will be provided for fish rescue activities which are not attended by the biologist. Information will include facility involved, timing, numbers of salmonids and sturgeon involved and fish condition (live, dead or stressed) and where the fish were returned to water.

e. The Project Biologist will invite CBFWA biologists participation in the dewatering and will assure that rescue equipment is available if needed.

f. If the Unit is planned to be out of service 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.

F. Endnotes

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).

2. Downstream Movement of Salmonids at Bonneville Dam. Gauley, Anas, and Schlotherbeck, BCF, USFWS. Special Scientific Report, Fisheries No. 236 (January 1958).

The Dalles Dam

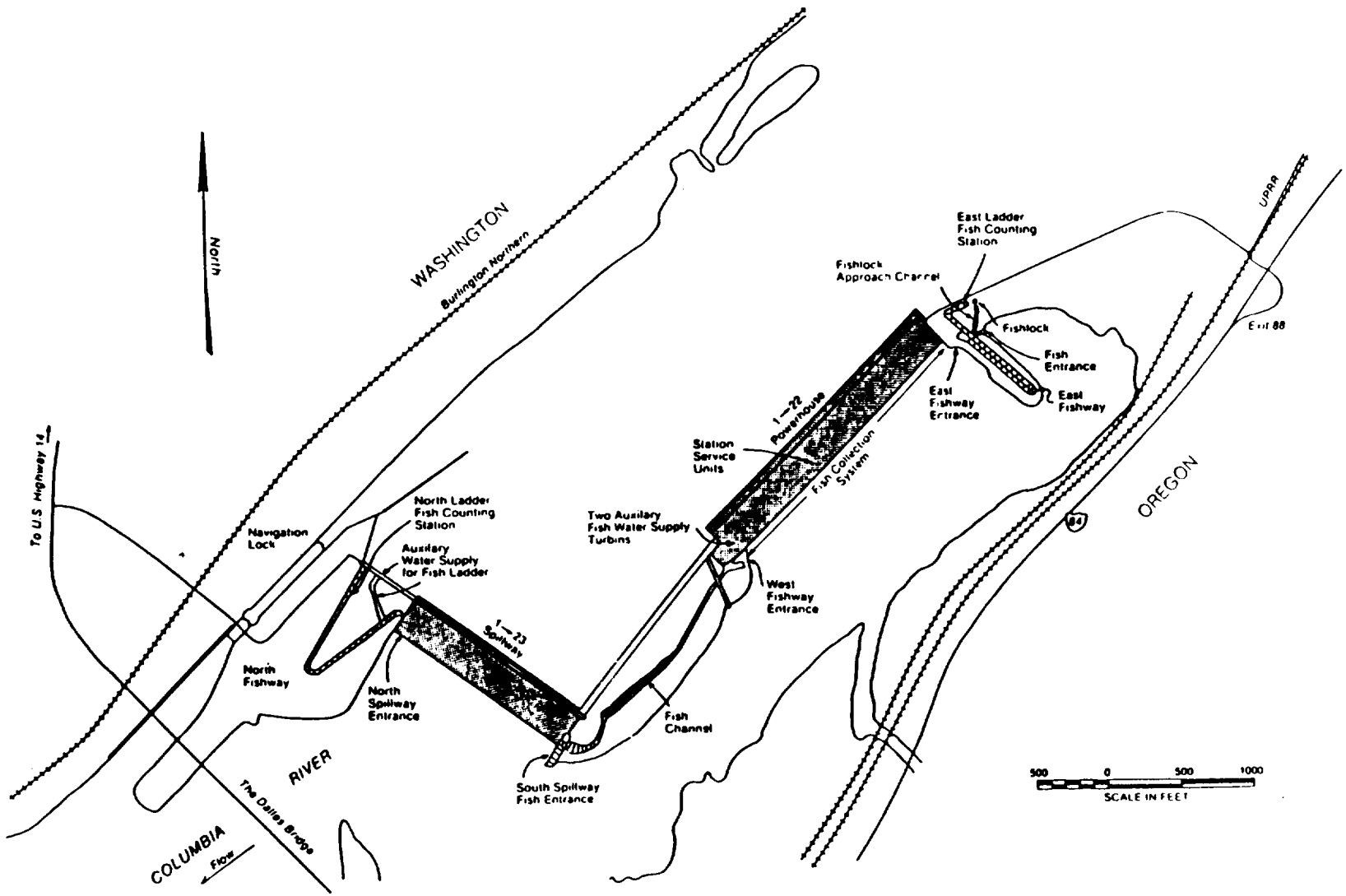
II. THE DALLES DAM

A. Fish Passage Information. The locations of fish passage facilities are shown on the following general site map for The Dalles Dam (Figure 4).

1. Juvenile Fish Passage

a. Facilities Description. Turbine units at The Dalles Dam are not screened. Juvenile fish passage facilities at The Dalles Dam consist of the ice and trash sluiceway and 8" orifices in each gatewell. The ice and trash sluiceway is a rectangular channel extending along the total powerhouse forebay the length of the 22 unit powerhouse and the gatewell orifices allow flow into the sluiceway, providing a potential means of passing fish from the gatewells to the sluiceway to tailwater. When sluiceway gates are opened, water and migrants are skimmed from the forebay into the sluiceway and deposited in the tailrace downstream of the project.

The Dalles Lock and Dam



b. Juvenile Migration Timing. The dates of peak passage of Snake River steelhead at The Dalles Dam have ranged from May 11 in 1978 to June 21 in 1977. Peak passage of Snake River spring chinook at The Dalles Dam ranged from May 8 in 1976 to June 17 in 1977. Travel time from the upper Snake River to The Dalles Dam ranges from 12 to 39 days for yearling chinook and 10 to 40 days for steelhead.[1] The primary juvenile passage period at The Dalles Dam is April through November. The following passage timing data were generated from studies of The Dalles Dam sluiceway in 1977-79, and 1981-82. NMFS conducted smolt monitoring at The Dalles in 1989 and 1990. The data include Snake River and Columbia River migrants.

Diel passage at The Dalles sluiceway is affected by spill and flow conditions. In 1977, peak passage occurred from 0500 to 2200.[2] ; in 1981, from 1200 to 1300; in 1982 from 0600 to 2200 (Willis, 1982) Average April-June flows at The Dalles was 121 kcfs in 1977, 253 kcfs in 1981, and 325 kcfs in 1982. In years of consistently high flow and spill, fish may be distributed higher in the water column and daytime passage may increase.

Table 6 Juvenile Fish Passage Timing at The Dalles Dam.

PERCENT OF MIGRATION	1977	1978	1979	1981	1982	1989[a]	1990[b]
Spring Chinook							
10%	4/30	5/6	5/6	5/2	5/2	---	4/17
90%	6/5	6/11	6/11	5/31	5/30	---	5/28
Sub-yearling Chinook							
10%	---	---	---	---	---	6/13	---
90%	---	---	---	---	---	8/01	---
Sockeye							
10%	5/2	5/1	5/7	5/8	5/2	---	---
90%	5/31	6/5	6/5	6/6	5/30	---	---
Steelhead							
10%	5/16	4/27	4/15	5/1	5/1	---	4/26
90%	6/8	5/30	5/26	5/31	5/30	---	6/2

Fall chinook are not included due to incomplete sampling.

Source: ODFW sluiceway passage research 1977, 1978, 1979, 1981 and 1982. NMFS smolt monitoring, 1989 and 1990.

[a] NMFS gate-well sampling terminated on 9/1 in 1989; gate-well and airlift operationss terminated on 8/31/90.

[b] Recapture of Corps barge release fish on 5/29 is not included in determination of 10 and 90% migration timing for yearling chinook and steelhead.

2. Adult Fish Passage

a. Facilities Description. Adult fish passage facilities at The Dalles Dam are composed of a north shore fish ladder which passes fish collected at the north end of the spillway, and an east fish ladder which passes those fish collected at the south end of the spillway and across the downstream face of the powerhouse. A fish lock exists at the east end of the powerhouse but is not operated.

A small hydropower facility utilizing the north fishway ladder auxiliary water supply is presently under construction by the North Wasco PUD and scheduled for completion in 1991. All construction with the potential to impact migrating adults using this ladder is scheduled to be completed by March 1. Construction

deadlines and possible effects on fish passage will be monitored closely.

b. Adult Migration Timing. Upstream migrants are present at The Dalles Dam throughout the year. Maintenance of upstream facilities is scheduled to take place between December 1 and February 28 to minimize impacts on upstream migrants. The following table shows the passage period by species and the earliest and latest recorded dates of peak passage since 1957.[3]

Table 7. The Dalles Dam Adult Fish Passage Timing.

	MIGRATION TIMING 1957-1990		
Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/3	4/17	5/13
Summer Chinook	6/4 - 8/3	6/6	8/1
Fall Chinook	8/4 -10/31	9/3	9/16
Sockeye	4/1 -10/31	6/20	7/10
Steelhead	4/1 -10/31	7/9	9/19
Coho	4/1 -10/31	9/3	9/21

B. Project Operation

1. Spill Management

a. The spill schedules starting with Table 8 will be used for juvenile fish passage during 2000-0600 hours.

b. The spill schedules starting at Table 13 will be used for adult fish passage during 0600-2000 hours.

Table 8. Spilling Schedule for The Dalles Dam, 2000-0600 hours.

Total Spill	Spill Bay													
kcfs	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10.5												7		
12.0												8		
13.5												9		
15.0												10		
16.5										6		5		
18.0										6		6		
19.5										7		6		
21.0										7		7		
22.5										8		7		
24.0										8		8		
25.5										9		8		
27.0										9		9		
28.5										10		9		
30.0										10		10		
31.5										7		7		7
33.0										8		7		7
34.5										8		8		7
36.0										8		8		8
37.5										9		8		8
39.0										9		9		8
40.5										9		9		9
42.0										10		9		9
43.5										10		10		9
45.0										10		10		10
46.5										7	6	6	6	6
48.0										7	7	7	6	6
49.5										7	7	7	7	6
51.0										7	7	7	7	7
52.5									6	6	6	6	6	6
54.0									7	6	6	6	6	6
55.5									7	7	6	6	6	6
57.0									7	7	7	6	6	6

Table 9. Spilling Schedule for The Dalles Dam, 2000-0600 hours.

Total Spill kcfs	Spill Bay													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
58.5									7	7	7	7	6	6
60.0									7	7	7	7	7	6
61.5									7	7	7	7	7	7
63.0								7	6	6	6	6	6	6
64.5								7	7	6	6	6	6	6
66.0								7	7	7	6	6	6	6
67.5								7	7	7	7	6	6	6
69.0								7	7	7	7	7	6	6
70.5								7	7	7	7	7	7	6
72.0								7	7	7	7	7	7	6
73.5							7	6	6	6	6	6	6	6
75.0							7	7	6	6	6	6	6	6
76.5							7	7	7	6	6	6	6	6
78.0							7	7	7	7	6	6	6	6
79.5							7	7	7	7	7	6	6	6
81.0							7	7	7	7	7	7	6	6
82.5							7	7	7	7	7	7	7	6
84.0							7	7	7	7	7	7	7	7
85.5							8	7	7	7	7	7	7	7
87.0							8	8	7	7	7	7	7	7
88.5							8	8	8	7	7	7	7	7
90.0							8	8	8	8	7	7	7	7
91.5							8	8	8	8	8	7	7	7
93.0							8	8	8	8	8	8	7	7
94.5							8	8	8	8	8	8	8	7
96.0							8	8	8	8	8	8	8	8
97.5					7	7	7	7	7	6	6	6	6	6
99.0					7	7	7	7	7	7	6	6	6	6
100.5					7	7	7	7	7	7	7	6	6	6
102.0					7	7	7	7	7	7	7	7	6	6
103.5					7	7	7	7	7	7	7	7	7	6
105.0					7	7	7	7	7	7	7	7	7	7

Table 10. Spilling Schedule for The Dalles Dam, 2000-0600 hours.

Total Spill kcfs	Spill Bay													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
106.5					8	7	7	7	7	7	7	7	7	7
108.0					8	8	7	7	7	7	7	7	7	7
109.5					8	8	8	7	7	7	7	7	7	7
111.0					8	8	8	8	7	7	7	7	7	7
112.5					8	8	8	8	8	7	7	7	7	7
114.0					8	8	8	8	8	8	7	7	7	7
115.5					8	8	8	8	8	8	8	7	7	7
117.0					8	8	8	8	8	8	8	8	7	7
118.5					8	8	8	8	8	8	8	8	8	7
120.0					8	8	8	8	8	8	8	8	8	8
121.5		7	7	7	6	6	6	6	6	6	6	6	6	6
123.0		7	7	7	7	6	6	6	6	6	6	6	6	6
124.5		7	7	7	7	7	6	6	6	6	6	6	6	6
126.0		7	7	7	7	7	7	6	6	6	6	6	6	6
127.5		7	7	7	7	7	7	7	6	6	6	6	6	6
129.0		7	7	7	7	7	7	7	7	6	6	6	6	6
130.5		7	7	7	7	7	7	7	7	7	6	6	6	6
132.0		7	7	7	7	7	7	7	7	7	7	6	6	6
133.5		7	7	7	7	7	7	7	7	7	7	7	6	6
135.0		7	7	7	7	7	7	7	7	7	7	7	7	6
136.5		7	7	7	7	7	7	7	7	7	7	7	7	7
138.0		8	7	7	7	7	7	7	7	7	7	7	7	7
139.5		8	8	7	7	7	7	7	7	7	7	7	7	7
141.0		8	8	8	7	7	7	7	7	7	7	7	7	7
142.5		8	8	8	8	7	7	7	7	7	7	7	7	7
144.0		8	8	8	8	8	7	7	7	7	7	7	7	7
145.5		8	8	8	8	8	8	7	7	7	7	7	7	7
147.0		8	8	8	8	8	8	8	7	7	7	7	7	7
148.5		8	8	8	8	8	8	8	8	7	7	7	7	7
150.0		8	8	8	8	8	8	8	8	8	7	7	7	7
151.5		8	8	8	8	8	8	8	8	8	8	7	7	7
153.0		8	8	8	8	8	8	8	8	8	8	8	7	7

Table 11. Spilling Schedule for The Dalles Dam, 2000-0600 hours.

Total Spill kcfs	Spill Bay													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
154.5		8	8	8	8	8	8	8	8	8	8	8	8	7
156.0		8	8	8	8	8	8	8	8	8	8	8	8	8
157.5	8	8	8	8	8	8	8	7	7	7	7	7	7	7
159.0	8	8	8	8	8	8	8	8	7	7	7	7	7	7
160.5	8	8	8	8	8	8	8	8	8	7	7	7	7	7
162.0	8	8	8	8	8	8	8	8	8	8	7	7	7	7
163.5	8	8	8	8	8	8	8	8	8	8	8	7	7	7
165.0	8	8	8	8	8	8	8	8	8	8	8	8	7	7
166.5	8	8	8	8	8	8	8	8	8	8	8	8	8	7
168.0	8	8	8	8	8	8	8	8	8	8	8	8	8	8
169.5	9	8	8	8	8	8	8	8	8	8	8	8	8	8
171.0	9	9	8	8	8	8	8	8	8	8	8	8	8	8
172.5	9	9	9	8	8	8	8	8	8	8	8	8	8	8
174.0	9	9	9	9	8	8	8	8	8	8	8	8	8	8
175.5	9	9	9	9	9	8	8	8	8	8	8	8	8	8
177.0	9	9	9	9	9	9	8	8	8	8	8	8	8	8
178.5	9	9	9	9	9	9	9	8	8	8	8	8	8	8
180.0	9	9	9	9	9	9	9	9	8	8	8	8	8	8
181.5	9	9	9	9	9	9	9	9	9	8	8	8	8	8
183.0	9	9	9	9	9	9	9	9	9	9	8	8	8	8
184.5	9	9	9	9	9	9	9	9	9	9	9	8	8	8
186.0	9	9	9	9	9	9	9	9	9	9	9	9	8	8
187.5	9	9	9	9	9	9	9	9	9	9	9	9	9	8
189.0	9	9	9	9	9	9	9	9	9	9	9	9	9	9
190.5	10	9	9	9	9	9	9	9	9	9	9	9	9	9
192.0	10	10	9	9	9	9	9	9	9	9	9	9	9	9
193.5	10	10	10	9	9	9	9	9	9	9	9	9	9	9
195.0	10	10	10	10	9	9	9	9	9	9	9	9	9	9
196.5	10	10	10	10	10	9	9	9	9	9	9	9	9	9
198.0	10	10	10	10	10	10	9	9	9	9	9	9	9	9
199.5	10	10	10	10	10	10	10	9	9	9	9	9	9	9
201.0	10	10	10	10	10	10	10	10	9	9	9	9	9	9

Table 12. Spilling Schedule for The Dalles Dam, 2000-0600 hours.

Total Spill kcfs	Spill Bay													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
202.5	10	10	10	10	10	10	10	10	10	9	9	9	9	9
204.0	10	10	10	10	10	10	10	10	10	10	9	9	9	9
205.5	10	10	10	10	10	10	10	10	10	10	10	9	9	9
207.0	10	10	10	10	10	10	10	10	10	10	10	10	9	9
208.5	10	10	10	10	10	10	10	10	10	10	10	10	10	9
210.0	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Use the same pattern trend for spill exceeding 210 kcfs; individual spill bay discharges during nighttime hours should not be less than 7.5 kcfs.

Table 13. Spilling Schedule for The Dalles Dam, 0600-2000 hours.

Based on pool elevation 159.6'

Spill Bay

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	kcfs
(1)																						1	3.0
1	(1)																				1	1	6.0
1	1	(1)																		1	1	1	9.0
1	1	1	(1)																1	1	1	1	12.0
1	1	1	1	(1)														1	1	1	1	1	15.0
1	1	1	1	1	(1)												1	1	1	1	1	1	18.0
1	1	1	1	1	1	(1)										1	1	1	1	1	1	1	21.0
1	1	1	1	1	1	1	(1)								1	1	1	1	1	1	1	1	24.0
1	1	1	1	1	1	1	1	(1)						1	1	1	1	1	1	1	1	1	27.0
1	1	1	1	1	1	1	1	1	(1)				1	1	1	1	1	1	1	1	1	1	30.0
1	1	1	1	1	1	1	1	1	1	(1)		1	1	1	1	1	1	1	1	1	1	1	33.0
1	1	1	1	1	1	1	1	1	1	1	1	(2)	1	1	1	1	1	1	1	1	1	1	36.0
1	1	1	1	1	1	1	1	1	1	2	1	2	1	(2)	1	1	1	1	1	1	1	1	39.0
1	1	1	1	1	1	1	1	2	1	2	1	2	1	2	1	(2)	1	1	1	1	1	1	42.0
1	1	1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	(2)	1	1	1	1	45.0
1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	(2)	1	1	48.0
1	1	1	1	2	1	2	1	2	2	2	(2)	2	1	2	1	2	1	2	1	2	1	1	51.0
1	1	1	1	2	1	2	2	2	2	2	2	2	(2)	2	1	2	1	2	1	2	1	1	54.0
1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	(2)	2	1	2	1	2	1	1	57.0
1	1	1	1	2	2	2	2	2	2	2	2	(3)	2	2	2	2	2	2	1	2	1	1	60.0
1	1	1	1	2	2	2	2	3	2	3	2	3	2	(3)	2	2	2	2	1	2	1	1	63.0
1	1	1	1	2	2	2	2	3	2	3	2	3	2	3	2	2	2	2	(2)	2	1	1	66.0
1	1	1	1	2	2	3	2	3	2	3	2	3	2	3	2	(3)	2	2	2	2	1	1	69.0
1	1	1	1	2	2	3	2	3	2	3	3	3	2	3	2	3	2	(3)	2	2	1	1	72.0
1	1	1	1	2	2	3	2	3	3	3	3	3	(3)	3	2	3	2	3	2	2	1	1	75.0
1	1	1	2	2	2	3	2	3	3	3	3	3	3	3	(3)	3	2	3	2	2	1	1	78.0
1	1	2	2	2	2	3	2	3	3	3	3	3	3	3	3	(3)	3	3	2	2	1	1	81.0
1	1	2	2	2	2	3	2	3	3	3	3	(4)	3	3	3	3	3	3	2	2	1	1	84.0
1	1	2	(3)	2	3	3	2	3	3	3	3	4	3	3	3	3	3	3	2	2	1	1	87.0
1	1	2	3	2	3	3	2	3	3	4	3	3	3	(4)	3	3	3	3	2	2	1	1	90.0

Table 14. Spilling Schedule for The Dalles Dam, 0600-2000 hours.

Based on pool elevation 159.6'

Spill Bay																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	kcfs
1	1	2	3	2	3	4	3	4	3	4	3	4	3	4	3	3	3	3	2	2	(2)	1	93.0
1	1	2	3	2	3	4	3	4	3	4	(4)	4	3	4	3	3	3	3	2	2	2	1	96.0
1	1	2	3	2	3	4	3	4	4	4	4	4	(4)	4	3	3	3	3	2	2	2	1	99.0
1	2	2	3	2	3	4	3	4	4	4	4	4	4	4	3	3	3	3	2	(3)	2	1	102.0
1	2	2	3	2	3	4	(3)	4	4	4	4	4	4	4	4	3	3	3	2	3	2	1	105.0
1	2	2	3	2	3	4	4	4	4	(5)	4	5	4	4	4	3	3	3	2	3	2	1	108.0
1	2	2	3	2	3	4	4	5	4	5	4	5	4	4	4	(4)	3	3	2	3	2	1	111.0
1	2	2	3	2	3	4	4	5	4	5	5	5	4	(5)	4	4	3	3	2	3	2	1	114.0
1	2	2	3	3	3	4	4	5	4	5	5	5	(5)	5	4	4	3	3	2	3	2	1	117.0
1	2	3	3	3	3	4	4	5	(5)	5	5	5	5	5	4	4	3	3	2	3	2	1	120.0
1	2	3	3	4	3	4	4	5	5	5	5	5	5	5	4	4	3	3	(3)	3	2	1	123.0
1	2	3	3	4	3	4	5	5	5	5	5	5	5	5	4	4	3	(4)	3	3	2	1	126.0
1	2	3	3	4	4	4	5	5	5	5	5	5	5	5	(5)	4	3	4	3	3	2	1	129.0
1	2	3	3	4	4	5	5	5	5	5	5	5	5	5	5	4	3	4	(4)	3	2	1	132.0
1	2	3	3	5	4	5	5	5	5	5	5	5	5	5	5	4	(4)	4	4	3	2	1	135.0
1	2	3	4	5	4	5	5	5	5	5	5	5	5	5	5	4	(5)	4	4	3	2	1	138.0
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	(5)	5	4	4	3	2	1	141.0
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	(4)	2	1	144.0
1	2	3	4	5	5	5	5	5	5	6	5	5	5	5	5	5	5	(5)	5	4	2	1	146.9
1	2	3	4	5	5	5	5	(6)	5	6	5	6	5	5	5	5	5	5	5	4	2	1	149.7
1	2	3	4	5	5	5	5	6	5	6	6	6	6	(6)	5	5	5	5	5	4	2	1	152.5
1	2	3	4	5	5	5	5	6	6	6	6	6	(6)	6	5	5	5	5	5	4	2	1	155.3
1	2	4	4	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	5	4	(3)	1	158.3
1	2	4	4	5	5	6	5	6	6	6	6	6	6	6	5	(6)	5	5	5	4	3	1	161.1
1	2	4	4	5	5	6	6	6	6	6	6	6	6	6	(6)	6	5	5	5	4	3	1	163.9
1	2	4	5	2	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	3	(2)	166.8
1	2	4	5	2	6	6	6	6	6	6	6	6	6	6	6	6	(6)	5	5	4	4	2	169.7
1	2	4	5	2	6	6	6	6	6	(7)	6	6	6	6	6	6	6	5	5	4	4	2	172.7
1	2	4	5	2	6	6	6	(7)	6	7	6	7	6	6	6	6	6	5	5	4	4	2	175.7
1	2	4	5	2	6	7	6	7	6	7	6	7	6	(7)	6	6	6	5	5	4	4	2	178.7

Table 15. Spilling Schedule for The Dalles Dam, 0600-2000 hours.

Based on pool elevation 159.6'

Spill Bay																							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	kcfs
1	2	4	5	5	6	7	7	7	7	7	(7)	7	7	7	6	6	6	5	5	4	4	2	181.7
1	2	4	5	5	6	7	7	7	7	7	7	7	(7)	7	6	6	6	5	5	4	4	2	184.7
1	2	4	5	(6)	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	4	4	2	187.5
1	2	(5)	5	6	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	5	4	2	190.5
1	3	5	5	6	6	7	7	7	7	7	7	7	7	7	7	6	6	6	5	5	4	2	193.5
1	3	5	5	6	7	7	7	7	7	7	7	7	7	7	7	(7)	6	6	5	5	4	2	196.0
1	3	5	6	6	7	7	7	7	7	7	7	7	7	7	7	7	(7)	6	5	5	4	2	199.4
1	3	5	6	6	7	7	7	7	7	8	7	7	7	7	7	(8)	7	6	5	5	4	2	202.3
1	3	5	6	6	7	7	7	8	7	8	7	(8)	7	7	7	8	7	6	5	5	4	2	205.0
1	3	5	6	6	7	8	7	8	7	8	7	8	7	(8)	7	8	7	6	5	5	4	2	207.8
1	3	5	6	6	7	8	7	8	8	8	(8)	8	7	8	7	8	7	6	5	5	4	2	210.6
1	3	5	6	6	7	8	8	8	8	8	8	8	7	8	7	8	7	6	(6)	5	4	2	213.4
1	3	5	6	7	7	8	8	8	8	8	8	8	7	8	7	8	7	(7)	6	5	4	2	216.4
1	3	5	7	7	7	7	8	8	8	8	8	8	(8)	8	7	8	7	7	6	5	4	2	219.3
1	3	5	7	7	8	8	8	8	8	8	8	8	8	8	(8)	8	7	7	6	5	4	2	222.1

Values in parentheses may be 1 foot less than the values shown.
For example: (1) means 0 or 1 foot
(2) means 1 or 2 feet

An approved spill schedule which incorporates raising spill bay gates in blocks of four will be implemented when changes in spill discharge are frequent.

2. Dissolved Gas Management and Control

Monitoring of dissolved gas, fish condition and migration data for juveniles and adults will be used for spill management decisions. Total dissolved gas monitoring during 1991 will be at the The Dalles forebay and reported every four hurs from April 1 through August 31. Related data reported at the same time will be spill volume, and total project flow.

3. Juvenile Fish Passage Facilities

a. Operating Criteria

(1) Prior to April 1 Each Year:

(a) Remove debris from forebay, trashracks and gatewell slots.

(b) Inspect and, where necessary, clean gatewell orifices of debris.

(c) Inspect, lubricate and test chain gates, end gates and hoists for operation as needed.

(d) Inspect and correct any epoxy or concrete deficiencies on walls and floors of ice and trash sluiceway.

(e) Install or repair avian predator control lines at the ice and trash sluiceway outfall.

(2) April 1 through November 15:

CBFWA recommends operation of the ice & trash sluiceway through November 25.

(a) Clean trashracks as flow conditions dictate or when drawdown in gatewell slots exceeds 1.5 feet or as indicated by fish condition at The Dalles and Bonneville (e.g., higher than expected descaling).

(b) Remove debris from forebay when needed, and from gatewell slots when gatewell water surface is one-half covered. Turbine units with gatewells which are fully covered with debris will only be used as last on/first off to 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fish protective measures.

(c) Operate all gate slot orifices full time.

(d) Either turbine unit 1 or unit 2 or both units should operate during daylight hours unless specially coordinated.

(e) Operate ice and trash sluiceway gates 1-1, 1-2 & 1-3 at least 16 hours per day (sunrise to sunset) through August 31, and at least sunrise to sunset from September 1 on with full surface flow (lower or raise sluice gates completely). During nighttime hours the ice and trash sluiceway should be operated as a plunge pool for the gateslot orifices. During periods of involuntary spill, sluice gates may be operated continuously. Operate the sluiceway end gate full open from sunrise to sunset. During periods when gates do not operate, set top of bottom end gate at 142 elevation to create orifice plunge pool.

(f) Once each week and more frequently if accumulations of debris are observed, close gates 1-1, 1-2 & 1-3, and open gates 17- 3, 18-1 & 18-2 for two hours to flush out debris and fish being held in the sluiceway channel east of unit 1.

(3) General

(a) During chain gate operation, maintain forebay level above elevation 158.0 to the extent practicable.

(b) Maintain orifices clear of debris.

(c) Inspect facilities twice each day.

(d) Operate turbine units within 1% of peak efficiency except as needed to 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fish protective measures.

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

(e) Follow the schedule starting at Table 8 for nighttime spill (2000 - 0600). This schedule was developed for juvenile fish passage.

(4) November 16 through March 1:

(a) Maintain orifices clear of debris.

(b) Set top of bottom end gate at 142 elevation to create orifice plunge pool.

(c) Turbines will be operated within 1% of peak turbine efficiency to the extent practicable.

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

4. Adult Fish Passage Facilities

a. Operating Criteria

(1) Prior to March 1

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

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

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

(d) Reinstall picketed leads at counting stations prior to watering up the ladders during maintenance.

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

(a) All Adult Facilities

i) Water depth over fish ladder weirs: 1.0 - 1.3 feet (prefer 1.2). 1.3 feet during shad passage (May 15 through July 31) on the east ladder.

ii) Head on all entrances: 1.0 to 2.0 feet (prefer 1.3 to 1.5). Refer to maintenance plan when unable to achieve head criteria.

iii) A transportation velocity of 1.5 to 4.0 feet per second (prefer 2.0 fps) shall be maintained in all

channels and the lower ends of the fish ladders which are below the tailwater.

iv) Maximum of 6" head on attraction water intakes and trashracks at all the ladder exits, with a 4" maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

v) Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period.

vi) Main entrance weir depths: 8 feet or greater below tailwater. Weirs will be lowered to bottom when 8 feet depth is not possible.

vii) Inspect facilities twice each day.

viii) At the end of each fish counting day, move count station crowders back and leave fish passage slot lighted over night.

(b) North Fishway

i) North Fishway Entrance: Operate entrances N1 and N2 during periods with spill. N2 may be closed during periods with no spill.

CBFWA recommends operating both north shore fishway entrances at all times, rather than just during periods of spill.

(c) Powerhouse

i) West Powerhouse Entrance: Operate two entrances (W1 and W2).

ii) East Powerhouse Entrance: Operate all three entrances (E1, E2, E3) except as required during low tailwater conditions (below el 78') when E1 entrance may be closed.

iii) Operate east ladder junction pool weirs as follows: JP2 at 7' below east entrance tailwater elevation, JP4 at 6', and JP6 at 7'.

iv) Operate 12 submerged orifices along the powerhouse collection system. Orifice numbers are: 3, 12, 24, 39, 57, 78, 102, 117, 129, 132, 135, and 136.

v) The cul-de-sac entrance will remain closed.

vi) South Spillway Entrance: Operate both downstream entrances (S1 and S2).

(3) December 1 through February 28 (Winter Operating Period)

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

(b) Operate the north spillway adult fish passage facilities according to the following criteria:

i) No spill period - Operate entrance gate N1, head attainable by ladder flow only. Weir crest 6 feet below tailwater.

CBFWA recommends that both ladder systems operate according to passage season operating standards throughout the year, when not down for maintenance.

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ii) Spill period - operate according to fish passage season criteria.

iii) East ladder dewatered or operating out of fish passage period criteria - Operate according to fish passage season criteria.

(c) Only one of the two fish facilities may be out of service at any one time unless specially coordinated. The lone operating facility should be operated according to fish passage season criteria unless specially coordinated.

C. Fish Facilities Maintenance

CBFWA recommends that a biologist be present to provide technical advice at all project activities which may involve handling fish.

1. Juvenile Fish Passage Facilities

a. Scheduled Maintenance

(1) Collection and Transportation Systems. The Dalles Dam ice and trash sluiceway 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 are dewatered downstream of the gatewell orifices. The system is then visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problem areas identified are repaired and modifications to the channel and general maintenance are completed. The trashracks are raked just prior to the juvenile fish passage season (April 1), whenever trash accumulations are suspected because of increased head across the trashracks or increased descaling of juvenile fish is noted at The Dalles or Bonneville dams and that Bonneville's trashracks are clean.

(2) Turbines and Spillways. The maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see Dewatering Plan). The schedule for this maintenance is reviewed by the Project and Operations biologists and coordinated within NPP, NPD, BPA and FPC. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the area of fishway entrances. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power and water management and will be coordinated with the appropriate resource agencies. No other fish related restrictions regarding maintenance will be placed on any units at this project, except to coordinate research activities.

b. Unscheduled Maintenance

(1) Collection and Transportation Systems. The ice and trash sluiceway is now being used as a juvenile bypass system. The chain gates are fully opened during normal operation. If

a chain gate fails, an adjacent gate can be operated until repairs can be made. Orifices allow fish out of the gatewells into the sluiceway. If orifices become plugged with debris they will be manually cleaned. The gatewells will be inspected daily and debris removed (debarked) when floating debris covers more than one-half the water surface. If a gate hoist fails, it will be repaired promptly. The gate will be removed when there are problems with the seal and the difficulty cannot be repaired promptly. If the epoxy lined section of the sluiceway is found to be damaged, it will be repaired.

(2) Turbines and Spillways.

2. Adult Fish Passage Facilities

a. Scheduled Maintenance

(1) Fishway Auxiliary Water Systems. The Dalles Project fishway auxiliary water is provided by discharge from hydroelectric turbine systems. Preventive maintenance and normal repair are carried out throughout the year.

(2) Powerhouse and Spillway Collection Systems. Preventive maintenance and repair occurs throughout the year. During the adult fish passage season the maintenance will not involve any operations which will cause a failure to comply with the fishway criteria, unless specially coordinated. Inspection of those parts of the adult collection channel systems, such as diffusion gratings, picket leads and entrance gates, will be scheduled at least once every five years unless a channel must be dewatered for fishway modifications or to correct observed problems. Inspection by 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. Any non-routine maintenance and fishway modification will be handled on a case by case basis.

The Project Biologist will attempt to attend all dewatering activities potentially involving large numbers of fish, as well as inspections to provide fishery input (See Dewatering Plans). However, in the absence of the Biologist, the project will proceed, using all due care to ensure that fish are not stranded or injured. In these circumstances, personnel in charge of the activities will provide reports to the Project Biologist summarizing each fish salvage activity. Information will include at least the following: facility involved, timing, numbers of salmonids and sturgeon handled, condition of fish (alive, stressed or dead) and where the fish were released. If an emergency occurs which threatens fish safety, then the Project Biologist or alternate will be contacted for assistance.

(3) Fish Ladders and Counting Stations. The adult fish ladders will be dewatered (see Dewatering plan) once each year during the winter maintenance period. Unless specially coordinated only one ladder will be dewatered at a time, with the other ladder capable of operating at full season criteria. During this time the ladders are inspected for blocked orifices, projections into the fishway that may damage fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion valves, ladder orifice reduction plates 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 are then repaired.

b. Unscheduled Maintenance

(1) Fishway Auxiliary Water Systems. Most fishway auxiliary water systems operate automatically. If the automatic system fails, the system can usually be operated manually by project personnel. This will allow the fish facility to operate according to criteria while the 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.

(a) Powerhouse - If one of the two fishway auxiliary water turbines fails or malfunctions during the spring/summer adult migration season (1 March - 31 July) use the following sequential procedure until a fishway head of 1.0 feet is achieved:

1: Raise the open West Powerhouse Entrance weirs W1 and W2 (W3 normally closed) in one-foot increments until a proper head is achieved or until the weirs reach 6 feet of depth below the tailwater surface.

2: Raise the East Entrance weirs E2 and E3 (E1 closed at tailwater below 78 feet) in one-foot increments to 6 feet of depth below the tailwater surface.

3: Close West Powerhouse Entrance weir W2.

4: Close one East Entrance weir E1.

5: Raise the South Spillway Entrance weirs S1 and S2 in one-foot increments to 6 feet of depth below the tailwater surface.

6: Close one South Spillway Entrance (S2).

7: Close alternating floating orifices starting from the west end of the powerhouse.

8: If a fishway head of 1.0 feet is still not achieved leave in this configuration until more auxiliary water becomes available. Then reverse the above procedure.

If one of the fishway auxiliary water turbines fails, malfunctions or is out of service for necessary maintenance during the fall adult migration or winter maintenance season (August 1-February 28) assuming no spill during this period, use the following sequential procedure until a fishway head of 1.0 feet is achieved:

1: Close the South Spillway Entrance weirs and all diffusers associated with these entrances, including those adjacent to the entrances and those at the west end of the powerhouse.

2: Close entrance E3 (leaving E1 & E2 open at 8' depth).

3: Close one West Entrance weir but one (W2).

4: Raise W1 to 6' depth.

5: Close every other floating orifice starting from the west end of the powerhouse.

6: Raise the East Entrance weirs in one-foot increments to 6 feet of depth below the tailwater surface.

7: If a fishway head of 1.0 feet is still not achieved, then leave in this configuration until more auxiliary water becomes available.

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

1: S1 open with the weir crest 6 feet below the tailwater surface, S2 closed;

2: The junction pool weir supplying the powerhouse collection system and west powerhouse entrances will be closed;

3: E3 will be open with the weir crest 6 feet below the tailwater surface and E1 and E2 will be closed.

(b) **North Ladder** - If the North Wasco County power unit auxiliary water system fails, the back-up auxiliary water systye will be started and the system operated at criteria.

If the back-up auxiliary water system fails, N1 will remain open with a weir depth of 6 feet below the tailwater surface and N2 will be closed.

(2) Powerhouse and Spillway Collection Systems. The Dalles Project contains several types of fishway entrances. In most cases if failures occur then 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 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. The entrance will be repaired in an expedient manner and the entrance will be returned to manual or automatic control at the earliest possible date.

(3) Fish Ladders and Counting Stations. The structures of the ladders include picket leads, counting stations, fishway exits and overflow weirs with orifices.

Picket leads can cause problems. Pickets with excessive spacing (greater than 1"), erosion of concrete around the picketed leads or missing pickets can allow fish into areas where escape is not possible. If picket lead failure or concrete erosion occurs, then the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in consultation with CBFWA.

D. Dewatering Plans.

CBFWA recommends that a biologist be present to provide technical advice at project activities which may involve fish handling.

1. Adult Fish Ladder

a. Scheduled Maintenance

(1) When possible, operate ladder to be dewatered at a reduced flow for at least 24 hours but no more than 48 hours prior to dewatering.

(2) Discontinue all fishway auxiliary water supply at least 24 hours but no more than 48 hours prior to dewatering.

(3) The Project Biologist will invite CBFWA biologists to participate in the dewatering and he will assure that fish rescue equipment is available. He will coordinate with the project to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

(4) Project personnel will install head gates to shut down ladder flow.

(5) The Project Biologist will attempt to attend all ladder dewaterings and oversee fish rescue. 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 tailwater, whichever is closest, for release. When rescue is accomplished in the absence of the Project Biologist a brief report will be provided which will include: facility involved, timing, salmonids and sturgeon found, fish condition (live, dead or stressed) and where the fish were moved to.

b. Unscheduled Maintenance

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

(2) Follow steps 3-5 above.

2. **Powerhouse Fish Collection System**

a. Scheduled Maintenance

(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.

(2) The Project Biologist will assure that rescue equipment is available if needed.

(3) The Project Biologist will provide technical guidance on fish safety and will assist directly when possible in rescue operations. Reports will be provided for fish rescue activities which are not attended by the biologist. Information will include facility involved, timing, numbers of salmonids and sturgeon involved and fish condition (live, dead or stressed) and where the fish were returned to water.

3. **Turbines**

a. When possible, place head gates and tail logs immediately after turbine unit is shut down if draft tube is to be dewatered.

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

c. Water levels in the draft tube will not be allowed to drop to a level which strands fish.

d. 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 will provide technical guidance on fish safety and when possible, will directly participate in fish salvage. Reports will be provided for fish rescue activities which are not attended by the biologist. Information will include facility involved, timing, numbers of salmonids and sturgeon involved and fish condition (live, dead or stressed) and where the fish were returned to water.

e. The Project Biologist will assure that rescue equipment is available if needed.

f. If the turbine unit is planned to be out of service 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.

E. Endnotes

1. Migrations of Juvenile Chinook Salmon and Steelhead Trout in the Snake River from 1973 to 1979. Sims & Ossiander, NMFS, CZES, June 1981. 31 pp.

2. Evaluation of The Dalles Dam Ice-Trash Sluiceway as a Downstream Migrant Bypass During 1977. Nichols, D., et. al., ODFW., 1978. 15 pp.

3. Annual Fish Passage Report - 1988. Columbia and Snake River Projects. US COE.

John Day Dam

III. JOHN DAY DAM

A. Fish Passage Information. The locations of fish passage facilities are shown on the following general site plan for John Day Lock and Dam (Figure 5).

1. Juvenile Fish Passage

a. Facilities Description. juvenile fish bypass facilities at John Day Dam completed in 1987, include the following:

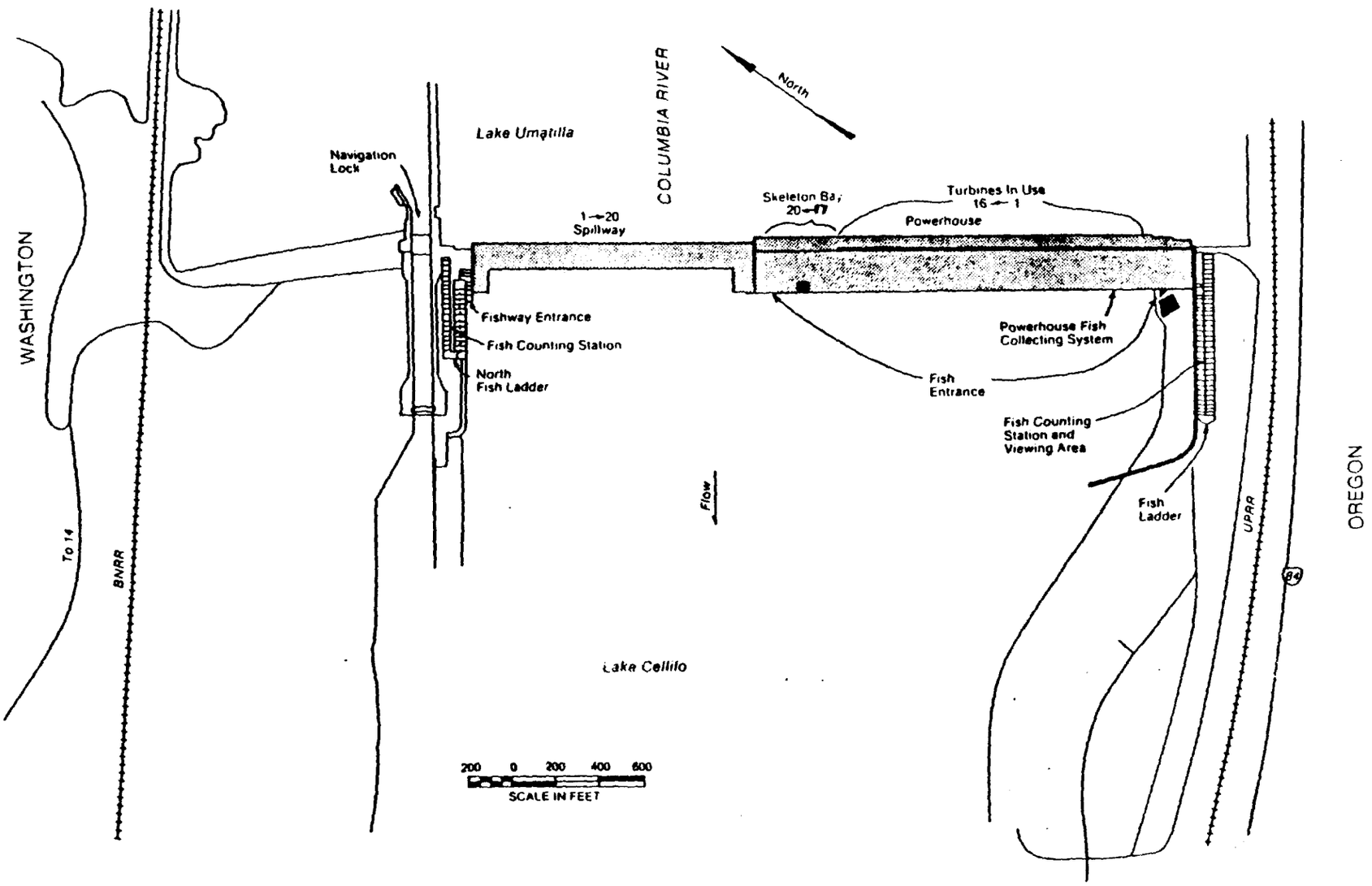
1. VBSs, STSs, and 12-inch diameter orifices in each of the project's 16 turbine units,

2. An enlarged orifice bypass collection conduit,

3. A transportation channel to carry fish from the collection conduit to the river below the dam, and

4. A fingerling sampler and juvenile fish evaluation facility located in the lower portion of the transportation channel.

John Day Lock and Dam



b. Juvenile Migration Timing. Juvenile passage timing has been determined by gatewell sampling at John Day Dam. Hydroacoustic monitoring has been conducted but has generally been concentrated on peak days and hours of passage, and therefore, cannot be used to evaluate seasonal or diel passage patterns. Extended monitoring conducted into December at John Day Dam in 1982 and 1983 showed that less than 3 percent of subyearling chinook migrants move past John Day Dam after October 31. As a result, smolt monitoring under the Water Budget Measures Program is now discontinued on October 31. Maintenance of juvenile fish facilities is scheduled for approximately November 1 through March 31 to minimize impact on downstream migrants.

Diel passage was monitored by hydroacoustics and gatewell sampling.[1] [2] [3] [4] Peak passage occurred between the hours of 2300 and 2400 with a long period of elevated passage until dawn when passage decreases. Passage increases dramatically at dusk -- about 0800. Gatewell sampling data indicate that roughly 80 percent of the juvenile migrants pass John Day Dam between 2100 and 0600. For example, the weighted average passage for subyearling chinook in July and August 1986, was 82 percent. However, some variation from this pattern has been noted such as in 1984. In that year, daytime passage at John Day Dam increased beginning on May 23. During the peak of the spring juvenile migration period at John Day Dam, 40% of the spring chinook and steelhead daily passage occurred between 0700 and 2200. Unit 3 gatewell sampling and hydroacoustic sampling confirmed the diel pattern.

2. Adult Fish Passage

a. Facilities Description. The adult fish passage facilities at John Day Dam comprise a north shore fish ladder which passes fish from entrances at the north end of the spillway, and a south shore fish ladder which passes fish from entrances along a collection channel which extends the full length of the powerhouse.

Auxiliary water is provided to all collection systems by pumping from the tailrace. Counting stations are provided in both fishways.

b. Adult Migration Timing. Fish are present at John Day Dam throughout the year. Adult passage facilities are operated year round. Maintenance of adult fish facilities is scheduled from December 1 through February 28 to minimize the impact on upstream migrants. The following table shows fish counting period by species and earliest and latest recorded dates of peak passage, from fish count data compiled by the Corps.

Table 16. John Day Dam Juvenile Fish Migration Timing.

% PAST PROJECT	YEAR/DATE								
	1982	1983	1984	1985[c]	1986	1987	1988	1989	1990[d]
Yrlg. Chin.									
10%	4/22	5/1	4/18		4/18	5/2	4/24	5/2	4/25
90%	5/27	5/24	5/27		5/28	5/31	6/1	5/27	NA
Suby. Chin.									
10%	4/26[b]	6/13	6/12	7/12[a]	6/8	6/7	6/22	6/7	NA
90%	8/16	8/22	8/19	8/5	8/24	9/18	9/7	8/16	NA
Steelhead									
10%	5/2	5/3	4/23		4/25	5/1	4/26	4/24	4/29
90%	6/16	6/3	6/2		6/3	5/29	6/2	5/27	NA
Coho									
10%	5/21	no	5/22	no	5/22	5/6	5/6	4/28	4/27
90%	6/4	data	6/5	data	6/7	5/30	5/31	5/29	NA
Sockeye									
10%	<-----no data------->				5/3	5/14	5/12	5/8	5/4
90%	<-----no data------->				6/4	6/6	6/3	6/3	NA

[a] It appeared in 1985 that hatchery releases of upriver bright fall chinook salmon either delayed or failed to migrate.

[b] Included tule stock fall chinook released into the Umatilla River in April.

[c] Consistent sampling in 1985 did not start until May 11.

[d] Fish sampling was done at unit 5 at John Day Dam. Outages of this unit during the periods April 16 - 19, May 30 - June 10, June 21 - 23, and August 13 - 16, make computed percentiles gross approximations only. It is likely that dates would be up to several days later if uninterrupted sampling had occurred. Dates where not even gross estimation is feasible are denoted by "NA".

B. Project Operation

1. Spill Management. The following spill schedules starting at Table 18 shall be followed during the spill period. These schedules were developed through studies funded by the Corps and by agreement of fishery agencies and with review by tribal

Table 17. John Day Dam Adult Fish Migration Timing.

1968-1990

Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/5	4/22	5/22
Summer Chinook	6/6 - 8/5	6/7	8/2
Fall Chinook	8/6 -10/31	9/8	9/25
Steelhead	4/1 -10/31	9/6	10/6
Sockeye	4/1 -10/31	6/23	7/10
Coho	4/1 -10/31	9/4	10/12

representatives.

2. Dissolved Gas Management and Control. Spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrating juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring during 1991 will be at the John Day Dam forebay automated station and reported every four hours from early March through September 30. Related data reported at the same time will be spill volume and total project flow.

Table 18. John Day Dam Daytime Spill Schedule (0600-2000).

SPILL BAY										
1	2	3	4	5 to 10	11 to 16	17	18	19	20	KCFS
1									(1)	6.4
1	1							(1)	1	8.2
1	1	1					(1)	1	1	9.6
1	1	2					(2)	1	1	12.8
1	2	1				(1)	2	1	1	16.0
1	1	2	2			(2)	2	1	1	19.2
1	2	2	2			2	2	(2)	1	22.4
1	2	2	2	0 or 2	0 or 2	2	2	2	1	60.8
1	2	2	2	(3)	(3)	2	2	2	1	80.0
1	2	3	3	3	3	(3)	2	2	1	84.8
1	2	3	3	3	3	3	(3)	2	1	86.4
1	2	3	3	(4)	(4)	3	3	2	1	105.6
2	3	4	4	(4)	(4)	4	4	3	2	118.4
2	3	4	4	(5)	(5)	4	4	3	2	137.6
2	4	4	5	(6)	(6)	4	4	3	2	160.0
2	4	5	5	6	6	(5)	4	3	2	163.2
2	4	5	6	6	6	5	(5)	3	2	166.4
2	4	6	6	6	6	(6)	5	3	2	169.6
2	4	6	6	6	6	6	(6)	4	2	172.8
2	4	5	6	(7)	(7)	6	6	4	2	190.4
2	4	6	7	7	7	(7)	6	4	2	195.2
2	4	6	7	(8)	(8)	7	6	4	2	214.4
2	4	6	8	8	8	(8)	6	4	2	217.6
2	4	6	8	(9)	(9)	8	6	4	2	236.8
2	4	6	9	(10)	(10)	8	6	4	2	257.6
2	5	6	9	10	10	(9)	6	4	2	260.8
2	5	6	9	(11)	(11)	9	6	4	2	280.0

Continue as in rows above, opening from ends toward center, using 1 stop increments on innermost gate of gates 5 - 16 if necessary.

Gates 1, 2, 18, 19 and 20 limits at 9 stops.

Circled values may be 1 stop less than value shown.

Each stop equals about 1.6 kcfs.

Nighttime spill will follow juvenile spill schedule.

Table 19. John Day Dam Nighttime Spill Schedule (2000-0600).

TOTAL SPILL KCFS	SPILL BAY 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
9.6																				6
11.2																				7
12.8																				8
14.4																				9
16.0																			5	5
17.6																			5	6
19.2																			6	6
20.8																			6	7
22.4																			7	7
24.0																			7	8
25.6																			8	8
27.2																			8	9
28.8																			9	9
30.4																		6	6	7
32.0																		6	7	7
33.6																		7	7	7
35.2																		7	7	8
36.8																		7	8	8
38.4																		8	8	8
40.0																		8	8	9
41.6																		8	9	9
43.2																		9	9	9
44.8																	7	7	7	7
46.4																	7	7	7	8
48.0																	7	7	8	8
49.6																	7	8	8	8
51.2																	8	8	8	8
52.8																	8	8	8	9
54.4																	8	8	9	9
56.0																	8	9	9	9
57.6																	9	9	9	9
59.2																7	7	7	8	8
60.8																7	7	8	8	8
62.4																7	8	8	8	8

Table 20. John Day Dam Nightime Spill Schedule (2000-0600). (cont.)

TOTAL SPILL KCFS	SPILL BAY																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
64.0																8	8	8	8	8
65.6																8	8	8	8	9
67.2																8	8	8	9	9
68.8																8	8	9	9	9
70.4																8	9	9	9	9
72.0																9	9	9	9	9
73.6															7	7	8	8	8	8
75.2															7	8	8	8	8	8
76.8															8	8	8	8	8	8
78.4															8	8	8	8	8	9
80.0															8	8	8	8	9	9
81.6	1														8	8	8	8	9	9
83.2	1	1													8	8	8	8	9	9
84.8	1	1	1												8	8	8	8	9	9
86.4	1	1	1	1											8	8	8	8	9	9
88.0	1	1	1	2											8	8	8	8	9	9
89.6	1	1	2	2											8	8	8	8	9	9
91.2	1	2	2	2											8	8	8	8	9	9
92.8	2	2	2	2											8	8	8	8	9	9
94.4	2	2	2	3											8	8	8	8	9	9
96.0	2	2	3	3											8	8	8	8	9	9
97.6	2	3	3	3											8	8	8	8	9	9
99.2	3	3	3	3											8	8	8	8	9	9
100.8	3	3	3	3	1										8	8	8	8	9	9
102.4	3	3	3	3	1										8	8	8	9	9	9
104.0	3	3	3	3	1										8	8	9	9	9	9
105.6	3	3	3	3	1										8	9	9	9	9	9
107.2	3	3	3	3	1										9	9	9	9	9	9
108.8	3	3	3	3	2										9	9	9	9	9	9
110.4	3	3	3	3	2									7	8	8	8	8	8	8
112.0	3	3	3	3	2									8	8	8	8	8	8	8
113.6	3	3	3	3	2									8	8	8	8	8	8	9
115.2	3	3	3	3	2									8	8	8	8	8	9	9
116.8	3	3	3	3	3									8	8	8	8	8	9	9

Table 21. John Day Dam Nighttime Spill Schedule (2000 - 0600). (cont.)

TOTAL SPILL KCFS	SPILL BAY																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
118.4	3	3	3	3	3									8	8	8	8	9	9	9
120.0	3	3	3	3	3									8	8	8	9	9	9	9
121.6	3	3	3	3	3									8	8	9	9	9	9	9
123.2	3	3	3	3	3									8	9	9	9	9	9	9
124.8	3	3	3	3	3	1								8	9	9	9	9	9	9
126.4	3	3	3	3	3	1								9	9	9	9	9	9	9
128.0	3	3	3	3	3	1							8	8	8	8	8	8	8	8
129.6	3	3	3	3	3	1							8	8	8	8	8	8	8	9
131.2	3	3	3	3	3	1							8	8	8	8	8	8	9	9
132.8	3	3	3	3	3	2							8	8	8	8	8	8	9	9
134.4	3	3	3	3	3	2							8	8	8	8	8	9	9	9
136.0	3	3	3	3	3	2							8	8	8	8	9	9	9	9
137.6	3	3	3	3	3	2							8	8	8	9	9	9	9	9
139.2	3	3	3	3	3	2							8	8	9	9	9	9	9	9
140.8	3	3	3	3	3	3							8	8	9	9	9	9	9	9
142.4	3	3	3	3	3	3							8	9	9	9	9	9	9	9
144.0	3	3	3	3	3	3							9	9	9	9	9	9	9	9
145.6	3	3	3	3	3	3						8	8	8	8	8	8	8	8	9
147.2	3	3	3	3	3	3						8	8	8	8	8	8	8	9	9
148.8	3	3	3	3	3	3	1					8	8	8	8	8	8	8	9	9
150.4	3	3	3	3	3	3	1					8	8	8	8	8	8	9	9	9
152.0	3	3	3	3	3	3	1					8	8	8	8	8	9	9	9	9
153.6	3	3	3	3	3	3	1					8	8	8	8	9	9	9	9	9
155.2	3	3	3	3	3	3	1					8	8	8	9	9	9	9	9	9
156.8	3	3	3	3	3	3	2					8	8	8	9	9	9	9	9	9
158.4	3	3	3	3	3	3	2					8	8	9	9	9	9	9	9	9
160.0	3	3	3	3	3	3	2					8	9	9	9	9	9	9	9	9
161.6	3	3	3	3	3	3	2					9	9	9	9	9	9	9	9	9
163.2	3	3	3	3	3	3	2				8	8	8	8	8	8	8	8	9	9
164.8	3	3	3	3	3	3	3				8	8	8	8	8	8	8	8	9	9
166.4	3	3	3	3	3	3	3				8	8	8	8	8	8	8	9	9	9
168.0	3	3	3	3	3	3	3				8	8	8	8	8	8	9	9	9	9
169.6	3	3	3	3	3	3	3				8	8	8	8	8	9	9	9	9	9
171.2	3	3	3	3	3	3	3				8	8	8	8	9	9	9	9	9	9

Table 22. John Day Dam Nighttime Spill Schedule(2000-0600). (cont.)

TOTAL SPILL KCFS	SPILL BAY 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
172.8	3	3	3	3	3	3	3	1			8	8	8	8	9	9	9	9	9	9
174.4	3	3	3	3	3	3	3	1			8	8	8	9	9	9	9	9	9	9
176.0	3	3	3	3	3	3	3	1			8	8	9	9	9	9	9	9	9	9
177.6	3	3	3	3	3	3	3	1			8	9	9	9	9	9	9	9	9	9
179.2	3	3	3	3	3	3	3	1			9	9	9	9	9	9	9	9	9	9
180.8	3	3	3	3	3	3	3	2			9	9	9	9	9	9	9	9	9	9
182.4	3	3	3	3	3	3	3	2		8	8	8	8	8	8	8	8	9	9	9
184.0	3	3	3	3	3	3	3	2		8	8	8	8	8	8	8	9	9	9	9
185.6	3	3	3	3	3	3	3	2		8	8	8	8	8	8	9	9	9	9	9
187.2	3	3	3	3	3	3	3	2		8	8	8	8	8	9	9	9	9	9	9
188.8	3	3	3	3	3	3	3	3		8	8	8	8	8	9	9	9	9	9	9
190.4	3	3	3	3	3	3	3	3		8	8	8	8	9	9	9	9	9	9	9
192.0	3	3	3	3	3	3	3	3		8	8	8	9	9	9	9	9	9	9	9
193.6	3	3	3	3	3	3	3	3		8	8	9	9	9	9	9	9	9	9	9
195.2	3	3	3	3	3	3	3	3		8	9	9	9	9	9	9	9	9	9	9
196.8	3	3	3	3	3	3	3	4		8	9	9	9	9	9	9	9	9	9	9
198.4	3	3	3	3	3	3	3	4		9	9	9	9	9	9	9	9	9	9	9
200.0	3	3	3	3	3	3	3	4	8	8	8	8	8	8	8	8	9	9	9	9
201.6	3	3	3	3	3	3	3	4	8	8	8	8	8	8	8	9	9	9	9	9
203.2	3	3	3	3	3	3	3	4	8	8	8	8	8	8	9	9	9	9	9	9
204.8	3	3	3	3	3	3	4	4	8	8	8	8	8	8	9	9	9	9	9	9
206.4	3	3	3	3	3	3	4	4	8	8	8	8	8	9	9	9	9	9	9	9
208.0	3	3	3	3	3	3	4	4	8	8	8	8	9	9	9	9	9	9	9	9
209.6	3	3	3	3	3	3	4	4	8	8	8	9	9	9	9	9	9	9	9	9

Spill bay openings are expressed in gate stops.

Use the same pattern trend for spill levels exceeding 210 kcfs (i.e. 80% at south bays, 20% at north bays).

3. Juvenile Fish Passage Facilities

a. Operating Criteria

(1) Prior to April 1 Each Year:

(a) Remove debris from forebay, trashracks and gatewell slots.

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

(c) Inspect each STS and operate on trial run (dogged off at deck level). By April 1, place STS in each intake of all operational units.

(d) Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems.

(e) Calibrate automatic control on DSM conduit tainter gate using measurement of water surface elevation in the air vent located nearest the pressure sensor.

(f) Inspect, maintain and, where necessary, repair the DSM conduit tainter gate.

(g) Inspect and correct any deficiencies of walls and floor DSM conduit, raceway, and outfall.

(2) April 1 through October 31

(a) Remove debris from forebay and trashracks as required to maintain less than 1 foot of additional drawdown in gatewell or as indicated by fish condition (e.g., higher than expected descaling). The trashracks for at least units 1, 2, and 3 should be raked again before June 15. Raking should proceed to the north as long as substantial debris continues to be collected. STSs in units being raked should run continuously during raking operation. Gatewell orifices of the unit being raked must be closed during the raking operation.

(b) Inspect each STS and VBS a minimum of once every two months (video acceptable). Preferably, inspections will occur immediately prior to peaks in the juvenile fish migrations (mid-May and mid-July). Inspections should be concentrated on the priority units and those others with the longer operating time. More frequent inspections may be required under the following conditions: 1) deterioration of fish condition; 2) increased debris load in bypass system; and 3) other indications

of STS or VBS malfunction or failure. If STS or VBS damage or plugging is detected, follow procedures in the following maintenance plan. Records of inspections or summary of such records will be made available to the FPC by January 1.

(c) Operate all gatewell orifices. Inspect daily to assure that the orifice lights are operating. Replace all burned out orifice lights within 24 hours. Close and open each orifice every day or as indicated by debris accumulations in the gatewells.

(d) Inspect each STS watt meter readings at least once per shift. If an STS failure occurs follow procedures in the following maintenance plan.

(e) Inspect all STS gatewells daily. The project will make an effort to clean before gatewell water surface becomes one-half covered with debris. However, the project will begin cleaning the gatewells before they become fully covered unless the gatewell becomes fully covered overnight or on a weekend, at which time cleaning will begin the next work day. The orifice of the gatewell being cleaned must be closed during the operation. Each VBS should be cleaned within three weeks either side of July 1 unless visually inspected and found free of debris.

Turbines with a gatewell fully covered with debris will be operated on a last on/first off basis to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; or 3) provide station service power. The powerhouse gatewell orifices should be closed during the debarking operation. After debarking a gatewell, back-flush the orifice in that gatewell. Check gatewell drawdown.

(f) Coordinate cleaning efforts with personnel operating downstream migrant sampling facilities.

(g) Turbines will be operated within 1% of peak turbine efficiency unless operation out of that range is neces-

sary to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

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

(h) STS operation cycling may begin when the mean length of the majority of juvenile chinook passing the project reaches or exceeds 112 mm. This time will be determined by the Project Biologist. A cycling time of a maximum 20 minutes off and a minimum of 2 minutes on must be followed. Cycling will be discontinued if warranted by fish condition or debris problems. STSs in intakes used for juvenile indexing will run continuously.

(i) Turbine units without full complements of STSs may operate only as last on/first off to: 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

CBFWA recommends no operation of partially or fully unscreened turbine units unless otherwise agreed.

(j) Inspect facilities twice each day

(3) August 16 through October 31

STSs may be removed from the powerhouse turbine units designated by the Project Biologist with no more than eight of the sixteen units unscreened to reduce wear and facilitate early

winter maintenance. Enough units should remain screened to allow the average expected daily peak river flow, (as estimated by RCC in coordination with BPA) for the remainer of the fish passage season to pass through screened units. STSs will be removed from lower priority units.

CBFWA recommends no operation of partially or fully unscreened turbine units unless otherwise agreed.

(4) November 1 through March 31

All STSs removed. DSM channel dewatered (see Dewatering Plans) only when required for maintenance. The period of maintenance should be minimized to the extent practicable. Additionally, all units are available to meet power demands and will be operated within 1% of peak turbine efficiency whenever practicable.

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

4. Adult Fish Passage Facilities

a. Operating Criteria

(1) Prior to March 1

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

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

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

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

(e) Repair or when necessary upgrade netting at top of both fish ladders to keep fish from leaping out of the ladders.

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

(a) Adult Fish Facilities

i) Water depth over fish ladder weirs: 1.0 - 1.3 feet (prefer 1.2).

ii) Head on all entrances: 1.0 to 2.0 feet (prefer 1.5). Refer to Section C when unable to achieve head criteria.

iii) A transportation velocity of 1.5 to 4.0 feet per second (prefer 2.0 fps) shall be maintained in all channels and the lower ends of the fish ladders which are below the tailwater.

iv) Maximum of 6" head on attraction water intakes and trashracks at all the ladder exits, with a 4" maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

v) Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period.

vi) Main entrance weir depths: 8 feet or greater below tailwater. Weirs fully lowered when 8 feet depth is not possible.

vii) Inspect facilities twice each day.

(b) North Fishway

i) Operate two downstream gates (N1 and N2). Use staff gauge located around the first ladder bend to calculate entrance head. Doing so helps account for the velocity head associated with these entrances.

ii) At the end of each fish counting day, fully open counting station crowder and leave fish passage slot lighted over night.

(c) Powerhouse

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

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

iii) Operate SE-1.

iv) At the south ladder counting station, leave the fish passage slot lighted overnight after counting ends each day.

v) From 0400-2000 P.S.T. operate powerhouse turbine unit #1 near 100 megawatts (±10MW) to facilitate best entrance conditions, unless additional load is required to 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; 2) be in compliance with other coordinated fishery measures; or 3) avoid forcing an unscreened unit to operate to provide required load.

(3) December 1 through February 28 (Winter Operating Period).

CBFWA recommends operating adult fish passage facilities according to passage season standards when not down for maintenance.

(a) Adult Fish Facilities

i) Water depth over fish ladder weirs: 1.0 - 1.3 feet (prefer 1.2).

ii) Only one of the two fish facilities may be out of service at a time unless specially coordinated. The other facility must be operated at passage season criteria unless specially coordinated.

iii) Main entrance weir depths: 6 feet or greater below tailwater. Weirs fully lowered when 6 feet depth is not possible.

iv) Pull picketed leads at counting stations and have crowders adjusted such that the counting slots are fully open at the end of the counting season.

v) Maximum of 6" head on attraction water intakes and trashracks at all ladder exits. Debris shall be removed when significant amounts accumulate.

vii) Inspect the facilities once per day.

(b) North Fishway

i) Operate gate N1 with N2 closed and with entrance head as follows for various conditions:

a) No spill - head attainable by ladder flow and one auxiliary water pump.

b) With spill - Standard passage season head (1.0 to 2.0 with 1.5 target).

c) South ladder dewatered or operating below winter standards - Operate according to adult fish passage season standards.

ii) Inspect the facilities once per day.

(c) Powerhouse

i) Head on all entrances - 1.0 foot.

ii) Operate NE-2 with NE-1 closed.

iii) Operate all ten floating orifices.

iv) Operate SE-1.

C. Fish Facilities Maintenance

1. Juvenile Fish Passage Facilities

CBFWA recommends that a biologist be present to provide technical advice at all project activities which may involve handling fish.

a. Scheduled Maintenance

(1) Submersible Traveling Screens. The STS system may receive preventive maintenance or repair anytime during the year including the winter maintenance period when all STSs may be removed from the intakes. 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. About one third of the STSs at John Day are scheduled for complete overhaul each year resulting in a three year maintenance cycle unless future developments indicate that a longer life expectancy is possible.

(2) Juvenile Bypass System. The John Day juvenile bypass facilities may 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 system is dewatered downstream of the gatewell orifices. The system is then visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problems identified are 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 channel are also completed at this time.

The trashracks are raked just prior to the juvenile fish passage season (April 1) and whenever trash accumulations are suspected because of increased differential (>1') across the trashracks or as determined by the Project Biologist in reference to indicators such as increased juvenile fish descaling is noted at John Day Dam or increased accumulations of tumbleweeds in the forebay. Additional raking of trashracks may be necessary when a storm brings large quantities of debris down river to the project. The gatewell orifices must be closed during the raking process.

(3) Turbines and Spillway. The maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see Dewatering Plan). The schedule for this maintenance will be reviewed by Project and Operations biologists and coordinated within NPP, NPD, BPA and FPC. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the area 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 CBFWA. No other fish related restrictions regarding maintenance will be placed on any units at these projects, except to coordinate research activities.

b. Unscheduled Maintenance

(1) Submersible Traveling Screens. If an STS is found to be damaged or inoperative in an operating unit refer to Figure 6. During the peak juvenile passage periods (April 16 to August 31), the six days following a juvenile fish release in the John Day pool or as determined by the Project Biologist based on juvenile salmon passage by John Day Dam, a crane crew will be taken off lower priority work or will work overtime to remove and replace (if spare available) a damaged or malfunctioning STS or VBS from any unit needed or likely to be needed for power within the next 48 hours. Crews will work overtime or on weekends as required.

(2) Juvenile Bypass System.

(a) John Day's juvenile bypass system is controlled by automatic systems. If the automatic system fails it can usually be operated manually. This allows the facility to operate according to criteria while repair of the automatic system is completed. If the orifices become plugged with debris they are mechanically cleaned out.

(b) The gatewells will be inspected daily and debris removed (debarked) when it covers over one-half of the water surface to maintain clean orifices and minimize fish injury. Turbines with a gatewell fully covered with debris will be operated on a last on/first off basis to 1) meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures. The gatewell orifices must be closed during the debarking process.

(c) If the bypass system fails in the powerhouse conduit, tainter gate, or transportation outfall making the system unsafe for fish, the decision to dewater for repairs will be made in consultation with CBFWA. During this emergency operating mode, power generation will be minimized to the extent practicable. If this operating mode is expected to last longer than four days, then all units required for generation will be sequentially shut down, fish salvaged from the gatewell, the STS removed and the unit restarted. The orifice gates will be closed then opened once each day to float any debris accumulating around the orifice. During fishway inspection activities VBSs may be found to be plugged with debris or damaged. In these cases refer to Figure 6.

1. If the project is operating with all available units to meet firm energy demands during low debris conditions continue operating until step 3 can be done, otherwise go to step 2.

2. Unit 5 (the station service unit) will continue in operation under any load conditions (except during high debris period) with a failed STS or VBS until step 3 can be accomplished. Under high debris load conditions any unit with a failed or malfunctioning STS or VBS will be shut down. If it is the priority unit, the failed STS or VBS will be repaired or replaced within 24 hours. Any other unit with a failed STS or VBS will be shut down until step 3 can be accomplished or that unit is required to meet firm energy demands, in which case that unit will be the last to be brought on line and the first off line.

3. During working hours, assuming the BPA dispatcher will unload John Day on request, the unit will be taken out of service and the failed STS or VBS will be examined. If the required repairs can be done that day, they will be done and the unit may then be returned to service. During the peak juvenile passage period (16 April - 31 August), six days following a juvenile fish release in the John Day pool, or as determined by the project biologist in consultation with FPC, if an STS or VBS fails on a unit required for generation, then a crane crew will be taken off lower priority work, will work overtime or weekends to remove and replace (if spare available) the damaged or malfunctioning STS or VBS.

4. If repairs require longer than the rest of the day, the STS or VBS will be replaced with a spare or one from a long term out of service unit. If this is not the situation begin removing the replacement STS or VBS from the northernmost unit and move sequentially to the south. STSs or VBSs should be removed from the A-slot first, B-slot second, C-slot third.

5. Operation of all partially screened or unscreened units will be restricted according to the Operating Standards until a spare or repaired STS or VBS is available for installation.

Figure 6. O&M Guidance for John Day Dam STS or VBS failure.

2. Adult Fish Passage Facilities

a. Scheduled Maintenance

(1) Fishway Auxilliary Water Systems. The John Day Project has pump style auxiliary water systems. Preventive maintenance and normal repair are carried out throughout the year.

(2) Powerhouse and Spillway 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 a failure to comply with the adult fishway criteria unless specially coordinated. Inspection of those parts of the adult collection channel systems which require dewatering such as diffusion gratings, picket leads and entrance gates, will be scheduled at least once every ten years with at least one underwater inspection in between unless a channel must be dewatered for fishway modifications or to correct observed problems (see Dewatering Plan). Inspection by 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. Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

The Project Biologist will attempt to attend all dewatering activities potentially involving large numbers of fish, as well as inspections to provide fishery input (See Dewatering Plans). However, in the absence of the Biologist, the project will proceed, using all due care to ensure that fish are not stranded or injured. In these circumstances, personnel in charge of the activities will provide reports to the Project Biologist summarizing each fish salvage activity. Information will include at least the following: facility involved, timing, numbers of salmonids and sturgeon handled, condition of fish (alive, stressed or dead) and where the fish were released. If an emergency occurs which threatens fish safety, then the Project Biologist or alternate will be contacted for assistance.

(3) Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year (unless specially coordinated) during the winter maintenance period (see Dewatering Plan). During this time the ladders are inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion gratings, unreadable or damaged staff gauges, defective diffusion valves and malfunctioning operating

equipment at the counting stations as well as other potential problems identified throughout the passage year that do not impact fish passage, as well as those identified during the dewatered period are then repaired.

The netting installed on the ladders to prevent fish leaping will be maintained annually.

b. Unscheduled Maintenance

(1) Fishway Auxilliary Water Systems. The fishway auxiliary water systems are operated mostly automatically. If the automatic system fails, the system can usually be operated manually by project personnel. This will allow the fish facility to operate according to criteria while the automatic system is repaired. If this operation becomes necessary then project personnel will increase the surveillance of the adult system to ensure that criteria are being met.

a) South Ladder - If one of the three auxiliary water turbines fails, assuming all three turbines are being used to meet criteria, bulkheads will be installed in the failed turbine discharge conduit and the output of the two remaining turbines will be increased to bring the fishway into agreement with the adult fishway criteria.

If a second turbine unit fails, bulkheads will be installed in the second failed turbine discharge conduit and the adult fish facility will be operated as follows until a fishway head of 1.0 foot is achieved:

1: Raise the north powerhouse entrances (NE1, NE2) in one-foot increments to 6 feet of depth below the tail water surface.

2: Close NE1.

3: Raise the south powerhouse entrance weir (SE1) in one-foot increments to 6 feet of depth below the tail water surface;

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

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

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

1: SE1 will be open with the weir crest 6 feet below the tail water surface;

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

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

(a) North Ladder. This system can operate according to the adult fishway criteria under most conditions by using fewer than the six auxiliary water pumps. If one pump fails, one of the standby pumps will be started up. This routine will be followed until the available pumps can no longer meet the adult fishway criteria. If this occurs, then N2 will be raised in one-foot increments until a fishway head of 1.0 foot is met or until the weir crest reaches a depth of 6 feet below the tail water surface. If this fishway criterion is still not met, N1 will be raised in one-foot increments until that criterion is met or the weir crest reaches a depth of 6 feet below the tail water surface. If the criterion is still not achieved close N2 and the N1 weir will be maintained at the 8 foot level. If head of 1.0 is not met, then raise N1 in one-foot increments until the weir crest reaches a depth of 6 feet below tail water surface. Maintain in this condition until repairs reach a stage which allows more water to be added to the system. The weirs should then be opened in the reverse order in which they were closed.

(2) Powerhouse and Spillway Fish Collection Systems. The John Day 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. 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 until expedient repairs are affected. If this is not possible, then the entrance will be repaired in an expedient manner (receive high priority) and the entrance will be brought back into manual or automatic control at the earliest possible time.

(3) Ladders and Counting Stations. The structures of the ladders include picket leads, counting stations, fishway exits and overflow weirs with orifices. Pickets with excessive spacing (greater than 1"), erosion of concrete around the picket leads or missing pickets can allow fish into areas where escape is not possible. In some instances of picket lead failure there are spare picket leads and spare installation slots. In these cases the spare leads are installed and the damaged leads are

removed and repaired. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in consultation with CBFWA, according to the described coordination procedures.

D. Dewatering Plans

CBFWA recommends that a biologist be present to provide technical advice at all project activities which may involve handling fish.

1. Adult Fish Ladder

a. Scheduled Maintenance

(1) When possible, operate ladder to be dewatered at orifice flow for at least 24 hours but no more than 48 hours prior to dewatering.

(2) Discontinue all auxiliary water supply at least 24 hours but no more than 48 hours prior to dewatering.

(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.

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

(5) The Project Biologist will oversee the fish rescue if possible when the ladders are dewatered. Rescue personnel will walk the inside of the ladder from the head gates down to tail water salvaging all fish either by moving fish to tail water within the ladder flow or capturing and placing the fish in a large water filled tank which is then transported to the forebay or tail water, whichever is closest, for release. When rescue is accomplished in the absence of the Project Biologist a brief report will be provided which will include: facility involved, timing, salmonids and sturgeon found, fish condition (live, dead or stressed) and where the fish were moved to.

b. Unscheduled Maintenance

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

(2) Follow steps 3-5 above.

2. Powerhouse Fish Collection System

a. Scheduled Maintenance (see Appendix A for coordination procedures)

(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.

(2) The Project Biologist will assure that rescue equipment is available if needed.

(3) The Project Biologist will provide technical guidance on fish safety and will assist in rescue operations as required.

3. Turbines

a. When possible, place head gates and tail logs immediately after the turbine unit is shut down if the draft tube is to be dewatered.

b. If the turbine unit draft tube is to be dewatered and the turbine unit has been idle for longer than three hours it will be operated when possible, at "speed/no load" and stop logs will then be placed immediately.

c. Water levels in the draft tube will not be allowed to drop to a level which strands fish.

d. 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 will provide technical guidance on fish safety and will directly participate in fish salvage as needed. Reports will be provided for fish rescue activities which are not attended by the biologist. Information will include facility involved, timing, numbers of salmonids and sturgeon involved and fish condition (live, dead or stressed) and where the fish were returned to water.

e. The Project Biologist will assure that rescue equipment is available if needed.

f. If the turbine unit is planned to be down for less than 4 days and low numbers of fish are trapped, then removal of fish will not necessary as long as an adequate "safety pool" is maintained.

E. Endnotes

1. Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam in 1983. R. Magne et. al. US COE Research Report. 35 pp. plus appendices. (1987)

2. Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam 1984-85. R. Magne et. al., US COE Research Report. 29 pp. plus appendices. (1987)

3. Hydroacoustic Evaluation of Juvenile Salmonid Fish Passage at John Day Dam in Summer 1986. Sue Kuehl, BioSonics, Inc. Final Report. Prepared for US COE under Contract No. DACW57- 86-C-0088. 61 pp. plus appendices. (1987)

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

McNary Dam

A. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for McNary Lock and Dam (Figure 7).

1. Juvenile Fish Passage.

a) Facilities Description. The juvenile facilities at McNary Dam consist of submersible traveling screens (STS), gatewell orifices system, and a bypass flume. Juvenile transportation facilities at McNary include: an upwell and fish size separator structure; a flume and pipe system for distributing the fish among the raceways; raceways for holding fish; sampling and marking facilities including a preanesthesia system; barge and truck loading facilities; and water supply conduits.

b) Juvenile Migration Timing.

Table 23. Juvenile Migration Timing at McNary Dam.

% Past Project	Earliest	Latest	1985	1986	1987	1988	1989	1990
Yearling chinook								
10%	4/10	4/30	4/11	4/10	4/27	4/18	4/30	
90%	5/19	5/27	5/27	5/26	5/19	5/22	5/23	
Steelhead								
10%	4/25	5/2	4/25	4/29	5/1	4/30	5/2	
90%	5/23	6/6	6/6	6/3	5/24	5/30	5/28	
Sub-yearling chinook								
10%	6/7	6/17	6/17	6/8	6/20	6/15	6/16	
90%	7/15	8/11	7/24	8/1	7/15	7/18	7/18	
Sockeye								
10%	4/30	5/7	4/30	5/1	5/7	5/4	4/30	
90%	5/31	7/6	6/8	6/6	5/31	5/26	5/27	

2. Adult Fish Passage.

a) Facilities Description. The adult fish passage facilities at McNary consist of separate north and south shore facilities. The north shore facilities are made up of a fish ladder with counting station, a small collection system, and a gravity-flow auxiliary water supply system. The collection system has three downstream entrances and a side entrance into the spillway basin. Two of the downstream entrances are used during normal operation. The gravity-flow auxiliary water supply system takes water from the forebay through 2 conduits and distributes it through diffusers at the bottom of the ladder and in the transportation channel. The south shore facilities are comprised of a fish ladder with counting station, two south shore

McNary Lock and Dam
North
RIVER
Traveling Screens
Fish Counting Station
Navigation Lock
Right Abutment
Juvenile Collection Facility
1→22 Spillway
14←1 Powerhouse
Left Abutment
Fish Counting Station
Oregon Shore Fish Ladder
Fish Viewing Room
009
Fishway Entrance
Powerhouse Fish Collection System
Fishway Entrance
Fishway Pumps
Washington Shore Fish Ladder
WASHINGTON
OREGON
COLUMBIA
Flow
600 0 600 1200
SCALE IN FEET

Figure 7

entrances, a powerhouse collection system, and gravity and pumped auxiliary water supply systems. The powerhouse collection system contains three downstream and one side entrance into the spillway basin at the north end of the powerhouse, twelve floating orifices located across the powerhouse, and a common transportation channel for all of the entrances. At the north end of the powerhouse, two of the downstream entrances are used during normal operation with the other downstream and side entrances closed. The gravity-flow auxiliary water is provided by one conduit from the forebay and supplies the diffusers at the bottom of the ladder at tailwater level. The pumped auxiliary water is supplied by three electric pumps with variable-pitched blades. Two pumps are capable of providing the required flow when the third pump is bulkheaded to prevent water from flowing back through the pump to the river. The electric pumps supply the auxiliary water for the diffusers at the entrances and in the transportation channel.

b) Adult Migration Timing. Upstream migrants are present at McNary Dam year round. Maintenance of upstream passage facilities is scheduled for January through February to minimize impacts on upstream migrants. Table 24 shows primary passage periods by species and the earliest and latest dates of peak passage on record, from fish count data compiled by the Corps of Engineers.

Table 24. Adult Migration Timing from Fish Counts 1954-1990.

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

B. Project Operation.

1. Spill Management. Spill at McNary is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at McNary shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section.

2. Dissolved Gas Management and Control. Total dissolved gas monitoring in the McNary forebay is at two locations: at the navigation lock on the north shore to monitor the mid-Columbia arm of the McNary pool; and on the south end of the powerhouse to monitor Snake River inflow. The McNary north and south shore stations have been automated wherein data are transmitted via satellite. Total dissolved gas levels will be reported every four hours from the first week of March through September 30 for automated stations. Related

data reported at the same time for McNary Project will be spill volume and total project flow. Requests for spill at McNary will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migrant monitoring data.

3. Juvenile Fish Passage Facilities.

a) Juvenile Collection/Bypass System Operations.

1) Yearling salmon will be separated from larger steelhead smolts by a mechanical fish size separator.

2) When river flows exceed 220 kcfs, yearling salmon will be bypassed to the river while steelhead and those yearling salmon not separated will be transported. Exceptions to the above may occur early in the migration season when yearling hatchery chinook make up 90-95 percent of the **B (large fish)** sample hopper. The following specific trigger levels provide guidelines whether to transport or bypass yearling chinook at this project that are separated through the large fish portion of the separator.

Percent Yrlg. Chin. (in B hopper)	Total Sthd. (in B hopper)	Passage Option (B hopper fish)
less than 25	----	Transport
26 - 50	less than 1000	Bypass
26 - 50	1000 - 2000	Transport
greater than 50	less than 2000	Bypass
----	2000 or more	Transport

3) The intent is to limit the proportion of the spring chinook run transported from McNary Dam to 10 percent or less in above average flow years.

4) In the absence of an effective fish size separator, all fish collected will be returned to the river when yearling chinook predominate.

5) When subyearling chinook counts exceed those of yearling salmon, transportation of all species will begin.

6) Summer migrants collected will be transported below Bonneville Dam. Barging for summer migrants will be operational from approximately June 15 to August 1.

7.) At McNary Dam transportation of smolts will continue until numbers of fish collected are 1000 or less for five consecutive days (approximately September 30).

b) Operating Criteria: April 1 to October 31 (or to the end of approved research period for monitoring adult fallback if later) operate according to criteria listed below and the Fish Transportation Oversight Team's (FTOT) Annual Work Plan (Appendix 1).

1) **Prior to April 1 each year:**

a> Forebay Area and Intakes:

1> Remove debris from forebay and trash racks.

2> Rake trash racks.

3> Remove debris from gatewell slots.

4> Measure and log drawdown in gatewell slots.

b> Submersible Traveling Screens:

1> Maintenance completed on all STS's.

2> Inspect screens and operate on one trial run.

3> Log results of trial run.

c> Gallery Bypass Flume:

1> Orifice lights operational.

2> Orifices clean and operational.

3> Clear plastic spools on orifices clean.

4> Orifice valves operational.

5> Water dissipation screens clean and ready for operation.

d> Sorting and Holding Facilities:

1> No rough edges on perforated plate.

2> Check wet separator and fish distribution system for operation.

3> All raceway retainer screens and crowder brushes in good order, with no holes or protruding wires.

4> Raceways clean of debris.

5> Sample and holding tanks smooth and clean.

6> All electronic counters checked for operation.

7> Inspect PVC pipes to insure they are clear of debris and cracks. Repair if required.

e> Fish Transport Trailers:

1> All systems operate properly.

2> No leaks around air stone fittings.

3> Plugs in end of air stones.

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

5> Each trailer carries two 5-inch hoses and necessary 5-inch "Kamlock" caps.

6> All valves operating properly.

7> Overall condition of trailer in good shape including hatch covers, release gates, and oxygen manifold system.

f> Maintenance Records:

Record all maintenance and inspections.

2) April 1 - October 31:

a> Forebay Area and Intakes:

1> Remove trash from forebay.

2> Inspect gatewell slots daily and clean as required.

3> Remove debris from forebay and trashracks as required to maintain drawdown in gate slots within FTOT criteria. Additional raking may be required when heavy debris loads are present in the river. Fish quality will also be an indicator of debris buildup on the trash racks.

4> Coordinate cleaning effort with personnel operating downstream migrant facilities.

5> Log drawdown differentials once a week.

b> Submersible Traveling Screens:

Inspect, operate, and cycle screens as per FTOT annual work plan.

c> Gallery Bypass Flume:

1> Operate one orifice per gate slot.

2> Orifices clean and operating.

3> Orifice lights operating on open orifices.

4> Orifice valve either full open or closed.

5> Water dissipation screens clean.

6> Maintain pinch valve in good operating condition and operate as open as is possible.

7> Adjust water flow over sorter to maintain a smooth, stable flow condition.

d> Sorter and Raceways:

Operate in accordance with FTOT annual work plan.

4. Adult Fish Passage Facilities.

a) Operating Criteria: Operate the adult fish passage facilities according to the following criteria:

1) Prior to March 1:

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

b> Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Repair deficiencies.

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

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

2) March 1 through December 31 (Adult Fish Passage Period):

a> Fishway Ladders:

Water depth over weirs: 1.0 to 1.3 feet

b> Head on all Entrances:

Head range: 1.0 to 2.0 feet

c> **Collection Channel Transportation Velocity:**

1.5 to 4 feet per second.

d> **North Shore Entrances (WFE 1 & 2):**

1> Operate 2 downstream gates

2> Weir depth: 8.0 feet or greater below tailwater.

e> **North Powerhouse Entrances (NFE 2 & 3):**

1> Operate 2 downstream gates.

2> Weir depth: 9.0 feet or greater below tailwater.

f> **Powerhouse Collection System Floating Orifices:**

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

g> **South Shore Entrances (SFE 1 & 2):**

1> Operate 2 entrances.

2> Weir depth: 9.0 feet or greater below tailwater.

h> **Head on Trashracks:**

1> Maximum head of 0.5 feet on ladder exits

2> Maximum head on picketed leads shall be 0.3 feet.

i> **Staff Gauges and Water Level Indicators:**

Shall be readable at all water levels encountered during the fish passage period.

C. **Project Maintenance.**

[CBFWA recommends that a biologist be present to provide technical guidance at all project activities which may involve fish handling.]

1. **Juvenile Fish Passage Facilities.**

a) Scheduled Maintenance: Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which require them to be out of service for extended periods of time are conducted during the winter maintenance period from November 1 to March 31. During the fish passage season, parts of the facilities are maintained on a

daily, weekly, or longer interval to keep them in proper operating condition.

b) Unscheduled Maintenance: Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Maintenance of facilities such as traveling screens, which sometimes break down during the fish passage season, will be carried out according to the FTOT annual plan. In these cases, repairs will be made as prescribed and the CBFWA notified through established channels agreed to in the plan. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA on a case-by-case basis by CENPW-OP-PO. CENPW-OP-PO will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-PO when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-PO includes:

1. Description of the problem.

2. Type of outage required.

3. Impact on facility operation.

4. Length of time for repairs.

5. Expected impacts on fish passage.

1) Traveling screens: Traveling screens are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged or malfunctions at any time, measures will be taken in accordance with the FTOT Annual Work Plan.

2) Gatewell orifices and bypass flume: Each gatewell has two orifices with valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated. If an orifice becomes blocked with debris or is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. The bypass flume is operated to transport juveniles to the collection facility or the overflow screens can be pulled to bypass them into the ice and trash sluiceway which enters the tailrace by turbine unit 14. If there are any problems with the flume, efforts will first be made to repair it without dewatering. If that is not possible, the flume will be dewatered and repaired as soon as possible. Traveling screens will remain in operation and the juveniles allowed to accumulate in the gatewells for up to two days. If repairs are to take longer than two days, a salvage program will be initiated to dipnet the juveniles from the gatewells until repairs are made and the system watered up again.

3) Transportation Facilities: The transportation facilities can be operated to either collect and hold juveniles for

the transportation program or to bypass them back to the river through the ice and trash sluiceway. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the overflow screens in the bypass flume will be pulled to bypass fish directly into the ice and trash sluiceway and around the transportation facilities or the entire bypass system may need to be dewatered to allow repairs to be made.

2. Adult Fish Passage Facilities.

a) Scheduled Maintenance: Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not effect fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to the normal operating criteria, unless otherwise coordinated.

b) Unscheduled Maintenance: Unscheduled maintenance which will significantly effect the operation of a facility will be coordinated with the CBFWA. Coordination of unscheduled maintenance of adult facilities shall be the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project so there will be less impact of it being unwatered or taken out of service. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

1) Fish Ladders and Counting Stations. The fish ladders contain tilting weirs, fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the fish ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, tilting weir mechanisms, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the CBFWA.

2) North Shore Auxiliary Water Supply System: During normal operation, conduits 1 and 4 are operated along with entrance weirs WFE2 and WFE3. Conduit #4 feeds diffusers 1 through 4 and conduit #1 feeds diffusers 5 through 12. Each diffuser has two or more rotovalves which control the amount of water going into a diffuser. If a rotovalve fails, the closest rotovalve that is closed will be opened to provide the required flow. If more rotovalves fail than there are closed valves and it is not possible to operate the entrances within criteria, WFE2 weircrest will be raised at one-foot

increments to maintain the required 1.0 to 2.0 head differential. If this is not possible by the time the weir reaches 4 feet below tailwater, the entrance will be closed. If one conduit fails, WFE2 will be closed and WFE3 will be operated as deep as possible to maintain the 1.0 to 2.0 feet head differential. If it is not possible to maintain the head differential at a depth of 6 feet or greater, the weir will be maintained at 6 feet regardless of the head. If both conduits fail, WFE 2 will be closed and WFE3 operated at a depth of 6 feet until repairs can be made.

3) **South Shore Auxiliary Water Supply System:** The south shore auxiliary water is made up of a combination of gravity flow from the forebay and pumped water from the tailrace. The gravity flow supplies the diffusers above weir 253 (diffusers 7 through 14) and the pumps supply the diffusers below weir 253 (diffusers 1 through 7 and the main unit diffusers). Diffuser 7 is where both systems meet and is supplied by either gravity flow or pumped flow. The gravity flow diffusers are regulated by rotovalves and the pumped flow diffusers by sluicegates. If a rotovalve fails, the nearest closed rotovalve will be opened to supply the flow. If more rotovalves fail than there are closed valves the sluicegates in diffusers 3 through 7 will be opened more to provide the required transportation flows. If any sluicegates fail, the sluicegates nearest it will be opened further to make up the water. If one pump fails, the other two pumps will be operated to maintain the facilities within criteria. If two pumps fail, SFE2 and NFE3 will be closed and SFE1 and NFE2 will be operated as deep as possible to maintain the 1.0 to 2.0-foot head differential. If all three pumps fail, the powerhouse transportation channel will be bulkheaded off at the junction pool and SFE1 and SFE2 operated a deep as possible and to maintain the 1.0 to 2.0 head differential. If a depth of 6 feet on both gates cannot be maintained, SFE2 will be closed. If the gravity flow and pumped auxiliary water supply systems both fail, the powerhouse transportation channel will be bulkheaded off at the junction pool, SFE2 closed, and SFE1 operated at 6 feet below tailwater until repairs can be made.

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

D. Turbine Unit Operation and Maintenance.

1. Turbine Unit Operation. The turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During this time period, the turbine unit operation will be 1, 2, 14, 4 through 10, and then 3, 11, 12, 13, consecutively, when units are available for operation. If warm water temperatures in the summer result in higher than normal mortality in the juvenile fish collection

system, refer to the summer unit operation schedule in the FTOT Annual Work Plan (Appendix 2). Turbine units will be operated within 1% of peak efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

[The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.]

2. **Turbine Unit Maintenance.** The project's turbine unit maintenance schedule will be reviewed annually 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.

Table 25. McNary Dam Spill Pattern for Adult Fish Passage.

Discharges in KCFS at Forebay Elevation 340

KCFS Spill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total Stops
1.5	1																					1
4.5	1	1																			1	3
8.0	1	1	1																	1	1	5
12.0	1	1	1	1															1	1	1	7
14.2	1	2	1	1															1	1	2	9
18.2	1	2	1	1	1													1	1	1	2	11
22.2	1	2	1	1	1	1											1	1	1	1	2	13
26.2	1	2	1	1	1	1	1									1	1	1	1	1	2	15
30.2	1	2	1	1	1	1	1	1							1	1	1	1	1	1	2	17
32.2	1	2	1	1	1	1	1	1	1						1	1	1	1	1	1	2	18
33.3	2	2	1	1	1	1	1	1	1						1	1	1	1	1	1	2	19
37.3	2	2	1	1	1	1	1	1	1	1			1		1	1	1	1	1	1	2	21
41.3	2	2	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	2	23
44.9	2	2	1	1	1	1	1	1	1	1	1	2	2		1	1	1	1	1	1	2	25
48.5	2	2	1	1	1	1	1	2	1	1	1	2	2		2	1	1	1	1	1	2	27
52.1	2	2	1	1	1	2	1	2	1	1	1	2	2		2	1	2	1	1	1	2	29
54.3	2	3	1	1	1	2	1	2	1	1	1	2	2		2	1	2	1	1	1	3	31
57.9	2	3	1	2	1	2	1	2	1	1	1	2	2		2	1	2	1	2	1	3	33
61.5	2	3	1	2	1	2	1	2	1	2	2	2	2		2	1	2	1	2	1	3	35
62.3	2	3	1	2	1	2	1	2	2	2	2	2	2		2	1	2	1	2	1	3	36
64.4	3	3	1	2	1	2	1	2	2	2	2	2	2		2	1	2	1	2	1	3	37
68.0	3	3	1	2	1	2	2	2	2	2	2	2	2		2	2	2	1	2	1	3	39
70.2	3	4	1	2	1	2	2	2	2	2	2	2	2		2	2	2	1	2	1	4	41
73.6	3	4	1	2	1	2	2	2	2	2	2	3	3		2	2	2	1	2	1	4	43
75.4	3	4	2	2	1	2	2	2	2	2	2	3	3		2	2	2	1	2	1	4	44
78.8	3	4	2	2	1	2	2	2	2	3	3	3	3		2	2	2	1	2	1	4	46
82.4	3	4	2	2	2	2	2	2	2	3	3	3	3		2	2	2	2	2	1	4	48
85.8	3	4	2	2	2	2	2	3	2	3	3	3	3		2	2	3	2	2	1	4	50
89.2	3	4	2	2	2	2	2	3	3	3	3	3	3		3	2	3	2	2	1	4	52
92.6	3	4	2	2	2	3	2	3	3	3	3	3	3		3	3	3	2	2	1	4	54
96.1	3	4	2	2	2	3	3	3	3	3	3	3	3		4	3	3	2	2	1	4	56
98.2	3	5	2	2	2	3	3	3	3	3	3	3	3		4	3	3	2	2	2	4	58
101.6	3	5	2	2	3	3	3	3	3	3	4	3	3		4	3	3	2	2	2	4	60
102.8	4	5	2	2	3	3	3	3	3	3	4	3	3		4	3	3	2	2	2	4	61
104.5	4	5	2	2	3	3	3	3	3	3	4	3	3		4	3	3	3	2	2	4	62

Table 25 (Continued). McNary Dam Spill Pattern for Adult Fish Passage.

KCFS Spill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total Stops
107.3	4	5	2	2	3	3	3	3	3	4	4	3	3		4	3	3	3	2	2	5	64
109.0	4	5	2	2	3	3	3	3	3	4	4	3	3		4	3	3	3	3	2	5	65
112.4	4	5	2	2	3	3	3	3	4	4	4	3	3		4	4	3	3	3	2	5	67
115.8	4	5	2	2	3	3	3	3	4	4	4	3	4		4	4	4	3	3	2	5	69
118.0	4	5	2	2	3	3	3	3	4	4	4	3	4		4	4	4	3	3	3	6	71
121.4	4	5	2	2	3	3	3	3	4	4	4	4	4		4	4	4	3	4	3	6	73
124.2	5	5	2	3	3	3	3	3	4	4	4	4	4		4	4	4	3	4	3	6	75
125.9	5	5	2	3	3	3	3	4	4	4	4	4	4		4	4	4	3	4	3	6	76
128.2	5	6	2	3	3	3	3	4	4	4	4	4	4		4	4	4	3	4	4	6	78
131.6	5	6	3	3	3	4	3	4	4	4	4	4	4		4	4	4	3	4	4	6	80
134.4	6	6	3	4	3	4	3	4	4	4	4	4	4		4	4	4	3	4	4	6	82
137.6	6	6	3	4	3	4	3	4	4	4	5	4	5		4	4	4	3	4	4	6	84
139.8	6	7	3	4	3	4	3	4	4	4	5	4	5		4	4	4	3	4	4	7	86
141.4	6	7	3	4	3	4	4	4	4	4	5	4	5		4	4	4	3	4	4	7	87
142.5	7	7	3	4	3	4	4	4	4	4	5	4	5		4	4	4	3	4	4	7	88
145.7	7	7	3	4	3	4	4	5	4	4	5	4	5		5	4	4	3	4	4	7	90
148.9	7	7	3	4	3	4	4	5	4	5	5	5	5		5	4	4	3	4	4	7	92
152.3	7	7	4	4	3	4	4	5	4	5	5	5	5		5	4	4	4	4	4	7	94
155.0	7	8	4	4	3	4	4	5	4	5	5	5	6		5	4	4	4	4	4	7	96
158.3	7	8	4	4	3	4	4	5	5	5	5	5	6		5	4	5	4	4	4	7	98
161.6	7	8	4	4	4	4	4	5	5	5	6	5	6		5	4	5	4	4	4	7	100
164.9	7	8	4	4	4	5	4	5	5	5	6	6	6		5	4	5	4	4	4	7	103
167.6	8	8	4	4	4	5	4	5	5	6	6	6	6		5	4	5	4	4	4	7	104
169.3	8	8	4	4	4	5	4	5	6	6	6	6	6		5	4	5	4	4	4	7	105
171.9	8	8	4	4	4	5	4	5	6	6	6	7	6		5	4	5	4	4	4	8	107
175.1	8	8	4	4	4	5	4	5	6	6	7	7	7		5	4	5	4	4	4	8	109
178.3	8	8	4	4	4	5	5	5	6	6	7	7	7		5	5	5	4	4	4	8	111
181.6	8	8	4	4	4	5	5	5	6	7	7	7	7		6	5	5	4	4	4	8	113
184.3	8	9	4	4	4	5	5	6	6	7	7	7	7		6	5	5	4	4	4	8	115
187.6	8	9	4	4	4	5	5	6	7	7	7	8	7		6	5	5	4	4	4	8	117
190.8	8	9	4	5	4	5	5	6	7	7	7	8	7		6	5	5	4	5	4	8	119
191.8	9	9	4	5	4	5	5	6	7	7	7	8	7		6	5	5	4	5	4	8	120
210.3	9	10	4	5	5	6	5	6	7	8	8	9	9		7	6	5	5	5	4	9	132
234.0	10	11	5	6	5	6	6	6	7	8	9	10	10		9	8	6	5	6	5	10	148

Ice Harbor Dam

Ice Harbor Dam

A. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for Ice Harbor Lock and Dam (Figure 8).

1. Juvenile Fish Passage.

a) Facilities Description. The juvenile passage facilities at Ice Harbor consist of 6-inch orifices drilled through the concrete leading from the gatewells to the ice and trash sluiceway, and electric hoists attached to the A-slot gates of the ice and trash sluiceway to allow operation of the sluiceway as a surface bypass system.

b) Juvenile Migration Timing. Table 26 shows dates of 10 and 90 percent passage. Data from 1964-1968 were compiled from gatewell dipping during the completion of the Snake River projects.

Table 26. Juvenile Migration timing at Ice Harbor Dam.

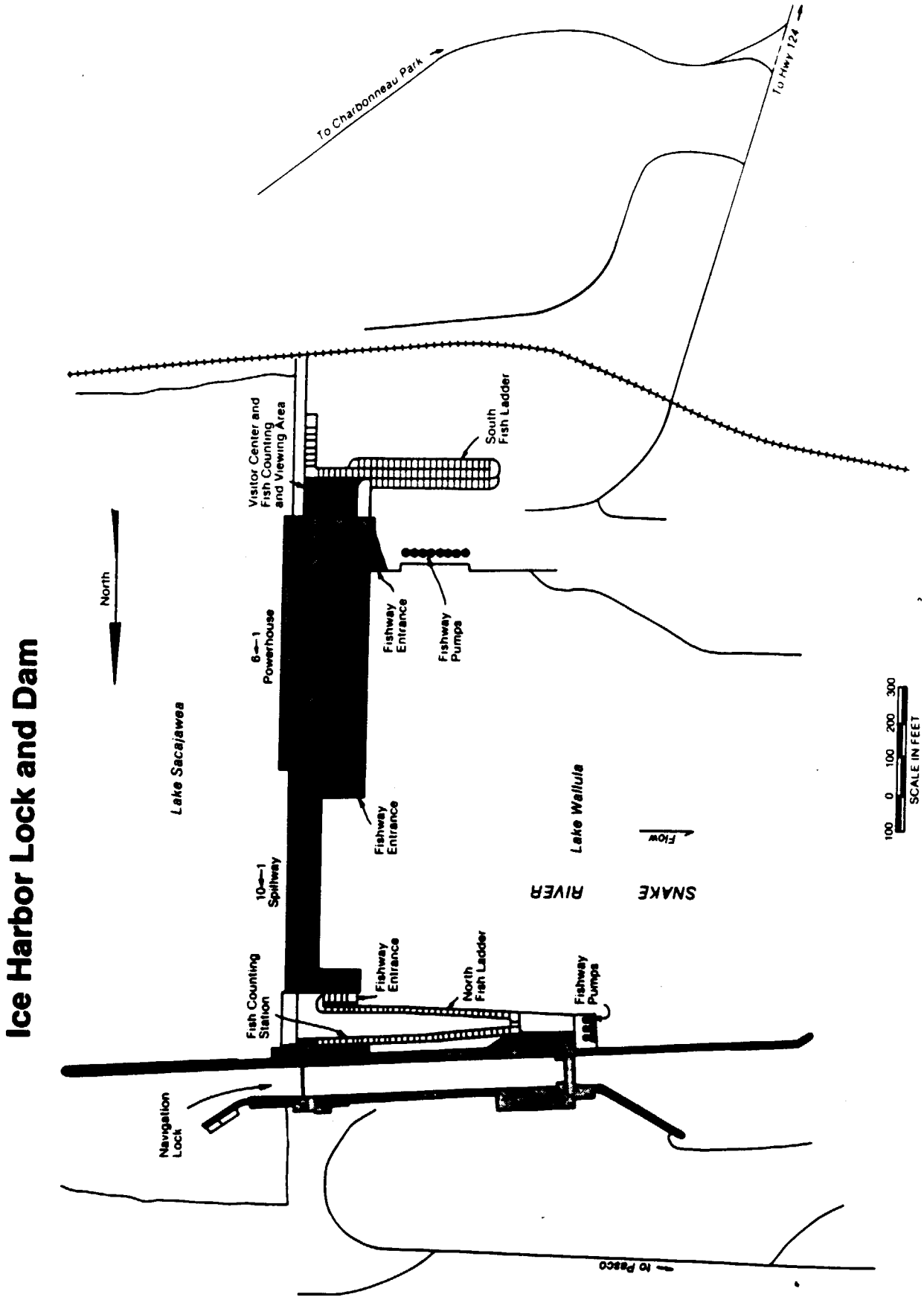
1964 - 1968	Yearling Chinook	Steelhead
Earliest date of 10% past project	4/10/65	4/20/65
Average date of 10% past project	4/15	5/5
Latest date of 10% past project	4/16/66	5/6/66
Earliest date of 90% past project	5/25/64	5/25/64
Average date of 90% past project	5/30	5/30
Latest date of 90% past project	6/5/66	6/5/66

*no data on sub-yearlings

2. Adult fish Passage.

a) Facilities Description. The adult fish passage facilities at Ice Harbor are made up of separate north and south shore facilities. The north shore facilities include a fish ladder with counting station, a small collection system, and a pumped auxiliary water supply system. The collection system includes two downstream entrances and one side entrance into the spillway basin. In normal operation one downstream entrance is used and the other two entrances are closed. The auxiliary water is supplied by three electric pumps with either two or three pumps operated at any one time, depending on tailwater. The south shore facilities are comprised of a fish ladder with counting station, two south shore entrances, a powerhouse

Figure 8



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collection system, and a pumped auxiliary water supply system. The powerhouse collection system includes two downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, twelve floating orifices, and a common transportation channel. One of the downstream north powerhouse entrances and seven of the floating orifices are used during normal operation. At the south shore entrances, one entrance is normally used. The auxiliary water is supplied by eight electric pumps of which from five to seven are normally used to provide the required flows.

d) Adult Migration Timing. Migrants are present at Ice Harbor year around. The maintenance of adult passage facilities is scheduled for the period of January through February to minimize impact on adult migrants. Table 27 shows primary passage periods for each species and shows earliest and latest date of peak passage on record from fish count data compiled by the Corps of Engineers.

Table 27. Adult Migration Timing at Ice Harbor Dam From 1962-1990 Fish Counts.

SPECIES	COUNTING PERIOD	EARLIEST PEAK	LATEST PEAK
Spring Chinook	4/1 - 6/11	4/24	5/26
Summer Chinook	6/12 - 8/10	6/12	7/23
Fall Chinook	8/11 - 10/31	9/07	9/30
Coho*	4/1 - 10/31	9/08	9/28
Sockeye	4/1 - 10/31	7/01	9/22
Steelhead	4/1 - 10/31		

*No Coho runs presently exist in the lower Snake Basin.

B. Project Operation.

1. Spill Management. In 1991, spill will be managed according to the Fish Spill MOA. Other problems may supersede spill requests such as high concentrations of dissolved gas, poor adult passage, or extreme low flows. When spill occurs during the daytime hours, that spill shall be shaped in accordance with the current spill schedule, table 28. Spill requests for adults will be based upon the CBFWA's objective of obtaining 100 percent unimpeded passage efficiency at this project.

2. Dissolved Gas Management and Control. Spill management requests will be based in part upon dissolved gas monitoring data along with juvenile migration data. Total dissolved gas monitoring during 1991 will be at the Ice Harbor forebay and reported every six hours from April 1 through August 31. Related data reported at the same time will be spill volume and total project flow.

3. Juvenile Fish Passage Facilities.

a) Operating criteria. April 1 to August 31 operate according to the following criteria:

1) **Prior to April 1 each year:**

a> Remove debris from forebay and gatewell slots.

b> Rake trash racks.

c> Inspect and clean orifices of debris. Video inspection permitted.

d> Test that chain gates are operational.

e> Run gates on manual and automatic operation.

2) **April 1 to end of bypass season:**

a> Remove debris from forebay.

b> Remove debris from trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

c> Inspect orifices daily and clean as required.
d> Inspect gatewell slots twice a week and clean as required.

e> Operate chain gates 1A, 2A, 3A, 4A, 5A, and 6A at maximum flows allowed by sluiceway capacity 24 hours a day.

f> Record all maintenance and inspections.

5. **Adult fish passage facilities.**

a) **Operating criteria:** Operate the adult fish passage facilities according to the following criteria:

1) **Prior to March 1:**

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

b> Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Repair deficiencies.

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

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

2) **March 1 through December 31 (Adult fish Passage Period):**

a> Fishway ladders:

Water depth over weirs: 1.0 to 1.3 feet

b> Head on all entrances:

Head range: 1.0 to 2.0 feet

c> North Shore Entrance (NEW 1):
(Elevaton of top of gate when on sill - 332.25)

1> **Operate downstream gate closest to shore.**

2> **Weir depth: 8 feet or greater below tailwater.**

(Note: At low river flow and tailwater, some of the diffusers are inoperable and project may only be able to maintain a 6 foot weir depth.)

[CBFWA recommends a weir depth of 8 feet or greater at all times]

d> North Powerhouse Entrance (NPE 1 & 2):
(Elevaton of top of gate when on sill - 332.25)

1> Operate 1 downstream gate.

2> Weir depth: 8 feet or greater below tailwater.

(Note: at low tailwater weirs may bottom out and be less than 8 feet below tailwater.)

e> Powerhouse Collection System:

Operate 7 floating orifices (O.G. numbers 1, 2, 4, 6, 8, 10, and 12).

f> South Shore Entrance (SPE-1):
(Elevaton of top of gate when on sill - 332.25)

1> Operate entrance closest to powerhouse.

2> Weir depth: 8 feet or greater below tailwater.

(Note: at low tailwater weirs may bottom out and be less than 8 feet below tailwater.)

g> Channel Transportation Velocity:

1.5 to 4 feet per second.

h> **Head on Trashracks:**

1> Maximum head of 0.5 feet on ladder exits.

2> Maximum head on picketed leads shall be 0.3 feet.

i> **Staff Gauges and Water Level Indicators:**

Shall be readable at all water levels encountered during fish passage period.

C. Project Maintenance.

[CBFWA recommends that a biologist be present to provide technical guidance at all project activities which may involve fish handling.]

1. Juvenile Fish Passage Facilities.

a) Scheduled Maintenance: Scheduled maintenance of the juvenile facilities is conducted during the non-fish passage season from the end of the bypass season (approximately September 1) to March 31. Long-term maintenance or modifications to the facilities which require them to be out of service are done during this period. During the fish passage season, the facilities are inspected on a daily basis to insure that they are operating correctly.

b) Unscheduled Maintenance: Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA on a case-by-case basis by CENPW-OP-PO. CENPW-OP-PO will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-PO when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-PO includes:

1. Description of the problem.

2. Type of outage required.

3. Impact on facility operation.

4. Length of time for repairs.

5. Expected impacts on fish passage.

If orifices become blocked with debris, they will be cleared by project personnel as soon as possible. If a sluiceway gate hoists fails, the gate will be closed and an alternate gate opened until repairs can be made.

2. **Adult Fish Passage Facilities.**

a) Scheduled Maintenance: Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect of fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not effect fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage past the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal criteria, unless otherwise coordinated.

b) Unscheduled Maintenance: Unscheduled maintenance which will significantly effect the operation of a facility will be coordinated with the CBFWA. Coordination of unscheduled maintenance of adult facilities shall be the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

1) Fish Ladders and Counting Stations: The fish ladders contain fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

2) North Shore Auxiliary Water Supply System: The north shore facilities contain three electric pumps which provide auxiliary water to the diffusers at the bottom of the ladder and at the entrances. During normal operation two or three pumps are required, depending on the tailwater elevation, to provide the necessary auxiliary water. If a pump fails during a two-pump operation, the pump on standby will be operated to provide the necessary flows. If a pump fails during a three-pump operation, NEW1 will be raised until the required 1.0 to 2.0-foot head differential is achieved. If this cannot be met by the time the weir reaches 6 feet below tailwater, the gate will remain at that level regardless of the head. If two or all three pumps fail, the weir will be maintained at a level of 6 feet below tailwater until repairs are made.

3) South Shore Auxiliary Water Supply System: The south shore auxiliary water is supplied by eight electric pumps. Fluctuating tailwater levels require from five to seven pumps to be operated to provide the auxiliary water. If one pump fails, a standby pump will be started to keep the fishway within criteria. If more

pumps fail, this procedure will continue until all the standby pumps are in operation. If criteria cannot be met, the floating orifices should be closed in the following order: OG-12, OG-10, OG-8, and OG-6. If the required head differential of 1.0 to 2.0 feet cannot be reached when the floating orifices are closed, SSE 1 and NFE 2 will be closed equally at one-foot intervals until it is reached or until the weirs are 5 feet below tailwater. Then the remaining floating orifices should be closed in the following order: OG-4, OG-1, and OG-2. If there is still not enough auxiliary water to maintain the head differential on the two main entrances, NFE 2 will be closed, the transportation channel bulkheaded off at the junction pool, and SSE 1 operated as deep as possible to maintain the head differential. If it cannot be maintained at a depth of 6 feet or greater, the weir will remain at 6 feet regardless of the head.

4) Fishway Entrances: The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction, the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure which prevents the entrance from being operated manually, an alternate entrance will be opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and the entrance bulkheaded off until the floating orifice is repaired.

D. Turbine Unit Operation and Maintenance.

1. Turbine Unit Operation. From March 1 through November 30, turbine unit 1 will be operated as a priority unit for adult fish passage. The recommended operating order for the other turbine units is 2, 3, 4, and 5 or 6 in either order, when units are available for operation. Turbine units will be operated within 1% of peak efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

[The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.]

2. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually 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.

Table 28. Ice Harbor Dam Spillway Pattern for Adult Fish Passage.

Gate Number 1	2	3	4	5	6	7	8	9	10	Total
(1)									1.5	2.5
1	(1)							1	1.5	4.5
1	1	(1)					1	1	1.5	6.5
1	(2)	1					1	2	1.5	8.5
1	2	1	(1)			1	1	2	1.5	10.5
1	2	1	1	(1)	1	1	1	2	1.5	12.5
1	2	(2)	1	1	1	1	2	2	1.5	14.5
1	2	2	(2)	1	1	2	2	2	1.5	16.5
1	2	2	2	(2)	2	2	2	2	1.5	18.5
1	2	2	2	(3)	3	2	2	2	1.5	20.5
1	2	2	(3)	3	3	3	2	2	1.5	22.5
1	2	(3)	3	3	3	3	3	2	1.5	24.5
1	2	3	3	(4)	4	3	3	2	1.5	26.5
1	2	3	3	4	4	4	3	2	1.5	27.5
1	2	3	3	(5)	5	4	3	2	1.5	30.5
1	2	3	(4)	5	5	4	3	3	1.5	31.5
1	(3)	3	5	5	5	4	3	3	1.5	33.5
1	3	(4)	5	6	5	4	3	3	1.5	35.5
(2)	3	4	(6)	6	5	4	4	3	1.5	38.5
2	3	4	6	6	(6)	5	4	3	1.5	40.5
2	3	(5)	6	6	6	5	4	3	1.5	41.5
2	3	5	6	(7)	6	5	5	3	1.5	43.5
2	3	5	(7)	7	6	6	5	3	1.5	45.5
2	3	(6)	7	8	6	6	5	3	1.5	47.5
2	(4)	6	7	8	6	6	5	3	1.5	50
2	4	6	7	8	(7)	7	5	4	2	52
2	4	6	(8)	8	7	7	6	4	2	54
2	4	6	8	(9)	8	7	6	4	2	56
2	4	(7)	8	9	9	7	6	4	2	58
2	4	7	(9)	10	9	7	6	4	2	60
2	4	7	(10)	10	9	8	6	4	2	62
2	4	7	10	11	9	8	(7)	4	2	64
2	4	7	(11)	11	10	8	7	4	2	66
2	4	(8)	11	12	10	8	7	4	2	68
2	4	8	11	13	10	(9)	7	4	2	70

Values in parentheses may be 1 foot less than values shown. For example: 1 means 0 or 1 foot. 2 means 1 or 2 feet. Each foot of opening equals about 1.7 kcfs at forebay elevation 439.0.

Lower Monumental Dam

Lower Monumental Dam

A. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for Lower Monumental Lock and Dam (Figure 9).

1. Juvenile Fish Passage.

a) Facilities Description. A new state of the art juvenile fish bypass system is under construction at Lower Monumental Dam and is scheduled to be in operation for the 1992 juvenile outmigration. It will contain standard length STS's, collection gallery, dewatering structure, and bypass flume to the tailrace below the project. In 1991, Washington Department of Wildlife will dip juvenile fish from project gatewell slots and transport them to a release site below the project.

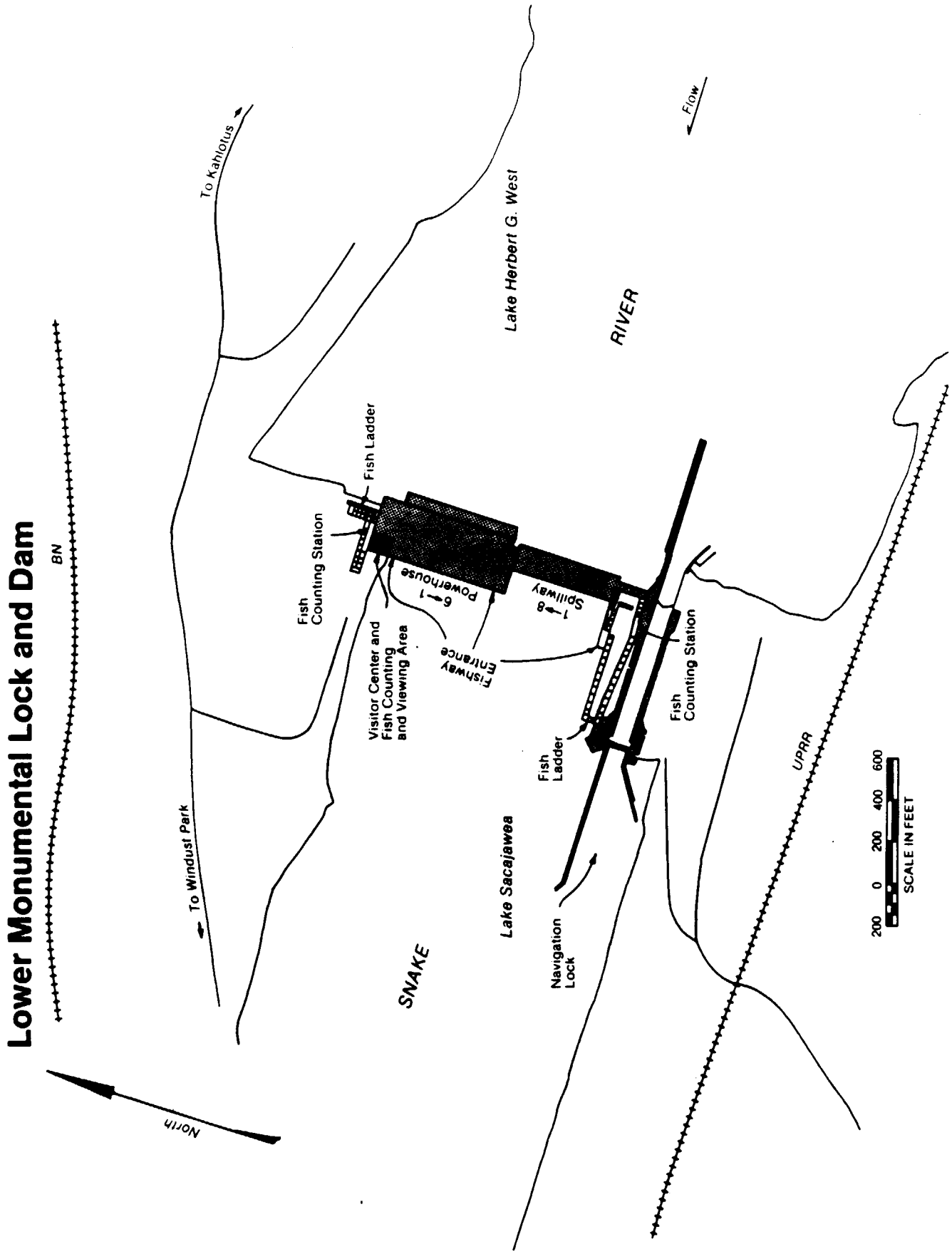
b) Juvenile Migration Timing. Gatewell sampling for juvenile salmonids has been conducted since 1986. Fish that volitionally entered the gatewell were sampled. These samples should be representative of the migration timing. The dates when 10, 50, and 90 percent of the migration passed the project in 1986 through 1989 are listed in Table 29. These dates were calculated from data collected during the sampling period and do not represent the entire juvenile migration since sampling was not consistent over the range of project operations that occurred (the 1987-89 90 percent dates are particularly questionable).

Table 29. Juvenile Migration Timing at Lower Monumental Dam.

% Migration past project	Year/Date 1986	1987	1988	1989	1990
Yearling chinook					
10%	4/10	4/29	4/24	4/22	4/21
50%	4/29	5/2	5/8	5/3	4/30
90%	5/22	5/15	5/29	5/19	5/30
peak	5/6	5/2	5/8	4/26	4/26
Subyearling chinook					
10%	6/15	6/16	5/9	6/11	N/A
50%	7/1	7/10	6/4	6/22*	N/A
90%	7/29	7/23	6/25	7/15*	N/A
peak	6/28	7/19	6/4	6/23	N/A
Steelhead					
10%	4/29	5/1	5/3	5/5	4/30
50%	5/18	5/9	5/20	5/18	5/17
90%	6/3	5/26	6/10	6/6	6/4
peak	5/6	5/10	5/8	5/18	5/31

* See Fish Passage Managers 1989 Annual Report for more information.

Figure 9



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2. **Adult Fish Passage.**

a) Facilities Description. The adult fish passage facilities at Lower Monumental are comprised of north and south shore fish ladders and collection systems with a common auxiliary water supply. The north shore fish ladder connects to two north shore entrances and the powerhouse collection system. The powerhouse collection system has two downstream entrances and one side entrance into the spillway basin at the south end of the powerhouse, ten floating orifices, and a common transportation channel. The two north shore entrances, two downstream south powerhouse entrances, and five of the floating orifices are used during normal operation. The south shore fish ladder has two downstream entrances and a side entrance into the spillway basin. The two downstream entrances are used during normal operation. The auxiliary water is supplied by three turbine-driven pumps located in the powerhouse on the north side of the river. The water is pumped into a supply conduit which travels under the powerhouse collection channel, distributing water to the powerhouse diffusers, and under the spillway to the diffusers in the south shore collection system.

b) Adult Migration Timing. Upstream migrants are present at Lower Monumental dam all year. Maintenance of adult fish facilities is scheduled in January and February to minimize impacts to adult migrants. Facilities are usually shut down one shore at a time for maintenance to minimize impacts on adult fish passage. Table 30 shows the primary passage periods by species and shows the latest and earliest recorded dates of peak passage from fish count records complied by the Corps.

Table 30. Adult Migration Timing at Lower Monumental Dam From 1969-1990.

SPECIES	COUNTING PERIOD	EARLIEST PEAK	LATEST PEAK
Spring Chinook	4/1 - 6/13	4/20	5/27
Summer Chinook	6/14 - 8/13	6/14	7/12
Fall Chinook	8/14 - 10/31	9/13	9/30
Steelhead	4/1 - 10/31	9/15	10/13
Sockeye	4/1 - 10/31	6/24	7/25
Coho*	4/1 - 10/31	9/7	10/7

*No Coho run presently exists in the Snake River.

B. **Project Operation.**

1. **Spill Management.** In 1991, spill will be managed according to the Fish Spill MOA. The revised spill schedule, Table 31, indicates preferred spill patterns for adult passage at Lower Monumental Dam. The schedule was developed by agency and Corps biologists based on on-site testing conducted in May 1989. However, these 1989 tests were very cursory and additional tests are needed, including the impact of spill on the fallback of adult migrants. Special nighttime spills for

bypassing juvenile salmonids may require different spillgate patterns to maximize their efficiency for bypassing juveniles. If these spills occur, special patterns will be provided at that time. Spill is limited to 60 kcfs from 1800 - 2000 hours for adult passage.

2. Dissolved Gas Management and Control. Dissolved gas is automatically monitored (via satellite) at Lower Monumental Dam. Spill management requests will be based upon total dissolved gas monitoring and juvenile migration data.

3. Juvenile Fish Passage Facilities.

a) Operating Criteria: Operate the juvenile bypass facilities according to the following criteria:

1) Prior to April 1 each year:

a> Remove debris from forebay and gatewell slots.

b> Rake trash racks.

2) April 1 to August 31:

a> Remove debris from forebay and trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

b> Washington Department of Wildlife and the Corps are developing a workplan for salvaging juvenile salmonids from gatewell slots in 1991. It is expected to occur 4 hours per day from April 1 to July 31. Frequency and duration of gatewell cleanout work in August will depend on the abundance of fish and project operations.

c> Avian predation control measures may be incorporated.

4. Adult Fish Passage Facilities.

a) Operating Criteria: Operate the adult fish passage facilities according to the following criteria:

1) Prior to March 1:

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

b> Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Repair deficiencies.

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

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

2) **March 1 through December 31 (Adult Fish Passage Period):**

a> **Fishway Ladders:**

Water depth over weirs: 1.0 to 1.3 feet

b> **Head on all Entrances:**

Head range: 1.0 to 2.0 feet

c> **North Shore Entrances (NSE 1 & 2):**
(Elevaton of top of gate when on sill - 429.0)

1> Operate both gates.

2> Weir depth: 8 feet or greater below tailwater.

d> **Powerhouse Collection System:**

Operate 5 floating orifices (O.G numbers 1, 3, 5, 7, 9).

e> **South Powerhouse Entrances (SPE 1 & 2):**
(Elevaton of top of gate when on sill - 432.0)

1> Operate both downstream gates.

2> Weir depth: 6 feet or greater below tailwater.

[CBFWA recommends that weirs be operated at 8 feet or greater below tailwater at all times]

f> **South Shore Entrances (SSE 1 & 2):**
(Elevaton of top of gate when on sill - 431.0)

1> Operate both downstream gates.

2> Weir depth: SSE 1 operate 8 feet or greater below tailwater. SSE 2 raise 6 feet above sill.

g> **Transportation Velocity:**

1.5 to 4 feet per second.

h> **Head on Trashracks:**

1> Maximum head of 0.5 feet on ladder exits.

2> Maximum head on picketed leads shall be 0.3 feet.

i> **Staff Gauges and Water Level Indicators:**

Gauges shall be readable at all water levels encountered during fish passage period.

C. **Project Maintenance.**

[CBFWA recommends that a biologist be present to provide technical guidance at all project activities which may involve fish handling.]

1. **Juvenile fish passage facilities.**

a) **Scheduled Maintenance:** Scheduled maintenance of the juvenile facilities is conducted during the non-fish passage season from the end of the bypass season (approximately September 1) to March 31. Long-term maintenance or modifications to the facilities which require them to be out of service are done during this time period. During the fish passage season, the facilities are inspected on a daily basis to insure that they are operating correctly.

b) **Unscheduled Maintenance:** Unscheduled maintenance which will have a significant effect on fish passage will be coordinated with the CBFWA similar to measures listed under the adult facilities. During daily inspections, gatewell slots are monitored for debris build-up and are cleaned when it accumulates.

2. **Adult Fish Passage Facilities.**

a) **Scheduled Maintenance:** Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant effect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July, and annual maintenance requires a two-week outage per pump during the winter maintenance period. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

b) **Unscheduled Maintenance:** Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and

survival. Unscheduled maintenance which will have a significant impact on adult fish passage shall be coordinated with the CBFWA on a case-by-case basis by CENPW-OP-PO. CENPW-OP-PO will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-PO when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-PO includes:

1. Description of the problem.

2. Type of outage required.

3. Impact on facility operation.

4. Length of time for repairs.

5. Expected impacts on fish passage.

If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

(1) Fish Ladders and Counting Stations: The fish ladders contain fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

(2) Auxiliary Water Supply System: The auxiliary water for the fish ladders and the collection systems is supplied by three turbine-driven pumps on the north shore with all three pumps being required for normal operation. If one, two, or all three pumps fail, the fishway will be adjusted in the following manner until repairs can be made: SPE 2 and SSE 2 will be closed and SPE 1 raised to provide the required 1.0 to 2.0 foot head differential in the system. If the desired head differential cannot be reached by the time SPE 1 reaches 5 feet below tailwater, the floating orifices should be closed starting at OG-9 and working north across the powerhouse. If the head differential still cannot be maintained when all the floating orifices are closed, SPE 1 should be closed, the collection channel bulkheaded off at the junction pool, and NSE 1 and 2 and SSE 1 operated as deep as possible to maintain the head. If it cannot be maintained at a depth greater than 6 feet, the weirs should be maintained at 6 feet regardless of the head differential.

(3) **Fishway Entrances:** The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually. The weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

D. Turbine Unit Operation and Maintenance.

1. Turbine Unit Operation. Turbine units at Lower Monumental will be operated to enhance adult fish passage from March 1 through November 30. From April 15 through July 22, nighttime operation of turbine units will differ from daytime operations in order to attract juvenile fish closer to the spillway for bypassing. The recommended turbine operation priority for adult fish passage shall be 1, 2, 3, 4, and 5 or 6 in either order , when units are available for operation. When the project spills for juvenile fish passage, the recommended turbine operation is 3, 5, 4, 2, 1, and 6. From April 1 through August 31 in 1991, turbine unit 6 should be operated on a last on, first off basis because the bulkhead stored in the C-slot prohibits the dipping of juvenile fish from the slot. Turbine units will be operated within 1% of peak efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

[The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.]

2. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually 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.

Table 31. Lower Monumental Dam Spillway Pattern for Adult Fish Passage.

Gate Numbers								Total	
1	2	3	4	5	6	7	8	Stops	Kcfs
1								1	1.1
1							1	2	2.2
1	1						1	3	3.3
1	1					1	1	4	4.4
2	1					1	1	5	6.1
2	1					1	2	6	7.8
2	1	1				1	2	7	8.9
2	1	1			1	1	2	8	10.0
2	1	1	1		1	1	2	9	11.1
2	1	1	1	1	1	1	2	10	12.2
2	1	1	1	1	1	1	3	11	13.9
2	1	1	1	1	1	2	3	12	15.6
2	1	1	1	1	2	2	3	13	17.3
2	1	1	1	2	2	2	3	14	19.0
2	1	1	1	2	2	3	3	15	20.0
2	1	1	1	2	2	3	4	16	22.5
2	1	1	1	2	3	3	4	17	24.3
2	1	1	1	3	3	3	4	18	26.0
2	1	1	1	3	3	4	4	19	27.7
2	1	1	1	3	3	4	5	20	29.5
2	1	1	1	3	3	5	5	21	31.2
2	1	1	1	3	4	5	5	22	33.0
2	1	1	2	3	4	5	5	23	34.0
3	1	1	2	3	4	5	5	24	36.6
3	1	2	2	3	4	5	5	25	38.4
3	2	2	2	3	4	5	5	26	40.2
3	2	2	2	3	4	5	6	27	41.9
3	2	2	2	3	4	6	6	28	43.6
3	2	2	2	3	5	6	6	29	45.3
3	2	2	2	4	5	6	6	30	47.0
3	2	2	3	4	5	6	6	31	48.7
3	2	3	3	4	5	6	6	32	50.4
3	2	3	3	4	5	6	7	33	52.1
3	2	3	3	4	5	7	7	34	53.8
3	2	3	3	4	6	7	7	35	55.5
3	2	3	3	5	6	7	7	36	57.2
3	2	3	4	5	6	7	7	37	58.9
3	2	4	4	5	6	7	7	38	60.6
3	2	4	4	5	6	7	8	39	62.3
3	2	4	4	5	6	8	8	40	64.0
3	2	4	4	5	7	8	8	41	65.7
3	2	4	4	6	7	8	8	42	67.4
3	2	4	5	6	7	8	8	43	69.1
3	2	4	5	6	7	8	9	44	70.8
3	2	4	5	6	7	9	9	45	72.5
3	2	5	5	6	7	9	9	46	74.2
3	2	5	5	6	8	9	9	47	75.9
3	2	5	5	7	8	9	9	48	77.6
3	2	5	6	7	8	9	9	49	79.3
3	2	6	6	7	8	9	9	50	81.0

Little Goose Dam

Little Goose Dam

A. Fish Passage Information.

The locations of fish passage facilities are shown in the following general site plan of Little Goose Lock and Dam (Figure 10).

1. Juvenile Fish Passage.

a) Facilities Description. Little Goose's juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains traveling screens, gatewell orifices, a bypass channel running the length of the powerhouse, a metal flume mounted on the face of the dam and the upper end of the fish ladder, a dewatering structure to eliminate excess water, two emergency bypass systems, and a corrugated metal flume to transport the fish to either the transportation facilities or to the river. The transportation facilities include a separator structure, raceways for holding fish, a distribution system for distributing the fish among the raceways, a sampling and marking building, truck and barge loading facilities, and associated water supply lines.

b) Juvenile Migration Timing. Juvenile passage timing at Little Goose corresponds closely with juvenile passage at Lower Granite Dam. Maintenance of juvenile fish facilities is scheduled from September through March to minimize the impact on downstream migrants.

2. Adult Fish Passage Facilities.

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

b) **Adult Migration Timing.** Upstream migrants are present atthe project year around. Maintenance of upstream passage facilities is scheduled for January through February to minimize the impact on upstream migrants. Table 32 lists primary passage periods by species and shows the earliest and latest dates of peak passage which have been recorded from compilation of fish counts by the Corps. Counting of adults at Little Goose was terminated in 1983.

Figure 10

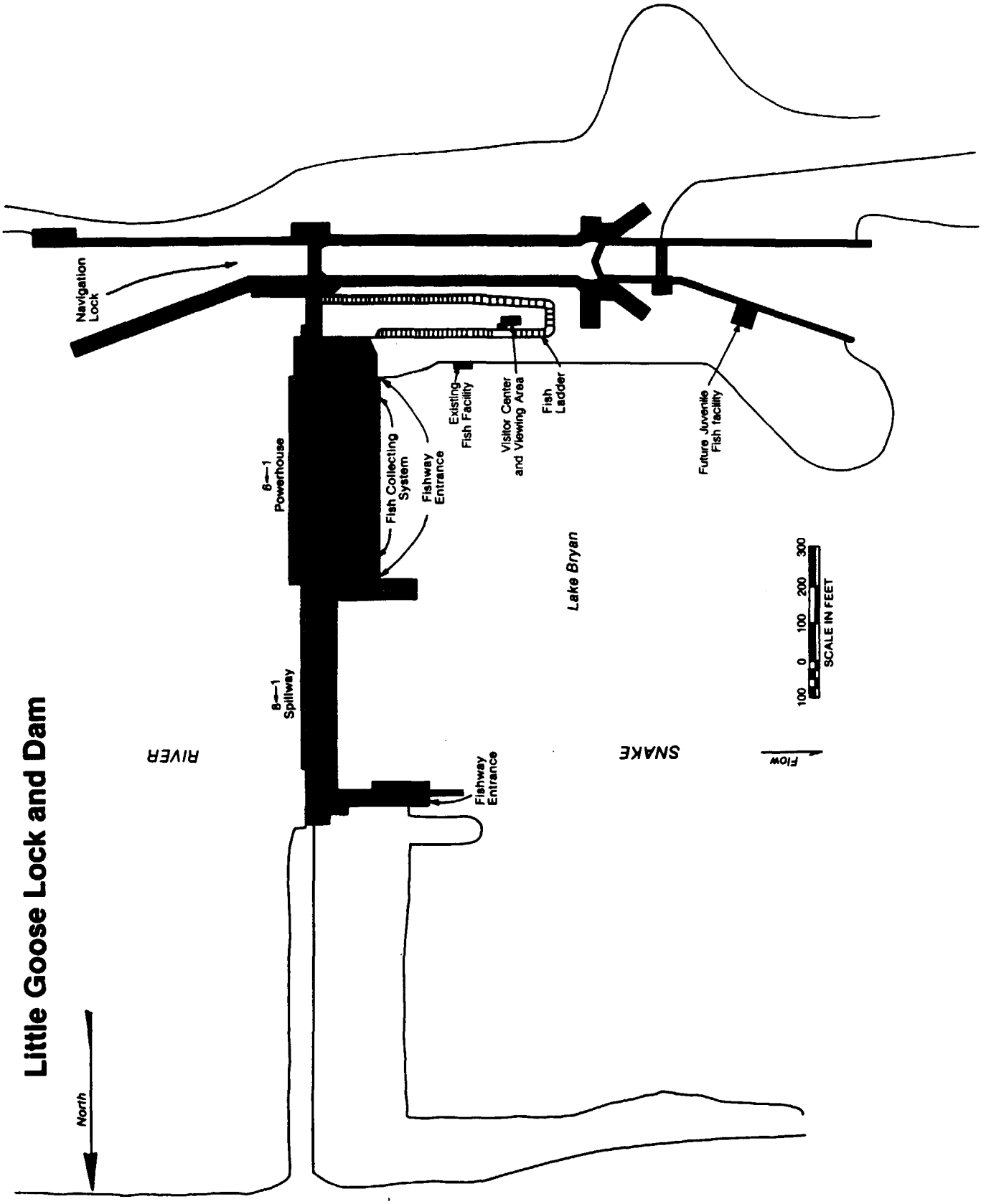

Little Goose Lock and Dam
Navigation Lock
8—1 Powerhouse
Fish Collecting System
Fishway Entrance
Existing Fish Facility
Visitor Center and Viewing Area
Fish Ladder
Future Juvenile Fish facility
8—1 Spillway
Fishway Entrance
Lake Bryan
RIVER
SNAKE
FLOW
SCALE IN FEET
100 0 100 200 300
North

Table 32. **Adult Migration Timing at Little Goose Dam From 1969 - 1983.**

SPECIES	PASSAGE PERIOD	EARLIEST PEAK	LATEST PEAK
Spring Chinook	4/1 - 6/15	4/20	5/27
Summer Chinook	6/16 - 8/15	6/14	7/12
Fall Chinook	8/16 - 10/31	9/14	9/30
Steelhead	4/1 - 10/31	9/15	10/10
Sockeye	6/15 - 10/31	6/24	7/25
Coho*	4/31 - 10/31	9/7	10/7

*No coho run presently exists in the Snake River.

B. Project Operations.

1. Spill Management. Spill at Little Goose is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Little Goose shall be distributed in accordance with the adult fish passage spill pattern listed on Table 33.

2. Dissolved Gas Management and Control. Spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring during 1991 will be at the Little Goose forebay and reported every four hours from April 1 through August 31. Related data reported at the same time will be spill volume, and total project flow.

3. Juvenile Fish Passage Facilities.

a) Juvenile Collection/Bypass System Operations.

1) Fish collected will be separated by a mechanical fish size separator. Except as noted in item #2 below, yearling salmon will be bypassed to the river after being separated from larger sized steelhead. Those salmon not separated and steelhead, will be held and transported.

2) Maximum collection of juvenile migrants for transportation will begin when approximately 80% of yearling salmon have passed the project. During low flow periods (less than 100 kcfs), transport operations will be maximized for all species.

3) In the event that significant fish injury, or descaling problems are observed in the bypass/collection system, an emergency gatewell dipping program or other measures may be implemented to salvage fish from gatewells upon recommendation of

FTOT and with input from the agencies and tribes. These fish will be released in the tailrace unless a satisfactory means of holding and counting them for transport can be developed through FTOT. The emergency measures will continue until bypass conditions are improved and acceptable to FTOT representatives and coordinated with agencies and tribes.

4) At Little Goose transportation of smolts will continue until approximately August 1 or until fish numbers approach 500 fish per day for 5 consecutive days. For more information refer to the FTOT Annual Work Plan (Appendix 1).

5) After transport operations cease, the fish facilities will be operated in a straight bypass mode through the end of August. If because of low summer flows or other reasons some units are not operating, STS's in those units may be removed. No unscreened units will be operated prior to the end of the juvenile migration period.

b) Operating Criteria. April 1 to August 31 operate according to the following criteria and the Fish Transportation Oversight Team's (FTOT) Annual Work Plan (Appendix 1).

1) Prior to April 1 each year:

a> Forebay Area and Intakes:

1> Remove debris from forebay and gatewell slots.

2> Rake trash racks.

3> Measure drawdown in gatewell slots.

b> Submersible Traveling Screens (STS):

1> Inspect screens for good running order and operate on one trial run (dogged off on deck).

2> Log trial run.

c> Collection Gallery:

1> Makeup water gate operational.

2> Orifice lights operational.

3> Orifices clean and operational.

d> Dewatering Structure:

1> Inclined screen clean and in good condition

with no holes.

2> Cleaning brush system maintained and operational.

3> Overflow weirs maintained and tested.

e> Transportation Facilities:

1> Flume switch gate maintained and operational.

2> Flume smooth with no rough edges.

3> Perforated plate edges smooth with no rough edges.

4> Check wet separator and fish distribution system for operation as designed.

5> Brushes on crowders in good order.

6> Crowders operate properly.

7> All valves, slide gates, and switch gates in good operating order.

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

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

10> Barge loading boom maintained and tested.

11> All sampling equipment maintained and operable.

f> Maintenance Records:

Record all maintenance and inspections.

2) April 1 to August 31:

a> Forebay Area:

Remove debris from forebay.

b> Intakes:

1> Inspect gatewell slots daily (preferably early in day shift) and remove debris when needed.

2> Clean trash racks in front on units as recommended in FTOT work plan.

3> Coordinate cleaning effort with personnel operating downstream migrant facilities.

4> Log drawdown differentials at least once a week.

c> Submersible Traveling Screens (STS):

1> Inspect screens as recommended in FTOT Plan.

2> Make formal determination at end of season with FTOT transport inspection for adequacy of screen mesh and replacement if necessary.

d> Collection Gallery Checks:

1> Orifice clean and operating.

2> Orifice lights operating.

3> Orifice jets not hitting back wall (bypass gallery full).

4> Makeup water gate operational.

5> Operate at least one 12-inch orifice per slot when possible.

e> Dewatering Structure:

1> Trash sweep operating correctly.

2> Overflow weirs operating correctly.

3> No holes in inclined screen.

f> Transportation Facilities:

1> No holes in screens.

2> Crowder screen brushes in good operating condition.

3> Retainer screens in raceway clean with no holes or protruding wires.

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

5> Truck and barge loading facilities in good operating condition.

g> Inspection and Record Keeping:

1> Inspect fish facilities once each shift.

2> Record all maintenance and inspections.

4. Adult Fish Passage Facilities.

a) Operating Criteria: Operate the adult fish passage facilities according to the following criteria:

1) Prior to March 1:

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

b> Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Repair deficiencies.

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

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

2) March 1 through December 31 (Adult Fish Passage Period):

a> Fishway Ladder:

Water depth over weirs: 1.0 to 1.3 feet

b> Head on all Entrances:

Head range: 1.0 to 2.0 feet

c> North Shore Entrances (NSE 1 & 2):
(Elevation of top of gates when on sill - 529.0)

1> Operate both downstream gates.

2> Weir depth: 6 feet or greater below tailwater.

[CBFWA recommends that weir depths be operated at 8 feet or greater below tailwater at all times]

d> North Powerhouse Entrances (NPE 1 & 2):
(Elevation of top of gates when on sill - 532.0)

1> Operate both downstream gates.

2> Weir Depth: 6 feet or greater below tailwater.

[CBFWA recommends that weir depths be operated at 8 feet or greater below tailwater at all times]

e> **Powerhouse Collection System:**

Operate 4 floating orifices (numbers 1, 4, 6, and 10).

f> **South Shore Entrances (SSE 1 & 2):**
(Elevation of top of gates when on sill - 529.0)

1> Operate both gates.

2> **Weir depth: 8 feet or greater below tailwater.**

g> **Transportation Velocity:**

1.5 to 4 feet per second.

h> **Tunnel Lights:**

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

i> **Head on Trashracks:**

1> Maximum head of 0.5 feet on ladder exits.

2> Maximum head on picketed leads shall be 0.3 feet.

j> **Staff Gauges and Water Level Indicators:**

Shall be readable at all water levels encountered during fish passage period.

C. **Project Maintenance.**

[CBFWA recommends that a biologist be present to provide technical guidance at all project activities which may involve fish handling.]

1. **Juvenile Fish Passage Facilities.**

a) **Scheduled Maintenance:** Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which requires them to be out of service for extended periods of time are conducted during the winter maintenance period from the end of the bypass season (approximately September 1) to March 31. During the fish passage season parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

b) **Unscheduled Maintenance:** Unscheduled maintenance is the

correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Maintenance of facilities such as traveling screens, which sometimes break down during the fish passage season, will be carried out according to the FTOT annual plan. In these cases, repairs will be made as prescribed and the CBFWA notified through established channels agreed to in the plan. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA on a case-by-case basis by CENPW-OP-PO. CENPW-OP-PO will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-PO when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-PO includes:

1. Description of the problem.

2. Type of outage required.

3. Impact on facility operation.

4. Length of time for repairs.

5. Expected impacts on fish passage.

1) Traveling Screens: Traveling screens are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged or malfunctions at any time, measures will be taken in accordance with the FTOT Annual Work Plan.

2) Gatewell Orifices: Each gatewell has two 12-inch orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated in. To minimize blockage from debris, orifices should be rotated every day.

3) Dewatering Structure: The dewatering structure acts as a transition from the collection channel to the corrugated metal flume. An inclined screen allows excess water to be bled off, with all fish and remaining water transitioning into the corrugated metal flume. The excess water is either discharged into the river or used as the water supply for the transportation facilities. The dewatering structure contains a trash sweep for cleaning the inclined screen of impinged debris. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen is damaged, an emergency bypass system at the upstream end of the dewatering structure will be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upper end of the inclined screen. The emergency bypass is then opened and the bypass system operated with 6 gatewell orifices open. Orifices will then need to be routinely rotated in order to let juveniles emigrate from all of the gatewell.

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

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

2. Adult Fish Passage Facilities.

a) Scheduled Maintenance: Scheduled annual maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant effect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July, and annual maintenance requires a two-week outage per pump during the winter maintenance period. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

b) Unscheduled Maintenance: Unscheduled maintenance which will significantly effect the operation of a facility will be coordinated with the CBFWA. Coordination of unscheduled maintenance of adult facilities shall be the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

1) Fishladder and Counting Station: The fishladder contains fixed weirs, a counting station with picketed leads, and a fish exit with trashrack. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

2) **Auxiliary Water Supply System:** The auxiliary water for the fish ladder and the powerhouse collection system is supplied by three turbine-driven pumps on the south shore with all three pumps being required for normal operation. If one, two, or all three pumps fail, the fishway will be adjusted down in the following manner to get the best fish passage conditions possible until repairs can be made: First, NSE 2 and NPE 2 should be closed and NPE 1 operated to provide the required 1.0 to 2.0-foot head differential. If the desired head differential cannot be maintained at a depth of 5 feet or greater, then NSE 1 should be raised until a depth of 5 feet below tailwater is reached. If the head differential cannot be maintained at this point, floating orifices OG-6 and OG-4 should be closed and SSE 1 and 2 should be raised at one-foot increments until 6 feet below tailwater is reached. If the head differential still cannot be maintained, the transportation channel to the north shore should be bulkheaded off at the end of the powerhouse collection channel. Next, OG-10 and OG-1 should be closed followed by NPE 1 and the powerhouse collection channel bulkheaded off at the junction pool. SSE 1 and 2 should then be operated as deep as possible to maintain the head, but not shallower than 6 feet regardless of the head.

c) **Fishway Entrances:** The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater level. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually, the weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

D. Turbine Unit Operation and Maintenance.

1. **Turbine Unit Operation.** Turbine units at Little Goose will be operated to enhance adult and juvenile fish passage from March 1 through November 30. From March 1 through November 30, unit operation will be 1, 2, 3, and then 4 - 6, when units are available for operation. Turbine units will be operated within 1% of peak efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

[The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.]

2. **Turbine Unit Maintenance.** The project's turbine unit maintenance schedule will be reviewed annually 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.

Table 33. Little Goose Dam Spillway Pattern for Adult Fish Passage.

Gate Numbers								Totals	
1	2	3	4	5	6	7	8	Increments	Kcfs
(1)							1		
1	(1)					1	1		
1	1	(1)			1	1	1		
1	1	1	(1)	1	1	1	1		
1	1	(2)	1	1	2	1	1	10	19
1	1	2	(2)	2	2	1	1		
(2)	1	2	2	2	2	1	1		
2	2	2	2	2	2	(2)	3		
(3)	2	2	2	2	2	2	(3)		
3	2	(3)	(3)	2	2	2	3	20	39
3	3	3	3	2	(3)	2	3		
3	3	3	3	2	3	(3)	4		
3	3	3	(4)	3	3	3	4		
4	3	(4)	4	3	3	3	4		
4	4	4	4	3	3	(4)	4	30	60
5	(5)	4	4	3	3	4	4		
5	5	(5)	4	4	3	4	4		
5	5	5	4	4	(4)	4	5		
5	(6)	5	5	4	4	4	5		
5	6	5	5	4	4	(5)	6	40	80
(6)	6	5	5	4	5	5	6		
6	6	5	5	(5)	5	6	6		
(7)	6	5	5	5	5	(6)	7		
7	6	5	(6)	6	5	6	7		
7	6	(6)	6	6	6	6	7	50	100
7	6	6	(7)	7	6	6	7		
7	(7)	6	7	7	7	6	7		
7	7	(7)	7	7	7	7	7		
8	7	7	7	7	7	7	(8)		
8	7	(8)	7	8	7	7	8	60	120
8	7	8	(8)	8	8	7	8		
8	(8)	8	8	8	8	8	8		
(9)	8	8	8	8	8	8	9		
9	8	(9)	8	9	8	8	9		
9	8	9	(9)	9	9	8	9	70	140

Values in parenthesis may be 1 increment less than indicated.
For example: (2) means 2 or 1 increments
(3) means 3 or 2 increments

Lower Granite Dam

A. Fish Passage Information.

The locations of fish passage facilities are shown on the following general design drawing of Lower Granite Lock and Dam (Figure 11).

1. Juvenile Fish Passage.

a) Facilities Description: Lower Granite's juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains traveling screens, gatewell orifices, a bypass channel running the length of the powerhouse, and a bypass pipe to transport the fish to the transportation facilities or to the river. The transportation facilities include an upwell and separator structure to separate thejuveniles from the excess water and adult fish, raceways for holding fish, a distribution system for distributing the fish among the raceways, a sampling and marking building, truck and barge loading facilities, and associated water supply lines.

d) Juvenile Fish Migration Timing. Maintenance of fish facilities should be scheduled for October through March to minimize impact on downstream migrants. Transportation of juvenile migrants is conducted according to the Fish Transportation Oversight Team (FTOT) Annual Work Plan as approved by the fishery agencies and tribes. Juvenile migrant numbers have been low in August, and post-season gatewell sampling attempts in September and October indicate that very few migrants are passing the facility.

Table 34. Juvenile Migration Timing at Lower Granite Dam.

% Migration Past Project	Earliest	Latest	1984	1985	1986	1987*	1988*	1989	1990
Yearling chinook									
10%	4/10	5/1	4/20	4/15	4/10	4/18	4/18	4/17	4/16
90%	5/10	6/11	6/10	5/24	5/21	5/8	5/24	5/25	5/21
Steelhead									
10%	4/21	5/5	4/30	5/3	4/27	4/28	4/27	4/28	4/26
90%	5/26	6/4	6/2	5/31	5/31	5/29	6/2	6/1	6/1
Sub-yearlings									
10%	4/25	6/30	4/25	6/11	6/10	---	---	---	---
90%	6/30	7/16	6/30	7/14	7/16	---	---	---	---

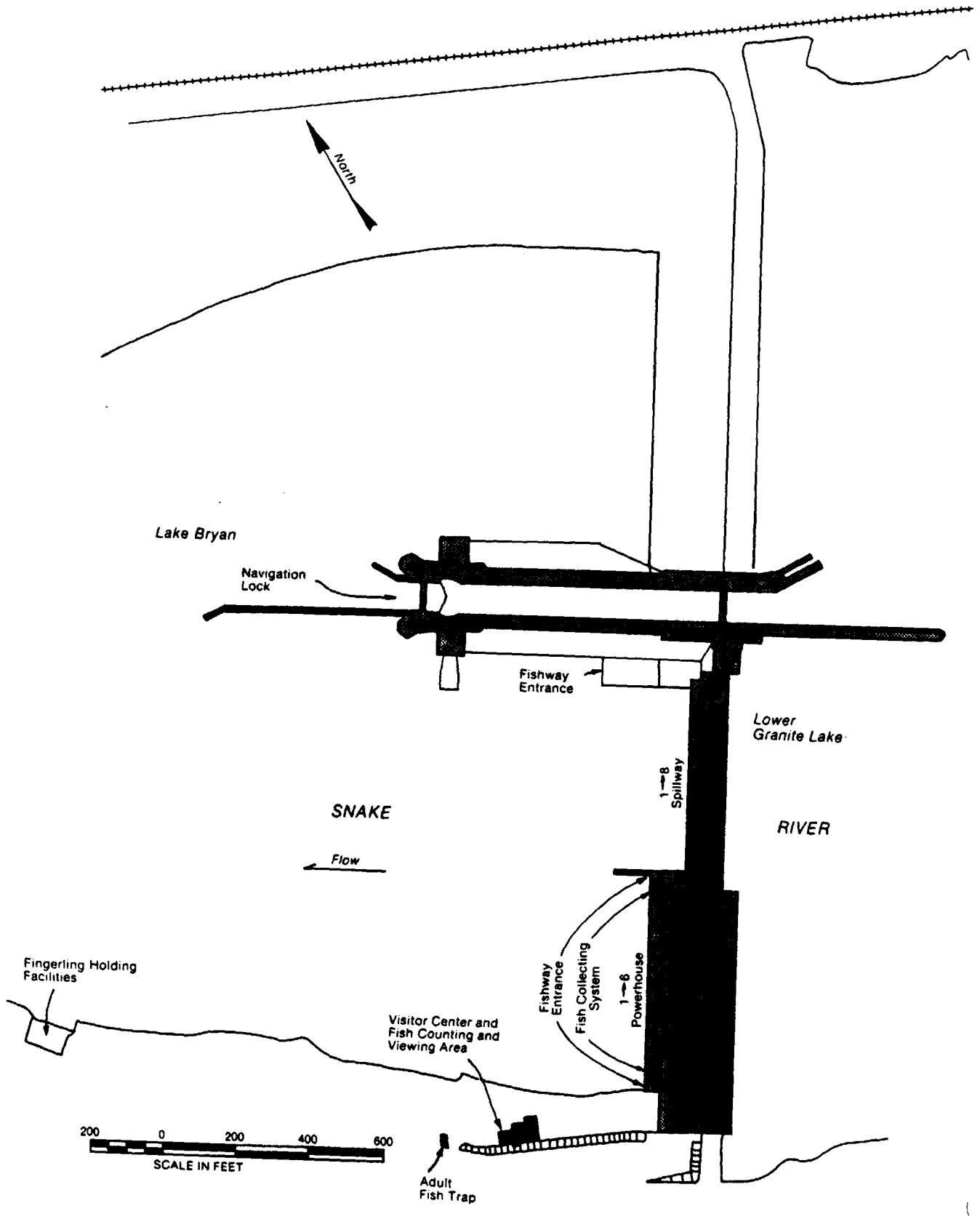
* Beginning in 1987 data combines yearling and subyearling chinook

2. Adult Fish Passage.

a) Facilities Description: The adult fish passage facilities at Lower Granite are made up of one fish ladder on the south shore, two south shore entrances, a powerhouse collection system, north shore

Figure 11

Lower Granite Lock and Dam



CFPP-LWG

entrances with a transportation channel underneath the spillway to the powerhouse collection system, and an auxiliary water supply system. The powerhouse collection system is comprised of ten floating orifices, two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. Four of the floating orifices and the two downstream entrances at the north end of the collection system are normally used. The north shore entrances are made up of two downstream entrances and a side entrance into the spillway basin with the two downstream entrances normally used. The auxiliary water is supplied by three electric pumps that pump water from the tailrace to the diffusers with two pumps normally used to provide the required flows.

b) Adult Migration Timing. Upstream migrants are present at Lower Granite throughout the year. Maintenance of adult facilities is scheduled for the period of January through February to minimize the impact on upstream migrants. Primary passage periods by species and earliest and latest date of peak passage follow.

Table 35. Adult Migration Timing at Lower Granite Dam From 1975-1990.

SPECIES	COUNT PERIOD	EARLIEST PEAK	LATEST PEAK
Spring chinook	3/1 - 6/17	5/3	5/27
Summer chinook	6/18 - 8/17	6/18	7/17
Fall chinook	8/18 - 12/15	9/5	10/6
Coho	3/1 - 12/15	9/16	9/29
Sockeye	3/1 - 12/15	7/1	7/19
Steelhead	3/ - 12/15	9/3	10/16

B. Project Operation.

1. Spill Management. Spill at Lower Granite is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Lower Granite shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section, Table 36.

2. Dissolved Gas Management and Control. Spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring during 1991 will be at the Lower Granite forebay automated station and reported every four hours from early March through September 30. Related data reported at the same time will be spill volume and total project flow.

3. Juvenile Fish Passage Facilities.

a) Juvenile Collection/Bypass System Operation.

1) There is no fish size separation system in operation at Lower Granite Dam. Species separation will be attempted by adjustment of hatchery release dates. The fishery agencies and tribes have requested that screen bypass systems be operational by March 25.

2) All fish that are collected will be transported unless they are part of a research program which includes releasing in river control groups.

3) Spill may be requested by Fishery Agencies and Tribes to bypass spring chinook [when average daily flows exceed 100 kcfs and prior to the date of 80% passage of chinook at that project].

4) Maximum collection for transportation will begin when approximately 80 percent of yearling salmon have passed the project.

5) If during 1991 species separation by adjustment of hatchery release dates proves ineffective, maximum collection for transportation may begin at an earlier date, e.g., when 50 percent of the collection is steelhead smolts. The design, construction, and installation of a fish size separation system is necessary for Lower Granite in the future.

6) After transport operations cease fish facilities will be operated in a bypass mode until approximately the end of August. If because of low summer flows or other reasons some units are not operating, STSs in those units may be removed. No unscreened units will be operated prior to the end of the juvenile migration.

b) Operating Criteria: April 1 to August 31 operate according to the following criteria and the Fish Transportation Oversight Team's (FTOT) Annual Work Plan (Appendix 1).

1) Prior to April 1 each year:

a> Forebay Area and Intakes:

1> Remove debris from forebay and gatewell slots.

2> Rake trash racks.

b> Submersible Traveling Screens (STS):

1> Maintenance completed on all STS's.

2> Inspect screens for good running order and operate on one trial run (dogged off on deck).

3> Log results of trial run.

c> Collection Gallery:

1> Makeup water gates and float control equipment operational.

2> Orifice lights operational.

3> Orifices clean and operational.

d> Sorter and Raceways:

1> 42-inch and 48-inch sluice gates operational.

2> Incline screens clean and in repair with no holes.

3> Perforated plate edges smooth with no rough edges.

4> **Check wet separator and fish distribution system for correct operation.**

5> Brushes on crowder screens in good order.

6> Crowder operates properly.

7> **All valves, slide gates, and switch gates in and around separator and raceways in good operating order.**

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

e> Sampling/Marking Facility:

Building and all operational equipment operable.

f> Barges:

1> **All pumps in good working order.**

2> **Dump gates operational.**

3> **No rough edges or support beams protruding into compartments.**

4> **No brass or galvanized fittings in circulation lines.**

5> **All loading hoses properly installed so fish will not hit sides of compartments or support beams when loading.**

6> **Loading hoses in good shape with rubber gaskets in "Kamlock" fittings.**

7> **Inside edges of Kamlock Lock joints should be beveled to avoid sharp edges.**

8> **Warning system operational.**

9> Provide net and/or deck covers.

g> **Log Maintenance:**

Record all maintenance and inspections.

2) **April 1 to August 31:**

a> **Forebay Area and Intakes:**

1> Remove debris from forebay.

2> Clean trash racks in front of units as recommended in FTOT work plan.

3> Coordinate cleaning effort with personnel operating downstream migrant facilities.

4> Inspect gatewell slots daily (preferably early in day shift), and remove debris when needed.

b> **Submersible Traveling Screens (STS):**

1> Inspect screens as recommended in FTOT plan.

2> Make formal determination at end of season for adequacy of screen mesh and replacement if necessary.

c> **Collection Gallery Checks:**

1> Orifices clean and operating.

2> Orifice lights operating.

3> Orifice jets not hitting backwall, bypass gallery full.

4> Makeup water gates and associated float controls operational.

5> Alternate orifices in fish screens slots daily (6 open).

6> Bulk head slots orifices opened (18) (6 unit operation).

d> **Sorter and Raceways:**

1> 42-inch and 48-inch sluice gate operational.

2> Maintain stable water conditions in upwell at sorter.

3> No holes in inclined screen.

4> Crowder and brushes in good operating order.

5> All valves, slide gates, and switch gates in and around separator and raceways operational.

6> Raceway retainer screens to be clean and have no holes or protruding wire.

e> **Barges and Trucks:**

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

f> **Towboats:**

Capable of making turn-around trip in less than 84 hours.

g> **Inspection:**

Inspect fish facilities once each shift.

h> **Maintenance Records:**

Record all maintenance and inspections.

4. **Adult Fish Passage Facilities.**

a) **Operating Criteria:** Operate the adult fish passage facilities according to the following criteria:

1) **Prior to March 1:**

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

b> Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Repair deficiencies.

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

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

2) **March 1 through December 31 (Adult Fish Passage Period):**

a> **Fishway Ladder:**

Water depth over weirs: 1.0 to 1.3 feet

b> **Head on all Fishway Entrances:**

Head range: 1.0 to 2.0 feet.

c> **North Shore Entrances (NSE 1 & 2):**
(Elevation of top of gates when on sill - 625)

1> Operate both downstream gates.

2> Weir depth: 7 feet or greater below tailwater.

d> **North Powerhouse Entrances (NPE 1 & 2):**
(Elevation of top of gates when on sill - 628)

1> Operate both downstream gates.

2> Weir depth: 8 feet or greater below tailwater.

e> **Powerhouse Collection System:**

Operate 4 floating orifices (numbers 1, 4, 7, and 10).

f> **South Shore Entrances (SSE 1 & 2):**
(Elevation of top of gates when on sill - 625)

1> Operate both gates.

2> Weir depth; 8 feet or greater below tailwater.

g> **Transportation Velocity:**

1.5 to 4 feet per second.

h> **Tunnel Lights:**

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

i> **Head on Trashracks:**

1> Maximum head of 0.5 feet on ladder exits.

2> Maximum head on picketed leads shall be 0.3 feet.

j> **Staff Gauges and Water Level Indicators:**

Shall be readable at all water levels encountered during fish passage period.

C. Project Maintenance.

[CBFWA recommends that a biologist be present to provide technical guidance at all project activities which may involve fish handling.]

1. Juvenile Fish Passage Facilities.

a) Scheduled Maintenance: Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which require them to be out of service for extended periods of time are conducted during the winter maintenance period from the end of the bypass season (approximately September 1) to March 31. During the fish passage season parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

b) Unscheduled Maintenance: Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Maintenance of facilities such as traveling screens, which sometimes break down during the fish passage season, will be carried out according to the FTOT annual plan. In these cases, repairs will be made as prescribed and the CBFWA notified through established channels agreed to in the plan. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA on a case-by-case basis by CENPW-OP-PO. CENPW-OP-PO will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-PO when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-PO includes:

1. Description of the problem.
2. Type of outage required.
3. Impact on facility operation.
4. Length of time for repairs.
5. Expected impacts on fish passage.

1) Traveling Screens: Traveling screens are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged or malfunctions at any time, measures will be taken in accordance with the FTOT Annual Work Plan (Appendix 2).

2) Gatewell Orifices: Each turbine intake has 4

orifices, 2 in the bulkhead slot and 2 in the fish screen slot, with 8-inch slide gates for allowing the fish to exit the slots. Under normal operation, a total of 24 orifices are operated with 18 being bulkhead slot orifices and 6 being fish screen slot orifices. At least 1 orifice is open in each bulkhead slot with the fish screen slot orifices rotated. If an orifice becomes blocked with debris it will be cleaned; however, a damaged orifice will be closed and the alternate orifice for that gatewell operated until repairs can be made.

3) **Bypass Pipe:** The bypass pipe goes from the end of the powerhouse bypass channel to the transportation facilities downstream of the dam. All juvenile fish in the bypass system must pass through this to the transportation facilities or to the tailrace. If any part of the bypass pipe is damaged, the gatewell orifices will be closed and the bypass system unwatered until repairs can be made. Traveling screens will remain in operation and the juveniles allowed to accumulate in the gatewells for up to two days. If repairs are to take longer than two days, a salvage program will be initiated to dipnet the juveniles from the gatewells until repairs are made and the system watered up again.

4) **Transportation Facilities:** The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities or the entire bypass system unwatered until repairs are made.

2. Adult Fish Passage Facilities.

a) Scheduled Maintenance: Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not effect fish passage may be conducted during the rest of the year. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

b) Unscheduled Maintenance: Unscheduled maintenance which will significantly effect the operation of a facility will be coordinated with the fishery agencies and tribes. Coordination procedures for unscheduled maintenance of the adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

1) **Fishladder and Counting Station:** The fishladder contains fixed weirs, a counting station with picketed leads, an adult fish trap located in an offshoot from the ladder, and a fish exit with trashrack. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. If the fish trap malfunctions or is damaged, fish may be passed around it until repairs are made. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

2) **Auxiliary Water Supply System:** The auxiliary water for the fish ladder and the powerhouse collection system is supplied by three electric pumps. During normal operations and most flow conditions, two pumps are capable of providing the required flows. If a pump fails during the two-pump operation, the pump on standby will be operated to make up the flows. If two pumps fail, NSE 2 and NPE 2 will be closed and NPE 1 raised in one-foot increments to provide the required 1.0 to 2.0-foot head differential. If the head cannot be maintained by the time the top of the weir reaches 5 feet, the floating orifices should be closed in the following order: OG-4, OG-7, OG-10, and OG-1. If the head in the system still cannot be maintained at this point, SSE 1 and SSE 2 should be raised in one-foot increments until 5 feet below tailwater is reached. If all three pumps fail, NSE 1 and NPE 1 should be closed, the powerhouse collection channel bulkheaded off at the junction pool, and SSE 1 and SSE 2 operated at 6 feet below tailwater regardless of the head.

3) **Fishway Entrances:** The fishway entrances consist of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater level. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually. The weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

D. Turbine Unit Operation and Maintenance.

1. **Turbine Unit Operation.** The turbine units will be operated to enhance adult and juvenile fish passage from March 1 through December 15. During these dates, unit operation will be 1, 2, 3, and then 4 - 6, when units are available for operation. Turbine units will be operated within 1% of peak efficiency unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requirements will be made in accordance with BPA's policy and statutory requirements; or 2) be in compliance with other coordinated fishery measures.

[The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.]

2. **Turbine Unit Maintenance.** The project's turbine unit maintenance schedule will be reviewed annually 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.

Table 36. Lower Granite Spillway Pattern for Adult Fish Passage.

Elevation 737

Gate Number								Total	
1	2	3	4	5	6	7	8	Stops	kcfs
1								1	1.75
1							1	2	3.5
1						1	1	3	5.25
1	1				1	1	1	4	7.00
1	1				1	1	1	5	8.75
1	1	1			1	1	1	6	10.50
1	2	1			1	1	1	7	12.37
1	2	1			1	2	1	8	14.25
1	2	1	1		1	2	1	9	15.99
1	2	2	1		1	2	1	10	17.86
1	2	2	1	1	1	2	1	11	19.61
1	2	2	2	1	1	2	1	12	21.48
1	2	2	2	2	1	2	1	13	23.35
1	2	2	3	2	1	2	1	14	25.27
2	2	2	3	2	1	2	1	15	27.14
2	2	2	3	3	1	2	1	16	29.06
2	2	2	3	3	2	2	1	17	30.93
2	2	3	3	3	2	2	1	18	32.85
2	3	3	3	3	2	2	1	19	34.77
2	3	3	4	3	2	2	1	20	36.67
3	3	3	4	3	2	2	1	21	38.61
3	3	4	4	3	2	2	1	22	40.53
3	3	4	4	3	3	2	1	23	42.45
3	4	4	4	3	3	2	1	24	44.37
3	4	4	4	4	3	2	1	25	46.29
3	4	4	5	4	3	2	1	26	48.21
3	4	5	5	4	3	2	1	27	50.13
4	4	5	5	4	3	2	1	28	52.05
4	5	5	5	4	3	2	1	29	53.97
4	5	5	5	4	4	2	1	30	55.89
4	5	5	5	5	4	2	1	31	57,81
4	5	5	6	5	4	2	1	32	59.73
4	5	6	6	5	2	2	1	33	61.65
4	6	6	6	5	4	2	1	34	63.57

NOTE: **Spills over 64,000 should be employed only at night if possible. Schedule is based on model studies and needs to be** verified.

APPENDIX 1

FISH TRANSPORTATION OVERSIGHT TEAM'S

1991 ANNUAL WORK PLAN

ANNUAL WORK PLAN FOR JUVENILE FISH TRANSPORT OPERATIONS LOWER GRANITE, LITTLE GOOSE, AND MCNARY DAMS 1991

by FISH TRANSPORTATION OVERSIGHT TEAM

I. Introduction:

A. This work plan describes operations and establishes criteria for the transportation of juvenile salmon and steelhead from Lower Granite, Little Goose, and McNary dams (collector dams) to release areas below Bonneville Dam. The Fish Transportation Oversight Team (FTOT) is an interagency team supported by state and Federal fishery agencies, the Columbia River indian tribes, the Corps of Engineers, and regional governing bodies to provide oversight for the transport program. The fishery agencies and tribes provide biological oversight through the Columbia Basin Fish and Wildlife Authority (CBFWA). On-site biological assistance is provided by state agencies at Lower Granite, Little Goose, and McNary Dams through Cooperative Agreements between the Corps (CENPW) and Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fisheries (WDF), respectively.

B. The transport program will be coordinated with other fishery monitoring, research, and management activities by FTOT. Coordination will be achieved among CBFWA through the Fish Passage Advisory Committee, the Fish Passage Center (FPC), CENPW, and other agencies as required.

II. Objective:

The work plan objective is to maximize survival of fish collected and transported by:

A. Providing safe and efficient collection and barge or truck transport of juvenile salmon and steelhead from collector dams to release areas below Bonneville Dam;

B. Inspecting facilities prior to, during, and after the juvenile transportation season. Inspections will be conducted by FTOT, project biologists, and project managers to ensure facility readiness, operation according to FTOT criteria, and to determine maintenance, replacement, and/or modification requirements for the following transportation season;

C. Identifying and recommending programs or facility changes that would benefit fish collection and transportation or bypass operations;

D. Assuring that collection, transport, and release site facilities are ready for operation prior to the beginning of transport operations.

E. Assuring that collection, transport, and release site facilities are properly maintained throughout the transport season;

F. Establishing operating criteria for facilities, barges, and trucks including fish holding and transport densities, sampling rates, and facility operations and maintenance;

G. Coordinating changes needed to accommodate fluctuations in the outmigration with project, CBFWA, and FPC personnel;

H. Coordinating transport evaluation and other research with the transportation program;

I. Participating in the training of new personnel associated with collection and transport facilities and equipment;

J. Providing all parties involved a list of emergency points of contact and appropriate telephone numbers so that any emergency can be coordinated and corrected efficiently;

K. Preparing an annual report detailing transportation activities and results for the previous year, and identifying maintenance, replacement, or modifications needed for the next transport season.

III. Project Operations for Juvenile Fish Protection:

A. CENPW is responsible for maintaining and operating all collection and transportation facilities and equipment in a manner that provides for safe collection, transportation, and bypass of juvenile fish. Procedures to meet this responsibility are:

1. Turbine Operation:

a. Turbines will be operated within 1 percent of peak efficiency (Bell, 1981) to minimize mortality of fish passing through turbines;

b. If turbines are operated outside operating efficiency criteria, turbine operation will be increased from the lowest to the highest priority units (Section III. 2. a.); downloading will be from highest priority units to lowest;

c. Whenever two or less turbine units are operated, running units should be kept at the 1 percent criterion unless river flow or project minimum flow requirements require operation below the 1 percent criterion.

d. Turbine operation data will be available from the

powerhouse operator upon request;

2. Turbine Unit Priority:

a. Research has shown that some turbine units collect more fish than others. These units shall receive priority when power demand or river flows require operation of more than one unit. At Lower Granite and Little Goose dams, priority units range from unit 1 (highest) to unit 6 (lowest). At McNary Dam, 4 through 10 are the priority fish collection units. Unit 14 at McNary Dam will also be given priority because it provides flow needed when bypassing fish to tailwater, and 1 and 2 will be given priority for providing adult fish attraction flow. Loading will proceed from 1, 2, 14, 4 through 10, 3, 11, 12, to 13.

b. During mid-summer, water temperatures at McNary Dam usually increase to levels which cause higher than normal fish mortality in the collection system. When that occurs, Units 14, 13, 12, 11, 10, 9, and 8 shall be operated in that order. Units will be operated within 1 percent of peak efficiency, and starting and stopping of units should be avoided. If more generation is needed, additional units will be operated within the 1 percent of peak efficiency criteria. If units cannot be operated consecutively from Unit 14 toward Unit 1, orifices will be closed for non-operating units between operating units. Orifices will be closed within one hour after unit shut-down and re-opened one hour after the unit is re-started. If such units are off for more than seven days, gatewells will be inspected and accumulated fish will be removed by gatewell dipping.

3. Submersible Traveling Screens (STS) Operations:

a. Installation: STSs will be installed and operated in Units 1 and 2 at Lower Granite and Little Goose Dams by March 15. Remaining STSs will be installed and in operation by April 1. At McNary Dam, STSs will be installed and operated in Units 1, 2, 14, and 4 through 7 by March 15, and remaining STSs, starting with Units 8 through 10, will be installed and operating by April 1.

b. Cycling: STSs will be operated in a cycling mode throughout the season at Lower Granite and Little Goose Dams. At McNary Dam, when the average fork length of chinook salmon in the daily sample at the collection facility is less than 112 millimeters (mm), or when a sudden decline in fish condition warrants, STS shall be operated in a continuous mode. Cycling may resume when chinook fork length exceeds 112 mm and/or fish condition has improved to an acceptable level. Immediately after resumption of screen cycling, fish condition will be monitored to verify that the operational change has not affected or has improved fish condition. FTOT will be notified when a change from continuous or cyclic operation of STSs is made by project managers, and effects of the change in operation will be reported to FTOT.

c. Maintenance: The number and condition of fish collected is directly related to efficient operation of STSs. Continuous monitoring of STS operation will be provided by annunciation (automatic warning system) to the powerhouse control room. Project operators will immediately inform project biologists of any STS malfunctions. Project biologists will notify FTOT of actions taken and anticipated repair schedules. Figure 1 on Page 5 prescribes actions to be taken.

d. Weekend procedures: If an STS malfunctions on a weekend when maintenance crews are not available to repair or replace the STS, the unit must be shut down and generation switched to another, fully screened unit. If all fully screened units are in operation and additional energy is needed to meet firm energy load, then generation may exceed the 1 percent criterion starting with the lowest priority units, or water may be spilled until the STS in the affected unit can be removed and repaired or replaced. If the affected unit is required for adult fish passage attraction flow (Unit 1 at Lower Granite and Little Goose Dams, and Units 1 and 2 at McNary Dam), any decision must be coordinated by FTOT with the FPC before the unit is shut off.

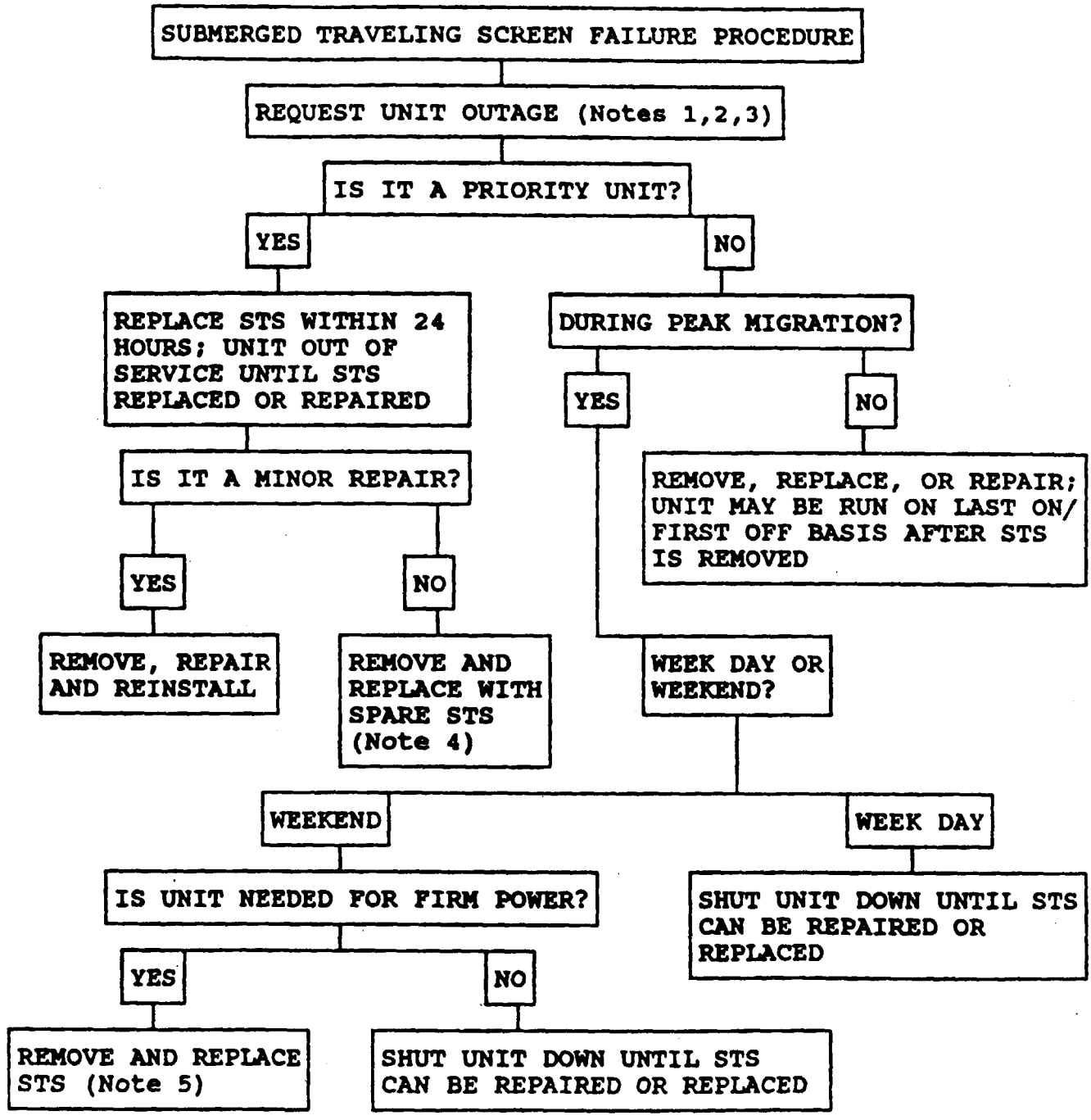
e. Spare STSs: Spare STSs are provided at each collector dam, one each at Lower Granite and Little Goose, and two at McNary Dam. If the spares are in use and additional STSs are needed to replace damaged STSs in priority units, they may be taken from a non-operating unit (out of service for long term maintenance or overhaul) or from the C slot of the lowest priority units on line. The low priority units from which a STS has been removed may be operated on a last on/first off basis without a full complement of screens.

4. Facility Inspections:

a. FTOT will inspect all transport facilities prior to, during, and following the transport season. Project biologists and management personnel will accompany FTOT inspections.

b. STS inspections: Television (TV) inspections of STSs at Lower Granite and Little Goose Dams will begin during the third and fourth week of April. Subsequent inspections will be conducted within one month of the last inspection as long as STS operation continues. At McNary Dam, all STSs in operating units will be inspected in at least two operating units per week. At all projects, unscheduled STS inspection may be required if: (1) fish condition deteriorates; (2) debris loading in the collection system increases; or (3) other indications of STS or collection system malfunction occurs. STS inspection may be waived by FTOT on a case-by-case basis if conditions (like high water temperature) warrant.

FIGURE 1.



Notes:
1. A unit must not be run with a known damaged or malfunctioning STS;
2. Project biologists should be notified as soon as practical of STS damage or malfunctions; biologists will notify FTOT of the problem and anticipated repair time;
3. If a screen malfunctions, all units are operating, and additional generation is needed, loadings above the 1 percent peak efficiency criteria may be placed on units starting with the lowest priority progressing to the highest priority units;
4. If no spare screen is available, a C slot screen from the lowest priority unit may be used;
5. Any unit operated with less than 3 STSs may be operated on a last on/first off basis.

c. Vertical Barrier Screen (VBS) Inspections: At McNary Dam, VBSs will be inspected whenever the gatewells of a unit are dewatered. In conjunction with extended STS and stationary bar screen research, the National Marine Fisheries Service will develop a system for TV inspection of VBSs in test units. If successful, that system could be used by project personnel to inspect other VBSs. CENPW will work on method of cleaning VBSs during the summer outmigration. At Lower Granite and Little Goose Dams, VBSs will be inspected with TV during the summer. VBS inspection results will be recorded by the project biologist and reported to FTOT. After all VBSs have been inspected and results are available, the frequency of future inspections will be determined in consultation with FTOT. Units with damaged VBSs will not be operated until the VBSs are repaired or replaced.

d. Flume Inspections: At McNary Dam, the flume should be dewatered and inspected in early June when juvenile fish abundance is low.

5. Peak Migration Periods: For the purpose of transport operations, the peak migration period is defined as beginning when total collection at an individual project reaches 20,000 fish per day (actual peak days may range from 250,000 to 680,000 fish per day). Normally, truck transportation will be used before and after the peak, and barge transportation will be used during the peak. Peak migration generally occurs between April 15 and May 31 at Lower Granite, Little Goose, and McNary Dams. At McNary Dam, a summer peak also occurs from July through August.

B. Debris Problems and Trash Raking:

1. Debris will be removed from trashracks and the forebay surface in front of turbine units prior to STS installation and thereafter as it accumulates. When biologists detect higher than normal descaling rates, trashracks will be raked again. Unit outages will be required for units being raked for trash. Additional raking of trashracks may be necessary as determined by project biologists when local storms or high water cause increased quantities of debris to come down the river.

2. At McNary Dam, trash racks will be raked concurrent with TV inspections of STSs unless determined unnecessary by the project biologist.

3. When trash raking is conducted at Little Goose Dam, additional unit outages may be required. When trashracks in the A or C slot are being raked, the adjacent unit should be shut down so debris dislodged from the slot being raked is not drawn into the adjacent slot. Gatewell orifices must be closed in the unit being raked.

4. At McNary and Lower Granite Dams, adjacent units will be

monitored during trash raking and appropriate steps taken if trash is drawn into an adjacent unit. Project biologists will inform FTOT of trashrack raking and note raking times and results in their logbooks. Screen inspections should be coordinated with trash raking operations to minimize unit outages.

C. Collection Facility Operations:

1. Once transport operations begin, collection facilities will be manned 24 hours per day until operations cease. Fish will be bypassed to the river if they are not transported. Fish to be bypassed may be held in raceways for night time release to minimize predation unless raceway holding criteria would be exceeded.

2. Gatewell orifices will be checked daily and cleaned when necessary from the beginning to the end of collection or bypass operations. At projects with air-operated orifice gates and air backflush systems on north and south orifices, orifices may be closed and backflushed to clear debris. Emphasis will be placed on operating the north orifices at all collector dams.

3. Water level in the gallery or flume will be checked daily. Flows at the juvenile fish separator will be monitored at least every 15 minutes throughout separator operations.

4. When collection and bypass systems are not providing safe fish passage or meeting FTOT criteria, project managers and biologists will need to make operational changes that are in the best interest of the fish, then notify FTOT as soon as possible. FTOT will coordinate changes with CBFWA and FPC.

a. McNary Dam: If average daily project flows exceed and are projected to exceed 220 thousand cubic feet per second (kcfs) for 5 consecutive days based on Corps/National Weather Service Columbia River 7-day forecasts of regulated stream flow, fish will be separated by size and smaller fish (salmon) will be bypassed and larger fish (steelhead) transported as long as yearling chinook salmon predominate in the collection. If average daily flows are projected to drop below 220 kcfs for approximately 5 days, transportation will be maximized to prevent bypassing fish into deteriorating flow conditions. If existing or projected conditions warrant a change in this criterion, FTOT will coordinate recommended changes with the CBFWA and FPC prior to the change. When subyearling chinook salmon predominate over yearling salmon in the collection sample, all collected fish will be transported. Sub-samples will be examined for marks or for use in research, then they will be released to the tailrace or transported. Maximum collection and transportation of all species will be implemented when average daily flows are at or below 220 kcfs.

b. Lower Granite Dam: All fish collected will be transported except those required to be released for approved fish

research or monitoring activities.

c. Little Goose: If average daily flow exceeds and is forecast to exceed 100 kcfs for 5 consecutive days, fish will be separated by size and smaller fish, predominantly yearling salmon, will be bypassed to the tailrace. Normally, if average daily flows are projected to drop below 100 kcfs for approximately 5 days, transportation will be maximized to prevent bypassing fish into deteriorating flow conditions. Because of the extended period expected for fish to move through the lower Snake River under low-flow conditions, it is desirable to anticipate sub-minimum flows as far in advance as practicable (approximately 3-5 days) and initiate transportation of all species at that time. If existing or projected conditions warrant a change in the criteria, FTOT will coordinate recommended deviations with the CBFWA and FPC prior to implementation. Bypass will continue until approximately 80 percent of the yearling salmon migrants (as determined by the FPC and FTOT) have passed and steelhead numbers predominate. When that happens, all fish collected will be transported.

d. Under low flow conditions, transportation may be maximized at all collector dams at the request of the CBFWA.

D. Sampling Procedures:

1. Sampling will be accomplished in accordance with sampling guidelines developed by CBFWA (Appendices I and II).

2. Fish that are sampled will be counted by electronic counting tunnels verified and adjusted by hand counts. All fish number estimates, raceway, truck, and barge loading densities and rates will be based on a sample of fish collected. Samples will be taken hourly 24 hours per day. Sample rates will be coordinated with smolt monitoring personnel and set by project biologists with approval by FTOT.

3. Species composition and weight samples will be taken to determine loading densities for raceways, barges, and trucks. Project personnel will keep a running total of hourly estimates of fish numbers, raceway totals, and direct loading totals for barges based on these estimates. Samples for monitoring descaling will include a minimum of 100 fish per group for which descaling is reported.

4. Where smolt monitoring activities are conducted at collector dams, project biologists may utilize daily total information gathered by those forces.

E. Facility and Equipment Logbooks and Records:

1. To document collection and transportation activities, the following items will be logged at each dam by either project personnel or state biologists:

a. STS activity - A log of STS operation and inspection information, including operation of unscreened units, will be maintained by the project biologist. Changes in operational modes, malfunctions, repairs, and replacements will be noted including a description, the date, and hour of occurrence.

b. Trash raking - The project biologist shall note conditions causing a request for trash raking, when raking occurred, and whether fish condition improved. If fish condition did not improve, follow-up measures will also be recorded.

c. Fingerling Facilities - Daily records will be maintained recording fish counts by hour, by day, and by species, numbers and species of fish trucked or barged, number and species of fish sampled, descaling rates, and mortality rates. Records will be transmitted daily to CENPW for processing and transmittal to CENPD. Facility personnel will follow standard operating procedures (SOPs), and will note in facility logbooks accomplishment of SOPs at various stations at the collection facilities. General observations of fish condition and juvenile fish passage will be documented in facility logbooks by state biologists.

d. Truck and Barge Logbooks: Each truck and barge shall have a logbook for recording fish loading rates, fish condition, estimated mortalities, area of release, equipment malfunctions, and accomplishment of scheduled work under the SOPs. When consecutive loading of trucks or barges occurs at downstream projects, truck drivers or barge riders will record numbers and condition of fish loaded. Towboat captains will keep logbooks on towboat activities. Barge riders will be authorized as inspectors by the Contracting Officer's Representative to initial entries noting towboat passage, loading, or fish release activities, and comments on barging operations.

F. Loading Criteria:

1. Raceways - Maximum raceway holding capacity will be 0.5 lbs. of fish per gallon of water. Inflow to raceways is approximately 1200 gallons per minute (gpm) at Lower Granite and Little Goose Dams, and 1000 gpm at McNary Dam. Individual raceway volume is approximately 12,000 gallons of water at Lower Granite and Little Goose Dams. The permanent raceways at McNary Dam hold 5,000 gallons each, and two temporary raceways hold 7,400 gallons each. The 0.5 pounds per gallon criterion is not to be exceeded without FTOT review and approval. Such decisions will be coordinated with CBFWA and FPC, and a joint decision whether to exceed criteria or bypass fish to the river will be made based on: (1) species composition; (2) total anticipated collection during the critical holding period; (3) in-river fish passage conditions; and (4) fish condition. Project biologists will provide FTOT information upon which to base these decisions.

2. McNary Dam - Loading criteria will be adhered to regardless of collection capabilities. When fish poundage in raceways reaches holding capacity, fish will be bypassed to the tailrace.

3. Lower Granite and Little Goose Dams - Raceway capacity may temporarily exceed 0.5 pounds per gallon at Lower Granite and Little Goose Dams when steelhead exceed 80 percent of the total fish collected. Capacity may be increased up to 1.0 pounds per gallon for up to 24 hours during peak collection days. Yearling chinook, when they comprise more than 20 percent of the daily collection, shall not be held at over 0.5 pounds per gallon.

4. Distribution among Raceways: Collected fish should be spread among raceways to minimize crowding and stress, and to reduce the risk of disease transmission. Additional groups should be added to each raceway at the discretion of the project biologist until holding capacity is reached. Whenever possible, small fish will be held in raceways separate from large fish.

5. Holding Time: Maximum holding time in raceways will be 2 days. Fish may be held up to 4 days at Lower Granite, Little Goose, and McNary Dams when fish barging begins and barging is on a 4-day rotation. Early in the season when fish numbers are less than 1,000 per day, if fish condition, dissolved Oxygen levels, and water temperatures permit, fish may be held up to 4 days with approval by FTOT.

6. Truck and Barge Capacities: Loading criteria are 5 pounds of fish per gpm inflow for barges and 0.5 pounds of fish per gallon of water for trucks. Capacities per vehicle are:

Barge	Capacity (gal)	Inflow(gpm)	Fish Capacity(lbs)
SOCKEYE (2127)	85,000	5,200	26,000
BLUEBACK (2817)	85,000	5,200	26,000
STEELHEAD (4382)	100,000	10,000	50,000
COHO (4394)	100,000	10,000	50,000
CHINOOK (8105)	150,000	15,000	75,000
KING SALMON (8106)	150,000	15,000	75,000
Truck	3,500		1,750

IV. Transport Operations:

A. Operating Dates:

1. Starting Operations - Transport operations will start during the last 2 weeks of March at Lower Granite and McNary Dams. Start-up at Lower Granite Dam will be triggered from fish counts at the FPC smolt monitoring traps on the Clearwater River above Lewiston, Idaho, and on the Snake River at Clarkston, Washington, in addition to

information on flow and fish movement provided by the FPC. Start-up at McNary Dam will be based on information on flow and fish movement provided by FPC from the mid-Columbia smolt monitoring stations. Start-up at Little Goose Dam will be keyed off fish collection numbers at Lower Granite Dam and the anticipated migration time to Little Goose Dam.

2. Summer Transport Operations - At McNary Dam, summer operations will begin when subyearling chinook numbers exceed yearling salmon in the daily sample.

3. Ending Operations - Transport operations at Lower Granite Dam will end during the last 2 weeks of July when fish collection drops below 500 fish per day for 5 consecutive days, or when water temperatures and fish condition make collection impractical. Transport may be terminated during the first 2 weeks of July at Little Goose Dam depending on the same fish number and condition criteria applied at Lower Granite Dam. At McNary Dam, operations may be terminated when fish numbers fall below 1,000 fish per day for five consecutive days.

B. Truck Operations: Five fish transport trucks are available for hauling fish. Normally these will be distributed two at Lower Granite Dam, one at Little Goose Dam, and two at McNary Dam. Trucks may be redistributed to meet transport demands.

1. Truck Release Sites: The normal spring release site for trucked fish will be at Bradford Island adjacent to Bonneville First Powerhouse. The normal summer release site will be at the Hamilton Island boat ramp below Bonneville Dam on the Washington shore. Releases may be adjusted from site to site depending on conditions observed by truck drivers and FTOT representatives. Changes will be made upon approval by FTOT.

2. Operation of Truck Life Support Systems: Truck drivers will be trained by project biologists and maintenance personnel on the operation of truck life support systems, the requirements of fish to be met, and signs of stress for which to watch. Routine checks will be made on support systems and fish condition at check points identified by project biologists. Life support system data and information on fish condition will be entered into the truck driver's logbook at each check point and at the release point. The truck driver's logbook will be reviewed by the project biologist upon the truck driver's return on each trip.

C. Barge Operations:

1. Barge Scheduling: Six fish barges will be available for use. Combined use of barges will allow from 26,000 to 76,000 pounds (small and medium sized barges operated in tandem) of fish to be transported at one time. It takes approximately 90 hours to make a trip from Lower Granite Dam to the release site near the Skamania

light buoy below Bonneville Dam and return. When collection exceeds 20,000 fish per day at Lower Granite Dam, one barge will leave Lower Granite Dam every four days. As fish numbers increase, two barges will be used so a barge will leave Lower Granite Dam every other day. At the highest part of the migration, a large barge, medium barge, or a combination of small and medium-sized barges in tandem will leave Lower Granite Dam each day. The sequence will operate in reverse as fish numbers decline. During all spring operations, barges will take on additional fish at Little Goose and/or McNary Dam as barge capacity allows. When available barge capacity will be exceeded, trucks may be used from Little Goose or McNary Dam to supplement barge transport. When combined barge/truck capacity is exceeded, FTOT will decide whether excess fish will be transported at higher densities, held for additional days, or bypassed to the river. During the summer, two barges will be used from McNary Dam. A round trip from McNary Dam to the release point takes less than 48 hours. One barge will leave McNary Dam every two days when numbers allow, and every day during higher fish collection days. Summer barge operations will continue while collection at McNary exceeds 20,000 fish per day or trends indicate numbers will exceed the 20,000 trigger number. The number of barges used will be governed by fish collection rates, and towboats may be used on an intermittent basis shifting from one to two barge operations as authorized by CENPW-FTOT.

2. Barge Loading: Whenever possible, small and large fish will be loaded in separate compartments in barges.

3. Barge Riders: CENPW barge riders will accompany each barge trip, supervising all loading and release operations, and barge operations en-route. Barge riders will be trained on barge operation, maintenance, and emergency procedures by project biologists and maintenance personnel. Barge riders will also be cross-trained in facility operations, and may rotate with facility operators as decided by project management. Barge riders shall be responsible for monitoring fish condition, barge equipment operations, and water quality (temperature and dissolved Oxygen levels) at regular intervals during downriver trips. Barge riders shall maintain logbooks recording loading activities and times, loading densities by barge compartment, information on equipment operations, and release locations. Standard operational procedure forms shall be filled out during routine monitoring on which equipment operated, equipment operation readings, fish mortality monitoring, and water quality monitoring. At each subsequent dam where fish are loaded onto the barge, the barge rider shall make appropriate notations in the logbook. The barge rider shall also serve as an inspector for the towboat contract, and record information required by the Contracting Officer's Representative, and shall initial the captain's logbook confirming operational information and lockage times. Any unresolved differences between barge riders and towboat crews shall immediately be reported to the Contracting Officer's Representative.

4. Barge Release Sites: The barge schedule is based on

release at the Skamania light buoy (approximately RM 144) with arrival at that point pre-determined to occur during night-time hours to minimize predation impacts. Barge travel time is affected by weather and river flows. As allowed by arrival time at Bonneville Dam, barge riders will randomly select barge release sites from Skamania light buoy downstream to Warrendale (approximately RM 141) to further decrease the ability of predators to prey on fish released from the barge.

V. Emergency Procedures:

In the event of an emergency (equipment failure at a facility or on a truck or barge, emergency lock outage, chemical spill in the river, etc.), facility workers, truck drivers, and barge riders will be expected to take appropriate actions to protect fish. If time allows, the worker, driver, or rider should consult with his/her supervisor by phone or radio in making emergency decisions. If time does not allow consultation, the worker, driver, or rider must take appropriate action on his/her own initiative, then report to his/her supervisor as soon as the action has been completed.

A. A complete listing of persons to be notified in case of emergencies and their business and home telephone numbers will be provided to each person involved in the transport program. Facility operators, truck drivers, and barge riders will be trained on emergency notification procedures by project biologists and FTOT. In case of emergency, the person involved will immediately notify his/her supervisor, or the next person up the line until the emergency has been properly reported and corrective action has been initiated. In addition to telephone reporting, barge riders will report emergencies by the towboat radio to the nearest Corps dam. The operator on duty will relay the message to the person or persons identified by the barge rider.

B. Emergency procedures will be followed at any time an emergency occurs, 24 hours per day, 7 days per week during the transport season. Emergencies will be reported to FTOT immediately.

VI. State Agency Roles:

A. The fishery agencies are legally responsible for biological oversight of fish at transportation dams. CENPW funds state fish biologists or culturists at each collector facility by Cooperative Agreements with IDF&G, ODF&W, and WDF. IDF&G personnel work at Lower Granite Dam, ODF&W personnel at Little Goose Dam, and WDF personnel at McNary Dam.

B. Task Orders under the Cooperative Agreements specify that state agency personnel at collector dams accomplish specific tasks for the project manager including:

1. Supervising or conducting handling, inspection, and

recording of data from fish sampled at the collection facility;

2. Evaluating and recording fish condition, and recommending operational changes or inspection of facilities if fish condition indicates a problem;

3. Providing hand counts of sampled fish, assisting the project biologist in adjusting electronic fish count, checking hourly and daily fish counts for accuracy, and coordinating facility counts with counts of FPC smolt monitoring teams where appropriate;

4. Conducting quality control inspections of collection facilities and transport equipment including visits to other collection facilities and rides on transport equipment when work schedules can be so arranged;

5. Monitoring the effects of smolt monitoring and research projects on transportation activities and reporting impacts, including numbers of fish handled for research purposes and the disposition of those fish, to the project biologist;

6. Participating in gatewell dipping as required to monitor fish condition, and;

7. Preparing text and tabular information for project and FTOT annual reports.

VII. Dissemination of Information:

A. Project biologists at each collector dam will be responsible for entering all pertinent information into the computer database and for transmitting daily reports to the Harris computer in CENPW. Weekday information will be transmitted by 1500 hours on the day collected. Weekend information will be transmitted to CENPW by 1200 hours on the following Monday.

B. CENPW will process the reports and transmit them to the Amdahl computer in CENPD.

C. CENPW will also coordinate daily reporting with the FPC Smolt Monitoring Program for their dissemination of information to user groups. The FPC will provide weekly summary reports of fish collected and transported in conjunction with their reports on Water Budget management, smolt monitoring activities, and hatchery release information.

VIII. Project Requirements for Fishery Agency Activities and Research:

A. Coordination: Agencies and tribes expecting to work at Corps dams will provide early coordination including work proposals, evidence of approval by CBFWA, and project needs and requirements

through written correspondence to the Chief, Operations Division, of CENPW (or CENPP for Portland District projects), and shall not start work until written approval has been received;

B. Protocol: To maintain good working relationships and safe working conditions, fishery agencies, tribes, and research organizations will be required to follow courtesy and safety protocols as follows.

1. Check in with the Project Manager upon first arrival at the project to receive information on who will be the project point of contact, and what courtesy and safety requirements must be followed;

2. Notify the point of contact whenever arriving or departing from the project so they will know where personnel will be working and when they will be on the project;

3. Adhere to project clearance, safety, and work procedures, and;

4. Notify the Project Manager or his/her representative of unscheduled or non-routine work and activities.

APPENDIX 1 - Sampling Guidelines for Collector Dams in 1991
APPENDIX 2 - Guidelines for Increased Fish samples at Lower Granite Dam in 1991

Reference:

Bell, Milo C. 1981. Recommendations for turbine generation loadings and blade gate relationships of the best survival of juvenile migrants at the eight Columbia Basin dams operated by the Corps of Engineers. Unpublished report prepared under contract to the Corps of Engineers.

APPENDIX I

SAMPLING GUIDELINES FOR COLLECTOR DAMS IN 1991

A. INTRODUCTION

Each year the fishery agencies and tribes are faced with the need to sample significant numbers of smolts at the transport collector dams and other sample points. These samples are used to monitor survival, abundance, and to evaluate operations in the bypass mode, the transportation program, and other research. Because capability exists to sample an extremely high percentage of the total run at each collection point, it is necessary to set guidelines for sampling at these projects to prevent the sampling program from overly impacting fish survival.

To minimize impacts of research and evaluation work on these runs, no more than 10 percent of the total run should be sampled during the season. Further, since a mix of transportation and in-river passage is being used to reduce mortality, neither segment (transported or bypassed) should be sampled at a rate exceeding 10 percent. (These guidelines presume that only a small percentage of sampled fish die as a result and that most are returned to the river or transported with a relatively good, though reduced, chance of survival).

Based on the presumption that sample sites other than projects that collect fish for transport will sample fish at a combined rate of less than 3 percent of the entire run, and that sampling done at sites other than transport dams will not require handling more than three percent of any one population segment, the following specific sampling guidelines are proposed for use at the transport dams:

B. LOWER GRANITE DAM

1. Sampling Objective

Not to exceed the lesser of 3 percent of the estimated weekly outmigration or 10 percent of the weekly total of smolts collected and/or bypassed. However, when collection numbers are low, the maximum sample rate may be increased to that at least 100 fish of the dominant species are collected each day.

2. Daily Sampling Rate (as obtained hourly by the sampler).

The daily sampling rate should remain constant during any given 24 hour (0700 - 0700 hrs.) sample period. Changes in sample rate should be made at the start of a new daily sample period. At Lower Granite, Little

Goose and McNary dams, there is a potential problem of edge effect when sample times of short duration are used. To reduce this effect it is recommended that a minimum time of 1 minute per hour, or a 15 second sample every 15 minutes be taken. To allow flexibility in obtaining fish without adding confusion to meeting the sampling objective (see No.1 above), the daily sampling rate, (0700 to 0700 hrs.) may not exceed the sampling objective except as follows:

a. For two days during any one week (Sunday to Saturday) the sampling rate may be doubled (the lesser of 6 percent of the outmigration or 20 percent of smolts collected or bypassed), provided that.

b. For each day that the sample rate is raised above the sampling objective, there must be a day within the same week in which the sample rate is lowered an equal or greater amount.

c. A minimal number of fish (100 of the dominant species present) would be sampled each day at collector projects, regardless of a and b above, to obtain information on species composition, weight and descaling. This information is required for safe and efficient operation of the juvenile fish transportation program.

3. Coordination

All researchers must inform FTOT of their previously approved fish needs prior to March 15. FTOT will coordinate the sampling to maximize efficiency of fish use. Researchers must apprise the Corps' project biologist of their exact fish needs at the earliest possible date. Requests for in-season deviations from these guidelines must be routed through the FTOT.

C. LITTLE GOOSE DAM

1. Sampling Objective

As required to determine pound counts, species composition, enumeration, quality control, etc. for standard bypass and transport operations. Generally not to exceed 2 percent of daily collection and/or bypass.

D. MCNARY DAM

Same as for Lower Granite Dam

APPENDIX II

GUIDELINES FOR INCREASED SAMPLING AT LOWER GRANITE DAM IN 1991

A. INTRODUCTION

In order to evaluate the success of transporting spring chinook smolts to below Bonneville Dam, the fishery agencies and tribes have authorized the Corps to conduct a marking program.[1] Contingent upon adequate streamflows in the Snake River, outmigrants marked in 1991 will form the third replicate of NMFS' 3-year transport evaluation based on adult returns of coded-wire tagged juveniles. Researchers have experienced difficulty collecting and marking the number of spring chinook required in approved study plans. In addition, marking for transport research has at times impacted the normal transport operations cycle.[2]

Without a variance in established sampling guidelines (Appendix I), it is unlikely that approved numbers of markable fish for the transport evaluation program (325k chinook and 72k steelhead, respectively) would be obtained. Therefore, the fishery agencies and tribes have agreed to waive portions of these guidelines for Snake River transport research in 1991. Research fish at Lower Granite will be diverted from the wet separator to selected east (upstream) raceways for marking. Fish will be pre-anesthetized, sorted and marked, then be held in an adjacent raceway. As such, a barge would not necessarily have to be on-site in order to mark fish as has been the case.

B. EXCEPTIONS TO ESTABLISHED GUIDELINES

1. Sampling Objectives

a. To safely handle the required numbers of fish to operate the transport program and monitor the smolt migration.

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[1] A juvenile fish transportation research program will not be conducted if the official COE/NWS April 1, April-July Volume-of-Runoff Forecast indicates a critical low-flow year. "Critical low-flow" is defined as a year, based on the official April 1 forecast, in which the weekly average flow for the Snake River in mid-to-late April will not equal or exceed 85 kcfs.

[2] Facility operation requirements may override research needs and result in foregone marking operations during migration peaks.

b. To provide previously approved numbers of markable fish to conduct transport evaluation research. Sampling up to 20 percent of the total season collection may be required. Early in the season, sampling of up to 80 percent of the total daily collection on any given day may occur to satisfy overall marking requirements.

2. Daily Sampling Rate

Fish used for transport evaluation marking will be diverted to selected east (upstream) raceways separate from daily sample operations.

APPENDIX B

DISSOLVED GAS MONITORING PROGRAM

PLAN OF ACTION FOR 1991

The Plan of Action for the 1991 operations consists of seven phases:

(1) Program start-up;
(2) Instrument Installation;
(3) In-season Monitoring;
(4) Instrument Removal and Storage;
(5) Data Compilation, Analysis and Storage; and
(6) Program Evaluation and Report.
(7) Special Field Studies

Phase 1: Program Start-Up

Responsible parties (See Table 1) will be contacted during the December 1990-January 1991 to ensure a good and mutual understanding of the objectives of the monitoring program, including data to be collected, instrument location, procedures to be used, etc.

Maintenance and service contract with Common Sensing will be renewed in early January 1991. This will be the second year of a three-year, year-round, contract tha provides also for winter-time maintenance.

Coordination will be made with the Bureau of Reclamation to initiate an inter-department purchase of a maintenance and service contract with Sutron in early January. Portland District, which discontinued their contract with Sutron in 1989, will no longer provide that coordination.

Contract with Fishery Inc. will be renewed for the continued use of the Covert monitoring site located at Warrendale, Oregon.

Phase 2: Instrument Installation

The list of the instruments to be installed and their assigned locations is given in Table 2. This calls for the same instrument deployment as in 1990.

The instruments are scheduled for installation and interface with SUTRON DCP's by 15 April 1991 at the latest at all Corps stations. The WQ staff hydrologist, together with COMMON SENSING and SUTRON representatives will jointly perform the installation, calibration and testing of all equipment at those stations. Selected project personnel may be requested to assist as needed. Project staff familiarization with the Program details will be carried out at each project during the instrument installation trips. Each project will be instructed on how to dry the probe once a week at its monitoring station. An instruction packet will be provided by NPD, along with pictures and description of the procedure to be followed.

Phase 3: In-season Monitoring

Actual data collection and transmission activities will start on or before 15 April and continue until Labor Day. Exact starting dates will be coordinated with the Reservoir Control Center, project biologists and cooperating agencies.

The following data will be collected approximately every four hours :

- Water Temperature (WC), ^{o}C
- Barometric Pressure (BH), mm of Hg
- TDG Pressure (NT), mm of Hg
- Dissolved Oxygen Pressure (OP), mm of Hg
- Nitrogen + Argon Pressure (NP), mm of Hg.

A 2-channel station will monitor WC and NT; a 3-channel: WC, BH and NT; a 4-channel: WC, NT, OP, and NP; and a 5-channel: all five parameters. The minimum required are WC, BH and NT.

The PUD's may continue to use CBT Coding sheets (or equivalents). Data transmission via CBT network will be done twice a day between 0915 to 1100 hours and 2115 to 2300 hours. The Corps' WQ Group will provide all necessary assistance, if needed. The same CBT coding sheets, once filled out, will be sent to WQ every three weeks for data reconciliation.

All Corps, USBR and PUD tensionometers interfaced with a SUTRON DCP will be powered by a 110V, AC line with internal battery back-up. Data collected by these instruments will be transmitted automatically every four hours, via the GOES Satellite, to the Corps' ground-receive station in Portland. After decoding, these data will be automatically transmitted to the AMDAHL computer for storage in the CROHMS data base.

In-season instrument and operational problems should be reported to WQ, who will then arrange for the necessary repairs to be made as expeditiously as possible.

Daily reports summarizing TDG saturation levels at all monitoring stations will be prepared and disseminated by WQ each day by 1330 hours. Reports 101, 102 and 103 will contain the following information (See Figure 1):

- Station Identifier
- Date and Time of the Tensionometer Probe Readings
- Water Temperature, ^{o}C
- Barometric Pressure, mm of Hg
- TDG Pressure, mm of Hg
- Calculated TDG Saturation Percent (%)
- Project Hourly Spill, KCFS (QS)
- Project Total Hourly Outflow, KCFS (QR)
- Number of Spillway Gates Open

The same information, except the calculated TDG saturation, will also be available for viewing by those who have access to CROHMS. Reconciliation between data received via the CBT and those manually recorded on the coding sheets will be made by WQ before the data are permanently stored in the WQ Data Base.

Efforts will be expanded to determine the contribution of each dam to the total accumulative dissolved gas saturation during the monitoring season.

Phase 4: Instrument Removal and Storage

Shortly after the end of the monitoring season the tensionometers will be removed from the various projects by WQ personnel. The 110-AC power line will be disconnected; the DCP interface cable wrapped with a plastic cover to protect against moisture; and the instruments packed and returned for regular maintenance and service by the service and maintenance contractor. These instruments will be ultimately stored at the Division office, Custom House Building, until the beginning of the next monitoring season. They may be available for off-season special monitoring activities upon request.

Phase 5: Data Compilation, Analysis and Storage

Time and manpower permitting, statistical analyses will be conducted to develop trends and relationships between spill and TDG saturation. Efforts will continue in the model calibration and application of GASSPIL (dissolved Gas) and COLTEMP (Water temperature) models.

Phase 6: Program Evaluation and Summary Report

An office report will be prepared to summarize the highlights of the 1991 TDG monitoring program. It will include a general program evaluation of the adequacy and timeliness of the information received from the field, and how that information is used to help control TDG supersaturation and high water temperature throughout the Basin.

Phase 7: Special Field Studies

CENPD will assist CENPW in monitoring dissolved gas saturation at the Lower Snake River dams during the testing of different spill patterns designed to improve adult fish passage conditions. This monitoring could start as early as the spring of 1991, and will continue on for several more years depending on flow conditions.

CENPD, in collaboration with CENPW, will attempt to identify the source(s) of high TDG saturation readings at Lower Monumental Dam forebay. This activity will include continuous monitoring at selected locations betwen Little Goose and Lower Monumental Dams for a few days in 1991.

TABLE 1
List of Contact Persons

Projects	Names	Position	Phone Numbers
Int'l Boundary	Dan Lute	Hydrologist (USBR)	(208) 334-1970
	Dave Zimmer	Limnologist (USBR)	(208) 334-9035
Grand Coulee	Dan Lute	Hydrologist (USBR)	(208) 334-1970
	Dave Zimmer	Limnologist (USBR)	(208) 334-9035
Chief Joseph	Joe Munk	Ch. of Operations	(509) 686-5501
	Jim Hahermehl	Biologist	(509) 686-5501
	Bob Fisher	Biologist	(509) 686-5501
Wells	Mike Erho	Biologist (Douglas)	(509) 884-7191
Rocky Reach	Steve Hays	Biologist (Chelan)	(509) 663-8121
Rock Island	Steve Hays	Biologist (Chelan)	(509) 663-8121
Priest Rapids	Mike Dell	Biologist (Grant)	(509) 754-3541
Lower Granite	Jesse Smiley	Ch. of Operations	(509) 843-1493
	Sarah Wik	Limnologist (CENPW)	(509) 522-6629
Little Goose	Ray Eaking	Ch. Of Operations	(509) 399-2233
	Sarah Wik	Limnologist (CENPW)	(509) 522-6629
Lo.Monumental	Larry Walker	Ch. Of Operations	(509)
	Sarah Wik	Biologist (CENPW)	(509) 522-6629
Ice Harbor	Larry Walker	Ch. Of Operations	(509) 522-6629
	Sarah Wik	Biologist (CENPW)	(509) 522-6629
McNary	Brad Eby	Reservoir Mgmt	(503) 922-3211
	Sarah Wik	Limnologist (CENPW)	(509) 522-6629
John Day	Gary Dunning	Power Proj.Supt.	(503) 739-2227
The Dalles	Larry Kerr	Power Proj.Supt.	(503) 296-1181
	Jim Williams	Chief Operator	(503) 296-1181
Bonneville	Byron Duke	Power Proj.Supt.	(503) 374-8338
	Darrell Hunt		
Warrendale	Hal McEwen	Reservoir Control	(503) 326-3750

TABLE 2
1990 Dissolved Gas Monitoring Network

Sta.ID	Location	Owner	Model of Tensionometer	Channels No.
CIBW	Boundary	USBR	TGO-FT	4-auto
GCGW	D/s GCL	USBR	TGO-FT	4-auto
CHJ	Forebay	NPD/BPA	TBO-FTR-002	5-auto
WEL	Forebay	Douglas PUD	FT	2-ch.
RRH	Forebay	Chelan PUD	FT	2-ch.
RIS	Forebay	Chelan PUD	FT	2-ch.
PRD	Forebay	Grant PUD	TBO-FTR	4-auto
LWG	Forebay	NPD	TGO-FTR-011 *	5-auto
LGS	Forebay	NPD	TGT-FR- 003 *	3-auto
LMN	Forebay	NPW	TGO-FTR-007 *	5-auto
IHR	Forebay	NPW	TGO-FTR-008 *	5-auto
MCQW	Forebay-WA	NPD/BPA	TBO-FTR-005 *	5-auto
MCQO	Forebay-OR	NPD/BPA	TBO-FTR-006 *	5-auto
JDA	Forebay	NPD	TGO-FTR-009 *	5-auto
TDA	Forebay	NPD	TB-F- 001 *	3-auto
BON	Forebay	NPD	TB-F- 002 *	3-auto
WRNO	Warrendale	NPD	TBO-FTR-001 *	5-auto

Notes :

USBR - U.S. Bureau of Reclamation
NPD - North Pacific Division
NPW - Walla Walla District
BPA - Bonneville Power Administration
* - Instruments upgraded in October 1989

FIGURE 1. Example of CROHMS dissolved gas report.

$$TW '$AC,103'

REPORT 103
TOTAL DISSOLVED GAS REPORT
FOR 21 JUL 1990

RUN DATE 23 JUL 1990

CBTT	PROJECT	DATE	TIME	WA TM DEG C	BARO PRES	TD GAS PRES	TD GAS %
CIBW	BOUNDARY	20JUL90	0800	16.7	736.3	+	+
		20JUL90	1200	16.8	733.8	1014.1	138.2
			+	+	+	+	+
		20JUL90	2000	17.2	732.6	1012.9	138.3
		20JUL90	2400	17.0	733.8	1010.4	137.7
		21JUL90	0400	16.9	735.0	1010.4	137.5
		21JUL90	0800	16.5	735.0	1003.1	136.5
		21JUL90	1200	16.9	735.0	1008.0	137.1

CBTT	PROJECT	DATE	TIME	WA TM DEG C	BARO PRES	TD GAS PRES	TD GAS %	SPL QS	TOT NUMB QR	GATES
GCGW	GRD COULEE	20JUL90	0800	14.7	752.1	882.0	117.3	0.0	86.2	0
		20JUL90	1200	16.0	741.0	879.0	118.6	0.0	157.4	0
		20JUL90	1600	+	+	+	+	0.0	166.0	0
		20JUL90	2000	15.3	752.1	883.2	117.4	0.0	118.8	0
		20JUL90	2400	15.2	752.1	880.8	117.1	0.0	107.9	0
		21JUL90	0400	14.6	+	+	+	0.0	60.2	0
		21JUL90	0800	14.4	753.4	888.1	117.9	0.0	86.2	0
		21JUL90	1200	15.8	753.4	891.3	118.4	0.0	124.0	0
CHJ	CHIEF JOSEPH	20JUL90	0800	15.6	741.0	854.0	115.2	0.0	65.0	0
		20JUL90	1200	15.8	741.0	857.0	115.7	0.0	168.7	0
		20JUL90	1600	16.0	738.0	852.0	115.4	0.0	166.8	0
		20JUL90	2100	16.2	738.0	848.0	114.9	0.0	121.9	0
		20JUL90	2400	16.1	741.0	847.0	114.3	0.0	120.2	0
		21JUL90	0400	15.8	741.0	840.0	113.4	0.0	55.9	0
		21JUL90	0800	15.8	739.0	848.0	114.7	0.0	65.0	0
		21JUL90	1200	16.0	741.0	857.0	115.7	0.0	127.4	0
WEL	WELLS DAM	20JUL90	0800	16.4	744.0	858.0	115.3	4.1	58.7	3
		20JUL90	1200	16.6	744.0	859.0	115.5	10.4	136.8	5
		20JUL90	1600	16.7	744.0	861.0	115.7	10.4	153.7	5
		20JUL90	2000	16.7	744.0	858.0	115.3	10.4	168.9	5
		20JUL90	2400	16.7	744.0	858.0	115.3	10.4	135.2	5
		21JUL90	0400	16.4	743.0	856.0	115.2	6.0	65.8	2
		21JUL90	0800	16.5	744.0	858.0	115.3	4.1	58.7	3
		21JUL90	1200	16.5	744.0	868.0	116.7	10.0	139.6	5
RRH	ROCKY REACH DAM	20JUL90	0800	16.7	743.0	840.0	113.1	0.0	55.2	0
		20JUL90	1200	+	+	+	+	0.0	129.1	+
		20JUL90	1600	+	+	+	+	0.0	157.0	+
		20JUL90	2000	+	+	+	+	0.0	170.3	+
		21JUL90	0100	17.0	742.0	850.0	114.6	0.0	130.8	0
		21JUL90	0400	16.4	743.0	847.0	114.0	0.0	82.3	0
		21JUL90	0800	16.3	743.0	842.0	113.3	0.0	55.2	0
		21JUL90	1200	+	+	+	+	0.0	127.0	+
RIS	ROCK ISLAND DAM	20JUL90	0800	17.7	745.0	840.0	112.8	0.0	51.3	0
		20JUL90	1200	+	+	+	+	0.0	130.0	+
		20JUL90	1600	+	+	+	+	0.0	158.3	+
		20JUL90	2000	+	+	+	+	0.0	167.6	+
		21JUL90	0100	20.6	745.0	859.0	115.3	0.0	133.6	0

APPENDIX C

SECTION III, PARA B2 - B13 OF THE

SPILL AMENDMENT FOR SPILL AT

CORPS OF ENGINEERS PROJECTS,

MODIFIED TO PROVIDE FOR NONPOWER USES

SPILL FOR JUVENILE FISH PASSAGE - The following spill plan contains the portion of the MOA pertaining to a one-year spill agreement.

a. The operation of turbines at Federal hydroelectric projects causes mortality to juvenile migrating anadromous fish. Passage of water over spillways rather than through turbines during periods of juvenile anadromous fish migration can reduce turbine-related mortality of juvenile anadromous fish. This Agreement is intended to provide improved fish passage conditions through the commitment of spill for juvenile anadromous fish and avoidance of turbine impacts.

b. Specific Principles for Implementation

1. Spill for juvenile fish passage at the Federal Columbia River Hydroelectric Projects shall be provided in accordance with the terms of this agreement insofar as the spill does not impact nonpower uses. The following table sets forth fundamental principles of this agreement.

2. Spill Table

	Spill Season	Spill Percentages (a)	
(Columns)	(1)	(2)	(3)
		--average	(range)--
L.Monumental			
Spring	4/15-5/31	70%	(65-75)
Summer	6/1 -7/22	70%	(65-75)
Ice Harbor			
Spring	4/15-5/31	25%	(15-35)
Summer	6/1 -7/22	25%	(15-35)
John Day			
Spring	N/A N/A		
Summer	6/7 -8/22	20%	(15-25)
The Dalles(b)			
Spring	5/1 -6/6	10%	(5-15)
Summer	6/7 -8/22	5%	(0-10)

(a) Spill for 12 hours/day at LMN and IHR, 10 hours/day at JDA, and 24 hours/day at TDA.

(b) During both the spring and summer the daily spill level at The Dalles Dam can be shaped on a seasonal basis by plus or minus 5% of the daily spill percentage indicated in the spill table.

3. Spill Requests - The agencies and tribes shall request that spill be provided in accordance with the Spill Table and other provisions of this agreement. Such requests shall be transmitted by the Fish Passage Center (FPC) to the Corps of Engineers' Reservoir Control Center (RCC) and BPA. The parties shall honor all requests by the Agencies and Tribes that are necessary for the implementation of this agreement and consistent with this agreement as long as the request does not impact nonpower uses. The agencies and tribes may request adjustments or modifications to the dates, hours, and percentages of spill to be provided, in accordance with this agreement.

4. Spill Seasons - Dates for the initiation and cessation of spill of fish passage under this agreement shall be determined in the following manner. The agencies and tribes, using the best available data and sound scientific methods, shall estimate the 10 and 90 percent passage dates ("estimated dates") for the spring and summer migrations. Information and analyses employed by the fishery agency and tribes in developing the estimates of the 10 and 90 percent passage dates shall be provided to the parties.

a. Spring spill may be requested at LMN, IHR and TDA on the respective estimated dates of 10 percent passage at each dam, but not before the respective spring starting dates in the Spill Table.

b. The spring spill period shall end on the respective estimated dates of 90 percent passage but, except as provided in subsection d below, no later than the spring ending dates in the table.

c. The parties recognize that there may be considerable overlap between the spring 90% and summer 10% passage dates. In the event these dates do not overlap, no spill shall be requested between the estimated date of 90 percent spring passage and the estimated date of 10 percent summer passage.

d. The parties also recognize that the estimated 90% spring passage date may extend beyond the spring season ending dates in the Spill Table. If neither 90 percent of spring migrants nor 10 percent of summer migrants have passed LMN or IHR by May 31 or TDA by June 6, then summer spill levels may be requested until 90 percent of spring migrants have passed.

e. Except as provided in subsection d above, summer spill may be requested at LMN, IHR, JDA and TDA on the estimated date of 10 percent passage, but not before the summer starting dates in the Spill Table.

f. The summer spill period shall end at LMN, IHR, JDA and tDA on the estimated date of 90 percent passage, but not later than the summer ending dates in the Spill Table.

5. Pre-Season Adjustments to Spill Percentages at LMN and IHR - The allocation of available spill between LMN and IHR may be adjusted in pre-season planning by mutual consent of the parties. No in-season spill transfers shall be allowed. This provision is intended to allow flexibility to improve overall fish passage, based on new information, without increasing

power system impacts. Factors that must be considered in determining the power impacts of such reallocations include differences in head between the projects and changes in the frequency of powerhouse shutdowns due to nonspilled flows inadequate to maintain turbine loading.

6. In-Season Adjustments to Spill Percentages at LMN and IHR - The method for determining the instantaneous spill percentages shall vary depending on the month and the April 1, Jan-Jul volume runoff forecast at Lower Granite (LGR).

a. When that forecast is less than 23 million acre feet (MAF), spill requests by the agencies and tribes during all months shall be based on the percentages and hours in the Spill Table and daily average flows and shall be calculated by the agencies and tribes in accordance with the following formula, hereinafter referred to as the Daily Average Method:

(Daily Avg Q * % Spill / Period Q) * (12 hours/N hours) = X

Where:

Daily Avg Q = projected daily average flow at the project

% Spill = the percent spill required by the Spill Table

Period Q = total average river flow during the requested spill period

12 hours = the number of hours of spill prescribed by the Spill Table

N hours = the number of hours of spill requested by the agencies and tribes

X = the instantaneous spill percentage required during the requested hours of spill which shall in no event exceed 100%

For example, with a daily average flow of 85 kcfs, and a 12 hour spill period average flow of 70 kcfs, the 70 percent spill from the table would equate to 85 percent instantaneous spill for 12 hours or 100 percent instantaneous spill for 10 hours.

(85 kcfs * 70% / 70) * (12 Hrs/12) = 85%, or

(85 kcfs * 70% / 70 kcfs) * (12 Hrs/10 Hrs) = 102%

b. When that forecast is greater than 30 MAF, spill requests by the agencies and tribes during all months shall be based on the percentages and hours in the Spill Table and shall be calculated by the agencies and tribes in accordance with the following formula, hereinafter referred to as the Instantaneous Method:

(12 Hrs * % Spill) / N Hrs = X

Where:

12 Hrs = the number of hours of spill prescribed by the Spill Table

% Spill = the percent of spill required by the Spill Table

N Hrs = the number of hours of spill requested by the fishery agencies and tribes

X = the instantaneous spill percentage required during the requested hours of spill which shall in no event exceed 100%

For example, 70 percent spill for 12 hours could be concentrated by request of the agencies and tribes into 84 percent for 10 hours or 100 percent for 8 hours.

c. When that forecast is between 23 and 30 MAF (inclusive), instantaneous spill levels requested by the agencies and tribes during April, May and June shall be calculated using the Instantaneous Method and spill during July shall be calculated by the agencies and tribes using the Daily Average Method.

7. In-Season Adjustment to Spill Percentages at JDA - At JDA the instantaneous spill percentage requests by the agencies and tribes shall be based on the percentage and hours in the Spill Table and shall be calculated by the agencies and tribes in accordance with the following formula:

(10 Hrs * % Spill) / N Hrs = X

Where:

10 Hrs = the number of hours of spill prescribed by the Spill Table

% Spill = the percent of spill required by the Spill Table

N Hrs = the number of hours of spill requested by the agencies and tribes

X = the instantaneous spill percentage required during the requested hours of spill which shall in no event exceed 50%

For example, 20 percent spill for 10 hours could by request of the agencies and tribes be adjusted to 17 percent for 12 hours or 25 percent for 8 hours.

8. In-Season Adjustments to Spill Percentages at TDA - At TDA the instantaneous spill percentage requested by the agencies and tribes will be based on the percentages and hours in the spill table and the daily average flow, and will be calculated by the agencies and tribes in accordance with the following formula:

(Avg Q * % Spill / Period Q) * (24 Hrs / N Hrs) = X

Where:

Avg Q = projected daily average flow at the project

% Spill = the percent spill required by the Spill Table

Period Q = total average river flow during the requested spill period

24 hours = the number of hours of spill prescribed by Spill Table

N hours = the requested number of hours of spill

X = the instantaneous spill percentage required during the requested hours of spill which shall in no event exceed 50%

For example, with a constant flow of 220 kcfs the 10 percent spill rate listed in the Spill Table could provide an instantaneous spill level of 10% for 24 hours, or, on request of the fishery agencies and tribes, 20 percent for 12 hours.

If, however, the daily average flow is 220 kcfs and the average river flow during the spill period is 165 kcfs, then the instantaneous spill percentage could be 27 percent for 12 hours or 32 percent for 10 hours at the discretion of the agencies and tribes:

(220 kcfs * 10% / 165 kcfs) * (24 Hrs / 12 Hrs) = 27%, or

(220 kcfs * 10% / 165 kcfs) * (24 Hrs / 10 Hrs) = 32%

9. Seasonal Spill Shaping - The daily spill percentage may be adjusted at the request of the agencies and tribes within the ranges specified in the parentheses and footnote in the Spill Table. The purpose of this operational flexibility is to provide an increased level of spillway bypass for a greater number of smolt migrants. The agencies and tribes shall be allowed this operational flexibility, provided that each day of increased spill is balanced by a day of decreased spill. For example, if agencies and tribes initial spill requests at LMN are for 65 percent, then each day of spill at that reduced percentage would entitle the agencies and tribes to request a day at 75 percent.

The determination of when to request more or less spill shall be made by the agencies and tribes. For example, earned days of a higher percentage spill would not be considered used unless requested by the agencies and tribes, regardless of whether the project actually provides higher spill than requested.

The agencies and tribes shall use this flexibility to shape spill to the fish migration and shall provide information and rationale in support of their requests. The rationale for their requests shall be based on available data and sound scientific methods. For the purposes of the above discussion, no spill shall be shifted from one season to the other.

a. In the Snake River in spring and summer, the agencies and tribes may request low spill days at the beginning of the season. Each such low day requested shall entitle them to request two high spill days during the peak of the migration, and shall obligate them to request (i.e. repay) one low spill day after the peak of the migration. The low and high day figures are contained in the parentheses and footnote in the Spill Table. The number of

low days that may be requested to earn high days is limited to 10 days, or 25 percent of the number of days between the estimated 10 percent passage date and the ending date in the Spill Table, whichever is less.

b. At TDA in spring, the formula described above in subsection a. applies, except the limitation on the number of low days that may be requested is eight.

c. At JDA and TDA in summer, the agencies and tribes may earn 1 high spill day for each low spill day requested and there is no limit on the number of low spill days that may be requested. The agencies and tribes may also request up to 14 unearned high days before requesting any low days provided that all unearned high days must be repaid with low days by July 15.

10. Spill Hours - Daily spill levels, determined by the agencies and tribes pursuant to this agreement, shall be spilled during hours requested by the agencies and tribes. No spill shall be requested to occur between 0600 and 1800 hours at LMN, IHR or JDA. During the migration periods specified in this agreement, BPA shall not make operational requests that result in nighttime spills less than 8.675 kcfs at LMN and 3.325 kcfs at IHR. Spill at TDA shall be provided during any hours requested by the agencies and tribes, subject to infrequent system reliability limitations imposed by BPA during the peak generating hours 0600-1000 and 1800-2000. Placement of limitations on spill at TDA during these peak generating periods shall be dealt with on a case-by-case basis. Notwithstanding these limitations, spill at all projects may be requested for all hours from 1800 hours on Fridays through 0600 hours on Mondays ("weekends"). Holidays shall be treated the same as weekends.

11. Hourly Spill Shaping - The agencies and tribes may request daily shaping of spill for fish passage. The decision to provide a higher percentage for fewer hours or a lower percentage for more hours rests with the agencies and tribes. If spill is higher than requested due to project operations, no reduction in hours or accounting against future requests shall occur.

The agencies and tribes may request a prescheduled constant level of spill during the allowable spill hours. At TDA, however, spill requests may specify two different spill rates, one for daytime and one for nighttime. The two spill rates may not be used to obtain a greater volume of water than would be available with one spill rate. Spill shall be provided at the hourly rates requested by the agencies and tribes. This subsection shall apply whether spill percentages are determined using the Instantaneous or Daily Average methods.

12. Maximum Instantaneous Spill Levels - Spill requested by the agencies and tribes at LMN and IHR may equal up to 100 percent of the instantaneous flow at each project. Summer spill requested at JDA shall be limited to 50 percent of the instantaneous flow at JDA, and spring and summer spill requested at TDA shall be limited to 50 percent of the instantaneous flow at TDA.

If BPA decides that any request consistent with this agreement for shaping prescheduled spill on any day cannot be implemented due to system reliability problems, then modifications to the shaping shall be made in consultation with

the agencies and tribes. Such modifications shall affect only the shape of spill and shall not reduce the spill for that day.

Following such consultations, a complete description of the reasons that the request cannot be implemented shall be provided to the fishery agencies and tribes. This communication shall be followed by a written explanation within one week. The parties anticipate that the occurrence of such modifications shall be very infrequent. If such modifications occur more frequently and at a frequency unacceptable to the agencies and tribes, they may pursue such remedies available to them including withdrawal from this agreement.

13. Prescheduling - Spill requests shall be prescheduled by the agencies and tribes through the FPC. Spill requests shall be provided to the RCC by 1500 each Monday through Thursday (Figure 1). Spill requests for weekends, Mondays, and holidays shall be pre-scheduled on Thursday. Spill requests for Tuesday after 1800 through 1800 on Wednesday shall be prescheduled no later than 1500 hours on Monday. The same prescheduling procedure shall be followed on Tuesday and Wednesday of each week. Spill requests for all projects for Friday after 1800 through 0600 hours on Tuesday shall be prescheduled no later than 1500 on Thursday. Spill requests at TDA for the 0600 through 1800 on Tuesday shall be prescheduled on Monday by 0900 through the RCC. Allowance of prescheduling outside these specified times shall be at BPA's discretion.

BPA shall provide the Summary of Planned Daily Operation, 30-day version, to the FPC on a weekly basis. Upon request and as needed, BPA shall provide technical assistance to the agencies and tribes so that the FPC can estimate daily average flows and average flows for the daily spill period, in order to determine the instantaneous spill percentages in subsections 6, 7 and 8.

Modifications by the agencies and tribes to prescheduled spill requests are discouraged but may be allowed. Requests by the agencies and tribes for such modifications shall be dealt with by BPA on a case-by-case basis. The parties anticipate that the occurrence of such modifications shall be very infrequent.

14. Use of Surplus (Overgeneration) Spill - Any remaining spill available after meeting the requirements of this agreement will be allocated among Federal and non-Federal hydroelectric projects according to a spill priority list established by the FPC.

15. Special Operations - Special operations outside of this agreement may be sought by the agencies and tribes to protect fish. For example, if guidance for all species does not meet the FPE standard, special operations may be requested to provide protection to fish not meeting the standard. Such operations shall be considered by BPA on a case by case basis.

16. Continued Operation of Ice and Trash Sluiceways - The parties shall request operation of the ice and trash sluiceways at IHR and TDA as in recent years during the implementation of this agreement. Juvenile fish protection provided through spill shall be in addition to, not in lieu of, protection provided through such sluiceway operation.

FIGURE 1

Spill Request Deadlines

Day and Hours That Spill Request is Implemented	Deadline for Providing Spill Request	Applicable Hydroelectric Projects
Friday (after 1800 hrs)	Thursday by 1500 hrs	All
Saturday (all hours)	Thursday by 1500 hrs	All
Sunday (all hours)	Thursday by 1500 hrs	All
Monday - Tuesday (0000 hrs) (1800 hrs)	Thursday by 1500 hrs	All
Tuesday - Wednesday (1800 hrs) (1800 hrs)	Monday by 1500 hrs	All
Wednesday - Thursday (1800 hrs) (1800 hrs)	Tuesday by 1500 hrs	All
Thursday - Friday (1800 hrs) (1800 hrs)	Wednesday by 1500 hrs	All
Tuesday (0600 - 1800 hrs)	Monday by 0900 hrs	TDA
Holidays	Thursday by 1500 hrs	All