SKAGIT RIVER HYDROELECTRIC PROJECT

FERC NO. 553

FISHERIES SETTLEMENT AGREEMENT

INCORPORATING
ANADROMOUS FISH FLOW PLAN (FLOW PLAN)
AND
ANADROMOUS AND RESIDENT FISH NON-FLOW PLAN
(NON-FLOW PLAN)

APRIL 1991

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UNITED STATES OF AMERICA

FEDERAL ENERGY REGULATORY COMMISSION

FISHERIES SETTLEMENT AGREEMENT
INCORPORATING
ANADROMOUS FISH FLOW PLAN (FLOW PLAN)
AND
ANADROMOUS AND RESIDENT FISH NON-FLOW PLAN (NON-FLOW PLAN)

1.0 PARTIES

This Fisheries Settlement Agreement (Agreement) is entered into this 24th day of April, 1991, by and between the City of Seattle, City Light Department (the City) and the U.S. Department of the Interior, National Park Service (NPS); U.S. Department of the Interior, Fish and Wildlife Service (FWS); U.S. Department of the Interior, Bureau of Indian Affairs (BIA); U.S. Department of Agriculture, Forest Service (USFS); U.S. Department of Commerce, National Marine Fisheries Service (NMFS); Upper Skagit Tribe, Sauk-Suiattle Tribe, and Swinomish Indian Tribal Community (the Tribes); Washington Department of Fisheries (WDF); Washington Department of Wildlife (WDW); and the North Cascades Conservation Council (NCCC); (collectively referred to as the Intervenors). Together the City and the Intervenors are referred to as the "Parties". The Skagit River Hydroelectric Project is referred to as the "Project".

2.0 GENERAL PROVISIONS

2.1 PURPOSE AND INTENT

This Agreement establishes the City's obligations relating to the Skagit River fishery resources (including related spawning grounds and habitat) affected by the Skagit Project, as currently constructed. It also establishes the Intervenors' obligations to support this Agreement and to submit it to the Federal Energy Regulatory Commission (FERC) as their recommendations relating to said fisheries resources under any applicable provisions of the Federal Power Act (including without limitation Sections 10(a), 10(j), and 4(e) thereof) and the Fish and Wildlife Coordination Act. The U.S. Forest Service agrees that this Agreement constitutes its preferred recommendation under Section 7(a) of the Wild and Scenic Rivers Act.

2.1.1 Resolution of Issues

This Agreement resolves all issues related to the effects on fisheries resources of the Project, as currently constructed, for the period May 12, 1981 through the duration of this Agreement. This includes resolution of the effects of the absence of flows in the Gorge bypass reach. It shall be submitted to the FERC for incorporation into the new license for the Project and shall be enforceable as an article thereof. The Parties agree that incorporation and enforcement as a license condition is a material provision of this Agreement. It is also the intent of the Parties that this Agreement shall be the basis for the dismissal of the Flow Proceeding, Docket No. EL 78-36.

2.1.2 Stipulation of Adequacy

The Parties stipulate that this Agreement constitutes adequate fish protection and compensation for fishery losses caused by the Project, as currently constructed, for the period May 12, 1981 through the duration of this Agreement.

2.1.3 Release and Waiver of Claims

For the period May 12, 1981 through the duration of this Agreement, the Intervenors and their successors and assigns, hereby release, waive, and discharge the City, its successors and assigns, from any and all claims, demands, actions, and causes of action of any kind (claims) arising during that period from the effects of the Project, as currently constructed, on fisheries, so long as the City performs its obligations under this Agreement. This release does not waive claims that may arise from the negligent or intentional misconduct of the City in the operation of the Project.

2.1.4 Compliance with Laws and Effect on Rights

Nothing in this Agreement precludes the City or the Intervenors from complying with their obligations under the National Environmental Policy Act (NEPA), the Endangered Species Act, the Federal Power Act, the Wild and Scenic Rivers Act, the Fish and Wildlife Coordination Act, or any other laws applicable to the Project. This Agreement shall not affect the rights of any Party except as expressly covered in this Agreement.

Nothing in this Agreement or in the plans, memoranda, procedures or other actions taken to further the purposes of this Agreement shall reduce or otherwise impair access to and exercise of implied or explicit Indian rights, including hunting, fishing and gathering rights; nor shall anything in this Agreement be construed as limiting, waiving or otherwise impairing whatever money damages claims the Tribes may have arising out of the construction and operation of the current Project outside the term of this Agreement.

2.1.5 Integrated Agreement

All previous communications between the Parties, either verbal or written, with reference to the subject matter of this Agreement are superseded by the terms and provisions of this Agreement,

and, once executed, this Agreement and its companion documents constitute the entire agreement between the Parties.

2.1.6 Assignment

This Agreement shall be binding on and inure to the benefit of the Parties and their successors and assigns.

2.1.7 Authority

Each Party to this Agreement represents and acknowledges that it has the full legal authority to execute this Agreement and shall be fully bound by its terms.

2.2 OBLIGATIONS OF THE PARTIES

2.2.1 The City's Obligations

2.2.1.1 Compliance and Submittal

By entering into this Agreement, the City agrees to comply with all of the terms of this Agreement, including the payment of monies and the funding of activities specified herein. The City further agrees to submit this Agreement including the Anadromous Fish Flow Plan and the Anadromous And Resident Fish Non-Flow Plan to the FERC as its proposed measures relating to the fisheries resources affected by the Project, as currently constructed, as required by applicable provisions of federal and state law, including without limitation the Federal Power Act.

2.2.1.2 Additional Staffing

The City shall assign adequate professional environmental staff to implement this Agreement. This shall include establishment of two new environmental staff positions with expertise in fisheries, wildlife, recreation, visual quality, cultural resources, and erosion control. One staff position shall be dedicated primarily to implementation of the Anadromous Fish Flow Plan and the Anadromous And Resident Fish Non-Flow Plan. The second staff position shall be dedicated primarily to implementation of the wildlife, recreation/visual quality, and cultural resource agreements.

2.2.2 The Intervenors' Obligations

2.2.2.1 Support For Project Relicense

The Intervenors agree to support the expeditious issuance of a new license to the City for the Project, as currently constructed, which is consistent with the provisions of this Agreement and which includes the Agreement as an article. This support shall include reasonable effort to expedite the NEPA process. The Parties shall file comments on any draft EA or EIS developed by the FERC in the relicensing proceedings for this Project and shall support the measures defined by this

Agreement as the preferred action. The Parties shall exchange drafts of their respective comments prior to submission to the FERC and consult with each other to ensure that the comments are consistent with this Agreement.

2.2.2.2 Fisheries Resources Recommendations

The Intervenors shall submit this Agreement to the FERC as their recommendations related to the fisheries resources (including spawning grounds and related habitat) affected by the Skagit Project under any applicable provision of the Federal Power Act (including without limitation Sections 10(a), 10(j), and 4(e) thereof) and the Fish and Wildlife Coordination Act. The U.S. Forest Service agrees that this Agreement constitutes its preferred recommendation under Section 7(a) of the Wild and Scenic Rivers Act.

2.2.2.3 Gorge Bypass Reach

The Intervenors agree that this Agreement obviates any need for flow releases in the Gorge bypass reach. The Intervenors shall support all efforts by the City to either retain its existing water quality certificate issued by the State of Washington, Department of Ecology (WDOE) on October 27, 1977 or, in the alternative, to obtain a new water quality certificate consistent with the terms and conditions of this Agreement, including the absence of flows in the Gorge bypass reach. In the event efforts are made to reclassify the Gorge bypass reach from a Class AA water to another Class water under WDOE regulations, the intervenors shall not oppose this action, and shall, at a minimum, provide written comments not opposing this action to the WDOE. Should the City be required to release flows in the Gorge bypass reach at any time before the issuance of a new FERC license and for any reason, this Agreement shall be voidable at the option of the City. Should the City be required to release flows in the Gorge bypass reach at any time after the issuance of a new FERC license and for any reason, this Agreement shall give rise to an immediate right of the City to petition the FERC to reconsider or reopen applicable license provisions to reconsider all fisheries resource provisions in light of such requirement. Under such circumstances, the City's efforts to initiate a proceeding before the FERC to reconsider or reopen shall not be opposed by the Intervenors; the Parties may, however, differ in their respective positions in such a proceeding.

2.2.3 The Parties' Obligations

2.2.3.1 Cooperation Among Parties

The Parties shall cooperate in conducting and participating in studies and other actions provided for in this Agreement and shall provide assistance in obtaining any approvals or permits which may be required for implementation of this Agreement.

2.2.3.2 Support Of Agreement

The Parties agree to join in the filing of an Offer of Settlement with the FERC based upon this Agreement and to request that the FERC issue appropriate orders approving this Agreement. All Parties shall refrain from seeking judicial review of FERC's approval of this Agreement. It is expressly agreed by the Parties that this Agreement shall be submitted to FERC as a unit and that

any material modification of its terms, approval of less than the entire Agreement, or addition of material terms by the FERC shall make the Agreement voidable at the option of any Party.

2.3 EFFECTIVE DATE AND DURATION

2.3.1 Execution and Effective Date

This Agreement shall take effect upon the effective date of a license issued by the FERC consistent with this Agreement. If the FERC issues a new license inconsistent with this Agreement and if a Party appeals, the Agreement shall not go into effect. The Parties retain the right to appeal the issuance of a license in whole or in part if unacceptable provisions are added, including stay of any provision.

2.3.2 Duration

This Agreement, together with any subsequent modifications, shall remain in effect for the term of the new FERC license period for the Project, which includes the term(s) of any annual license(s) which may be issued after the foregoing new license has expired. This includes ongoing operations and maintenance expenses which shall continue to be funded for the duration of this Agreement.

2.4 COORDINATED IMPLEMENTATION

2.4.1 Across Forum Coordination

It is understood and agreed by the Parties that similar settlement agreements are being executed between the City and these Intervenors as well as other Intervenors (not party to this Agreement) in the Project relicensing proceedings concerning other resources affected by continuing Project operations. These other settlement agreements and mitigation and enhancement plans include:

Wildlife—Settlement Agreement Concerning Wildlife incorporating the Wildlife Habitat Protection and Management Plan

Recreation and Aesthetics—Settlement Agreement On Recreation and Aesthetics

Erosion—Settlement Agreement Concerning Erosion Control incorporating the Erosion Control Plan

Cultural Resources—Settlement Agreement Concerning Cultural Resources (Archaeological and Historic Resources) incorporating the Cultural Resources Mitigation and Management Plan, which includes the historic and archaeological resources mitigation and management plans

2.4.2 Annual Meeting

The City shall host an annual meeting of the Intervenors to facilitate coordination of implementation of the various settlement agreements. The Intervenors agree to cooperate in across forum coordination as necessary and appropriate to further effective program implementation.

2.5 MONETARY FIGURES

2.5.1 Adjustments For Inflation/Deflation

All dollar amounts listed in this Agreement are defined as 1990 dollars and shall be adjusted annually for inflation or deflation by using the revised Consumer Price Index (CPI-U) for All Urban Consumers as published by the United States Department of Labor for the Seattle Metropolitan area. The indices used shall be those published for the last half of 1990, and for succeeding years, the last half of the calendar year preceding that in which a payment or expenditure is to be made. Indexing of items in this Agreement shall continue until the year of actual payment, unless otherwise provided in this Agreement. The percentage of change from the earlier index to the later index shall be multiplied by the amount specified in this Agreement and the result added to or subtracted from that amount to arrive at the total payment or expenditure. Should the CPI-U index not be available, the Parties agree to negotiate another statistical basis for determining annual changes in the City's monetary commitments.

2.5.2 Time Basis For Payments and Obligations

Payments and obligations by the City for this Agreement shall be made and met on a license-year basis. License years are based on the date of the FERC order issuing a new license for the Project; however, unless specifically provided otherwise in the plans, the City's monetary obligations do not become payable until the license becomes effective (Section 2.3). The City shall make Project specific monies due in license year one available at the time they are needed as soon as possible after the license becomes effective. In subsequent license years, the City shall make payments to the Intervenors for the implementation of specific Anadromous Fish Flow Plan and the Anadromous And Resident Fish Non-Flow Plan projects at the time they are needed. Moneys required to be paid to or on behalf of the Intervenors for non-project specific purposes shall be paid on the last day of each license year. If the license is issued and accepted during a season critical for implementation, it may be impossible to implement a particular program element that year. Therefore, the Parties agree that implementation of such elements may not occur until the license year following its stated schedule in the plans. Agreed upon re-scheduling of projects solely as a result of seasonal considerations shall not be considered a license compliance violation.

2.6 FORCE MAJEURE

The City shall not be liable or responsible for failure to perform or for delay in performance due to any cause or event or circumstance of Force Majeure. For purposes of this Agreement, Force Majeure is any cause or event beyond the City's reasonable control. This may include but is not limited to, fire, flood, mechanical failure or accidents that could not reasonably have been avoided by the City, strike or other labor disruption, act of God, act of any governmental authority or of the Parties, embargo, fuel or energy unavailability (ancillary to, but not including, basic power generation), wrecks or unavoidable delays in transportation, and inability to obtain necessary labor, materials or manufacturing facilities from generally recognized sources in the applicable industry, or communications systems breakdowns, or for any other reason beyond the City's control. The City shall make all reasonable efforts to resume performance promptly once the Force Majeure is eliminated.

2.7 DESIGNATED CONTACTS

2.7.1 Contact Persons

For purposes of implementing this Agreement, the Parties agree that the following individuals shall be designated by each to be the primary contact persons. The initial contact person for the City is:

Superintendent
Seattle City Light
1015 Third Avenue
Seattle, WA 98104

and the initial contact persons for each of the Intervenors are:

Superintendent, North Cascades National Park Service Complex
Pacific Northwest Region, National Park Service
U.S. Department of the Interior
North Cascades National Park Service Complex
2105 Highway 20
Sedro Woolley, WA 98284
(206)856-5700

Regional Director, Region 1
Fish and Wildlife Service
U.S. Department of the Interior
Eastside Federal Complex
911 N.E. 11th Avenue
Portland, OR 97232-4181
(503)230-5967

Field Supervisor
U.S. Fish and Wildlife Service
Fish and Wildlife Enhancment
3704 Griffin Lane, S.E.
Suite 102
Olympia, WA 98501-2192

Area Director, Portland Area Office
Bureau of Indian Affairs
Attn. Branch of Fisheries
911 N.E. 11th Avenue
Portland, OR 97232

Forest Supervisor
U.S. Department of the Agriculture, Forest Service
Mount Baker - Snoqualmie National Forest
21905 - 64th Avenue West
Montlake Terrace, WA 98043
(206)744-3393

Regional Director, Northwest Region
U.S. Department of Commerce
National Marine Fisheries Service
7600 Sand Point Way, N.E., Building No. 1
Seattle, WA 98115
(206)526-6426
Attn: Skagit Project Biologist

Tribal Chairperson
Upper Skagit Tribe
2284 Community Plaza
Sedro Woolley, WA 98284
(206)856-5501

Fisheries Manager
Upper Skagit Tribe
2284 Community Plaza
Sedro Woolley, WA 98284
(206)856-5501

Tribal Chairperson
Sauk-Suiattle Tribe
5318 Chief Brown Lane
Darrington, WA 98241
(206)436-0131

Fisheries Manager
Sauk-Suiattle Tribe
5318 Chief Brown Lane
Darrington, WA 98241
(206)436-0131

Tribal Chairperson
Swinomish Indian Tribal Community
P.O. Box 817
LaConner, WA 98257
(206)466-4047

Fisheries Manager
Swinomish Indian Tribal Community
P.O. Box 817
LaConner, WA 98257
(206)466-4047

Director
Washington Department of Fisheries
115 General Administration Building, MS: AX-11
Olympia, WA 98504
(206)753-3624

Director
Washington Department of Wildlife
600 North Capital Way
MS: GJ-11
Olympia, WA 98504
(206)753-3318

R. Gary Engman
Department of Wildlife
Region 4
16018 Mill Creek Blvd.
Mill Creek, WA 98012

President
North Cascades Conservation Council
P.O. Box 95980
University Station
Seattle, WA 98145

Notification of changes in the contact persons must be made in writing and delivered to all other contact persons.

2.7.2 Notices

All written notices to be given pursuant to this Agreement shall be mailed by first class mail or overnight express service postage prepaid to each Party at the addresses listed above or such subsequent address as a Party shall identify by written notice to all Parties. Notices shall be deemed to be given five (5) working days after the date of mailing.

2.8 REOPENER AND MODIFICATION

2.8.1 Use of Reopener Clause in License

Notwithstanding any other provision of this Agreement, any Party may at any time invoke or rely on any reopener clause(s) in the license for the Project in order to request the imposition by the FERC of different or modified measures for fisheries. Any provision of this Agreement that might be read to limit or preclude a Party from raising any relevant material issue of fact or law in reopening or to otherwise conflict with reopening (e.g., Sections 2.1, 2.1.1, 2.1.2, 2.1.3, 2.1.4, and 2.2.2.2) shall be inoperative to the extent of any such limitation, preclusion or conflict.

2.8.2 Modification

Before invoking any reopener clause under Section 2.8.1, a Party shall request all other Parties to commence negotiations for a period of up to 90 days to modify the terms and conditions of this Agreement in whole or in part. Any such modification shall be subject to FERC approval, except that the Parties may agree to implement on an interim basis, pending FERC approval, any measure not requiring prior FERC approval.

2.8.3 Burden of Proof

In any action under Section 2.8, the petitioning Party shall have the burden of proof.

2.8.4 Effect of Reopener Proceedings

The Parties shall continue to implement this Agreement pending final resolution of any modification sought from the FERC, or until the relief sought becomes effective by operation of law, or unless otherwise agreed. At the time of petitioning the FERC under Section 2.8.1, nothing shall prevent any Party from requesting the imposition of different or modified measures or from bringing any cause of action in any appropriate forum, or from taking other actions relating to any issue or matter addressed by this Agreement.

2.9 PROJECT MODIFICATIONS (HIGH ROSS)

2.9.1 Project Modifications

This Agreement applies to the Project excluding High Ross or any modified High Ross construction. It does not address mitigation for the effects of raising Ross Dam. In the event the City decides to consider raising Ross Dam, separate provisions will be made for additional mitigation. The Parties shall initiate discussion regarding fish mitigation according to the following procedures.

2.9.2 Notice

The City shall notify the Intervenors of its decision to consider raising Ross Dam at least thirty (30) months before construction would commence.

2.9.3 Consultation

At the same time, the City shall commence consultation on necessary fish studies and possible mitigation measures using the Skagit Fisheries Coordinating Committees.

2.9.4 Resolution

At least 180 days before construction would commence, the City shall either agree with the Intervenors on modifications to this Agreement or remaining disputes over fisheries measures may proceed as described in Section 3.0 at the option of any Party.

2.9.5 Mitigation Criteria

Mitigation for the effects on fisheries, if any, of raising Ross Dam shall be based on criteria developed through any necessary fisheries studies that are conducted at the time that the City decides to consider raising Ross Dam.

2.9.6 Preservation Of Rights

Nothing in this Agreement shall preclude any Party from challenging the construction and operation of High Ross or modified High Ross, including disputed mitigation, in any proceeding. The mitigation procedures set out in this Section are not exclusive and need not be commenced or exhausted prior to such challenges.

3.0 DISPUTE RESOLUTION

3.1 REFERRAL OF DISPUTES

Any dispute between the Parties solely concerning asserted non-compliance with the terms of this Agreement shall be referred for consideration to the Flow Coordinating Committee or the Non-Flow Coordinating Committee established under Section 5.0. The appropriate committee shall convene as soon as practicable following issuance of a written request by any Party. All decisions of the committee must be unanimous. In the event a committee cannot resolve the dispute within thirty (30) days after its first meeting on a dispute, it shall give notice of its failure to resolve the dispute to all Parties.

3.1.1 Optional Policy Review

The Parties may, at their option prior to elevating an issue to the FERC, convene an in-person or telephone conference of policy-level administrators should committee-level dispute resolution fail. Any Party through its designated contact in Section 2.7 may invoke optional policy review by contacting the other Parties' designated contacts and arranging a suitable conference. Decisions by unanimous consent shall bind all Parties. In the event that the policy representatives cannot resolve the dispute within 15 days, the matter may be taken to the next level.

3.1.2 Following failure of resolution by the Flow Coordinating Committee or the Non-Flow Coordinating Committee and the optional policy review, any Party may request the FERC to refer the dispute to (1) the Chief Administrative Law Judge of the Commission; or (2) the Division of Project Compliance and Administration within the Office of Hydropower Licensing, or its successor (any one of which is hereinafter referred to as the Decisionmaker), in the order listed above (unless otherwise agreed by the Parties or directed by FERC), for expedited review in accordance with the procedures set forth in this Section 3.0.

3.1.3 Any issue in dispute that is not subject to the expedited review process may be referred to the FERC for resolution pursuant to the FERC's Rules of Practice and Procedure.

3.2 SCOPE

The expedited review process specified in this section shall be utilized solely to resolve any issues in dispute between the Parties that arise under asserted non-compliance with the terms of this Agreement under the Anadromous Fish Flow Plan or the Anadromous And Resident Fish Non-Flow Plan where the amount in controversy is less than $500,000 (1990 dollars). For the purpose of this section, the amount in controversy shall be determined by calculating the difference between the calculated annual cost of the Intervenors' proposal for resolution of the dispute and the calculated annual cost of the City's proposal for resolution of the dispute.

3.3 PROCEDURES

Under the expedited review process, each Party that desires to present an initial position statement to the Decisionmaker shall file the statement with the Decisionmaker and all other Parties within twenty (20) days of mailing of notice by a Party that expedited review is requested. Responsive statements shall be filed and served within forty (40) days of the mailing of the notice. The Decisionmaker shall set a date for submission of any briefing, affidavits or other written evidence and a further date for hearing of oral evidence and argument. Except by agreement of all Parties involved in the dispute, the hearing shall be held not later than seventy (70) days after the date of mailing of the requesting Party's notice or as soon thereafter as the Decisionmaker shall be available. The hearing shall be held in Seattle, Portland, or any other location agreed upon by the Parties, or mandated, upon a finding of special circumstances, by the Decisionmaker. The Decisionmaker shall decide all matters presented within fifteen (15) days of the hearing or as soon thereafter as possible.

3.4 EFFECTIVENESS

All decisions under the expedited review process shall be effective and binding upon issuance and pending appeal, if any. Nothing in this section shall limit or restrict the right of any Party to petition the FERC for de novo review of any decision under the expedited review process. All such appeals shall be in accordance with the FERC's Rules of Practice and Procedure.

3.5 ALTERNATIVE DECISIONMAKER

The Parties may agree to refer any issue subject to expedited review, including those related to the Anadromous Fish Flow Plan, to a third party Decisionmaker other than someone within FERC for processing pursuant to this subsection or as otherwise agreed by the Parties.

3.6 NON-COMPLIANCE

Notwithstanding any other provision of this Agreement, any Party may seek relief arising solely from non-compliance with this Agreement by any Party.

4.0 ISSUES OF GENERAL CONCERN

4.1 ROSS LAKE OPERATIONS

4.1.1 Refill After April 15

The City shall fill Ross Lake as early and as full as possible after April 15 each year, subject to adequate runoff, anadromous fisheries protection flows (specified in the Anadromous Fish Flow Plan, see Section 6.0), flood protection, minimized spill, and firm power generation needs. Subject to the above constraints and hydrologic conditions permitting, the City shall achieve full pool by July 31 each year.

4.1.2 Full Pool Through Labor Day

The City shall hold Ross Lake as close to full pool as possible through Labor Day weekend, subject to adequate runoff, anadromous fisheries protection flows (specified in the Anadromous Fish Flow Plan, see Section 6.0), flood protection, minimized spill, and firm power generation needs.

4.1.3 Overdraft Years

In any overdraft year (i.e., in those years in which Ross Lake is drafted below the energy content curve), the City shall bring the Ross Lake level up to the Variable Energy Content Curve (VECC) no later than March 31, subject to adequate runoff, anadromous fisheries protection flows (specified in the Anadromous Fish Flow Plan, see Section 6.0), flood protection, minimized spill, and firm power generation needs.

4.1.4 Conflict

In the event of conflict between the provisions of this Section 4.1.1 and other provisions of the Agreement, the other provisions shall control.

5.0 SKAGIT FISHERIES COORDINATING COMMITTEES

General oversight, coordination, and direction regarding the implementation of this Agreement shall be provided by Flow Plan Coordinating Committee (FCC) and by a Non-Flow Plan Coordinating Committee (NCC)

5.1 FUNCTIONS

5.1.1 Flow Plan Coordinating Committee (FCC)

The functions of the FCC shall include but not be limited to the following:

1) addressing/resolving disputes regarding implementation of the Anadromous Fish Flow Plan;
2) providing technical assistance to the City on seasonal, monthly, and daily operations that could affect Skagit River fisheries downstream of the Gorge powerhouse;
3) developing and supervising model verification studies;
4) developing and supervising monitoring studies to identify start and end dates for salmon and steelhead spawning and fry protection periods;
5) developing and supervising annual salmon and steelhead redd tracking and fry stranding surveys;
6) developing and proposing modifications to the Anadromous Fish Flow Plan;
7) reviewing reports prepared by and in consultation with the City;
8) establishing, making assignments, and setting schedules and deadlines for Sub-Committees or Technical Working Groups;
9) providing technical expertise and assistance on matters of fish biology and ecology relative to the Flow Plan;
10) coordinating with Field Monitoring Representatives for actions under Section 6.7 Monitoring and Compliance;
11) maintaining coordination with the NCC; and
12) adopting rules and procedures for its proper functioning, consistent with the provisions of this Agreement.

5.1.2 Field Monitoring Representatives

The Parties shall designate Field Monitoring Representatives for actions under Section 6.7. The City shall designate one Field Monitoring Representative and the Intervenors shall designate at least one additional Field Monitoring Representative.

5.1.3 Non-Flow Plan Coordinating Committee (NCC)

The functions of the NCC shall include but not be limited to the following:

1) addressing/resolving disputes regarding implementation of the Non-Flow Plan;
2) reviewing and approving studies, program alternatives, facility designs, plans and proposed actions for all Non-Flow Programs, based upon documents provided by the Program Managers;
3) developing and proposing modifications to the Anadromous Fish and Resident Fish Non-Flow Plan;
4) providing technical expertise and assistance on matters of fish biology and ecology relative to the Non-Flow Plan;
5) maintaining coordination among all Non-Flow Programs and with the FCC;

6) reviewing reports prepared by Sub-Committees, Program Managers, or prepared by and in consultation with the City;
7) determining the allocation of unspent, under spent, and carry over funds pursuant to Section 7.0 of the Anadromous and Resident Fish Non-Flow Plan;
8) reviewing and approving an annual report prepared by the City accounting for expenditures and remaining funds;
9) establishing, making assignments, and setting schedules and deadlines for Sub-Committees or Technical Working Groups; and
10) adopting rules and procedures for its proper functioning, consistent with the provisions of this Agreement.

5.2 MEMBERSHIP

5.2.1 General

5.2.1.1 The following Parties shall be members of both the FCC and NCC: NPS, USFS, FWS, NMFS, Upper Skagit Tribe, Sauk-Suiattle Tribe, Swinomish Indian Tribal Community, WDF, WDW, and the City.

5.2.1.2 Each member shall appoint one representative and one alternate to act for it in matters pertaining to functions of the FCC and NCC. Each member shall provide written notice of its appointed representative to the other members, and may, by similar notice, at any time change its representative or alternate.

5.2.1.3 Any member may temporarily or permanently choose not to participate in either the FCC, the NCC, or both, by written notice to all Parties.

5.2.2 Voting

The members of the FCC and NCC will attempt to achieve consensus in decision making in both the FCC and the NCC. For the purposes of this Agreement, "consensus" is defined as a collective agreement of opinion, not requiring unanimous approval. Consensus is achieved when all members in a quorum (as defined in Section 5.3.2) agree, when a majority of the members in a quorum agree and the others choose not to dissent, or when a single dissenting member is overruled according to the provisions of Sections 5.2.2.3 or 5.2.2.4. Consensus is not achieved when more than one member dissents.

5.2.2.1 FCC And NCC Chairpersons

The Chairperson for the FCC and NCC shall be on a rotating annual basis between the following member groups: Federal, State, and Tribal. It shall be the responsibility of the Chairperson to encourage cooperation and information exchange between members and to facilitate consensus decisions.

5.2.2.2 Subcommittee Delegation

The FCC and NCC may delegate specific decision making authority to Subcommittees made up of selected members. The purpose of the delegation is to facilitate rapid decision making when delay will result in significant impact to fisheries or other resources or when required for expedient program implementation.

5.2.2.3 FCC Decision Making

Decisions of the FCC shall be by consensus of the members constituting a quorum. If one member dissents from the decision and cannot demonstrate that the decision violates a legal authority, the FCC Chairperson may overrule the dissenting member to achieve a decision. The members, when addressing issues involving special expertise or authority, shall give deference to the members whose agencies possess such expertise or authority. Provided, however, the City shall have a veto on decisions before the FCC when those decisions directly affect Project operations or when those decisions require additional expenditures beyond those contemplated by this Agreement for the performance of the specific functions set forth in Section 5.1.1 (Items 1 through 12).

5.2.2.4 NCC Decision Making

Decisions of the NCC shall be by consensus of the members constituting a quorum. If one member dissents from the decision and cannot demonstrate that the decision violates a legal authority, the NCC Chairperson may overrule the disagreeing party to achieve a decision. The members, when addressing issues involving special expertise or authority, shall give deference to the members whose agencies possess such expertise or authority.

5.3 MEETINGS

5.3.1 During the first three (3) years of the license period, meetings shall be held quarterly or upon request of any two members. Thereafter, the FCC or NCC shall meet as mutually agreed or upon the request of any two members.

5.3.2 When a meeting of the FCC or NCC is scheduled, as many of the member representatives as are available shall meet promptly to address the business at hand. A quorum shall be required to conduct business. The presence of a simple majority of members shall constitute a quorum, provided there is at least one representative from the tribes, the state, the federal government, and the City. Members may be represented by proxy if necessary.

5.3.3 Information or data required for meetings may be transmitted by facsimile machine or by mail. Activities may be conducted by telephone conference.

5.4 DOCUMENTATION

5.4.1 The City shall schedule and document the proceedings of all FCC and NCC meetings.

5.4.2 The City shall notify all Parties of the time, location, and agenda for quarterly meetings at least thirty (30) days prior to the meeting date. For all other meetings, the City shall be responsible for notifying all Parties of the meeting time, location, and agenda at the earliest possible date, usually no less than seven (7) days prior to the meeting date.

5.4.3 The City shall make audio recordings of all regular meetings and prepare a summary of decisions reached at these meetings for distribution to all Parties. The summary shall be deemed approved within sixty (60) days of distribution by the City unless a member objects. The audio recordings and summaries shall be held on file by the City for a ten (10) year period.

5.4.4 The City, in consultation with the FCC and NCC, shall produce an annual report summarizing the activities of the FCC and NCC for the preceding calendar year, including an accounting summary for each program of the Non-Flow Plan. This annual report shall be submitted to all Parties and the FERC no later than June 30 of the following calendar year.

5.4.5 All studies, reports, and other documents prepared under this Agreement shall be available to all Parties as soon as reasonably possible. Drafts shall be circulated through the FCC or NCC for review and comment, and comments shall be addressed and/or made an appendix to the final report. All studies shall be conducted following techniques and methodologies accepted by the FCC and NCC and shall be based on sound biological statistical design and analysis.

6.0 ANADROMOUS FISH FLOW PLAN

6.1 DEFINITIONS

Daily Spawning Flow

Shall mean the actual average daily flow at Newhalem gage minus the portion of flow due to flood control, spill, avoiding firm load curtailment, or high Sidestream Inflow as specified by Section 6.5.4.3. A sample calculation is shown in Appendix A (Calculation of Spawning Flow), Part 1.

Downramp Amplitude

Shall mean the difference between the highest Newhalem gage reading and the subsequent lowest Newhalem gage reading during any consecutive 24-hour period due to a flow reduction at Gorge Powerplant and/or at Gorge Dam, which is calculated as shown in Appendix L (Miscellaneous Calculations), Part 1.

Downramp Event
Shall mean a reduction in flow at Newhalem gage due to a controlled reduction in generation and/or spill at Gorge powerplant or dam at a rate exceeding 300 cubic feet per second (cfs) for one hour, or which exceeds a total reduction in flow of 300 cfs over two or more consecutive hours. Downramp rate is calculated in units of cfs per hour as the difference in average flow at Newhalem gage between one hour and the next.

Effective Spawning Habitat Model
Shall mean the model or successor model, as approved by the Parties, which predicts the relationship between spawning and incubation flows in terms of fish habitat and which is documented in Section 6.7.1.1 (Effective Spawning Habitat Model).

Firm Load
Shall mean the minimum amount of power which the City is obligated to provide from a combination of generation and contract resources for the use of its customers.

Inflow Day
Shall mean the last calendar day preceding a Power Scheduling Day for which data are available to calculate inflow conditions.

Insufficient Month
Shall mean a month for which it is determined, pursuant to Section 6.4, that there is insufficient stream flow to meet both minimum flows and other constraints.

Marblemount Gage
Shall mean the United States Geological Survey (USGS) gaging station no. 12181000 located at the town of Marblemount, Skagit County in the State of Washington.

Maximum Spawning Flow
Shall mean an average daily flow measured at Newhalem gage of 4,500 cfs for chinook salmon, 4,000 cfs for pink salmon, 4,600 cfs for chum salmon, and the highest average daily flow that the City can release during the steelhead spawning season without exceeding the current Spawning Control Curve (refer to Appendix E).

Natural Flow
Shall mean the flow which represents the average daily flow which would occur without the Skagit Project in place, which is calculated as shown in Appendix L, Part 2.

Newhalem Gage
Shall mean the USGS gaging station No. 12178000 located at the town of Newhalem, Whatcom County in the State of Washington.

Percent Exceedance Flow
Shall mean the flow calculated from historical flow records that represents the flow which is exceeded with a specific probability frequency. For example, the "95 percent exceedance flow" is less than 95 percent of all flows. (Only 5 percent of flows are lower)

Planned Spawning Flow
Shall mean the average daily flow included in the monthly operating plan of the City as the target flow for spawning during a particular month.

Power Scheduling Day
Shall mean any day in which power schedulers at the City's Power Control Center prepare generation schedules for the following day or days.

Predicted Marblemount Flow
Shall mean the sum of the instantaneous flow at Newhalem gage for a given calendar day and the Tributary Inflow for the corresponding Inflow Day which is calculated shown in Appendix L, Part 3.

Redd
Shall mean the gravel nest in which salmon or steelhead lay their eggs.

Season Spawning Flow
Shall mean the flow at Newhalem gage that determines incubation flows based on spawning conditions over the entire spawning period of a salmon species or steelhead spawning group and which is calculated as described in Sections 6.3.2.1 and 6.3.3.1. Sample calculations are shown in Appendix A, Parts 2 and 3.

Sidestream Inflow
Shall mean the inflow from tributaries between Ross Dam and Newhalem gage.

Spawning Control Flow
Shall mean the planned spawning flow for steelhead based on forecasted conditions prior to and during the spawning period which is determined as shown in Appendix E (Shaping of Flows During Steelhead Spawning).

Temperature Unit Model
Shall mean the existing model or its successor model, as approved by the Parties, which predicts dates of hatch and emergence based on the relationship between temperature and rate of incubation of salmon and steelhead and which is documented in Section 6.7.1.3 (Temperature Unit Model).

Threshold Sidestream Inflow

Shall mean the inflow between Ross Dam and Newhalem gage which is beyond the City's reasonable means to control and shall be defined as 3,500 cfs during the chinook salmon spawning period, 2,500 cfs during the pink salmon spawning period, 3,000 cfs during the chum salmon spawning period, or the Spawning Control Flow minus 500 cfs during the steelhead spawning period.

Tributary Inflow

Shall mean the inflow from tributaries between the Newhalem gage and the Marblemount gage calculated as the mean daily flow at Marblemount gage minus the mean daily flow at Newhalem gage on the same calendar day. A sample calculation is included in Appendix L, Part 4.

6.2 GENERAL

This section of this Settlement Agreement establishes the City's obligations to (a) provide instantaneous minimum flows, (b) limit downramping to specific rates and times, (c) limit maximum average daily flows during spawning periods; (d) restrict downramp amplitude, (e) monitor and evaluate the performance of the Effective Spawning Habitat Model and Temperature Unit Model, and (f) conduct field monitoring of salmon and steelhead deemed necessary by the FCC.

6.2.1 The Anadromous Fish Flow Plan addresses flows for the fishery resources in the mainstem Skagit River downstream of Gorge powerhouse. Its primary purpose is to address the effects of Project operations on salmon and steelhead. This objective requires specific measures for each species and life stage.

6.2.2 For spawning salmon and subsequent protection of redds, the effects of operations are addressed by limiting maximum flow levels during spawning, and maintaining minimum flows throughout the incubation period that are adequate to keep most redds covered until the fry emerge.

6.2.3 For newly emerged salmon fry, the effects of operations are addressed by limiting the daily downramp amplitude, maintaining minimum flows throughout the salmon fry protection period that are adequate to cover areas of gravel bar commonly inhabited by salmon fry, and limiting downramping to nighttime hours except in periods of high flow.

6.2.4 For spawning steelhead and subsequent protection of redds, the effects of operations are addressed by limiting maximum flow levels during spawning, shaping daily flows for uniformity over the extended spawning period, and maintaining minimum flows through the incubation period that are adequate to keep most redds covered until fry emerge from the gravel.

6.2.5 For newly emerged steelhead fry, the effects of operations are addressed by limiting daily downramp amplitude and maintaining minimum flows throughout the steelhead fry protection period that are adequate to cover areas of gravel bar commonly inhabited by steelhead fry. In addition, downramping will be limited to a very slow rate when Project discharge is moderately

low and limited to a moderate rate when Project discharge is relatively high to minimize or prevent fry stranding on gravel bars.

6.3 FLOW REGULATION

6.3.1 General

The Parties agree that continual provision of adequate instream flows and continued adherence to operating parameters and guidelines are essential for the protection and improvement of anadromous fish habitat and fish production in the Skagit River. Where minimum flows required for incubation and fry protection for the various species of anadromous salmon or steelhead spawning groups overlap in time, the City shall provide the highest minimum flow indicated on any particular day.

6.3.2 Flow Regulation For Salmon

The City shall provide instream flow and limit operations to protect salmon as indicated below.

6.3.2.1 Salmon Redd Protection

Subject to the exception for Insufficient Months as determined pursuant to Section 6.4 (Flow Insufficiency), the City shall regulate spawning and incubation flows to provide protection of salmon redds and offspring as indicated below.

(1) Salmon Spawning and Incubation Periods

(a) Salmon Spawning Periods—The spawning periods for salmon are defined as follows unless these periods are optionally modified pursuant to Appendix J (Alternative Salmon Spawning Periods). The spawning period of chinook salmon shall start at 0001 hours on August 20 and shall end at 2400 hours on October 15 each year. The spawning period of pink salmon, which occurs only in odd numbered years, shall start at 0001 hours on September 12 and shall end at 2400 hours on October 31 each year. The spawning period of chum salmon shall start at 0001 hours on November 16 and shall end at 2400 hours on January 6 each year.

(b) Salmon Incubation Periods—Incubation periods shall start at 0001 hours on the first day of the spawning period and shall end at 2400 hours on April 30 for chinook and pink salmon and on May 31 for chum salmon.

(2) Salmon Spawning Flow

During the spawning period of each salmon species, Daily Spawning Flows shall not exceed 4,500 cfs for chinook salmon, 4,000 cfs for pink salmon, and 4,600 cfs for chum salmon unless (a) the flow forecast made by the City shows a sufficient volume of water will be available to sustain a higher incubation flow, thereby permitting a higher spawning flow (see Appendix C—Salmon Spawning/Incubation Flow Tables), or (b) uncontrollable flow conditions are present, as described in Sections 6.4 and 6.5.

The Season Spawning Flow for each species shall be defined as the average of the highest ten (10) Daily Spawning Flows at the Newhalem gage during the spawning period of that species. Daily Spawning Flows shall be calculated as shown in Appendix A, Part 1 (General Calculation of Daily Spawning Flow). A sample calculation of Season Spawning Flow is shown in Appendix A, Part 2.

(3) Salmon Incubation Flow

The City shall provide instantaneous minimum incubation flows for each day of the incubation period of each species, as follows, unless higher minimum flows are required as specified under Section 6.3.1 (General Provisions of Flow Regulation).

(a) Salmon Incubation Flow During the Spawning Period—Incubation flow during the first ten (10) days of the spawning period of each species shall be based on the Planned Spawning Flow. After the first ten days, incubation flow for each species shall be based on the average of the highest ten (10) Daily Spawning Flows that have occurred up to that day during the spawning period. For example, the incubation flow for the twentieth day of the spawning period is based on the average of the highest ten (10) Daily Spawning Flows during the preceding 19 days, and so on for the twenty-first, twenty-second, etc. days.

Appropriate incubation flows shall be determined for the spawning flows that are calculated as described above according to Appendix C (Salmon Spawning/Incubation Flow Tables). Sample calculations are shown in Appendix B, Parts 1 and 2.

(b) Salmon Incubation Flow Following the Spawning Period—Incubation flow during days following the spawning period of each species shall be based on the Season Spawning Flow which is calculated as the average of the highest ten (10) Daily Spawning Flows at the Newhalem gage during the spawning period of that species. Appropriate incubation flows shall be determined for the Season Spawning Flow according to Appendix C (Salmon Spawning/Incubation Flow Tables). A sample calculation is shown in Appendix B, Part 3.

6.3.2.2 Salmon Fry Protection

During the period from 0001 hours on February 1 through 2400 hours on May 31 when salmon fry are emerging from redds, which shall be known as the Salmon Fry Protection Period, the City shall implement the following restrictions of downramp conditions and minimum flow for the purpose of protecting salmon fry.

(1) Downramp Amplitude During Salmon Fry Protection Period—The City shall limit the Downramp Amplitude to no more than 4,000 cfs.

(2) Downramping During Salmon Fry Protection Period—The City shall restrict its maximum downramping rate, as measured at Newhalem gage, to protect salmon fry as follows:

(a) Daytime Downramping During the Salmon Fry Protection Period—During the period of time beginning six and one-half hours prior to official sunrise and ending at official sunset (Pacific Standard or Pacific Daylight Time), no downramping is allowed from the moment

when Predicted Marblemount Flow is less than or equal to 4,700 cfs. Downramping may proceed at a rate of up to 1,500 cfs per hour as long as Predicted Marblemount Flow is greater than 4,700 cfs

(b) Nighttime Downramping During the Salmon Fry Protection Period—Downramping is allowed at a rate up to 3,000 cfs per hour during all periods other than daytime.

(3) Salmon Fry Protection Flow—Subject to the exception for Insufficient Months as determined in Section 6.4 (Flow Insufficiency), the City shall maintain a minimum flow at the Newhalem gage that is the higher of either the flow that results in a Predicted Marblemount Flow of at least 3,000 cfs or the monthly flows as set forth in Appendix I (Fry Protection Flows At Newhalem gage). For the purpose of salmon fry protection, the City shall not be required to release flows (as measured at Newhalem gage) greater than 2,600 cfs. Sample calculations are included in Appendix D, Parts 1, 2, and 3.

6.3.3 Steelhead

The City shall provide instream flows and limit operations to protect steelhead as indicated below:

6.3.3.1 Steelhead Redd Protection

Subject to the exception for Insufficient Months as determined pursuant to Section 6.4 (Flow Insufficiency), the City shall regulate spawning and incubation flows to protect steelhead redds and offspring as indicated below.

(1) Steelhead Spawning and Incubation Periods

(a) Steelhead Spawning Periods—The steelhead spawning period shall be March 15 through June 15 each year. This total spawning period shall be divided into three subperiods which correspond to the months, or portions thereof: March 15 - 31, April 1 - 30, and May 1 through June 15 which shall be treated as separate spawning groups for the purpose of determining succeeding steelhead incubation flows.

The spawning subperiod of March steelhead shall start at 0001 hours on March 15 and shall end at 2400 hours on March 31. The spawning subperiod of April steelhead shall start at 0001 hours on April 1 and shall end at 2400 hours on April 30. The spawning subperiod of May and June steelhead shall start at 0001 hours on May 1 and shall end at 2400 hours on June 15.

(b) Steelhead Incubation Periods—The incubation periods for each spawning group shall start at 0001 hours on the first day of the spawning subperiods and shall end at 2400 on June 30 for March steelhead, and July 31 for both April steelhead and May through June 15 steelhead. During the month of August minimum flows of 2,000 cfs will be maintained for fry protection purposes as described in Section 6.3.3.1.(3)(b).

(2) Steelhead Planned Spawning Flow

During the steelhead spawning period, Planned Spawning Flows shall not exceed the flows indicated by the most current Spawning Control Curve, which is determined as shown in Appendix E (Shaping of Flows During Steelhead Spawning). Further, to the extent Ross Lake has sufficient storage volume to contain and shape the forecast runoff without causing spill, Planned Spawning Flows shall be less than the following amounts: 5,000 cfs for March steelhead, 5,000 cfs for April steelhead, and 4,000 for May through June 15 steelhead, unless the forecasted inflow and storage is great enough to provide incubation flows for higher Season Spawning Flows. Any Planned Spawning Flows greater than the flow ranges above shall not be implemented prior to discussion in the FCC. Spawning flows shall be shaped such that they result in reservoir elevations greater than or equal to the Spawning Control Curve and less than the Spill Control Curve as described in Appendix E. The City shall endeavor to provide uniform Season Spawning Flows over the entire spawning period as described in Appendix E.

The actual Season Spawning Flow for each subperiod shall be defined as the average of the highest ten (10) Daily Spawning Flows at the Newhalem gage during each spawning subperiod. Daily Spawning Flow shall be calculated as shown in Appendix A, Part 1 (Calculation of Spawning Flow).

(3) Steelhead Incubation Flow

The City shall provide instantaneous minimum incubation flow for each day of the incubation period of steelhead, as follows, unless higher minimum flows are required as specified under Section 6.3.1:

(a) Steelhead Incubation Flow During the Spawning Subperiods—Incubation flow during the first ten (10) days of each spawning subperiod shall be based on the Planned Spawning Flow. Thereafter, daily incubation flows shall be based on the average of the highest ten (10) Daily Spawning Flows that have occurred up to that day. Appropriate incubation flows for any given day shall be determined for the spawning flows that are calculated as described above and the Season Spawning Flows according to Appendix G (Steelhead Spawning/Incubation Flow Tables). Sample calculations are shown in Appendix F, Parts 1 and 2.

(b) Steelhead Incubation Flow Following the Spawning Subperiods—Incubation flow during days following each spawning subperiod shall be based on the Season Spawning Flow which shall be calculated as the average of the highest ten (10) Daily Spawning Flows during that subperiod. Appropriate incubation flows for any given day shall be determined by the Season Spawning Flows according to Appendix G. A sample calculation is shown in Appendix F, Part 3.

During the months of June and July, the City shall maintain daily incubation flows at Newhalem gage, at least as great as the monthly minimum fry protection flows set forth in Appendix I, that result in Predicted Marblemount Flows no less than the flows listed in Appendix G which correspond to the appropriate Season Spawning Flows. A sample calculation is shown in Appendix F, Part 3. For the purposes of incubation, the City shall not be required to release flows (as measured at Newhalem gage) greater than 2,600 cfs. During the month of August, the City shall maintain instantaneous daily incubation flows at Newhalem gage of 2,000 cfs, except that when Natural Flow on the Inflow Day is less than 2,300 cfs, the minimum incubation flow may be reduced to 1,500 cfs until the Natural Flow exceeds 2,300 cfs.

6.3.3.2 Steelhead Fry Protection

During the Steelhead Fry Protection Period from 0001 hours on June 1 through 2400 hours on October 15, unless modified pursuant to Appendix K (Alternative Steelhead Fry Protection Period), the City shall implement the following restrictions on downramp conditions and minimum flow for the purpose of protecting steelhead fry.

(1) Downramp Amplitude During the Steelhead Fry Protection Period—Maximum 24 hour Downramp Amplitude shall be limited to 3,000 cfs, except that when Section 6.4 (Flow Insufficiency) flow reductions are in effect, the maximum 24 hour Downramp Amplitude for August shall be limited to 500 cfs. From the point that flow at Newhalem gage is 4,000 cfs or less, the Downramp Amplitude is further limited as shown in Table 1 below, regardless of whether the maximum 24 hour amplitude can be attained. A sample calculation is shown in Appendix H, Parts 1, 2, and 3.

(2) Downramping During the Steelhead Fry Protection Period—The City shall restrict its maximum downramping rate, as measured at Newhalem gage, to protect steelhead fry as follows:

(a) Newhalem Instantaneous Flow 4,000 cfs or Less—Downramping is allowed up to 500 cfs per hour.

(b) Newhalem Instantaneous Flow Above 4,000 cfs—Downramping is allowed up to 1,000 cfs per hour.

(3) Steelhead Fry Protection Flow—Subject to the exception for Insufficient Months as determined in Section 6.4 (Flow Insufficiency), the City shall maintain minimum flows at Newhalem gage which are the higher of flows specified in Appendix I (Fry Protection Flows at Newhalem Gage) or determined by Section 6.3.3.1 (Incubation Flows). During the portions of June and October excluded from the Steelhead Fry Protection Period pursuant to Appendix K (Alternative Steelhead Fry Protection Period), minimum flows shall be determined by Section 6.3.3.1 (Incubation Flow). Further, the minimum flow for August may be reduced to 1,500 cfs when Natural Flow at Newhalem gage on the Inflow Day is less than 2,300 cfs.

6.3.4 Measures Beyond The Required Operation Constraints

6.3.4.1 The Parties recognize that the operational requirements in this section for the protection of anadromous fish spawning, incubation, and rearing may not provide full and complete protection, particularly when uncontrollable flow events occur. However, it is the goal of the City and Intervenors to provide full and complete protection each year. Achieving this goal will require continuing cooperation among all Parties.

6.3.4.2 Certain actions beyond the Project operational requirements may be available to the City which will help achieve this goal. Such actions could include augmenting minimum flows or reducing daily average flows at the Gorge powerplant to reduce the effects of controlled and uncontrolled flow events which may be detrimental to anadromous fish spawning, incubation, and

Table 1. Downramp amplitude in cfs allowed during steelhead fry protection period.

Month	Maximum Daily 24 hour Amplitude (cfs)	Portion of Amplitude When Newhalem Gage < 4,000 cfs (cfs)
June 1 or Alternative Start Date to June 30	3,000	2,000
July	3,000	2,000
August	3,000*	2,000*
September	3,000	2,500
October 1 to 15 or Alternative End Date	3,000	2,500

* Limited to 500 cfs per day when Section 6.4 (Flow Insufficiency) provisions are in effect.

rearing. The specific actions to be taken shall be cooperatively developed through the FCC taking into account system flexibility, economic considerations, and potential impacts upon all anadromous species and life stages. Critical data to be considered shall include but not be limited to actual Newhalem to Marblemount Tributary Inflow and field monitoring of actual redd locations.

6.3.4.3 The City will initially develop proposed actions at the end of the spawning season for each species (or spawning group in the case of steelhead) or whenever uncontrollable flow events occur during the spawning, incubation, and rearing periods. The City will present the proposal to the FCC for review and discussion in an effort to reach consensus on a plan of action.

6.4 FLOW INSUFFICIENCY

6.4.1 General

This chapter establishes the conditions under which the City may have reduced requirements for minimum instream flows. During Insufficient Months, the City will be allowed to reduce flows set out in Sections 6.4.3 and 6.4.4 as specified in this Section 6.4. Insufficient Monthly flow conditions could adversely affect the City's ability to provide sustained minimum flows for fish. Prior to taking action, the City shall discuss with the FCC the need to take action and possible options for resolution of the insufficiency.

6.4.2 Definition

Flow Insufficiency shall mean water conditions during a month or months characterized by abnormally low precipitation and sidestream runoff that has the potential to result in a failure to refill Ross Lake by July 31 or empty Ross Lake if operations continue to draft at the rate determined by minimum required flows. Months which are characterized by any of the flow insufficiency criteria in Section 6.4.3 (Determination of Flow Insufficiency), shall be considered Insufficient Months.

6.4.3 Determination Of Flow Insufficiency

An Insufficient Month shall be deemed to occur when any one of the following criteria are met:

6.4.3.1 Criterion 1

When discharge of the required minimum flows at the Newhalem gage, plus 300 cfs, combined with the forecasted inflow to Ross Lake which is exceeded with 95 percent confidence and the current reservoir volume results in Ross Lake drafting to empty. A sample calculation is shown in Appendix L, Part 5.

6.4.3.2 Criterion 2

When discharge of the required minimum flows at the Newhalem gage, plus 300 cfs, combined with the forecasted inflow to Ross Lake which is exceeded with 95 percent confidence, and the current reservoir volume results in a Ross Lake volume that does not meet the applicable Energy Content Curve. An example is shown in Appendix L, Part 6.

6.4.3.2 Criterion 3

When Natural Flow at Newhalem gage on any Inflow Day in the month of August is less than 2,300 cfs. An example is shown in Appendix L, Part 7.

6.4.4 Response To Flow Insufficiency

6.4.4.1 At the earliest possible time after flow insufficiency has been determined, the City shall notify the FCC of the need to meet to discuss the flow insufficiency problem and action alternatives. The Parties shall mutually agree on the best course of action. Alternatives for action which shall be considered shall include but not be limited to the following: (1) reduced requirements for minimum instream flows for some or all succeeding months in which the condition of flow insufficiency persists, and (2) no action, which could potentially lead either to Newhalem gage flows reduced to a level equal to Natural Flow or to load curtailment.

6.4.4.2 When no consensus on a course of action is achieved within two weeks of the date the City notifies the Parties of a condition of Flow Insufficiency, then the City may take the following actions: for Criteria 1 or 2, the City may reduce each month's minimum flow proportionally to the extent necessary to remove Flow Insufficiency provided, however, that the result of such reductions will be flows no less than the lesser of Natural Flow or 1000 cfs.

6.4.4.3 Proportional reduction of minimum flows shall be implemented as follows:

The City shall:

1) notify FCC representatives of its intent to implement proportional flow reductions;
2) calculate the total volume of flow (flow deficit) that is required to remove Flow Insufficiency (i.e., or to keep Ross Lake from drafting to empty or to keep Ross Lake elevation above the VECC);
3) divide that total flow deficit among the months during the entire period from the current date to the date when the City predicts that Ross Lake will be empty or Ross Lake elevation will fall below the VECC—flows are divided proportionally according to each month's normal minimum flow; and
4) either reduce monthly minimum flows according to each months' proportion of the flow deficit or preferably reduce monthly minimum flows according to an alternative schedule recommended by the FCC which will accomplish the same result (i.e., remove Flow Insufficiency within the same time frame).

For Criterion 3, the City may reduce minimum flows in August in conformance with Section 6.3.3.2 (Steelhead Fry Protection).

6.4.4.4 During the months when minimum flows are reduced due to Flow Insufficiency, the Flow Insufficiency conditions will be reassessed weekly for Criteria 1 and 2 and reassessed daily for Criterion 3. When reassessment confirms that Flow Insufficiency criteria are no longer met, the City will resume sufficient month minimum flows.

6.4.5 Flow Forecasting

At any time of the year, several flow forecasting techniques may be available or appropriate. Also, better forecasting methods are expected to be developed in the future. Accordingly, the City will make the assumptions and methods of each particular forecast available to the Parties at the time the flow forecast is made.

6.5 FLOW LIMITATIONS

6.5.1 Purpose

There are some circumstances for which the effect of this Agreement shall be limited due to the City's inability to react to or control the flows or operating factors that affect fish.

6.5.2 Spill

The City is not obligated to spill on a planning basis for the purposes of maintaining minimum flows; however, the City will spill to the extent possible during generator outages that would otherwise violate minimum flow requirements.

6.5.3 Emergency Conditions

Nothing in this agreement shall constrain the City from taking appropriate action to respond to an emergency condition which includes but is not limited to a cause or event of Force Majuere. An emergency condition may include mechanical or electrical failure or deficiencies of power necessary to serve firm load where there are no options available, including power purchases from any source. As soon as possible after the end of an emergency condition, the City will return to an operation schedule in compliance with the terms of this Agreement. The City may be liable and responsible for certain emergency conditions that do not constitute Force Majuere.

6.5.4 Uncontrolled Flow Measures

The limitations on storage capacity in Gorge and Diablo Lakes mean that Ross Dam is the only effective point of control of downstream flows. Nevertheless, there are conditions under which control of downstream flows is not possible even at Ross Dam. The City is responsible for protecting fish only so far as it can control the downstream flows. Therefore, the portion of the

total daily flow which occurs under the conditions of flood control or spill avoidance, load curtailment avoidance, and high Sidestream Inflow shall be considered uncontrolled flow and shall be excluded from the calculation of Season Spawning Flow pursuant to this Section 6.5.4.

6.5.4.1 Flood Control Measures or Spill Avoidance

The City shall not be responsible for flow which is released due to actions of the Corps of Engineers or due to reasonable actions taken to avoid exceeding the flood control curve or full pool. The City in its semi-annual compliance report will provide information upon which a decision to exercise this clause was made. A sample calculation is shown in Appendix A, Part 1.b (Calculation of Spawning Flow).

6.5.4.2 Load Curtailment Avoidance

The City shall not be responsible for flow which is released when there are no options available other than Firm Load Curtailment, including purchase of power from any source. This section is not intended to permit flow releases to meet the generation requirements resulting from any increase in Firm Load growth after the execution of this Agreement. For the purpose of this Agreement, Firm Load shall mean the minimum amount of power which the City is obligated to provide from a combination of generation and contract resources for the use of its customers. A sample calculation is shown in Appendix A, Part 1.d.

6.5.4.3 High Sidestream Inflow

The City shall not be responsible for that portion of flow which is released due to Sidestream Inflow greater than 3,500 cfs during the chinook salmon spawning period, 2,500 cfs during the pink salmon spawning period, 3,000 cfs during the chum salmon spawning period, or due to Sidestream Inflow which is greater than the current Spawning Control Flow for steelhead minus 500 cfs. The Sidestream Inflow values shall be considered Threshold Sidestream Inflows for the purpose of calculating Daily Spawning Flows. Sample calculations are shown in Appendix A.

6.6 OPERATING CONSIDERATIONS

6.6.1 Power Planning

The City shall submit the provisions of the Anadromous Fish Flow Plan as non-power constraints for Project operations in annual planning under the Pacific Northwest Coordination Agreement, as it may be amended. The City shall provide the FCC with a copy of this submittal. Further, in all power planning the City will use these provisions for purposes of determining firm capabilities for the Skagit Project.

6.6.2 Scheduling Procedures

6.6.2.1 General Principles

Schedules of hourly generation during each calendar day are prepared in advance on the preceding Power Scheduling Day. Actual generation may deviate from the scheduled generation due to power system and stream flow conditions that were not anticipated when schedules were prepared on the Power Scheduling Day. Whenever an instrument reading affecting fish flow requirements appears to be erroneous, the power scheduler shall use the last reliable instrument reading available for the purpose of preparing the next generation schedule. Malfunctions of instruments affecting fish flow requirements for a period longer than 24 hours will be promptly reported to FCC to make a determination of appropriate action.

When changes in operating constraints occur from one day to the next (such as from the end of one month to the beginning of another), the changes must not occur prior to 0001 hours on the day such changes are supposed to be in effect.

6.6.2.2 Scheduling Generation for the Succeeding Calendar Day

When scheduling power generation for the succeeding calendar day, power schedulers shall assume that Tributary Inflow is the same as on the Inflow Day. Further, they shall calculate the Predicted Marblemount Flow as the planned flow at Newhalem gage plus the Tributary Inflow that occurred on the Inflow Day and shall plan Gorge powerplant releases accordingly.

6.6.2.3 Scheduling over Holidays and Weekends

When scheduling power generation for a period greater than one day during the Salmon Fry Protection Period, power schedulers shall calculate an appropriate Newhalem gage flow for each day as 3,000 cfs minus the receded Tributary Inflow. Receded Tributary Inflow shall be calculated as the Tributary Inflow on the Inflow Day minus the difference between the Tributary Inflow on the Inflow Day and the 90 percent exceedance flow for the month, multiplied by the number of days from the current Power Scheduling Day to the day being scheduled, divided by the total number of days being scheduled. The 90 percent exceedance flows which are calculated from historical flow records and which may be periodically updated as additional years of data become available, are as shown in Appendix M. A sample calculation is shown in Appendix D, Parts 2 and 3.

6.6.2.4 Scheduling During Conditions of Extremely Low Natural Inflows

When the Tributary Inflow on the Inflow Day is less than or equal to the 90 percent exceedance flow, then power schedulers shall assume that the Tributary Inflow remains the same on each day until the next Power Scheduling Day.

6.6.3 Operating To Meet The Schedule

6.6.3.1 Normal Conditions

Ramp rates, which are expressed in cfs per hour, shall be treated as instantaneous constraints and ramping shall be accomplished in as uniform a rate as practical over the hour.

6.7 MONITORING AND COMPLIANCE

6.7.1 Model Verification Studies

Field monitoring studies will be required to verify the accuracy of the Effective Spawning Habitat Model and the Temperature Unit Model. Model verification studies shall be developed by consensus of the FCC.

6.7.1.1 Effective Spawning Habitat Model

The Effective Spawning Habitat Models (ESH) were developed based on instream flow studies performed on the Skagit River between Gorge Powerplant and Marblemount by the Fisheries Research Institute during the term of the Interim Flow Agreement. The models show the relationship between spawning flows and succeeding incubation flows in terms of percentage of spawned habitat protected. There are two models based on different assumptions about the incubation requirements of salmon and steelhead.

The below gravel model is based on the reduced flow requirements of unhatched eggs while the above gravel model is based on the higher flow required for developing and emerging alevins. The output of the Effective Spawning Habitat Model formed the basis of the Spawning/Incubation Flow Appendices C and G that are incorporated as part of this Settlement Agreement.

6.7.1.2 Field monitoring surveys will be conducted annually by the City, unless termination is agreed to by the FCC, to confirm the accuracy of the Effective Spawning Habitat Model output for salmon and steelhead spawning and incubation flows. These surveys will be conducted monthly for each species during each complete spawning month and incubation month beginning in the year following acceptance of the new license by the City. Each survey will be conducted between Newhalem and Rockport at predetermined index locations on the Skagit River. Observation locations will be developed and/or modified by the FCC.

Surveys will be coordinated with the City's operations to ensure that observations are made during periods of flow conditions consistent with the design of the study. These surveys may also be coordinated with spawning surveys being conducted by the Parties.

In the event that field survey observations are not consistent with the ESH Model spawning and incubation flow outputs, FCC will review the circumstances and determine the nature of the problem. If the nature of the problem cannot be determined (such as occurrence of flows beyond the City's control), then it may be necessary to re-calibrate the ESH Model. The necessity of re-

calibration will be determined by the FCC and the process of re-calibration will be developed by that body.

6.7.1.3 Temperature Unit Model

The Temperature Unit Model (TU Model) was developed to predict the incubation timing of salmon and steelhead in the Skagit River. It is based primarily on temperature unit data collected in studies performed by the Fisheries Research Institute during the early term of the Interim Agreement and historical water temperature data collected by the USGS at the Alma Creek gage site on the Skagit River.

The TU Model can predict the calendar date of hatching and emergence for each of the pink, chum, and chinook salmon and steelhead. The data upon which the temperature and incubation timing is based may be altered in the future as more reliable data is collected under the direction of the FCC.

6.7.1.4 If the FCC deems that the accuracy and usefulness of the TU Model can be improved for steelhead or one or more of the species of salmon by verification studies, then the City shall develop a draft work plan for that purpose. The City shall submit the work plan for verifying the TU Model to the FCC for review and approval. The development and implementation of the verification work plan shall be completed within two years of the determination to proceed, unless the FCC agrees otherwise. Any modification of the TU Model will be based on the outcome of these verification studies.

6.7.2 Field Monitoring

Several field monitoring procedures will be conducted throughout the term of this Agreement. In particular, the starting and ending dates of salmon spawning may be monitored each year as described in Appendix J. Annual monitoring may also be used to identify when the Steelhead Fry Protection Period begins and/or ends. Fry stranding surveys may be conducted during the peak fry vulnerability periods to monitor fry stranding levels. All field monitoring studies shall be developed by consensus of the FCC and shall be conducted by a monitoring team composed of at least one representative of the City and at least one representative of another Party.

6.7.2.1 Whenever disputes arise regarding the data collected in field studies or the interpretation of that data within or between the FCC or the Field Monitoring team, the default start and end dates established in Sections 6.3.2.1 and 6.3.3.1 of this Agreement shall prevail.

6.7.2.2 Salmon Spawning Start and End Dates

This Agreement specifies default start and end dates for salmon spawning. The City may elect to conduct annual surveys that will provide site specific data required to either delay the start or advance the end dates according to criteria listed in Appendix J. Surveys will be conducted as needed at index locations and/or reaches predetermined by the FCC. These surveys will be conducted at the direction of the FCC, acting through a Field Monitoring team as described in Appendix J.

Redd protection measures as described in Sections 6.3.2.1 and 6.3.3.1 will be implemented in the case of start date or maintained in the case of end date on the default dates unless the surveys indicate that spawning activity (according to evidence described in Appendix J) has begun or ceased, respectively. If survey observations are determined to be unreliable, the default dates shall determine the start or end of redd protection measures.

6.7.2.3 Steelhead Fry Protection Period Start and End Dates

This Agreement specifies that the default start and end dates for the Steelhead Fry Protection Period shall be June 1 and October 15, respectively. However, annual monitoring efforts may be used to identify alternate Steelhead Fry Protection Period start and end dates. This monitoring procedure is described in Appendix K.

6.7.2.4 Fry Stranding Surveys

Following execution of this Agreement, fry stranding surveys will be conducted annually for a period of no less than three years to monitor the effectiveness of the fry protection measures implemented in Sections 6.3.2.2 and 6.3.3.2. These surveys will be conducted during the peak vulnerability periods of both the salmon and steelhead fry. Steelhead fry surveys will be conducted between August 1 to 31, and salmon fry surveys will be conducted between March 15 and April 15, unless the FCC agrees otherwise.

Three separate surveys will be completed during the steelhead survey period by the Field Monitoring team. Five separate surveys will be completed during the salmon survey period by the Field Monitoring team. The surveys, which will record species, locations, and numbers of stranded fry, will be conducted on 300-foot sections of exposed Rockport and Marblemount river bars between the high and low water lines of a downramp event. The results of surveys will be presented at FCC meetings for review and discussion. After three years of annual surveys, the FCC may agree to continue surveys at annual intervals or otherwise.

6.7.3 Compliance Monitoring

6.7.3.1 The flow levels specified in this Agreement will be measured at USGS gages, which have certain inherent ranges of accuracy. For example, the current gage at Newhalem gives a real time reading that is within 5 percent of the true discharge; the current gage at Marblemount gives a real time reading that is within 10 percent of the true discharge (USGS Water-Data Report, WA-8601). The Parties recognize that ranges of accuracy exist and are an operational aspect the USGS gages. For the purposes of this Agreement, operations will be determined based on real time gage readings, which will be recorded by the City.

6.7.3.2 The City shall record and make available to all Intervenors complete records of the real-time flow data at both the Newhalem and Marblemount gages.

6.7.3.3 The City shall prepare semi-annual reports to demonstrate compliance with the instream flows and operating restrictions embodied in this Agreement. The reporting periods shall be January 1 through June 30 and July 1 through December 31. The reports shall be sent to the

Intervenors and to the FERC within 120 days of the end of each reporting period. Due to the complexity of this Agreement and the comprehensive nature of the reporting requirements it is agreed by all Parties that the City may require an additional 30 days to complete this report during the first 5 years of the new license. The reports shall contain but may not be limited to the following:

1) Minimum flows recorded at Newhalem gage;
2) Hourly ramping rates during Salmon and Steelhead Fry Protection Periods;
3) Daily Predicted Marblemount Flows during the Salmon Fry Protection Period;
4) Mean Daily Tributary Inflow;
5) Daily total Downramp Amplitude and portion of amplitude that occurred at Newhalem gage flows less than 4,000 cfs during Salmon and Steelhead Fry Protection Periods;
6) Daily required instantaneous incubation flows based on Appendices C and G;
7) The Season Spawning Flow or spawning flows calculated to date for each salmon species or steelhead spawning group;
8) Documentation and explanation of any flow violations;
9) Calculated Daily Spawning Flows;
10) Planned Spawning Flow for each species spawning or incubating during the reporting period;
11) List of daily flows calculated from the Spawning Control Curve for steelhead;
12) Documentation of any decision to exercise a limitations clause (per Section 6.5), including consultations with Intervenors;
13) Documentation of any emergencies that caused deviation from this Agreement;
14) Summary list of the FCC actions during the reporting period;
15) Daily fry protection flows as listed in Appendix I; and
16) Applicable Minimum Flows for the reporting period.

7.0 ANADROMOUS AND RESIDENT FISH NON-FLOW PLAN

7.1 GENERAL

7.1.1 This Section of the Agreement establishes the City's commitment to provide $6,320,000 for support and implementation of Non-Flow measures described in this Section (Table 2). The cost limitations set out in this section do not include the costs of staff, support, or administration provided by the City.

7.1.2 The Anadromous Fish Flow Plan contained in this Agreement (Section 6.0) is intended to mitigate the impacts of daily and seasonal downstream flow fluctuations. However, even with complete implementation of the Anadromous Fish Flow Plan, some level of these impacts will continue to occur. Fish will still be exposed to daily flow changes that would not commonly be seen in the natural environment, and this will result in the continuation of chronic fry stranding at a reduced yet unknown level. In addition, the configuration and operation of the Project has

Table 2. Anadromous and resident fish Non-Flow Plan summary.

Program	Dollar Allocation*	License Years	Program Manager(s)	Comments
ANADROMOUS FISH PROGRAM				
Steelhead Smolt Production			WDW and/or	
Engineering	175,000	1 - 2	SSC and/or	
Capital improvements/construction	1,250,000	3 - 5	WDF	
Operation and maintenance	1,275,000	6 - 30		O&M total based on maximum
Sub-Total	**2,700,000**	1 - 30		of $51,000 per year
Chinook Research			WDF	
Startup, tagging, rearing	250,000	1 - 4		
Rearing, tagging, recovery	450,000	5 - 7		Maximum of $150,000 / year
Recovery, evaluation	600,000	8 - 13		Maximum of $100,000 / year
Sub-Total	**1,300,000**	1 - 13		
Chum Habitat			WDF / SSC	
Site inventory, evaluation , ranking,	50,000	1		
habitat development, maintenance	1,450,000	2 - 30		Max $150,000 / year till
Sub-Total	**1,500,000**	1 - 30		funds exhausted
County Line and Newhalem Ponds			WDF	City to repay WDF for development.
Sub-Total	**220,000**			If funds left over, used for O & M
Instream & off-channel habitat	150,000	1 - 4	USFS	
improvement and sediment reduction	150,000	5 - 30		
Sub-Total	**300,000**	1 - 30		
Anadromous Fish Program Total	**6,020,000**			
RESIDENT TROUT PROTECTION AND PRODUCTION PROGRAM				
Ross Tributary Transitory Barrier Removal	see comments	1- 30	SCL	SCL performs each year as necessary
Diablo and Gorge Fisheries	300,000	1 - 30	WDW / NPS	Additional funds may be drawn from Steelhead Smolt Production Program
Resident Trout Program Total	**300,000**	1 - 30		Total does not include SCL barrier removal costs or money reallocated from Steelhead Smolt Production Program
NON-FLOW PLAN TOTAL	**6,320,000**	1 - 30		

* Amounts in 1990 dollars

rendered some formerly productive fish habitat inaccessible. The Anadromous and Resident Fish Non-Flow Plan (Non-Flow Plan) is specifically intended to address these residual impacts and habitat losses and, possibly, to provide a measure of improvement.

7.1.3 The Non-Flow Plan contains measures for steelhead production, chinook research, off-channel chum habitat development and improvement, instream or off-channel fish habitat development and sediment reduction, and provisions for a resident trout protection and production program. It establishes the intent, cost, and implementation procedures and schedules for each measure of the plan, including designation of a Program Manager(s).

7.2 PROGRAM MANAGER(S)

7.2.1 The specific programs authorized under this Section 7.0 shall be implemented by Program Manager(s) designated by the NCC or within this Agreement. For this Agreement, Program Manager(s) shall be the designated agency or Tribe or the City, as the case may be, acting by and through their appropriate representatives (Table 2). The Program Managers shall have complete responsibility for program implementation, including the conduct of studies, expenditure of funds, construction of capital facilities within budget, and operation and maintenance within budget. For each program administered, a Program Manager shall develop the following information, as appropriate, for NCC review and approval:

1) detailed study plans;
2) site evaluation criteria;
3) production and/or site alternatives;
4) conceptual design;
5) final design and construction plans; and
6) monitoring and evaluation of programs and facility performance.

7.2.2 Each Program Manager shall prepare an annual report in consultation with and for submission to the NCC. Each report shall include a budget report and a prospective work plan for the next reporting period and budget plan for the next two reporting periods. The individual program annual reports shall include requirements specific to that program as described in the appropriate program sub-section.

7.3 ANADROMOUS FISH PROGRAMS

7.3.1 General

7.3.1.1 The City will make available a maximum of $6,020,000 to the WDF, WDW, and the Tribes to implement the measures identified in Sections 7.3, 7.4, and 7.5 and summarized in Table 2. The specific measures, schedule for implementation, and cost scheduling will be as identified below unless modified by the NCC.

7.3.1.2 The NCC can delay the implementation schedule of the programs described in this Section 7.0 without losing the dollars allocated for the specific program (e.g. design of steelhead facilities or start of chinook research could be delayed without penalty). It is not the intent of any Party to advance Program cost schedules. Cost schedules cannot be advanced without City approval. Dollars allocated to a specific program are not lost if under-spent but may be shifted to another program or species within this plan. Dollars not spent within a scheduled period may also be carried forward into succeeding periods, provided that they will be adjusted for inflation or deflation under Section 2.5.1. Under-spent dollar shifts and carryovers will be subject to NCC approval.

7.3.1.3 It is agreed by all Parties that the protection measures described in the Anadromous Fish Flow Plan of this Agreement will protect anadromous fish produced under the terms of the Non-Flow Plan.

7.3.2 Steelhead Smolt Production Program

7.3.2.1 The purpose of the Steelhead Program is to increase steelhead production in the upper Skagit River, upstream of Marblemount, in order to offset any residual Project related impacts on the steelhead fishery resource. The Intervenors intend to accomplish this using low cost, small scale methods consistent with sound management practices and using existing facilities where appropriate. Possible steelhead augmentation alternatives are:

1) Expansion of the Clark Creek salmon hatchery or other compatible facility to provide space and water for steelhead smolts, with steelhead smolt production as the primary function of the expanded capacity and increased production in other stocks or species as a secondary function.

2) Production divided between existing facilities and new or expanded satellite stations, including development of net pen rearing at appropriate and feasible site(s) or a new stand-alone satellite rearing station.

3) Development of a new stand-alone facility incorporating all phases of production.

7.3.2.2 The Program Manager for the Steelhead Smolt Production Program shall be WDW, WDF, or the Tribes or some combination. In the event the program selected for funding is implemented at more than one site, the NCC may identify separate Managers for each site.

7.3.2.3 In addition to the reporting provisions of Section 7.2.2, annual progress reports shall include the following specific details: source and number of broodstock utilized, number of eggs incubated, fish growth and feed records, number and pounds of fish reared and their disposition, disease and mortality records, egg to fry, fry to smolt, and the results of any marking or other experiments.

7.3.2.4 Expenditures for the Steelhead Smolt Production Program shall be evenly divided between winter- and summer-run steelhead, except that any funds re-allocated from this program to the Resident Fish Program shall be drawn from the summer-run share.

7.3.2.5 The City shall fund the Steelhead Smolt Production Program according to the following costs and schedule; and subject to the provisions of Section 7.3.1:

- Years 1-2: $175,000 for engineering.
- Years 3-5: Up to $1,250,000 for capital improvements/construction.
- Years 6 (or year program begins production) – remainder of license period: O&M up to $51,000/year.
- Total steelhead production program not to exceed $2,700,000 (Table 2).

7.3.3 Chinook Research Program

7.3.3.1 The purpose of this program is to support the investigation of the declining trend in recruitment of the Skagit chinook stocks. The decline in recruitment has occurred for both natural and hatchery components of the chinook population. The Parties desire to reverse the decline in chinook recruitment (juvenile release to adult survival). The chinook recruitment issue will be investigated prior to developing any new program so that the program implemented will have a reasonable chance of success.

7.3.3.2 The City shall fund the Skagit Chinook Research Program according to the following costs and schedule, subject to the provisions of Section 7.3.1:

- Years 1-4: Up to $250,000 for program start-up, rearing, tagging, and related studies.
- Years 5-7: Up to $150,000/year for rearing, tagging, recovery, and related studies.
- Years 8-13: Up to $100,000/year recovery, evaluation, and related studies.
- Total Chinook Research Program not to exceed $1,300,000 (Table 2).

7.3.3.3 The final funding schedule, consistent with Section 7.3.1, and the experimental design shall be more fully developed and/or approved by NCC. At some point in this program, the NCC may determine that no satisfactory solution exists to reverse the decline in chinook recruitment and terminate the research program. In this event, the NCC may reallocate funds to other Anadromous Fish Programs identified in this Agreement.

7.3.3.4 The Chinook Research Program Manager shall be WDF, which shall (1) coordinate the development of the experimental design with the NCC, (2) prepare workplans, budget plans, and perform the research, (3) provide annual progress reports to the NCC, and (4) provide a program completion report to the NCC.

7.3.3.5 In addition to the reporting provisions of Section 7.2.2, annual progress reports shall include the following specific details: source and number of broodstock utilized, number of eggs

incubated, fish growth and feed records, number and pounds of fish reared and their disposition, disease and mortality records, egg to fry, fry to smolt, smolt to adult survival and recruitment rates, and the tag codes of each experimental group. The prospective workplan shall note and justify any deviation from the experimental design.

7.3.3.6 The Program Manager shall produce a Program Completion Report within one year of finishing the study. The report shall satisfy all contracting requirements and be produced in a form and format suitable for publication. The draft of the report shall address the feasibility of hatchery chinook production and be submitted to the NCC for review. The final report shall include any comments and recommendations from the Parties.

7.3.4 Off-Channel Chum Habitat Development and Improvement Program

7.3.4.1 The Parties agree to a phased approach to examine off-channel chum habitat development and improvement. WDF and the Tribes shall be the Program Co-Managers. The first phase of this process will be a site inventory, evaluation and ranking. The inventory will include review of existing information such as inventory lists compiled by the City, SSC, WDF, WDW, NPS, and the USFS. Additional field inventory may be necessary. The inventory study of potential site improvements or developments will not be limited to new spawning channels (e.g., Park Slough). Consideration will also be given to improving access to off-channel or tributary habitat that is presently inaccessible or under-utilized. Sites will be ranked based an evaluation of cost effectiveness, species utilization, engineering, and other feasibility factors. Prior to implementation of the inventory and evaluation phase, the NCC will approve the site ranking criteria to be used. Once the site inventory and evaluation phase has been completed, the NCC shall be responsible for ranking candidate sites and for any refinement of the ranking list.

7.3.4.2 The second phase of this program will be the implementation of habitat development and improvement measures. During the implementation phase, the site improvements shall be monitored by the Program Managers to measure performance and durability. The NCC shall have the authority to depart from or alter the list of ranked projects if the performance of certain site improvement methods fail to provide the expected outcome.

7.3.4.3 The City agrees to fund the Off-Channel Chum Habitat Development And Improvement Program according to the following costs and schedule subject to the provisions of Section 7.3.1:

- Year 1: up to $50,000 for site inventory, evaluation, and ranking phase.
- Year 2—until funds are exhausted: up to $150,000/year for implementation of habitat development, and improvement measures as determined by the NCC.
- Post-Construction Maintenance as needed and agreed upon by the NCC.
- Total Off-Channel Chum Habitat Development And Improvement Program expenditures not to exceed $1,500,000 (Table 2).

7.3.4.4 The Program Manager is responsible for the annual report. In addition to the reporting provisions of Section 7.2.2, annual progress reports shall include the following specific details: inventory lists, project development criteria, site ranking criteria, site rankings, development, and monitoring reports for projects completed.

7.4 COUNTY LINE AND NEWHALEM PONDS

7.4.1 The Parties agree that County Line and Newhalem ponds be developed for additional off-channel spawning and rearing habitat. The modifications shall follow those outlined by the conceptual designs of WDF and the City, as set out in a WDF letter dated August 23, 1990. The final design, construction timing, and coordination methods shall be determined through the Skagit Standing Committee or its successor, the NCC. The Skagit Standing Committee was established by Section 6.0 of the Offer of Settlement approved by FERC on May 12, 1981. This committee was established for consultations and meetings among the parties as may be appropriate under the Offer of Settlement Agreement. The Skagit Standing Committee remains in full effect until such time as the City accepts a new license from the FERC.

7.4.2 The Skagit Standing Committee or NCC shall approve the design of the County Line and Newhalem Pond program. The WDF shall be Program Manager. Using WDF funds, WDF shall develop the sites according to the approved design. The City agrees to repay WDF's costs to develop such sites, up to a maximum of $220,000. This repayment shall be made within one year of the date of issuance of a new FERC license or within one year of program completion, if not completed until after the new license is issued. Should WDF's program development costs be less than $220,000, the City shall fund operation and maintenance (O&M) expenses until the $220,000 maximum is reached.

7.4.3 The City shall provide access to both sites for program construction, operation, and maintenance purposes. The construction required at each site shall not interfere with any City uses unless coordinated with and agreed to by the City in advance.

7.4.4 The City shall leave undisturbed the existing riparian zone around all pond and channel habitat unless such disturbances are approved in advance by the Skagit Standing Committee or NCC. The City shall retain ownership of both sites. The City's existing uses shall not be reduced as a result of this Agreement.

7.5 INSTREAM OR OFF-CHANNEL HABITAT IMPROVEMENT AND SEDIMENT REDUCTION PROGRAM

7.5.1 The City shall provide a total of $300,000 for instream or off-channel habitat improvement and sediment reduction measures on the Skagit Wild and Scenic River or its tributaries (Table 2). For the purposes of this Agreement, sediment reduction measures shall be considered measures used to reduce sediment load in tributaries which impact spawning grounds by such actions as instream check-dams and bank stabilization by revegetation. During the first year of the new license, $150,000 shall be provided to the USFS by the City and shall remain

available for habitat and sediment reduction measures until expended. In the fifth year of the new license, the City shall provide to the USFS the remaining $150,000 for Program activities.

7.5.2 The USFS shall be Program Manager. Prior to the expenditure of these funds, a comprehensive site list shall be developed by the Program Manager for evaluation and ranking by the NCC. Substitutions may be made with the approval of the NCC. Projects will include but are not limited to instream fish habitat improvement and sedimentation reduction measures.

7.5.3 In the fifth year of the new license, the Program Manager shall evaluate progress made on any projects that have been initiated and propose initiation or continuation of projects based on potential for success in increasing salmon and/or steelhead production.

7.5.4 The Program Manager is responsible for the annual report. In addition to the reporting provisions of Section 7.2.2, annual progress reports shall include the following specific details: inventory lists, project development criteria, site ranking criteria, site rankings, and development reports for sites completed.

7.6 RESIDENT TROUT PROTECTION AND PRODUCTION PROGRAMS

7.6.1 General

7.6.1.1 The City shall provide $300,000 specifically for implementation of the measures identified in Section 7.6.4 Diablo And Gorge Lake Fisheries (Table 2). Beyond the funding limits specified in this section, the City will be responsible for additional activities specified in Sections 7.6.2 (Annual Inspection Of Drawdown Zone and Removal of Transitory Tributary Barriers In the Drawdown Zone), and 7.6.3 (Ross Lake Resident Trout Working Group) and 7.6.4 (Diablo And Gorge Lake Fisheries).

7.6.2 Annual Inspection Of Drawdown Zone and Removal of Transitory Tributary Barriers In the Drawdown Zone

7.6.2.1 Before April 1 of each year, the City shall conduct inspections within the United States portion of the Ross Lake tributary drawdown zones and at the mouths of Diablo and Gorge tributaries. The following Ross Lake tributaries shall be surveyed annually: Lightning, Roland, Little Beaver, Big Beaver, Devils, Silver, Ruby, Arctic, Dry, Hozomeen, and Pierce creeks. This list may be modified at the discretion of the NCC.

7.6.2.2 The annual inspections will identify any transitory barriers that might obstruct or delay the upstream migration of resident trout during the spawning season. Transitory barriers include drift logs, drift boom logs, and accumulations of sediment or debris caused by Project operations that may potentially block migration of trout between minimum and maximum reservoir elevations.

7.6.2.3 The NPS and WDW shall be given 14 days notice and must participate in these surveys.

7.6.2.4 Any transitory barriers identified and determined by WDW and NPS to be detrimental to trout migration shall be removed by City crews. The City shall remove the detrimental barriers as soon as possible after identification and confirmation. Surveys shall be conducted by the City to monitor the effectiveness of barrier removal. These surveys will be made when rainbow trout spawners are expected to be present in the tributaries. Timing of surveys described in Section 7.6.2.1 and of barrier removal may be altered with WDW and NPS concurrence, based on the results of effectiveness monitoring.

7.6.2.5 The City shall be the Program Manager. The City shall submit annual reports to the NCC regarding barrier identification, removal, and effectiveness monitoring.

7.6.3 Ross Lake Resident Trout Working Group

The City agrees to become a participating member of the proposed cooperative Ross Lake Resident Trout Working Group. This proposed Working Group shall consist of the City, WDW, SSC, NCCC, and NPS. Other organizations or individuals may attend as desired or appropriate. The Working Group will consider, discuss, or address any issues that may affect the continued success of the Ross Lake resident trout fishery resource as a self-sustaining, native population and as a viable recreational resource. The Working Group may make management recommendations to NPS and WDW.

7.6.4 Diablo And Gorge Lake Fisheries

7.6.4.1 Native broodstock from Ross Lake or Gorge and/or Diablo lakes will be used to develop a captive broodstock supplementation program designated for Skagit River and tributaries above Gorge Dam, with specific emphasis on Gorge and Diablo lakes. Native brood stock will be collected when necessary by WDW, and the remainder of the program will be carried out at facilities developed under Section 7.3.2 or at other facilities. The goal will be to produce 400,000 fingerlings each year.

7.6.4.2 The WDW and NPS will cooperatively develop a program plan that shall include but not be limited to management considerations, facility requirements, and program costs and schedule. This plan should be completed within two years of issuance of a new license. The program plan and costs shall require NCC review and approval prior to implementation.

7.6.4.3 The City shall provide $300,000 specifically for implementation of this program. Up to $200,000 may be drawn from the summer steelhead program described in Section 7.3.2 if needed. Additional funding may be provided to this program subject to the unanimous approval of WDW, NPS, Upper Skagit Tribe, Sauk-Suiattle Tribe, and Swinomish Indian Tribal Community. Monies not used for this program will be used for the summer steelhead program, as described in Section 7.3.2.4.

7.6.4.4 WDW and NPS shall be Co-Program Managers and are responsible for the annual report. In addition to the reporting provisions of Section 7.2.2, annual progress reports shall include the following specific details: source and number or broodstock utilized, number of eggs incubated, fish growth and feed records, number and pounds of fish reared and their disposition, disease and mortality records, egg to fry, fry to release stage survival, and the results of any marking programs or other studies/experiments.

7.6.4.5 The fish produced and monies spent for this program are designated for the Skagit River and tributaries above Gorge Dam, with specific emphasis on Gorge and Diablo lakes for the length of the License term. The Parties agree to replace fish taken from the brood source to ensure continued viability of that stock and to minimize the impacts on the donor stock's and the captive brood stock's genetic integrity (e.g., age when stock becomes sexually mature, date of spawning, migration timing, and specific spawning stream origin). Numbers of fry required for this purpose depends on many variables including egg take and expected survival. The priority for use of fry produced by this program will be brood source and captive brood stock replacement, with outplants to meet supplementation objectives coming from the balance of fry production. Brood stock source replacement with fingerlings shall not be mandatory but shall be done to the extent it remains biologically necessary to maintain natural carrying capacity. Initial fry planting goal for Diablo and Gorge lakes is 300,000 wild origin rainbow trout. Long-term planting levels for Gorge and Diablo lakes will be based on observed performance and WDW and NPS management objectives for these waters. The goal of this program for Ross Lake is to reach carrying capacity through utilization of naturally occurring available habitat.

8.0 SIGNATURES

IN WITNESS WHEREOF, the City has caused this Settlement Agreement to be executed by its Superintendent of Light pursuant to Ordinance No. 106741 and the Intervenors have executed same pursuant to applicable legal authority.

Respectfully submitted.

Dated: April 24, 1991

THE CITY OF SEATTLE

By: _____

Randall W. Hardy
Superintendent of City Light

Address for Notice:

Seattle City Light
1015 Third Avenue
Seattle, WA 98104

Dated: April 23, 1991

U.S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE

By: John A. Earnst

John Earnst
Superintendent

Address for Notice:

North Cascades Park Service Complex
Pacific Northwest Region, National Park Service
U.S. Department of the Interior
North Cascades National Park Service Complex
2105 Highway 20
Sedro Woolley, WA 98284

Dated: April 22, 1991

U.S. DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE

By: _____

Marvin L. Plenert
Regional Director, U.S. Fish and Wildlife Service

Addresses for Notice:

United States Fish and Wildlife Service
Eastside Federal Complex
911 N.E. 11th Avenue
Portland, OR 97232-4181

Field Supervisor
U.S. Fish and Wildlife Service
Fish and Wildlife Enhancment
3704 Griffin Lane, S.E.
Suite 102
Olympia, WA 98501-2192

Dated: April 22, 1991

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS

By: _____

Wilford G. Bowker
Acting Area Director

Address for Notice:

U.S. Bureau of Indian Affairs
Portland Area Office
Attention: Branch of Land Services
911 N.E. 11th Avenue
Portland, OR 97232-4169

Dated: April 17, 1991

U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE

By: _____

John F. Butruille
Regional Forester, Pacific Northwest Region

Address for Notice:

Sam Nagel
U. S. Forest Service
21905 64th Avenue West
Montlake Terrace, WA 98043

Dated: April 16, 1991

U.S. DEPARTMENT OF COMMERCE,
NATIONAL MARINE FISHERIES SERVICE

By: _____
Rolland Schmitten
Regional Director, Northwest Region

Addresses for Notice:

F. Lorraine Bodi
NOAA, Office of General Council (GCNW)
National Marine Fisheries Service
7600 Sand Point Way, N.E., Building No. 1
Seattle, WA 98115

Jon R. Linvog
National Marine Fisheries Service
7600 Sandpoint Way N.E. BIN C-15700
Seattle, WA 98115

Dated: April 25, 1991

UPPER SKAGIT TRIBE

By: _____
Floyd Williams
Tribal Chairperson

Address for Notice:

Upper Skagit Tribe
2284 Community Plaza
Sedro Woolley, WA 98284

Dated: April 19, 1991

SAUK-SUIATTLE TRIBE

By: _____
Lawrence Joseph
Tribal Chairperson

Address for Notice:

Sauk-Suiattle Tribe
5318 Chief Brown Lane
Darrington, WA 98241

Dated: April ____, 1991

SWINOMISH INDIAN TRIBAL COMMUNITY

By: _____

Robert Joe
Tribal Chairperson

Addresses for Notice:

Swinomish Indian Tribal Community
P.O. Box 817
LaConner, WA 98257

Steve Fransen
Skagit System Cooperative
P.O. Box 338

Dated: April 19, 1991

STATE OF WASHINGTON,
acting by and through the Washington Department of Fisheries

By: _____
Joseph Blum
Director, Department of Fisheries

Addresses for Notice:

Rod Woodin
Department of Fisheries
115 General Administration Building, AX-11
Olympia, WA 98504

William C. Frymire
Office of Attorney General
7th Floor
Highway Licenses Bldg.
Olympia, WA 98504

Dated: April 22, 1991

STATE OF WASHINGTON,
acting by and through the Washington Department of Wildlife

By: Curt Smitch

Curt Smitch
Director, Department of Wildlife

Addresses for Notice:

R. Gary Engman
Department of Wildlife
Region 4
16018 Mill Creek Blvd.
Mill Creek, WA 98012

William C. Frymire
Office of Attorney General
7th Floor
Highway Licenses Bldg.
Olympia, WA 98504

Dated: April 24, 1991

NORTH CASCADES CONSERVATION COUNCIL

By: David Fluharty
David Fluharty
President

Address for Notice:

NCCC
P.O. Box 95980
University Station
Seattle, WA 98145-1980

APPENDICES

APPENDIX A

CALCULATION OF DAILY AND SEASONAL SPAWNING FLOWS FOR SALMON AND STEELHEAD

1. GENERAL CALCULATION OF DAILY SPAWNING FLOW

Mean daily spawning flows for salmon and steelhead shall be calculated as follows:

$$DSF = ANF - MAX (RDF, RDL) - MAX (SS - TSS, 0)$$

where:

DSF = Mean daily spawning flow;
ANF = Actual average daily flow at Newhalem gage;
RDF = Mean daily Ross Dam discharge for flood control, which shall be calculated as the average amount released throughout the day to avoid exceeding the flood control curve or spilling (equal to inflow to Ross Lake from the moment that the flood control curve or spill point is reached);
RDL = Mean daily Ross Dam Discharge to serve firm load, which shall mean the average amount released to avoid curtailing firm load beyond the Maximum Spawning Flow (Section 6.5.4.2);
SS = Mean Daily Sidestream Inflow from Ross Dam to Newhalem gage;

TSS = Threshold Sidestream Inflow (Definitions - Section 6.1)

a. Normal Conditions

Assumptions:

Assume that you are calculating the flow for a pink salmon spawning day during which no water was released from Ross Lake for flood control or to avoid curtailing firm load, and there was no high Sidestream Inflow.

Actual Ross Discharge = 2,600 cfs

RDF = 0

RDL = 0

SS = 900 cfs

TSS = 2,500

ANF = 3,500 cfs

Calculations:

DSF = 3,500 - 0 - (0) = 3,500 cfs

Conclusion:

The Daily Spawning Flow is calculated as 3,500 cfs for that day.

b. **Flood Control Measures or Spill Avoidance**

"The City shall not be responsible for flow which is released due to actions of the Corps of Engineers or due to reasonable actions taken to avoid exceeding the flood control curve or full pool" (Section 6.5.4.1).

Assumptions:

Assume that you are calculating the flow for a chum salmon spawning day during which a flood control release was required. Ross Lake elevation is near full or flood control curve.

Inflow to Ross = 5,000 cfs

Actual Ross Discharge = 6,000 cfs

RDF = 6,000 cfs

RDL = 0

SS = 3,000 cfs

TSS = 3,000 cfs

ANF = 9,000 cfs

Calculations:

DSF = 9,000 - 6,000 - (0) = 3,000 cfs

Conclusion:

The Daily Spawning Flow is calculated as 3,000 cfs for that day.

c. Sidestream Inflow Greater than the Threshold Sidestream Inflow

"The City shall not be responsible for that portion of flow which is released due to Sidestream Inflow greater than 3,500 cfs during the chinook salmon spawning period, 2,500 cfs during the pink salmon spawning period, 3,000 cfs during the chum salmon spawning period, or due to Sidestream Inflow which is greater than the current Spawning Control Flow for steelhead minus 500 cfs ". (Section 6.5.4.3)

Assumptions:
Assume that you are calculating the flow for a pink salmon spawning day during which no water was released for flood control or for meeting a firm load requirement.

Actual Ross Discharge = 500 cfs

RDF = 0

RDL = 0

SS = 5,500 cfs

TSS = 2,500 cfs

ANF = 6,000 cfs

Calculations:

DSF = 6,000 - 0 - (5,500 - 2,500) = 3,000 cfs

Conclusion:

The Daily Spawning Flow is calculated as 3,000 cfs for that day.

d. Load Curtailment Avoidance

"The City shall not be responsible for flow which is released when there are no options available other than Firm Load Curtailment" (Section 6.5.4.2)

Assumptions:

A power scheduler is calculating the spawning flow for a pink spawning day during which heating loads in Seattle are expected to be very high due to effects of an Arctic air mass in the area. The Seattle generating system is operating at maximum capacity. No secondary, exchange, or stored energy is available for acquisition and all firm contract rights are being exercised. Increased generation at the Skagit project is required to meet the load without curtailing power supplies to some firm power customers. The City can voluntarily increase flows at Newhalem up to the Maximum Spawning Flow which for pink salmon is 4000 cfs. Since the Sidestream Inflow is 2500 cfs, 4000 - 2500 = 1500 cfs is within the City's control. Therefore RDL = 5500 - 1500 = 4000 cfs.

Actual Ross Discharge = 5,500 cfs

RDF = 0

RDL = 4,000 cfs

SS = 2,500 cfs

TSS = 2,500 cfs

ANF = 8,000 cfs

Calculations:

DSF = 8,000 - 4,000 - 0 = 4,000 cfs

Conclusion:

The Daily Spawning Flow is calculated as 4,000 cfs for that day.

2. SEASON SPAWNING FLOW FOR SALMON

"The Season Spawning Flow for each species shall be defined as the average of the highest ten (10) Daily Spawning Flows at Newhalem gage during the spawning period" (Section 6.3.2.1). A sample calculation follows:

Suppose that spawning flow is based on the 10 highest days in a fifty (50) day spawning period. In the year X, the City planned to spawn pink salmon at an average Daily Spawning Flow (DSF) of 3,500 cfs or less. The fish actually spawned over a fifty day period at the following average DSF. Days marked with an asterisk were characterized by

high Sidestream Inflow conditions beyond the City's means of control (see Sidestream Inflow, above). The DSF calculated for those days excludes the effect of Sidestream Inflow beyond the threshold of 2,500 cfs.

DAILY SPAWNING FLOWS AT NEWHALEM GAGE IN CFS (SEPTEMBER 12 - OCTOBER 31, YEAR X)

day 1	3021	day 26	2789
day 2	3202	day 27	2987
day 3	3105	day 28	3154
day 4	3220	day 29	3218
day 5	3305	day 30	3212
day 6	3011	day 31	3290
day 7	3232	day 32	3110
day 8	3111	day 33	3009
day 9	2993	day 34	3005
day 10	3002	day 35	2998
day 11	3209	day 36	2780
day 12	**3403**	day 37	2657
day 13	**3577**	day 38	2678
day 14	**3598**	day 39	2790
day 15	**3899**	day 40	2899
day 16*	**3555**	day 41	2869
day 17*	**3600**	day 42	2765
day 18*	**3450**	day 43	2876
day 19*	**3400**	day 44	2975
day 20	**3389**	day 45	3081
day 21	3107	day 46	3110
day 22	3025	day 47	3265
day 23	2987	day 48	3350
day 24	2807	day 49	**3449**
day 25	2524	day 50	3354

Calculations:

The average of the highest 10 days DSF (3899, 3577, 3598, 3600, 3555, 3450, 3403, 3400, 3449, and 3389) is 3,532 cfs. This is the Season Spawning Flow for pink salmon in the year X.

Action:

Referring to the nearest Season Spawning Flow listed in APPENDIX C, Table C-2, (Salmon Spawning/Incubation Flow Tables), the power scheduler determines the minimum requirements for incubation flow:

November	2,100 cfs	February	2,400 cfs
December	2,500 cfs	March	2,300 cfs
January	2,500 cfs	April	2,300 cfs

3. SEASON SPAWNING FLOW FOR STEELHEAD

"The actual Season Spawning Flow for each subperiod shall be defined as the average of the highest ten (10) Daily Spawning Flows at Newhalem gage during each spawning subperiod" (Section 6.3.3.1 (2)). A sample calculation follows:

The spawning flow in April is based on the 10 highest days in a thirty (30) day spawning period. While the City planned to release flows at Gorge in April based on the Spawning Control Curve as outlined in Appendix E, incubation flows are based on actual spawning flows. Suppose the April Spawning Control Curve showed 4500 cfs. The fish actually spawned over a thirty day period at the following average DSF. Days marked with an asterisk were characterized by high Sidestream Inflow conditions beyond the City's means of

control (see Sidestream Inflow, above). The DSF calculated for those days excludes the effect of Sidestream Inflow beyond the threshold which is based on the Spawning Control Flow minus 500 cfs (2,500 cfs for this case).

DAILY SPAWNING FLOWS AT NEWHALEM GAGE IN CFS (APRIL, YEAR X)

day 1	4021	day 16	3789
day 2	4202	day 17	3987
day 3	4105	day 18	4154
day 4	4220	day 19	4218
day 5	**4350**	day 20	4212
day 6	4011	day 21	**4290**
day 7	4232	day 22	4110
day 8	4111	day 23	4009
day 9	**4693**	day 24	4005
day 10*	**4500**	day 25	3998
day 11*	**4500**	day 26	4280
day 12*	**4500**	day 27	**4290**
day 13	**4577**	day 28	**4478**
day 14	4245	day 29	**4450**
day 15	3899	day 30	4199

Calculations:

The average of the highest ten days DSF (4693, 4577, 4500, 4500, 4500, 4478, 4450, 4350, 4290 and 4290) is 4,463 cfs. This is the Season Spawning Flow for April steelhead in the year X.

Action:

Referring to the nearest Season Spawning Flow (4,500) listed in APPENDIX G, Table G-2, (Steelhead Spawning/Incubation Flow Tables), the power scheduler determines the minimum requirements for incubation flow:

April: 1,800 cfs (Newhalem gage)

May: 2,200 cfs (Newhalem gage)

June: 4,084 cfs (Predicted Marblemount Flow)

July: 3,823 cfs (Predicted Marblemount Flow)

APPENDIX B

SALMON SPAWNING/INCUBATION EXAMPLES

1. SALMON INCUBATION FLOW - DURING SPAWNING (FIRST TEN DAYS)

"Incubation flow during the first ten (10) days of the spawning period of each species shall be based on the Planned Spawning Flow." (Section 6.3.2.1 (3))

Assumptions:

The power scheduler is preparing a schedule for September 19 on September 18.

Chinook salmon spawning is ongoing.

Calculated spawning flow for chinook through September 18 = 4,000 cfs

Pink salmon are spawning for the second day.

The Planned Spawning Flow = 3,000 cfs

Calculation:

The required incubation flow for pink salmon based on the Planned Spawning Flow is obtained from APPENDIX C, Table C-2, and for the month of September is 1,300 cfs. The required incubation flow for chinook based on the calculated spawning flow is 1,000 cfs.

Action:

The higher required incubation flow takes precedence, therefore the power scheduler must schedule a flow of at least 1,300 cfs for each hour of September 19.

2. SALMON INCUBATION FLOW - DURING SPAWNING (AFTER FIRST TEN DAYS)

"After the first ten days, incubation flow for each species shall be based on the average of the highest ten (10) Daily Spawning Flows that have occurred up to that day during the spawning period. For example, incubation flow for the twentieth day of the spawning period is based on the average of the highest ten Daily Spawning Flows during the preceding 19 days, and so on for the twenty-first, twenty-second, etc. days. Appropriate incubation flows shall be determined for the spawning flows that are calculated as described above according to APPENDIX C" (Section 6.3.2.1 (3)).

Assumptions:

The power scheduler is preparing a schedule for October 4 on October 3

Chinook salmon spawning is ongoing.

Calculated spawning flow for chinook through October 3 = 4,000 cfs

Pink salmon spawned on October 2 for the fifteenth day.

Daily Spawning Flows through October 2 = **3011**, **3124**, **3190**, **3012**, **2991**, 2725, 2601, 2788, 2790, **2897**, **2993**, **3110**, **3007**, **3101**, and 2868 cfs.

Calculation:

The spawning flow for pinks calculated as the ten highest Daily Spawning Flows through the last Inflow Day is 3,044 cfs. Thus, the required incubation flow for pink which is obtained from APPENDIX C, Table C-2, is 1,300 cfs. The required incubation flow for chinook based on the calculated spawning flow is 1,000 cfs.

Action:

The higher required incubation flow takes precedence, therefore the power scheduler must schedule a flow of at least 1,300 cfs for each hour of October 4.

3. SALMON INCUBATION FLOW - AFTER SPAWNING

"Incubation flow during days following the spawning period of each species shall be based on the Season Spawning Flow which is calculated as the average of the highest ten (10) Daily Spawning Flows at the Newhalem gage during the entire spawning period of that species. Appropriate incubation flows shall be determined for the Season Spawning Flow according to APPENDIX C". (Section 6.3.2.1 (3)(b))

Assumptions:

A power scheduler is preparing a schedule for November 4 on November 3.

Chinook salmon spawning ended October 15.

Season Spawning Flow for chinook = 4,000 cfs

Pink salmon spawning ended October 31.

Season Spawning Flow for pink = 3,500 cfs

Chum salmon have not begun to spawn.

Calculation:

The required incubation flow for the next day based on the Season Spawning Flows are obtained from APPENDIX C for chinook and pink salmon. The required incubation flows for chinook and pink salmon during the month of November should be 1,100 and 2,500 cfs, respectively.

Action:

The higher required incubation flow takes precedence, therefore the power scheduler must schedule a flow of at least 2,500 cfs for each hour of the day on November 4.

APPENDIX C

SALMON SPAWNING/INCUBATION FLOW TABLES

SALMON SPAWNING/INCUBATION FLOW TABLES

TABLE C-1

CHINOOK SALMON

SEASON SPAWNING FLOW (CFS)	SEASON MINIMUM INSTANTANEOUS INCUBATION F								
	AUG*^	SEP*^	OCT^	NOV^	DEC	JAN	FEB	MAR	APR
2000	2000	1500	1500	1000	1000	1000	1800	1800	1800
2100	2000	1500	1500	1000	1000	1000	1800	1800	1800
2200	2000	1500	1500	1000	1000	1000	1800	1800	1800
2300	2000	1500	1500	1000	1100	1100	1800	1800	1800
2400	2000	1500	1500	1000	1100	1100	1800	1800	1800
2500	2000	1500	1500	1000	1200	1200	1800	1800	1800
2600	2000	1500	1500	1000	1300	1300	1800	1800	1800
2700	2000	1500	1500	1000	1300	1300	1800	1800	1800
2800	2000	1500	1500	1000	1400	1400	1800	1800	1800
2900	2000	1500	1500	1000	1400	1400	1800	1800	1800
3000	2000	1500	1500	1000	1400	1400	1800	1800	1800
3100	2000	1500	1500	1000	1500	1500	1800	1800	1800
3200	2000	1500	1500	1000	1500	1500	1800	1800	1800
3300	2000	1500	1500	1000	1600	1800	1800	1800	1800
3400	2000	1500	1500	1000	1700	1700	1800	1800	1800
3500	2000	1500	1500	1000	1700	1700	1800	1800	1800
3600	2000	1500	1500	1000	1800	1800	1800	1800	1800
3700	2000	1500	1500	1000	1800	1800	1800	1800	1800
3800	2000	1500	1500	1000	1800	1800	1800	1800	1800
3900	2000	1500	1500	1100	1900	1900	1800	1800	1800
4000	2000	1500	1500	1100	2000	2000	1800	1800	1800
4100	2000	1500	1500	1100	2100	2100	1900	1800	1800
4200	2000	1500	1500	1200	2100	2100	1900	1800	1800
4300	2000	1500	1500	1200	2200	2200	2100	1900	1900
4400	2000	1500	1500	1200	2300	2300	2100	2000	1900
4500	2000	1500	1500	1300	2300	2300	2200	2100	2000
4600	2000	1500	1500	1300	2400	2400	2200	2100	2000
4700	2000	1500	1500	1300	2500	2500	2300	2200	2100
4800	2000	1500	1500	1300	2500	2500	2400	2200	2200
4900	2000	1500	1500	1400	2500	2500	2400	2200	2200
5000	2000	1500	1500	1500	2600	2600	2400	2300	2200

TABLE C-1 CONTINUED

CHINOOK SALMON

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS)								
	AUG*^	SEP*^	OCT*^	NOV^	DEC	JAN	FEB	MAR	APR
5100	2000	1500	1600	1500	2600	2600	2500	2300	2300
5200	2000	1500	1800	1600	2700	2700	2500	2400	2400
5300	2000	1500	1800	1700	2700	2700	2600	2500	2400
5400	2000	1600	1900	1800	2700	2700	2600	2500	2500
5500	2000	1700	1900	1900	2700	2700	2600	2500	2500
5600	2000	1800	2000	1900	2900	2900	2600	2600	2500
5700	2000	1800	2000	2000	3100	3100	2900	2800	2700
5800	2000	1900	2000	2000	3100	3100	2900	2800	2700
5900	2000	1900	2100	2000	3100	3100	3000	3000	2900
6000	2000	1900	2100	2000	3100	3100	3000	3000	2900
6100	2000	2000	2100	2100	3100	3100	3000	3000	2900
6200	2000	2000	2100	2100	3200	3200	3100	3000	2900
6300	2000	2000	2400	2300	3400	3400	3100	3000	2900
6400	2100	2000	2400	2400	3400	3400	3200	3000	2900
6500	2100	2200	2400	2400	3500	3500	3300	3100	3000
6600	2200	2300	2600	2500	3700	3700	3400	3200	3100
6700	2200	2300	2700	2500	4000	4000	3600	3300	3100
6800	2500	2300	2800	2600	4000	4000	3800	3500	3100
6900	2500	2400	2800	2700	4000	4000	3800	3700	3600
7000	2500	2600	2800	2700	4100	4100	3900	3900	3800

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

TABLE C-2

PINK SALMON

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS)							
	SEP*^	OCT*^	NOV^	DEC	JAN	FEB	MAR	APR
2000	1000	1500	1100	1400	1400	1800	1800	1800
2100	1000	1500	1100	1500	1500	1800	1800	1800
2200	1200	1500	1300	1600	1600	1800	1800	1800
2300	1200	1500	1300	1700	1700	1800	1800	1800
2400	1200	1500	1300	1700	1700	1800	1800	1800
2500	1200	1500	1300	1700	1700	1800	1800	1800
2600	1300	1500	1400	1800	1800	1800	1800	1800
2700	1300	1500	1400	1800	1800	1800	1800	1800
2800	1300	1500	1400	1800	1800	1800	1800	1800
2900	1300	1500	1400	1800	1800	1800	1800	1800
3000	1300	1500	1400	1900	1900	1800	1800	1800
3100	1400	1500	1500	2100	2100	1900	1800	1800
3200	1400	1500	1700	2300	2300	2100	1900	1900
3300	1700	1700	1800	2400	2400	2200	2100	2100
3400	1800	1800	2100	2500	2500	2400	2300	2300
3500	2000	2000	2100	2500	2500	2400	2300	2300
3600	2000	2000	2100	2600	2600	2500	2300	2300
3700	2000	2000	2100	2700	2700	2600	2500	2500
3800	2100	2100	2200	2700	2700	2600	2500	2500
3900	2100	2100	2200	2700	2700	2600	2500	2500
4000	2100	2100	2200	2700	2700	2600	2500	2500
4100	2100	2100	2200	2700	2700	2600	2500	2500
4200	2200	2200	2300	2800	2800	2600	2600	2500
4300	2200	2200	2300	3100	3100	2900	2800	2700
4400	2300	2300	2500	3100	3100	3000	2900	2800
4500	2400	2400	2500	3100	3100	3000	3000	2900
4600	2400	2400	2500	3100	3100	3000	3000	2900
4700	2400	2400	2500	3100	3100	3000	3000	2900
4800	2400	2400	2600	3400	3400	3100	3000	2900
4900	2400	2400	2700	3400	3400	3200	3100	3000
5000	2600	2600	2700	3400	3400	3200	3100	3000

TABLE C-2 CONTINUED

PINK SALMON

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS)							
	SEP*^	OCT*^	NOV^	DEC	JAN	FEB	MAR	APR
5100	2600	2600	2700	3500	3500	3300	3100	3000
5200	2600	2600	2700	3500	3500	3300	3200	3100
5300	2800	2800	3100	3700	3700	3600	3600	3500
5400	3100	3100	3200	4100	4100	4000	3900	3900
5500	3100	3100	3200	4100	4100	4000	3900	3900
5600	3100	3100	3200	4100	4100	4000	3900	3900
5700	3100	3100	3200	4100	4100	4000	3900	3900
5800	3100	3100	3200	4100	4100	4000	3900	3900
5900	3200	3200	3300	4100	4100	4000	3900	3900
6000	3200	3200	3300	4100	4100	4000	4000	3900
6100	3200	3200	3300	4200	4200	4000	4000	3900
6200	3200	3200	3300	4200	4200	4100	4000	3900
6300	3200	3200	3300	4200	4200	4100	4100	4000
6400	3300	3300	3400	4200	4200	4100	4100	4000
6500	3300	3300	3400	4200	4200	4100	4100	4000
6600	3500	3500	3600	4200	4200	4100	4100	4000
6700	3500	3500	3600	4200	4200	4100	4100	4000
6800	3500	3500	4000	5000	5000	4600	4300	4100
6900	3900	3900	4000	5000	5000	4900	4900	4700
7000	4000	4000	4100	5000	5000	4900	4900	4800

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

TABLE C-3

CHUM SALMON

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS)						
	NOV*^	DEC*^	JAN^	FEB^	MAR	APR	MAY
3000	1000	1000	1400	1800	1800	1800	1500
3100	1000	1000	1500	1800	1800	1800	1500
3200	1000	1000	1500	1800	1800	1800	1500
3300	1000	1000	1500	1800	1800	1800	1500
3400	1000	1000	2100	1800	2100	2000	1500
3500	1000	1000	2200	1900	2100	2000	1500
3600	1000	1000	2200	1900	2100	2000	1500
3700	1000	1000	2200	1900	2200	2000	1500
3800	1000	1000	2200	1900	2200	2000	1500
3900	1000	1000	2200	1900	2200	2000	1500
4000	1000	1000	2200	1900	2200	2100	1500
4100	1000	1000	2200	2000	2300	2200	1500
4200	1000	1000	2300	2000	2300	2200	1500
4300	1000	1100	2400	2000	2300	2200	1500
4400	1000	1100	2400	2000	2400	2200	1500
4500	1000	1300	2400	2000	2400	2300	1600
4600	1000	1300	2600	2300	2600	2500	1600
4700	1200	1300	2800	2500	2800	2600	1700
4800	1200	1300	2900	2600	2800	2600	1800
4900	1400	1500	3000	2600	2900	2800	1900
5000	1500	1500	3000	2600	2900	2800	1900
5100	1500	1700	3000	2600	3000	2800	1900
5200	1500	1700	3000	2600	3000	2900	1900
5300	1500	1700	3000	2600	3100	3000	2100
5400	1700	1700	3200	2800	3300	3100	2100
5500	1800	1700	3200	2800	3300	3100	2200
5600	1900	1700	3200	2800	3300	3100	2200
5700	1900	1800	3200	3000	3500	3300	2300
5800	1900	1900	3400	3000	3500	3300	2400
5900	2200	2000	3400	3000	3500	3300	2600
6000	2500	2300	3400	3000	3500	3300	2700
6100	2500	2400	3400	3100	3700	3600	2900
6200	2600	2400	3600	3400	4000	3900	2900
6300	2700	2400	4100	3700	4300	4100	3000
6400	2900	2800	4100	3700	4300	4100	3300
6500	3100	2800	4100	3700	4300	4100	3500
6600	3100	3000	4200	3800	4500	4300	3600
6700	3400	3000	4300	3900	4500	4300	3600
6800	3500	3100	4600	4300	4900	4800	3700
6900	3500	3200	4700	4300	5000	4800	3700
7000	3600	3200	4700	4300	5000	4800	3800

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

APPENDIX D

SALMON FRY PROTECTION EXAMPLES

1. SALMON FRY PROTECTION FLOW - REGULAR WORKDAYS

"Subject to the exception for Insufficient Months as determined in Section 6.4 (Flow Insufficiency), the City shall maintain a minimum flow at Newhalem gage that is the higher of either the flow that results in a Predicted Marblemount Flow of at least 3,000 cfs, or the monthly flows as set forth in APPENDIX I (Fry Protection Flows at Newhalem gage). For the purpose of salmon fry protection, the City shall not be required to release flows (as measured at Newhalem gage) greater than 2,600 cfs" (Section 6.3.2.2 (3)).

Assumptions:

A power scheduler is preparing a schedule for a Thursday on a Wednesday in April.

Required minimum Predicted Marblemount Flow = 3,000 cfs

Required fry protection flow at Newhalem gage = 1,800 cfs

Required incubation flow at Newhalem gage = 1,900 cfs

Mean daily Tributary Inflow on Inflow Day (Tuesday) = 300 cfs

Maximum required fry protection flow at Newhalem gage = 2,600 cfs

Calculation:

Minimum Flow at Newhalem plus Tributary Inflow = 1,900 + 300 = 2,200 cfs

Minimum Flow Needed to Achieve 3,000 cfs Predicted Marblemount Flow = 3,000 - 300 = 2,700 cfs

Action:

A release of the minimum required incubation flow (1,900 cfs) plus Tributary Inflow would result in a Predicted Marblemount Flow which is 700 cfs short of the required 3,000 cfs. However, the amount of Newhalem flow required to provide a Predicted Marblemount flow of 3,000 (2,700 cfs) is greater than 2,600 cfs, so generation schedules will be prepared such that a minimum flow of at least 2,600 cfs is provided for each hour on Thursday.

2. SALMON FRY PROTECTION FLOW OVER WEEKENDS AND HOLIDAYS

The following scheduling procedures accommodate possible reductions in tributary inflow over weekends and holidays. "When scheduling power generation for a period greater than one day during the Salmon Fry Protection Period, power schedulers shall calculate an appropriate Newhalem gage flow for each day as 3,000 cfs minus the receded Tributary Inflow. Receded Tributary Inflow shall be calculated as the Tributary Inflow on the Inflow Day minus the difference between the Tributary Inflow on the Inflow Day and the 90 percent exceedance flow for the month, multiplied by the number of

days from the current Power Scheduling Day to the day being scheduled, divided by the total number of days being scheduled" (Section 6.6.2.3).

Assumptions:

A power scheduler is preparing schedules for Saturday through Monday on a Friday in February.

Required minimum Predicted Marblemount Flow = 3,000 cfs

Required fry protection flow at Newhalem gage = 1,800 cfs

Required incubation flow at Newhalem gage = 1,900 cfs

Mean daily Tributary Inflow on Inflow Day (Thursday) = 1,000 cfs

90 percent Exceedance Flow for February = 850 cfs

Calculation:

Receded Tributary Inflow on Saturday = 1,000 - [(1,000 - 850 cfs) X (1/3)] = 950 cfs

Receded Tributary Inflow on Sunday = 1,000 - [(1,000 - 850 cfs) X (2/3)] = 900 cfs

Receded Tributary Inflow on Monday = 1,000 - [(1,000 - 850 cfs) X (3/3)] = 850 cfs

Required Newhalem gage flow on Saturday = 3,000 - 950 cfs = 2,050 cfs

Required Newhalem gage flow on Sunday = 3,000 - 900 cfs = 2,100 cfs

Required Newhalem gage flow on Monday = 3,000 - 850 cfs = 2,150 cfs

Action:

The power scheduler must schedule generation such that a minimum flow of at least 2,050 cfs is provided for each hour on Saturday, 2,100 cfs for each hour on Sunday, and 2,150 cfs is provided for each hour on Monday.

3. SALMON FRY PROTECTION FLOW OVER WEEKENDS AND HOLIDAYS WITH LOW TRIBUTARY INFLOW

"When the Tributary Inflow on the Inflow Day is less than or equal to the 90 percent exceedance flow, then power schedulers shall assume that the Tributary Inflow remains the same on each day until the next Power Scheduling Day" (Section 6.6.2.4).

Assumptions:

A power scheduler is preparing schedules for Saturday through Monday on a Friday in February.

Required minimum Predicted Marblemount Flow = 3,000 cfs

Required fry protection flow at Newhalem gage = 1,800 cfs

Required incubation flow at Newhalem gage = 1,900 cfs

Mean daily Tributary Inflow on Inflow Day (Thursday) = 800 cfs

90 percent Exceedance Flow for February = 850 cfs

Calculation:

Assumed Tributary Inflow on Saturday = 800 cfs

Assumed Tributary Inflow on Sunday = 800 cfs

Assumed Tributary Inflow on Monday = 800 cfs

Required Newhalem gage flow on Saturday = 3,000 - 800 cfs = 2,200 cfs

Required Newhalem gage flow on Sunday = 3,000 - 800 cfs = 2,200 cfs

Required Newhalem gage flow on Monday = 3,000 - 800 cfs = 2,200 cfs

Action:

The power scheduler must schedule generation such that a minimum flow of at least 2,200 cfs is provided for each hour on Saturday, Sunday, and Monday.

APPENDIX E

SHAPING OF FLOWS DURING STEELHEAD SPAWNING

OBJECTIVES

The basic objective of intentional shaping, or redistributing, the spawning flows during steelhead spawning is to provide relatively uniform spawning and incubation conditions for steelhead throughout the spawning period. Also, incubation flows are selected that protect redds without jeopardizing refill nor causing avoidable spill. Shaping the flows requires recognition that the Tributary Inflow is less in the earlier part of the steelhead spawning period (March) than at the end of the spawning period (June). Also, the greatest proportion of wild steelhead spawning occurs in the middle of the spawning season, April and May (approximately 38 and 44 percent, respectively). To accomplish flow shaping, Daily Spawning Flows (DSF) at Newhalem gage will be kept as low as is consistent with actual available reservoir storage and sidestream flows below Ross Lake during periods of high Tributary Inflow and peak spawning (i.e., April and May).

OPERATING PRINCIPLES

Each year a certain volume of water will runoff from precipitation and snow pack between March and July. This volume is forecast by the City on or about the first of each month from December 1 to June 1. The earlier forecasts are of lower accuracy and have a large confidence interval. However, by updating the forecasts (with increasing accuracy) each month, the City is able to redistribute the runoff to some

extent using available storage in Ross Lake.

Shaping can be planned to discharge the lowest average flow from Gorge Powerplant in May to June 15, slightly higher flow in April, and the remainder of the volume of excess runoff in March and after June 15. This roughly reverses the trend of Tributary Inflow and helps achieve the goal of uniform spawning and incubation conditions for the steelhead throughout the spawning period. The actual spawning flows that are created in each of the spawning months by this shaping effort are later compared to the Steelhead Spawning/Incubation Flow Tables (APPENDIX G) to determine the required incubation flow for each month.

METHODOLOGY

Monthly Planned Spawning Flows will be calculated in advance of the steelhead spawning season and adjusted each month during the season based on the following criteria:

(1) current runoff volume forecast,
(2) maximum capability (output) of Gorge Powerplant,
(3) refill constraints,
(4) storage ability of Ross Lake

These Planned Spawning Flows are defined by the Spawning Control Curve (SCC), the basic planning tool in this shaping

process. The actual Daily Spawning Flows are influenced by two additional criteria: actual runoff (timing and volume) and daily adherence to physical limitations. Further, Monthly Planned Spawning Flows shall be limited to the maximums provided in Section 6.3.3.1.(2).

The SCC is a set of Planned Spawning Flows that are derived by solving an equation that includes three variables: (1) forecasted total runoff into Ross Lake; (2) forecasted storage available in Ross Lake; and (3) monthly flows that sum to the total volume. In general terms, the water that will create spawning flows is the difference between the water that runs off into Ross Lake and the available storage at Ross Lake. Sidestream Inflow is also a factor, and the equation takes that into account by shaping forecasted flows at Gorge using available Ross storage. Actual Sidestream Inflow may produce minor variations.

More specifically, the entire volume of runoff at Gorge from March 1 to June 30 is divided among the months that constitute the forecast period, namely March, April, May, and June. Each monthly flow in the equation is expressed in terms of the flow in May (X), the month of highest expected Tributary Inflow. Tributary Inflow in March is about 1,500 cfs lower than in May, so the Planned Spawning Flow in March should be X + 1,500 cfs. Tributary Inflow in April is about 1,000 cfs lower than in May, so the Planned Spawning Flow in April should be X +

1,000 cfs. Tributary Inflow in the first half of June is about the same as in May, so it was assumed that June 1-15 Planned Spawning Flows should also be equal to X. Finally, it was assumed that a high flow of 6,000 cfs at the Newhalem gage would exist from June 15 - 30, independent of X.

Expressed as an equation, the sum of expected volume flows in March, April, May, and June is set equal to the total volume of forecasted runoff (measured in volume terms of second-foot-days or SFD), less the total amount of forecasted storage in Ross Lake. That is, March + April + May + June average flows = forecasted runoff - forecasted storage.
In algebraic terms,

[(X+1500)*31 days] + [(X+1000)*30 days] + [X*31 days] + [X*15 + 6000*15 days] = VF - VS, (1)

where

VF = forecasted runoff in Ross Lake from March 1 to June 30, and

VS = storage available in Ross Lake from March 1 to June 30.

For example, if the March 1 elevation in Ross Lake is actually measured at 1535 ft. and the June 30 elevation is forecasted to be 1595 ft., then VS is 60 ft. which is approximately 296,000 SFD when converted to volume terms, and the Spawning Control Curve equation is solved as follows:

[Left side of equation (1)] = VF - 296,000

Multiplying out and collecting terms,

$107X + 166,500 = VF - 296,000$

Solving for X,

$X = (VF - 296,000 - 166,500) / 107$

Assume further that based on snow surveys and historical data that the runoff forecast, VF, for the sample year is 730,000 SFD. Then, the equation above is solved giving X = 2500 cfs.

Therefore, the Planned Spawning Flows in the forecast period are:

March = X + 1500 = 4000 cfs

April = X + 1000 = 3500 cfs

May = X = 2500 cfs

June 1-15 = X = 2500 cfs

In summary, the Spawning Control Curve for this sample year for the period March 1 to June 15 is determined by (a) the set of monthly average forecasted flows, (b) total forecasted runoff, and (c) forecasted storage in Ross Lake. These calculations are shown in Table E-1.

The flows that constitute the SCC are recalculated at least monthly as runoff forecasts are updated, and a new set of spawning flows are derived. Plant operators at the Skagit Project will then endeavor to operate the Project such that the spawning flows, as measured at the Newhalem gage, will

average out to equal those on the SCC over the course of each month and over the forecast period.

Occasionally, however, things do not go as planned. For example, severe weather conditions or the lack of perfect foresight may require Planned Spawning Flows to differ from the Spawning Control Curve.

To deal with this uncertainty, additional steps are taken. In addition to targeting Project operations to a set of monthly spawning flows, a new set of targets is devised in the form of month-end elevations for Ross Lake. There are operating constraints that are not captured by using the flow variables in the SCC formulation, such as refill by a certain date or avoiding spill, that can be dealt with by using month-end elevations. Moreover, just as Ross Lake starts from a given point on March 1, the Planned Spawning Flow for March dictates a month-end elevation which represents another target for reservoir operations. A set of these month-end elevations defines the Spawning Elevation Control Curve (SECC).

In planning the operations of Ross Lake, one of the criteria used is that the reservoir must be full (1602.5 ft.) by July 31. In order to have a high probability of meeting this constraint, the reservoir must be operated such that at no time is the reservoir elevation too low or too high. If it's too low, for example in the month of April, then the refill

date cannot be met given the expected runoff and required releases likely to occur between April and July. Conversely, if it's too high at any given time, there will be insufficient space to accommodate the runoff and the only recourse is to spill water. The general idea is that the month-end elevations represented by the SECC fall in between the month-end elevations needed to ensure refill and the month-end elevations needed to ensure the avoidance of spill. In technical terms, the SECC is bounded by the Variable Energy Content Curve (VECC) and the Spill Control Curve (SPCC).

The **Variable Energy Content Curve (VECC)** is the set of month-end elevations at Ross Lake required to meet refill by the target refill date (usually July 31). These elevations are calculated by proportioning the 95 percent volume forecast among the months of the forecast period according to historical runoff patterns. Calculations are then done backwards in time from July 31 to the forecast date, to ensure refill and maintain minimum required flows at Newhalem gage. This is essentially the VECC calculation which is currently done each month of the period beginning February 1 and ending June 1 each year as mandated by the Pacific Northwest Coordination Agreement to which the City is a party.

The VECC calculation takes the most likely forecast runoff and subtracts a "hedge" to ensure 95 percent confidence of refill.

The Ross Lake elevations associated with the end of month volumes are the data points that constitute the VECC by which the City operates. The City can greatly increase the probability of failure to refill Ross Lake by July 31 if Ross elevations fall below the VECC. The VECC month end elevations represent the minimum permissible elevation to which the City can operate Ross Lake and still refill by the target refill date with a high level of confidence (95 percent). An example of the VECC is shown in graph E-2 which follows.

The **Spill Control Curve** (SPCC) is determined in a fashion similar to the VECC, except that the City takes the 8 percent confidence level runoff forecast, and then works backwards from July 31, using the most efficient generation flow (6,000 cfs at Gorge Powerplant), and reserves enough available storage during each month so that with the expected runoff in that month, no more than 6,000 cfs will have to be passed through Gorge. The Ross Lake elevations associated with the end of month volumes calculated in this manner are the data points that constitute the SPCC by which the City operates. The City must avoid Ross Lake elevations greater than the SPCC to have a good chance of avoiding spill.

In practice, since the City attempts to avoid spill whenever possible, the City will operate to the lower of the SECC and SPCC. However, the VECC always determines the lowermost bound of reservoir operations during the refill period and may,

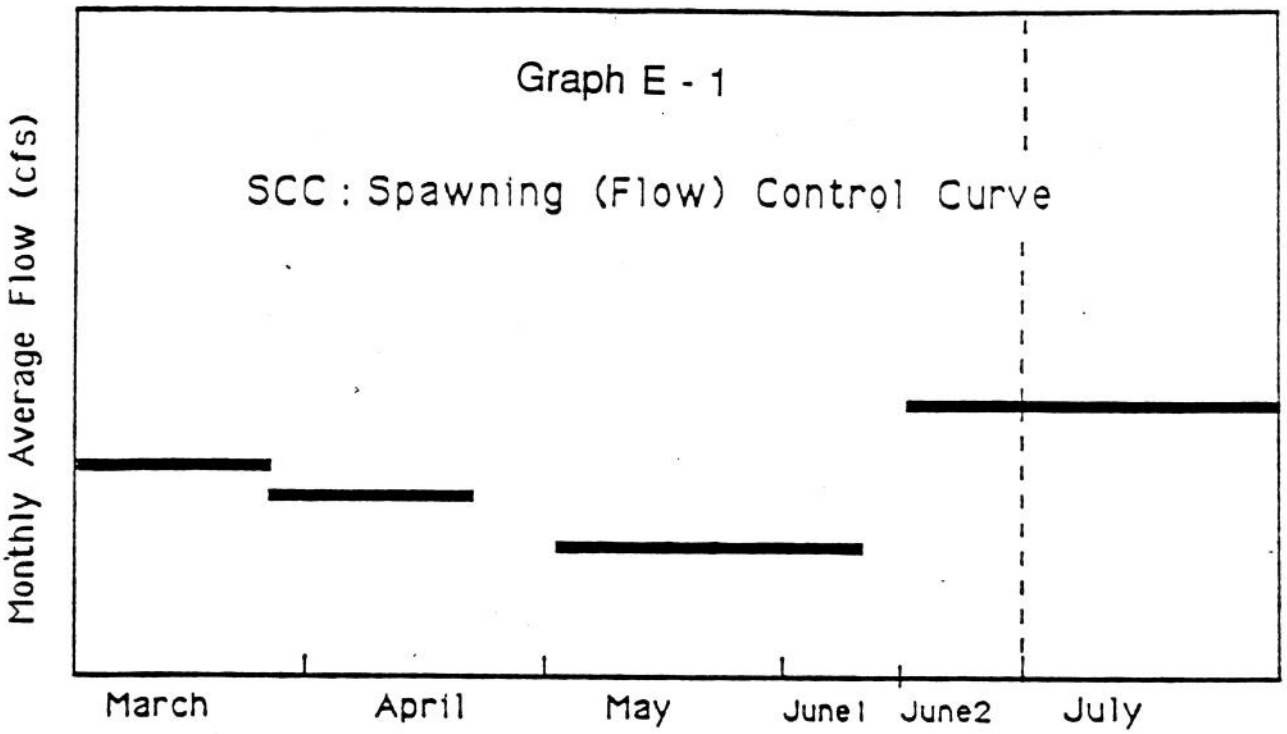
under unusual circumstances, require that the City operate the project above one or both of the SECC and the SPCC. Examples of these curves are shown in graph E-2.

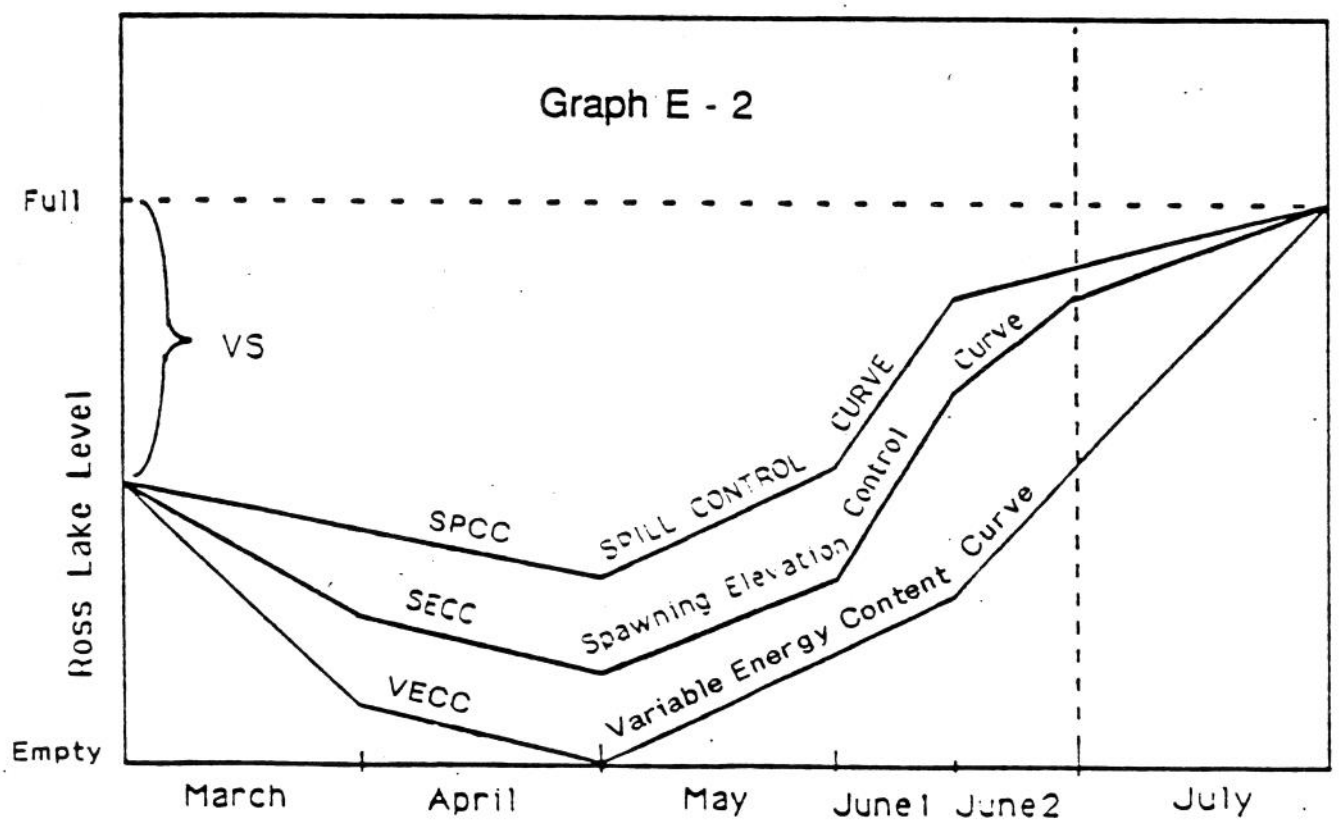
As shown in graph E-2, in most years, the SECC will fall between the VECC and the SPCC. The City must operate between the SPCC and the SECC to achieve (at least) the target protection level and avoid spill. If the City follows the SECC exactly and the runoff forecasts are perfectly accurate, then the steelhead will be spawned at a uniform flow level at Marblemount throughout their spawning period and the City will have a 95 percent chance of refilling Ross Lake by July 31.

TABLE E-1
GENERAL FORMULAS FOR DETERMINING PLANNED SPAWNING FLOWS

Month	Spawning Flow in CFS	Calculation of X
March	X + 1500	X = [VF - (1500 * 31 + 1000 * 30 + 6000 * 15)-VS]/(31+30+31+15)
April	X + 1000	X = [VF - (1000*30 + 6000*15) - VS]/(30 + 31 + 15)
May	X	X = [VF - (6000 * 15) - VS]/ (31 + 15).
June 1-15	X	X = [VF - (6000 * 15) - VS]/ (31 + 15), unless spill is shown between June 16 and July 31
June 16-30	6000	(Independent of X)

Graph E-1
EXAMPLES OF SPAWNING, VECC AND SPILL CONTROL CURVES





APPENDIX F

STEELHEAD INCUBATION FLOW EXAMPLES

1. STEELHEAD INCUBATION FLOW - DURING SPAWNING (EARLY SUBPERIOD)

"Incubation flow during the first ten (10) days of each spawning subperiod shall be based on the Planned Spawning Flow. Thereafter, daily incubation flows shall be based on the average of the highest ten (10) Daily Spawning Flows that have occurred up to that day. Appropriate incubation flows for any given day shall be determined for the spawning flows that are calculated as described above and the Season Spawning Flows according to APPENDIX G." (Section 6.3.3.1 (3)(a)).

Assumptions:

The power scheduler is preparing a schedule for April 3 on April 2.
Season Spawning Flow for March steelhead = 5,000 cfs
April steelhead are spawning for the third day.
The Planned Spawning Flow for April steelhead = 4,500 cfs
The required fry protection flow for salmon = 1,800 cfs

Procedure:

The required incubation flow for early April spawners based on the Planned Spawning Flow is obtained from APPENDIX G, Table G-2, and for April 3 is 1,800 cfs. The required incubation flow for March steelhead incubating in April

based on the Season Spawning Flow is (from Table G-1) 2,000 cfs.

Action:

The higher of the incubation (2,000 cfs) or fry protection flows (1,800 cfs) takes precedence. Of the two incubation flows (1,800 and 2,000 cfs), the higher required incubation flow takes precedence, therefore the power scheduler must schedule a flow of at least 2,000 cfs for each hour of April 3.

2. STEELHEAD INCUBATION FLOW - DURING SPAWNING (MID-SUBPERIOD)

"Incubation flow during the first ten (10) days of each spawning subperiod shall be based on the Planned Spawning Flow. Thereafter, daily incubation flows shall be based on the average of the highest ten (10) Daily Spawning Flows that have occurred up to that day. Appropriate incubation flows for any given day shall be determined for the spawning flows that are calculated as described above and the Season Spawning Flows according to APPENDIX G" (Section 6.3.3.1 (3)(a)).

Assumptions:

The power scheduler is preparing a schedule for April 15 on April 14

Season Spawning Flow for March steelhead = 5,000 cfs

April steelhead spawned on April 13 for the thirteenth day.

Daily Spawning Flows through April 13 = **5011**, **5024**, **4990**, **5012**, **4910**, **4870**, 4650, **4690**, 4450, **5010**, **5007**, **5101**, and 4468 cfs.

The required fry protection flow for salmon = 1,800 cfs

Procedure:

The spawning flow for April steelhead calculated as the ten highest Daily Spawning Flows through the last Inflow Day is 4,962 cfs. Thus, the required incubation flow for April steelhead which is obtained from APPENDIX G, Table G-2, is 1,800 cfs. The required incubation flow for March steelhead based on the Season Spawning Flow is (from Table G-1) 2,000 cfs.

Action:

The higher of the incubation or fry protection flows takes precedence. The higher required incubation flow takes precedence over the lower incubation flow, therefore the power scheduler must schedule a flow of at least 2,000 cfs for each hour of April 15.

3. STEELHEAD INCUBATION FLOW - AFTER SPAWNING

"Incubation flow during days following each spawning subperiod shall be based on the Season Spawning Flow which shall be calculated as the average of the highest ten (10) Daily Spawning Flows during that subperiod. Appropriate incubation flows for any given day shall be determined by the Season

Spawning Flows according to APPENDIX G" (Section 6.3.3.1 (3)(b)).

Assumptions:

The power scheduler is preparing a schedule for a day in late June

Season Spawning Flow for March steelhead = 5,000 cfs

Season Spawning Flow for April steelhead = 4,000 cfs

Season Spawning Flow for May - June 15 steelhead = 3,500 cfs

The required fry protection flow for salmon = none

The required fry protection flow for steelhead = 1,500 cfs

Tributary Inflow on last Inflow Day = 2,100 cfs

Procedure:

The required incubation flows for March, April, and May - June 15 steelhead which are obtained from APPENDIX G, Tables G-1, G-2, and G-3, are 3584, 4084, and 4584 cfs (Predicted Marblemount Flow), respectively, during the incubation month of June. Based on Tributary Inflow on the Inflow Day (2,100 cfs), these flows correspond to Newhalem gage flows of 1484, 1984, and 2484 cfs, respectively.

Action:

When scheduling minimum daily flows, the higher of the incubation or fry protection flows takes precedence. In this case the highest required incubation flow (4584 cfs, Predicted Marblemount Flow, which corresponds to 2,484 cfs

at Newhalem based on the last Inflow Day's Tributary Inflow) takes precedence over the lower fry protection flow that is measured at Newhalem gage (1,500 cfs). Therefore the power scheduler must schedule an instantaneous flow of at least 2,484 cfs at Newhalem gage for each hour of the day in June being scheduled.

APPENDIX G

STEELHEAD SPAWNING/INCUBATION FLOW TABLES

MARCH STEELHEAD TABLE G-1

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS) MARCH*^	APRIL^	MAY	JUNE#
3000	1800	1800	1500	3584
3100	1800	1800	1500	3584
3200	1800	1800	1500	3584
3300	1800	1800	1500	3584
3400	1800	1800	1500	3584
3500	**1800**	**1800**	**1700**	**3584**
3600	**1800**	**1800**	**1700**	**3584**
3700	**1800**	**1800**	**1700**	**3584**
3800	**1800**	**1800**	**1700**	**3584**
3900	**1800**	**1800**	**1700**	**3584**
4000	**1800**	**1800**	**1700**	**3584**
4100	**1800**	**1800**	**1700**	**3584**
4200	**1800**	**1800**	**1700**	**3584**
4300	**1800**	**1800**	**1800**	**3584**
4400	**1800**	**1800**	**1900**	**3584**
4500	**1800**	**1800**	**1900**	**3584**
4600	**1800**	**1900**	**1900**	**3584**
4700	**1800**	**1900**	**1900**	**3584**
4800	**1800**	**1900**	**1900**	**3584**
4900	**1800**	**2000**	**1900**	**3584**
5000	**1800**	**2000**	**1900**	**3584**
5100	1800	2100	1900	3584
5200	1800	2100	1900	3584
5300	1800	2100	1900	3584
5400	1800	2100	1900	3584
5500	1800	2100	1900	3584
5600	1900	2300	2100	3684
5700	1900	2300	2100	3784
5800	1900	2300	2100	3884
5900	1900	2300	2100	3984
6000	1900	2300	2100	4084
6100	2200	2500	2300	4184
6200	2200	2500	2400	4284
6300	2300	2500	2500	4384
6400	2400	2600	2500	4484
6500	2400	2600	2600	4584

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

Predicted Marblemount Flow.

APRIL STEELHEAD TABLE G-2

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS)			
	APRIL*^	MAY	JUNE#	JULY#
3000	1800	1500	3584	3623
3100	1800	1700	3684	3623
3200	1800	1900	3784	3623
3300	1800	1900	3884	3623
3400	1800	1900	3984	3623
3500	**1800**	**1900**	**4084**	**3623**
3600	**1800**	**1900**	**4084**	**3643**
3700	**1800**	**1900**	**4084**	**3663**
3800	**1800**	**1900**	**4084**	**3683**
3900	**1800**	**1900**	**4084**	**3703**
4000	**1800**	**2000**	**4084**	**3723**
4100	**1800**	**2100**	**4084**	**3743**
4200	**1800**	**2100**	**4084**	**3763**
4300	**1800**	**2200**	**4084**	**3783**
4400	**1800**	**2200**	**4084**	**3803**
4500	**1800**	**2200**	**4084**	**3823**
4600	**1800**	**2200**	**4084**	**3823**
4700	**1800**	**2200**	**4084**	**3823**
4800	**1800**	**2200**	**4084**	**3823**
4900	**1800**	**2200**	**4084**	**3823**
5000	**1800**	**2200**	**4084**	**3823**
5100	1900	2200	4084	3823
5200	1900	2200	4084	3823
5300	1900	2300	4084	3823
5400	1900	2300	4084	3823
5500	1900	2300	4084	3823
5600	2100	2400	4284	3823
5700	2200	2400	4384	3823
5800	2400	2400	4444	3823
5900	2500	2500	4564	3823
6000	2500	2600	4684	3823
6100	2600	2600	4684	3823
6200	2600	2600	4684	3823
6300	2600	2600	4684	3823
6400	2600	2600	4684	3823
6500	2600	2600	4684	3823

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

Predicted Marblemount Flow.

TABLE G-3

MAY - JUNE 15 STEELHEAD

SEASON SPAWNING FLOW (CFS)	MINIMUM INSTANTANEOUS INCUBATION FLOW (CFS) MAY*^	JUNE*#	JULY#
2000	1500	3584	3823
2100	1500	3584	3823
2200	1500	3584	3823
2300	1500	3584	3823
2400	1500	3584	3823
2500	1500	3584	3823
2600	1500	3764	3823
2700	1500	3944	3823
2800	1500	4124	3823
2900	1500	4304	3823
3000	**1500**	**4484**	**3823**
3100	**1500**	**4504**	**3823**
3200	**1500**	**4534**	**3823**
3300	**1500**	**4544**	**3823**
3400	**1500**	**4564**	**3823**
3500	**1500**	**4584**	**3823**
3600	**1500**	**4604**	**3823**
3700	**1500**	**4624**	**3823**
3800	**1500**	**4644**	**3823**
3900	**1500**	**4664**	**3823**
4000	**1500**	**4684**	**3823**
4100	1500	4684	3823
4200	1500	4684	3823
4300	1500	4684	3823
4400	1500	4684	3823
4500	1500	4684	3823
4600	1500	4684	3823
4700	1500	4684	3823
4800	1500	4684	3823
4900	1500	4684	3823
5000	1500	4684	3823
5100	1900	4684	3823
5200	1900	4684	3823
5300	2000	4684	3823
5400	2100	4684	3823
5500	2100	4684	3823
5600	2100	4684	3823
5700	2100	4684	3823
5800	2100	4684	3823
5900	2100	4684	3823
6000	2100	4684	3823
6100	2100	4684	3823
6200	2100	4684	3823
6300	2100	4684	3823
6400	2100	4684	3823
6500	2100	4684	3823

Most likely spawning flows in bold lettering.

* Months during which spawning occurs are based on 50 percent tributary inflow exceedance probabilities (EP) for both spawning and incubation. Succeeding incubation flows are based on 50 percent EP during spawning and 90 percent EP during incubation.

^ Months during which incubation flow is based on the below gravel model.

Predicted Marblemount Flow.

APPENDIX H

STEELHEAD FRY PROTECTION EXAMPLES

1. DOWNRAMP AMPLITUDE DURING STEELHEAD FRY PROTECTION PERIOD - NORMAL CONDITIONS

"Maximum 24 hour Downramp Amplitude shall be limited to 3,000 cfs, except that when Section 6.4 (Flow Insufficiency) flow reductions are in effect, the maximum 24 hour Downramp Amplitude for August shall be limited to 500 cfs. From the point that flow at Newhalem gage is 4,000 cfs or less, the Downramp Amplitude is further limited as shown in Table 1 below, regardless of whether the maximum 24 hour amplitude can be attained" (Section 6.3.3.2 (1))

Assumptions:

A power scheduler is preparing a schedule for July 10 on July 9.

Natural Flow on Inflow Day (July 8) = 3,500 cfs

Fry Protection Flow requirement = 1,500 cfs

Maximum 24 hour Downramp Amplitude = 3,000 cfs

Maximum Downramp Amplitude Below 4,000 cfs at Newhalem gage = 2,000 cfs

March steelhead incubation has ended.

Season Spawning Flow for April steelhead = 3,500 cfs

Season Spawning Flow for May - June 15 steelhead = 3,000 cfs

Tributary Inflow on the last Inflow Day = 2,323 cfs

Procedure:

The required incubation flows for April and May - June 15 steelhead, which are obtained from APPENDIX G, Tables G-2 and G-3, are 3,633 and 3,823 cfs (Predicted Marblemount Flow). Based on Tributary Inflow on the last Inflow Day (2,323 cfs), these flows correspond to Newhalem gage flows of 1,300 and 1,500 cfs, respectively. The highest required incubation flow (1,500 cfs) is no larger than the fry protection flow requirement (1,500 cfs). Also, the power scheduler determines that a minimum flow of 1,500 is an adequate flow in the low demand hours. Hence, the maximum Downramp Amplitude below 4,000 cfs at Newhalem gage (2,000) plus the minimum (1,500) provides the upper limit of fluctuation (i.e., the maximum flow of the 24 hour period: 2,000 + 1,500 = 3,500 cfs).

Action:

The scheduler then must schedule hourly generation such that the minimum (1,500 cfs) and maximum (3,500 cfs) flow bounds are adhered to while reducing generation during a 24 hour period. The maximum Downramp Amplitude of 3,000 cannot be achieved under these conditions. The scheduler must also make sure that reductions in generation that continue past midnight from one day to another do not result in 24 hour Downramp Amplitudes that exceed the maximum.

2. DOWNRAMP AMPLITUDE DURING STEELHEAD FRY PROTECTION PERIOD - NORMAL CONDITIONS (AUGUST)

"Maximum 24 hour Downramp Amplitude shall be limited to 3,000 cfs, except that when Section 6.4 (Flow Insufficiency) flow reductions are in effect, the maximum 24 hour Downramp Amplitude for August shall be limited to 500 cfs. From the point that flow at Newhalem gage is 4,000 cfs or less, the Downramp Amplitude is further limited as shown in Table 1 below, regardless of whether the maximum 24 hour amplitude can be attained" (Section 6.3.3.2 (1)).

Assumptions:

A power scheduler is preparing a schedule for August 10 on August 9.

Natural Flow on Inflow Day (August 8) = 3,500 cfs

Fry Protection Flow requirement = 2,000 cfs

Maximum 24 hour Downramp Amplitude = 3,000 cfs

Procedure:

The power scheduler determines that the minimum flow (2,000) is an adequate flow in the low demand hours. Hence, the minimum (2,000) plus the maximum Downramp Amplitude (3,000) provides the maximum peak of the day (2,000 + 3,000 = 5,000 cfs).

Action:

The scheduler then must schedule hourly generation such that the minimum (2,000 cfs) and maximum (5,000 cfs) flow bounds

are adhered to while reducing generation during a 24 hour period. The scheduler must also make sure that reductions in generation that continue past midnight from one day to another do not result in 24 hour Downramp Amplitudes that exceed the maximum.

3. DOWNRAMP AMPLITUDE DURING STEELHEAD FRY PROTECTION PERIOD - INSUFFICIENT MONTHS (AUGUST)

"From the point that flow at Newhalem gage is 4,000 cfs or less, the Downramp Amplitude is further limited as shown in Table 1 below, regardless of whether the maximum 24 hour amplitude can be attained" (Section 6.3.3.2 (1)). "Further, the minimum flow for August may be reduced to 1,500 cfs when Natural Flow at Newhalem gage on the Inflow Day is less than 2,300 cfs" (Section 6.3.3.2 (3)).

Assumptions:

A power scheduler is preparing a schedule for August 10 on August 9.

Natural Flow on Inflow Day (August 8) = 1,500 cfs

Flow Insufficiency Provisions are in effect, because the Natural Flow at the Newhalem gage is less than 2300 cfs.

Fry Protection Flow requirement = 1,500 cfs

Maximum 24 hour Downramp Amplitude = 500 cfs

Calculations:

The power scheduler decides that the minimum flow (1,500) will be the desirable flow in the low demand hours. Hence, the minimum (1,500) plus the maximum Downramp Amplitude (500) provides the maximum peak of the day (1,500 + 500 = 2,000 cfs).

Action:

The scheduler then must schedule hourly generation such that the minimum (1,500 cfs) and maximum (2,000 cfs) flow bounds are not exceeded while reducing generation during a 24 hour period. The scheduler must also make sure that reductions in generation that continue past midnight from one day to another do not result in 24 hour Downramp Amplitudes that exceed the maximum.

APPENDIX I

FRY PROTECTION FLOWS AT NEWHALEM GAGE

Sufficient Months	Minimum Instantaneous Flow in CFS
January	**
February	1800
March	1800
April	1800
May	1500
June	1500
July	1500
August	2000*
September	1500
October	1500
November	**
December	**

* Minimum flow may be reduced to 1500 cfs when Natural Flow on the Inflow Day is less than 2300 cfs (Section 6.3.3.2 (3)).

** Minimum flows in these months are determined by incubation flow requirements.

APPENDIX J

ALTERNATIVE SALMON SPAWNING PERIODS

In any year, the City may elect to conduct studies to monitor the actual start and end dates of the spawning periods of each salmon species. For any particular season, monitoring may result in delaying the start or advancing the end dates of the spawning period of a particular salmon species during which operational constraints are imposed to protect spawning fish. The monitoring program will be developed by a monitoring team composed of at least one representative of the City and at least one representative of another Party. The monitoring program must be approved by FCC and shall be conducted by the monitoring team.

Whenever disputes arise concerning interpretation of field observations or other data pertaining to the alternative start or end date, which the FCC cannot resolve in a timely fashion, the default date shall prevail, or, if the default start date has passed, the City shall implement spawning/incubation flow restrictions on the day following the next Power Scheduling Day.

START OF SPAWNING PERIODS

The start of spawning may be determined by field monitoring that ascertains the presence of spawning fish or redds. The Parties shall agree on certain reaches of river to be observed on a daily basis beginning at least two days prior to the

default spawning start dates of each species. Default start dates and criteria for evidence of onset of spawning are as follows:

Species	Evidence of Spawning	Default Start Date
chinook	Observed behavior or redd construction	August 20
pink	Observed behavior or redd construction	September 12
chum	Observed behavior or redd construction	November 16

END OF SPAWNING PERIODS

The end of spawning may be determined by field monitoring that ascertains the absence of fish spawning . The Parties shall agree on certain reaches of river to be observed on a daily basis beginning any number of days prior to the default spawning end dates of each species. Default end dates and evidence of cessation of spawning are as follows:

Species	Evidence of Cessation of Spawning	Default End Date
chinook	No observed behavior	October 15
pink	No observed behavior	October 31
chum	No observed behavior	January 6

APPENDIX K

ALTERNATIVE STEELHEAD FRY PROTECTION PERIODS

The Default start and end dates for the Steelhead Fry Protection Period shall be June 1 and October 15, respectively, unless the Parties mutually agree to alternative start and end dates for fry protection restrictions. Alternative start and end dates shall be based on field monitoring or the start date may be based on the use of the Temperature Unit Model (Section 6.7.1.3).

FIELD MONITORING

Field monitoring of steelhead fry presence shall be performed initially to determine the start of emergence and the end of the period during which steelhead fry are vulnerable to stranding. Field monitoring plans must be approved by the FCC as provided in Section 6.7.2. Eventually the start date may be determined as the first day that emerged fry are captured in steelhead redd caps or via some other mutually agreeable sampling method.

Start Date

Until such date that the Temperature Unit model is used, start date shall be either June 1 or a later date based primarily on redd capping. However, stick seining and electroshocking will be used as backups in case redd capping fails. The Parties shall agree on certain reaches of river to be sampled at intervals of three (3) days beginning May

31. A field crew comprised of one monitoring representative from the City and at least one from the Agencies shall select appropriate habitat to sample within those reaches according to flow conditions.

End Date

The End Date shall be either October 15 or an earlier date based on lengths of fry captured by stick seining or electroshocking. The end date shall be the first day that 90 percent or more of captured steelhead fry are of total lengths of 45 mm or greater. The Parties shall agree on certain reaches of river to be sampled at intervals of three (3) days beginning August 15. A field crew comprised of one monitoring representative each from the City and at least one from the combined Agencies shall select appropriate habitat to sample within those reaches according to flow conditions.

TEMPERATURE UNIT MODEL USE

If the FCC determines that the Temperature Unit Model is an acceptable means of predicting appropriate dates of hatching and emergence, it may be used in lieu of field monitoring for setting an appropriate start date. The Temperature Unit Model may be used to estimate the start of steelhead fry protection periods based on known temperature unit requirements of each species and the actual Skagit River temperatures. Skagit River temperatures shall be collected using hydrographic instruments within or in the vicinity of Marblemount gage.

APPENDIX L

MISCELLANEOUS CALCULATIONS

1. DOWNRAMP AMPLITUDE

Downramp Amplitude: "Shall mean the difference between the highest Newhalem gage reading and the succeeding lowest Newhalem gage reading during any consecutive 24 hour period due to a flow reduction at Gorge Powerplant and/or at Gorge Dam..." (Definitions, Section 6.1).

Assumptions:

On day x, a peak of 7,000 cfs occurred at hour 1030.

On the following day a low flow of 3,000 cfs occurred at 0430.

Calculation:

Subtract the highest and lowest flows in a 24 hour period:

7,000 - 3,000 = 4,000 cfs

Conclusion:

The Downramp Amplitude for day x is 4,000 cfs.

2. NATURAL FLOW

Natural Flow: "Shall mean the flow which represents the average daily flow which would occur without the Skagit Project in place..." (Definitions, Section 6.1). It is calculated as the sum of changes in storage volume of the Skagit Lakes, spill, and generation discharge at Gorge Powerplant.

Assumptions:

A power scheduler calculates the natural flow on November 7.

Generation discharge at Gorge Powerplant = 5414 cfs

Change in Volume of Ross Lake in 24 hours = -2151 cfs

Change in Volume of Diablo Lake in 24 hours = -898 cfs

Change in Volume of Gorge Lake in 24 hours = +335 cfs

Spill at Ross = 0 cfs

Spill at Diablo = 0 cfs

Spill at Gorge = 0 cfs

Calculation:

Natural Flow at Newhalem gage = 5414 + (-2151) + (-898) + 335 + 0 + 0 + 0 = 2,700 cfs

Conclusion:

The Natural Flow at Newhalem gage on the Inflow Day is calculated as 2,700 cfs.

3. PREDICTED MARBLEMOUNT FLOW

Predicted Marblemount Flow: "Shall mean the sum of the instantaneous flow at Newhalem gage for a given calendar day and the Tributary Inflow for the corresponding Inflow Day..." (Definitions, Section 6.1). "Subject to the exception for Insufficient Months as determined in Section 6.4 (Flow Insufficiency), the City shall maintain a minimum flow at Newhalem gage that is the higher of either the flow that results in a Predicted Marblemount Flow of at least 3,000 cfs, or the monthly flows as set forth in APPENDIX I " (Section

6.3.2.2 (3)). "When scheduling power generation for the succeeding calendar day, power schedulers shall assume that Tributary Inflow is the same as on the Inflow Day. Further, they shall calculate the Predicted Marblemount Flow as the planned flow at Newhalem gage plus the Tributary Inflow that occurred on the Inflow Day and shall plan Gorge Powerplant releases accordingly" (Section 6.6.2.2).

Assumptions:

A power scheduler is preparing a schedule for Thursday on a Wednesday in April.

Required minimum Predicted Marblemount Flow = 3,000 cfs

Required fry protection flow at Newhalem gage = 1,800 cfs

Required incubation flow at Newhalem gage = 1,800 cfs

Mean daily Tributary Inflow on Inflow Day (Tuesday) = 1,100 cfs

Calculation:

Predicted Marblemount Flow for Thursday = 1,800 cfs + 1,100 cfs = 2,900 cfs

Action:

2,900 cfs is 100 cfs less than the required 3,000 cfs, so the generation schedules will be made such that a minimum flow of at least 1,900 cfs is provided for each hour on Thursday.

4. TRIBUTARY INFLOW

Tributary Inflow: "Shall mean the inflow from tributaries between the Newhalem gage and the Marblemount gage calculated as the mean daily flow at Marblemount gage minus the mean daily flow at Newhalem gage on the same calendar day..." (Definitions, Section 6.1).

Assumptions:

Mean daily flow at Marblemount gage = 6,000 cfs

Mean daily flow at Newhalem gage = 3,400 cfs

Calculation:

Tributary Inflow = 6000 - 3400 = 2,600 cfs

Conclusion:

The Tributary Inflow is 2,600 cfs for the Inflow Day.

5. FLOW INSUFFICIENCY - CRITERION 1

"When discharge of the required minimum flows, at the Newhalem gage, plus 300 cfs, combined with the forecasted inflow to Ross Lake which is exceeded with 95 percent confidence, and the current reservoir volume results in Ross Lake drafting to empty." (Section 6.4.3.1).

An example of how this criterion will be determined is:

Assumptions:

Spawning conditions for Chinook, Pink and Chum Salmon resulted in minimum flows for February and March and April of 2500 cfs,

2400 cfs and 2400 cfs, respectively for incubation. Volume in storage at Ross on January 31 is 63,900 SFD (this corresponds to an elevation of 1505, which would be caused by abnormally low winter runoff.) The City provides forecast flows for February and March, with documentation to the Intervenors, that shows 95% confidence forecast inflow into Ross is 800 cfs in both February and March with 200 cfs sidestream inflow between Ross and Gorge. The forecast for April is 3500 cfs, with 800 cfs sidestream. The calculations are:

Ross Volume

Start	63,900	SFD
+ February inflow	22,400	= 800 cfs x 28 days
- Ross Minimum volume	-72,800	= (2500+300-200) x 28 days
February 28 Volume	13,500	= elevation 1481 - no problem yet
+ March inflow	24,800	= 800 cfs x 31 days
- Minimum	-77,500	= (2400 + 300 - 200) x 31 days
March 31 value	-39,200	= below empty (elev < 1475) - problem
+ April inflow	105,000	= (2400 + 300 - 800) x 30 days
- Minimum	-57,000	= (2400 + 300 - 800) x 30 days
April 30 volume	8,800	= above empty (elev > 1475) - no problem, assuming VECC is at empty

This calculation would set February and March as insufficient months. This would call for a quick meeting of the FCC to determine the best course of action. Absent consensus agreement, the City would reduce minimum flows in February and March by equal percentages (pro-rata reduction) until the March 31 volume is just enough above zero to meet minimum flows in April. In this example a 27% reduction in minimum flow will

achieve sufficiency. The new February minimum would be 1825 cfs and March would be 1752 cfs.

This procedure would leave Ross empty at the end of March. If spring runoff was expected to be normal, this would be no problem, as the VECC under normal circumstances on March 31 is near empty. However, the action the City would recommend would be to reduce minimum flows so that February and March would be lower still, to protect against a continuation of 1000 cfs natural flow at Gorge, with an empty reservoir at Ross.

Note that this example was picked to demonstrate the technique. In practice, this calculation would be done each month through July 31 so that an early warning could be given. Also note that in this circumstance something must be done. Ross cannot physically release enough water to maintain minimum flows.

6. FLOW INSUFFICIENCY - CRITERION 2

"When discharge of the required minimum flows at the Newhalem gage, plus 300 cfs, combined with the forecasted inflow to Ross Lake which is exceeded with 95 percent confidence, and the current reservoir volume results in a Ross Lake volume that does not meet the applicable energy content curve" (Section 6.4.3.2).

An example of how this criterion is determined is:

Assumptions:

Previous spawning conditions produce required incubation flows in May, June, and July of 1700 cfs, 1300 cfs, and 1700 cfs respectively. Ross begins May at 1500 ft, which is a volume of 60,000 SFD. The 95% confidence in flow to Ross is 5500 cfs in May, 6500 cfs in June and 4000 cfs in July. Sidestream between Ross and Gorge is 1700 cfs 2000 cfs and 1200 cfs in May, June and July respectively (90% confidence).

Ross Volume

Start	60,000 SFD	
+ May Inflow	170,500	= 5500 cfs x 3 days
- Ross minimum	-9,300	= (1700+300-1700) cfs x 31 days
May 31 Volume	221,200	
+ June inflow	195,000	= 6500 cfs x 30 days
- Ross minimum	0	= (1300+300-2000)cfs x 30 days (Minimum is zero because there is more sidestream inflow [2000 cfs] than needed to maintain minimum flow.)
June 30 volume	416,200	
+ July inflow	124,000	= 4000 cfs x 31 days
- Ross minimum	-24,800	= (1700 + 300 - 1200) cfs x 31 days
July 31 value	515,400	= Below full (full is 530,000 SFD)
Full	-530,000	
Deficit	-14,600 SFD	

This calculation would set May, June, and July as insufficient months since Ross does not fill. This would call for a meeting of the FCC to determine the best course of action. Absent consensus, the city would reduce minimum flows in May, June and

July by equal percentages (pro-rata) so that Ross did fill. In this example a reduction of 20% in May and July would achieve sufficiency (Ross is already shut down in June). The new minimum at Newhalem for May, June, and July would be 1360 cfs, 1300 cfs, and 1360 cfs respectively.

Note that in these circumstances, the FCC might decide to take no action, and leave minimum flows alone, because Ross is so close to full (elevation 1600 ft) in July. Also note that warning of this would probably come as early as January at these conditions, giving FCC an opportunity to spread the reduction over more months, alleviating the impact on any given month. Also note that should the coordinated system as a whole be drafting to meet firm load, the deficit in July might not appear.

7. FLOW INSUFFICIENCY - CRITERION 3

"When natural Flow at Newhalem gage on any Inflow Day in the month of August is less than 2,300 cfs." (Section 6.4.3.3).

Assumptions:

The power scheduler is preparing a schedule for Wednesday on a Tuesday in August. Natural Flow at the Newhalem gage on the Inflow Day is 1800 cfs. The Fry Protection Flow requirement is 2000 cfs.

Action:

The power schedules may drop the flow to as low as 1500 cfs subject to daily amplitude being no greater than 500 cfs for all days in which the minimum flow is below 2000 cfs. The schedule for Wednesday may show a minimum flow of as low as 1500 cfs. Since the downramp rate for steelhead fry protection is 500 cfs/hour, the minimum flow could start at 0100 hrs on Wednesday, with no further downramps for the day.

APPENDIX M

TRIBUTARY PERCENT EXCEEDANCE FLOW BETWEEN NEWHALEM AND MARBLEMOUNT

Month	50 Percent Exceedance Flow(cfs)	90 Percent Exceedance Flow(cfs)
January	1,664	684
February	1,533	853
March	1,450	1,044
April	1,504	1,111
May	2,530	1,742
June	2,763	2,084
July	2,174	1,223
August	1,093	644
September	975	617
October	968	611
November	1,781	742
December	1,537	656