UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232-1274

February 9, 2011

VIA ELECTRONIC FILING

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Subject: Biological Opinion for ESA Section 7 consultation for the Jackson Hydroelectric Project, FERC Project No. 2157-188. NMFS Consultation F/NWR/2010/01972

Dear Secretary Bose:

Enclosed is the Biological Opinion prepared by National Marine Fisheries Service (NMFS) regarding the Federal Energy Regulatory Commission's (FERC's) proposed relicensing of the Jackson Hydroelectric Project on the Sultan River in Snohomish County, WA.

This document presents NMFS' Biological Opinion on the effects of the proposed Federal action on listed Puget Sound Chinook salmon and steelhead trout in accordance with Section 7 of the Endangered Species Act (ESA) of 1973 as amended (16 USC 1531 *et seq.*). The FERC requested formal consultation by letter of May 6, 2009. As no revised license order or proposed revised license order has yet been issued, this Opinion addresses the Settlement Agreement of January 2010 and FERC's Draft Environmental Assessment (DEA) of May 2010. Should FERC issue a new license order that differs materially from the recommended license articles contained in the DEA, it may be necessary for FERC to reinitiate Section 7 consultation.

In this Biological Opinion, NMFS determined that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon or Puget Sound steelhead trout or destroy or adversely modify designated critical habitat of Puget Sound Chinook salmon. National Marine Fisheries Service determined that the proposed action is not likely to adversely affect the southern resident killer whale or adversely modify its designated critical habitat.

Enclosed as Section 11 of the Biological Opinion is a consultation regarding Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). NMFS finds that the proposed action will adversely affect for Chinook, coho, and pink salmon EFH and recommends that the terms and conditions of Section 9 of the Biological Opinion be adopted as EFH conservation measures. Pursuant to MSA (§ 305(b)(4)(B)) and 50 CFR 6000.920(j), Federal agencies are required to provide a written response to NMFS' EFH conservation recommendations within 30 days of receipt of those recommendations.

Comments or questions regarding this Biological Opinion and MSA consultation should be directed to Steve Fransen at 360-753-6038 (steven.m.fransen@noaa.gov) or Keith Kirkendall, FERC/Water Diversions Branch Chief, at 503-230-5431 (keith.kirkendall@noaa.gov).

Sincerely,

Will Stelle
Regional Administrator

Enclosure

cc: Service List

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility District Number 1,	)	**Jackson Hydroelectric Project**
Snohomish County, Washington	)	**FERC No. 2157-188**

CERTIFICATE OF SERVICE

I hereby certify that I have this day served, by electronic or first class mail, a letter to Kimberly D. Bose, Federal Energy Regulatory Commission, from the National Marine Fisheries Service, regarding National Marine Fisheries Supplemental Biological Opinion for ESA Section 7 consultation for the Jackson Hydroelectric Project, FERC Project No. 2157-188 and this Certificate of Service to each person designated on the official service list compiled by the Commission in the above captioned proceeding.

Dated on February 9, 2011

Bonnie J. Hossack

Bonnie J. Hossack

Endangered Species Act
Section 7(a)(2) Consultation

Biological Opinion

And

Magnuson-Stevens Fishery Conservation And Management Act Consultation

Federal Energy Regulatory Commission License to operate the

Jackson Hydroelectric Project

FERC Project No. 2157

Located on the Sultan River

HUC 17100090402

Snohomish County, Washington

Action Agency:	Federal Energy Regulatory Commission
Consultation Conducted by:	National Marine Fisheries Service Northwest Region Hydropower Division
NOAA Fisheries Log Number:	F/NWR/2010/01972
Date:	February 9, 2011

Table of Contents

LIST OF TABLES

LIST OF FIGURES

TERMS AND ABBREVIATIONS

AMP	Adaptive Management Plan
ARC	Aquatic Resource Committee
BA	Biological Assessment
BE	Biological Evaluation
BMP	Best Management Practice
BRT	Biological Review Team
ºC	Degrees Celsius
CFS	Cubic Feet per Second
COMMISSION	Federal Energy Regulatory Commission
Corps	U.S. Army Corp of Engineers
CWA	Clean Water Act
CWT	Coded Wire Tags
DEA	Draft Environmental Assessment
District	Snohomish Public Utility District's
DNR	Department of Natural Resources
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Act
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
FHMP	Fisheries and Habitat Monitoring Plan
FWS	U.S. Fish and Wildlife Service
General Investigation	Flood Damage Reduction General Investigation
HCP	Habitat Conservation Plan
HEAD	Elevation difference
HGMP	Hatchery and Genetics Management Plan
HOF	Hatchery Origin Fish
HPA	Hydraulic Project Approval
HPMP	Historic Properties Management Plan
HRA	Habitat Restoration Account
ILP	Integrated Licensing Process
HUC	Hydrologic Unit Code
ISAB	Independent Scientific Advisory Board
ITS	Incidental Take Statement
KW	Kilowatt
LWD	Large Woody Debris
MGD	Million Gallons per day
MMHPP	Marbled Murrelet Habitat Protection Plan
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean sea level
MW	Megawatts
NGO	Non-governmental organizations
NFS	National Forest Service
NMFS	National Marine Fisheries Service
NOF	Natural Origin Fish
NWMP	Noxious Weed Management Plan
Opinion	Biological Opinion
OR	Operational Reach

PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PME	Protect, Mitigate & Enhance
Project	Henry M. Jackson Hydroelectric Project
PR	Process Reaches
PS	Puget Sound
RM	River Mile
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
RRMP	Recreation Resources Management Plan
RSP	Relicensing Study Plan
SA	Settlement Article
Staff Alternative	Staff Alternative with Mandatory Conditions
TRT	Technical Recovery Team
TRMP	Terrestrial Resources Management Plan
USFS	United States Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Services
VSP	Viable Salmonid Population
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish & Wildlife
WDOE	Washington Department of Ecology
WQPP	Water Quality Protection Plan
WUA	Waited Usable Area

1. INTRODUCTION

The purpose of this Biological Opinion (Opinion) is to determine the effects of the Federal Energy Regulatory Commission's (FERC or Commission) proposed new license for Snohomish Public Utility District's (District's) Henry M. Jackson Hydroelectric Project (Project) on species listed under the Endangered Species Act (ESA), as well as their designated critical habitat. For convenience, this document includes NMFS' essential fish habitat (EFH) consultation on this action though the EFH consultation is separate from the ESA consultation.

1.1 Background and Consultation History

The Project is located on the Sultan River, a tributary to the Skykomish River, which is tributary to the Snohomish River, which flows into northern Puget Sound, in Washington State. In 1999, Puget Sound Chinook salmon, indigenous to the Sultan River basin, were listed as a threatened species under the ESA and critical habitat was designated in 2006. The Puget Sound Chinook recovery plan for the Snohomish basin is complete (Shared Strategy 2007). Puget Sound steelhead, also indigenous to the Sultan River, were listed as threatened in May of 2007. No critical habitat for steelhead has yet been designated.

Additional species listings and critical habitat designations have occurred near the action area. The Southern Resident killer whale is listed as endangered in 2005 (NMFS 2005a), and critical habitat was designated (NMFS 2006a). The final recovery plan for killer whale is complete (NMFS 2008c).

The District began its relicensing process with meetings with state and Federal agencies, the Tulalip Tribe, local governments, and non-government organizations (NGOs) in 2004. Study plans were developed, studies performed, and settlement discussions and negotiations began in January 2009. Relicensing studies addressed instream flows, fish passage, habitat inventory and improvements, recreational whitewater flows, ecosystem process flows, and other issues. The negotiations successfully culminated in a settlement agreement (SA) in October 2009.

Snohomish County Public Utility District (PUD) District Number 1, the applicant, acting as FERC's non-Federal representative, provided FERC with a Biological Evaluation (BE), dated August 2010, of the likely effects of the Proposed Action on ESA-listed species (Meridian Environmental 2010). By letter dated May 6, 2010, FERC requested formal Section 7 consultation on relicensing of the Project, submitting the applicant-generated BE as its Biological Assessment (BA) for the action. Based on information contained in the DEA and the BE, FERC determined that the proposed actions would adversely affect Puget Sound Chinook salmon and Puget Sound steelhead. FERC also determined that the proposed action may adversely affect EFH for Skykomish Chinook, Skykomish coho, and Puget Sound pink salmon. FERC determined that the action would not adversely modify designated critical habitat of Chinook salmon. In its May 6 letter, FERC determined that its proposed action would not adversely affect Southern Resident killer whales and, and requested NMFS' concurrence. NMFS concurs with the FERC's determination that the proposed actions may affect, but are not likely to adversely affect Southern Resident killer whales and their critical habitat (the NMFS concurrence is appended to the opinion; Appendix 1).

1.2 The Federal Trust Responsibility

NMFS and FERC have an obligation to support the Treaty tribes in their efforts to preserve and restore treaty salmon fisheries in their usual and accustomed areas. The Tulalip Tribe and NMFS have worked side by side throughout the relicensing proceeding. The Tribe played an important role in developing the SA and is a signatory to the agreement. The Proposed Action addresses the Tribe's concerns regarding treaty fisheries issues and Tribal Trust resources. Additionally in accordance with Secretarial Order 3206 (June 5, 1997), NMFS conducted a government to government meeting with representatives Melvin Sheldon Jr., Thomas McKinsey, and Daryl Williams of the Tulalip Tribe on September 16, 2009 to discuss the Jackson SA and this consultation.

2. PROPOSED ACTION

Proposed actions are defined in NMFS' regulations (50 CFR §402.02) as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas". Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The Proposed Action for this consultation is the Commission's issuance of a new 45-year project operating license with *Staff Alternative with Mandatory Conditions* (staff alternative), as described in the DEA (FERC 2010). The DEA provides details of the proposed action that are not presented in this Opinion and is hereby incorporated by reference. In addition, this Opinion addresses the effects of two off-license agreements (the Jackson Off-License Supplementation Program Agreement and the Lake Chaplain Tract Land Management Off-License Agreement), which are considered interrelated actions (i.e., actions that would not occur apart from the proposed action) (see Attachments A and B in Snohomish County PUD [2009b]).

Except as otherwise described, the proposed action includes all existing facilities and operations of the Project. Section 2.2.3 below identifies the proposed environmental mitigation measures.

2.1 General Description of the Project as Currently Licensed

The Henry M. Jackson Hydroelectric Project is located in the northwestern section of Washington State, on the western slopes of the Cascade Mountains (Figure 1). The Project facilities are sited on the Sultan River between river mile (RM) 4.3 and RM 16.5, and between elevations 285 and 1,470 feet mean sea level (msl). The Sultan River flows into the Skykomish River at RM 34.4. The Skykomish and Snoqualmie rivers join at Monroe (RM 20.5) to form the Snohomish River. The Snohomish River watershed has a drainage area of 1,980 square miles and is the second largest river basin draining to Puget Sound (Haring 2002, page 36).

The Project has an installed capacity of 111.8 megawatts (MW). Project facilities currently include Spada Lake[1] (the Project reservoir), Culmback Dam, the power conduit and powerhouse, the Lake Chaplain pipeline, Portal 2 structure, the City of Everett's (City's) diversion dam, and a 1-mile-long transmission line extending from the power plant switchyard to the Lake Chaplain

[1] Although technically considered a reservoir being that it is manmade, it is commonly referred to as "Spada Lake" on maps and in fishing regulations.

Substation. The Henry M. Jackson Hydroelectric Project is part of the municipal water supply works for the City of Everett, Washington and operation of the Project for power generation is subordinate to municipal water supply.

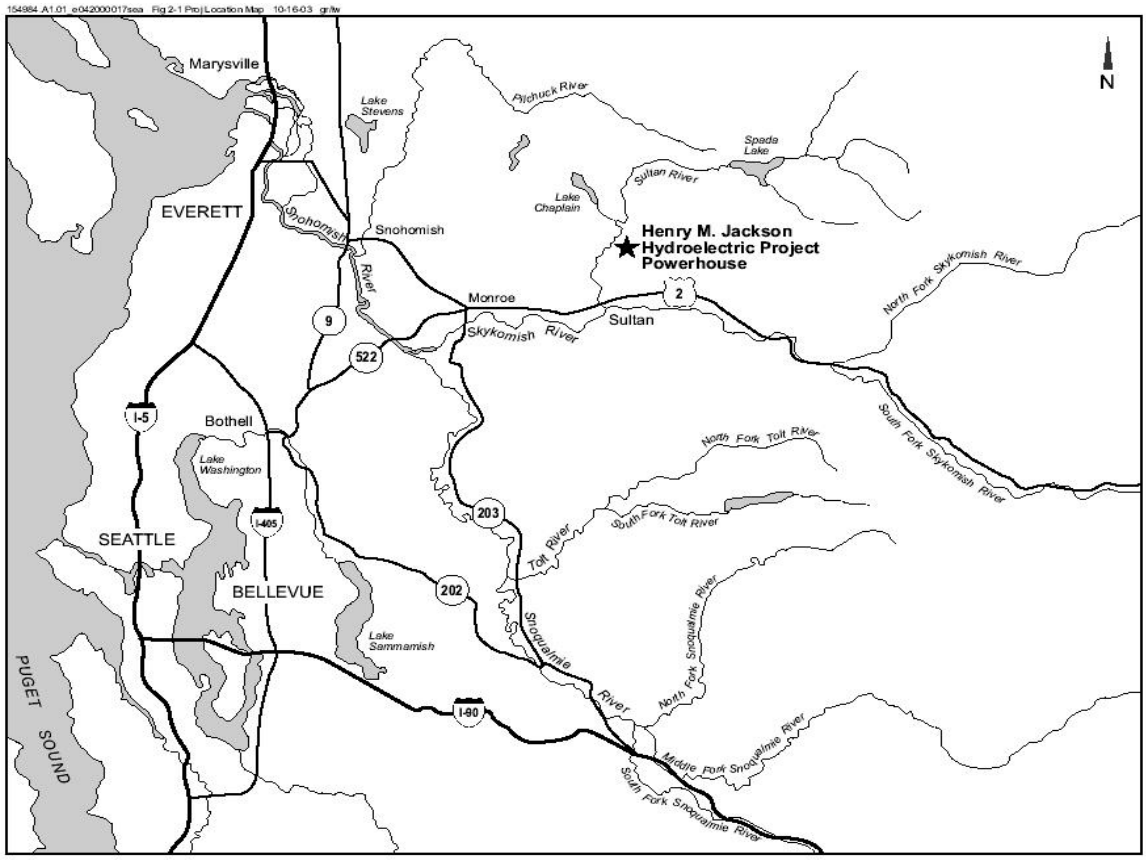


Figure 1 Project location.

2.1.1 Spada Lake

At 1,450 feet msl, Spada Lake has a gross area of 1,908 acres and a gross storage capacity of 153,260 acre-feet (Table 1). While the maximum operating pool is at elevation 1,450 feet msl, the normal maximum surface elevation is 1,445 feet msl. At this elevation, which typically occurs from June through mid-July, the normal maximum surface area of the lake is 1,802 acres, with a storage capacity of 143,982 acre-feet. Starting in late July, the pool is lowered to elevation 1,415 feet msl by mid-September to avoid spill later in the fall. This measure provides about 58,500 acre-feet of incidental flood storage prior to the onset of the October to December wet season. To avoid vortex stresses in the power tunnel, diversion of water into the power tunnel ceases if the pool elevation drops to 1,380 feet msl or lower (Snohomish County PUD 2009a, page E-5 and E-6).

Prior to development of the hydroelectric facilities (c. 1984), water required to meet the City's municipal water demands was released at Spada Lake, diverted from the Sultan River at the diversion dam, piped to Lake Chaplain and delivered to the City via pipeline. Today, the Project typically diverts all inflow to Spada Lake through the power conduit to the powerhouse except as required to meet minimum instream flows in the river reach between Culmback Dam and the

diversion dam and any spill at Culmback Dam to the Sultan River. Water required to meet the City's municipal supply demands and to supplement instream flows for fisheries below the diversion dam generates power through two Francis turbine units installed at the powerhouse, using the 700 feet of elevation difference (head) between Spada Lake and Lake Chaplain. Water in excess of the above requirements generates power through two Pelton units discharging directly into the Sultan River, using the 1,000 feet of head between Spada Lake and the powerhouse.

Table 1 Morphometric and operational data for Spada Lake

Drainage area (square miles)	69.21
Drainage area: surface area	23.7 : 1
Average annual discharge (acre-feet)	526,338
Surface elevation (feet msl)	
Full pool	1,450
Normal maximum surface elevation	1,445
Average annual drawdown	1,420
Maximum drawdown on record (January 20, 1993)	1,395.5
Surface area	
Full pool (acres)	1,908
Normal maximum surface area	1,802
Average days/year at full pool	6.1
Average days/year > 1445.0 feet msl	32.8
Average annual drawdown (acres)	1,500
Minimum operational pool (acres)	1,380
Volume (acre-feet)	
Full pool	153,260
Normal maximum volume	143,982
Average annual drawdown	102,204
Minimum operational pool	52,046
Maximum length (miles)	
Reservoir centerline	5.00
Old riverbed thalweg	5.25
Shoreline length (miles)	
Full pool	21.98
Average annual drawdown	16.90
Depth (feet)	
Maximum (full pool)	210
Mean (full pool)	180
Storage ratio (volume/average inflow)	0.29 : 1
Lake filling time (volume/inflow; years)	0.474
Lake flushing time (volume/outflow; years)	0.287

2.1.2 Culmback Dam

Culmback Dam forms Spada Lake. Located at RM 16.5 on the Sultan River, the dam was originally built by the City in 1965 to provide water storage for its water supply system. The dam was raised to its current height, 1,470 feet msl, in 1984, to facilitate the hydroelectric development (Snohomish County PUD 2009a, page E-7).

Figure 2 Culmback Dam and the morning glory spillway.

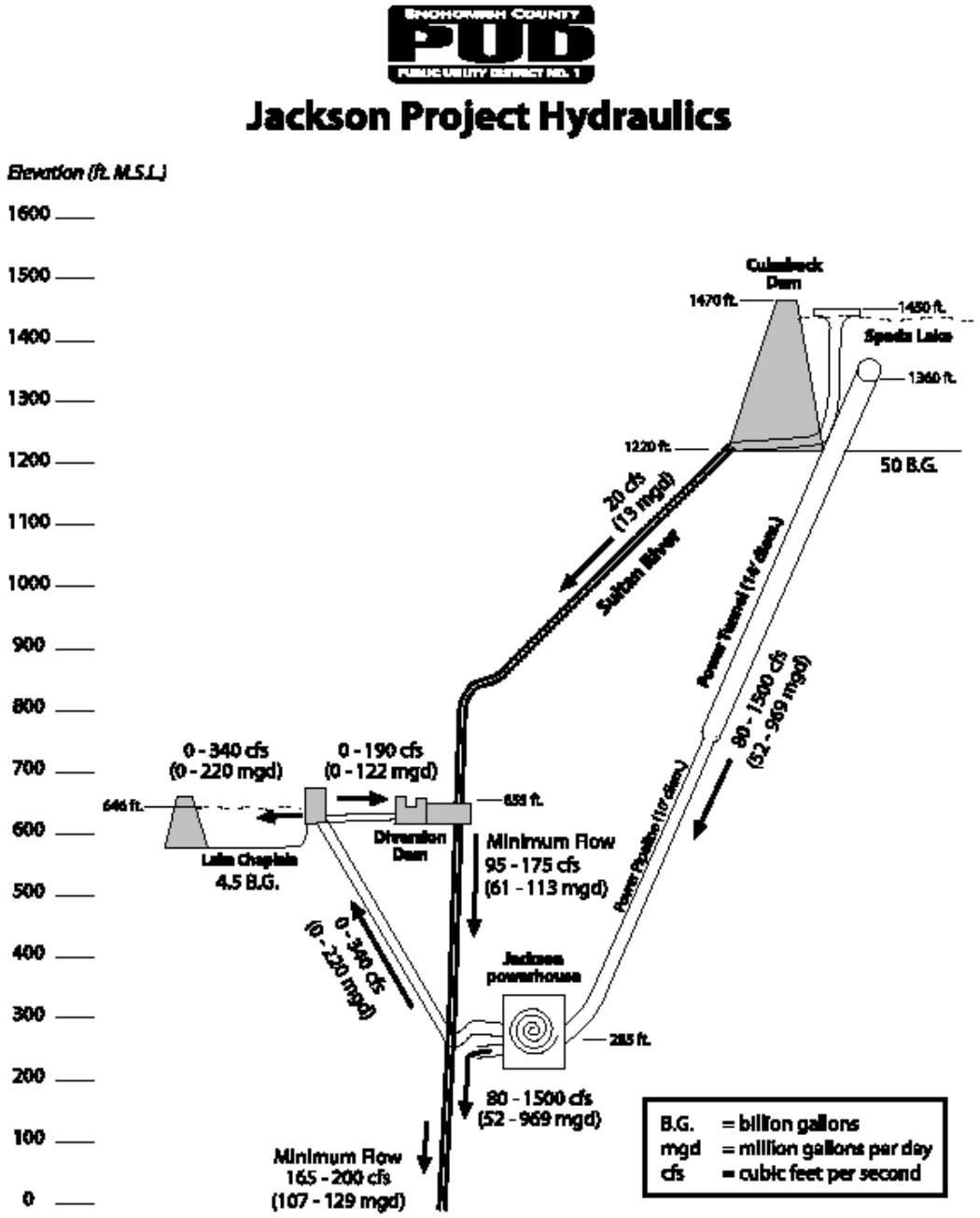


Figure 3 Jackson Hydroelectric Project hydraulic schematic view.

The power conduit intake structure is located near the left abutment, about 250 feet upstream of the dam. The 110-foot-tall concrete structure has three 20-foot moveable panels. Positioning of these panels allows the selective withdrawal of stored water from various depths to facilitate the control of water temperature in the Sultan River below the powerhouse and the diversion dam.

2.1.3 Power Conduit

The power conduit is a 14-foot-diameter unlined tunnel, extending 3.8 miles from the intake structure through Blue Mountain.

2.1.4 Power Plant

The powerhouse is located at RM 4.3 and houses two Pelton turbines and two Francis turbines. The two Pelton turbines discharge directly into 40-foot-long discharge canals that transport water to the main river channel. The Francis turbines re-route a portion of flow under the river via a pipeline (the Lake Chaplain pipeline) to the City's municipal water supply storage at Lake Chaplain. To alleviate any concerns that at certain flows power generation might attract and delay adult fish migrating upstream past the powerhouse, the District constructed and maintains a low-head fish passage berm at the upstream end of the powerhouse. This berm has a passageway or slot near the powerhouse to concentrate the river flows into an area that is more attractive to and can be more easily detected by migrating fish. The berm has successfully facilitated fish passage upstream of the powerhouse since its construction in 1983.

Figure 4 Jackson Hydroelectric Project powerhouse and switchyard.

2.1.5 Lake Chaplain Pipeline

The City's water supply requirements are mainly met by diverting water from Spada Lake through the powerhouse's two Francis units, through a pipeline to Lake Chaplain. Sufficient pressure is retained, because of the 700-foot elevation difference between Spada Lake and Lake Chaplain and the diversion dam, to route the water from the powerhouse through a buried pipeline to the Portal 2 structure located on the shore of Lake Chaplain.

2.1.6 Portal 2 Structure

To maintain minimum instream flows below the diversion dam, water diverted at Spada Lake to the power conduit is returned to the Sultan River via the Portal 2 control structure located at the terminus of the Lake Chaplain pipeline. From Portal 2, the water is routed through the diversion tunnel to the diversion dam where it returns to the river. By adjusting the Portal 2 gate opening,

the required amount of water to be diverted to both Lake Chaplain and to the diversion dam can be accurately controlled.

2.1.7 Sultan River Diversion Dam

The Sultan River diversion dam has been in place since 1930. It was originally used to divert water from the Sultan River into Lake Chaplain for the City of Everett's water supply (Figure 5). Under current operations, the diversion dam is seldom used to divert water from the Sultan River to Lake Chaplain except when the powerhouse is off-line. The diversion dam creates only a small headpond measuring a few acres in size. Water from Portal 2 flows into the forebay and is accurately measured through a weir in the main sluice gate

Figure 5 The Sultan River diversion dam at RM 9.7

When the power conduit or the Lake Chaplain pipeline is not operational, the City's water requirements can also be met by supplementing Lake Chaplain storage with water diverted from the Sultan River via the diversion dam and diversion tunnel to Lake Chaplain.

2.1.8 Existing Project Operations

As described above, the Project diverts water from Spada Lake to provide water for hydroelectric generation, and the City of Everett's municipal water supply storage reservoir, Lake Chaplain. Flow to the powerhouse from the intake structure at Spada Lake passes through the power conduit. Upon reaching the powerhouse, flow either passes through the two Pelton turbines and/or the two Francis turbines. Flows passing through the Pelton turbines discharge directly into the Sultan River at the powerhouse. Flows passing through the Francis turbines enter the Lake Chaplain pipeline, propelled by the head differential between Spada Lake reservoir and

Lake Chaplain. At the end of the Lake Chaplain pipeline, the Portal 2 structure regulates both the amount of water to be delivered to Lake Chaplain for municipal water supply purposes and the amount of water passing through the Sultan River diversion dam tunnel and pipeline back to the Sultan River diversion dam and released to the bypassed reach to meet aquatic habitat needs.

The existing License (Article 54) requires the District to maintain the following minimum instream flows in the Sultan River:

- a 20-cfs year round minimum flow to the reach of the Sultan River between Culmback Dam (Spada Lake) and the Sultan River diversion dam,
- a 95- to 175-cfs minimum flow from the Sultan River diversion dam to the powerhouse (varies by season), and
- a 165- to 200-cfs minimum flow from the powerhouse to the Sultan River –Skykomish River confluence (varies by season).

In 1965, Stage I of Culmback Dam (Spada Lake) was built to provide additional storage for the City's municipal water supply; the traditional operation of the Sultan River diversion dam and tunnel to Lake Chaplain were essentially unchanged. The function of the diversion dam changed with completion of the Stage II hydroelectric Project facilities in 1984. Stage II included a raised Culmback Dam (to its current dimensions), the power tunnel and pipeline, the powerhouse and Lake Chaplain pipeline, and Portal 2 structure. Prior to the completion of Stage II, water flowed west from the Sultan River diversion dam through the tunnel into Lake Chaplain. Currently, water typically flows east through the tunnel between Lake Chaplain and the Sultan River diversion dam to meet the minimum instream flow requirements below the diversion dam as specified in the existing License.

Project operations are governed by an operating plan which has been modified several times since the power generation facilities were constructed in the early 1980s. Currently, operation of the powerhouse is dictated by four different reservoir states (Figure 6):

State 1 – Zone of Spill. Above elevation 1,450 feet msl, Spada Lake is in a state of spill. Therefore, the District operates the powerhouse to withdraw at least 1,300 cfs through the power tunnel.

State 2 – Zone of Potential Spill. The District operates the powerhouse to withdraw at least 1,300 cfs through the power tunnel.

State 3 – Zone of Discretionary Operation. The District may operate the powerhouse between the extremes of State 2 and State 4 depending on maintenance, power supply, and prudent operation to minimize the impacts to the fishery resources.

State 4 – Zone of Water Conservation. The District operates the powerhouse to satisfy the requirements of its water supply obligations to the City of Everett and the instream flow requirements in the Sultan River.

The Project is not operated to provide flood storage or specific flood regulation; however, Spada Lake reduces downstream peak flows whenever the water surface elevation is below 1450 feet.

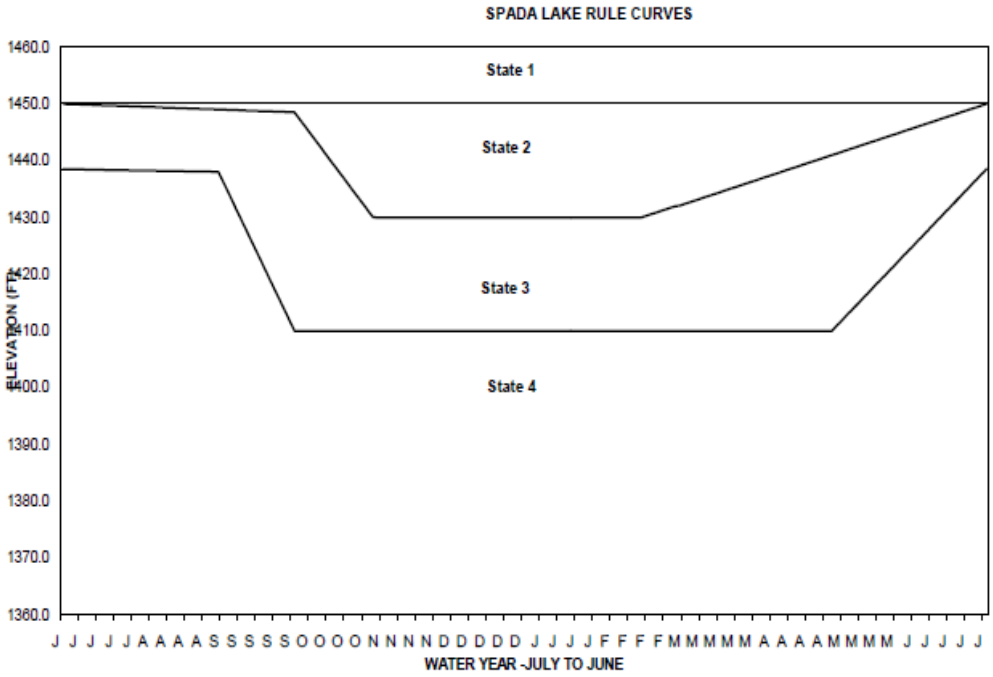


Figure 6 Spada Lake Current Operational Rule Curves.
(Note: Rule curve states are defined in the accompanying text)

These rule curves allowed the District to minimize spill at Culmback Dam and provide a balance of reliable municipal water supply to the City of Everett, instream flows for fisheries resources, incidental winter flood storage, and higher lake levels for early summer recreation. Flows through the Project are constrained by the following: (1) water supply needs from Lake Chaplain to the City of Everett must be met; (2) minimum instream flows downstream of Culmback Dam, the diversion dam, and the powerhouse must be met; (3) flows must be protective of incubating Chinook salmon eggs downstream of the powerhouse; and (4) when the Spada Lake water surface elevation drops below elevation 1,380 feet msl, restrictions in generation flow are implemented to avoid vortex conditions that could cause damage to the power tunnel.

2.2 The Action Area

An action area is defined by 50 CFR §402 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." Regarding the District's analysis of ESA-listed fish species, the area directly or indirectly affected by the Project includes Spada Lake (including the Williamson Creek tract) and the Sultan River from Culmback Dam downstream to the Skykomish River. Project effects on fish and fish habitat in the Skykomish River downstream from the Sultan River confluence would be negligible and the Skykomish River is therefore not part of the action area. Historically, an impassible barrier, slightly downstream of the Culmback Dam site, represented the upper limit of historical Chinook, steelhead, and bull trout distribution (Ruggerone 2006).

In addition to the Sultan River from Culmback Dam downstream to the Skykomish River, the action area for listed species includes District-owned lands and National Forest System (NFS) lands in the upper Sultan River Canyon. These areas are shown in Figure 7, below.

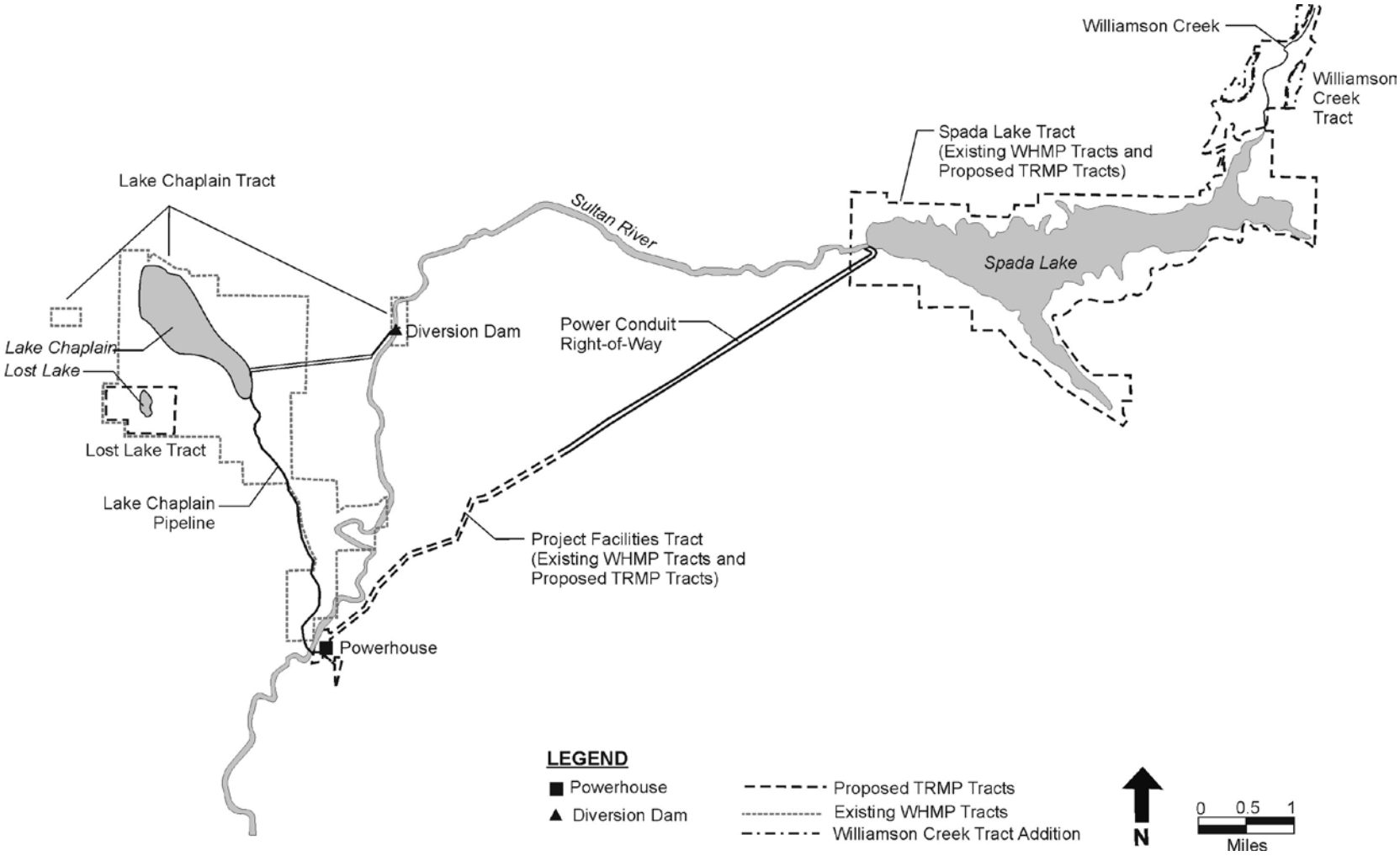


Figure 7 Proposed Project boundary, including lands that would be managed under the District's proposed Terrestrial Resources Management Plan (TRMP).

2.2.1 Proposed Project Facilities

The Proposed Action requires the District to remodel the governor and needle valve controls for the Pelton units to protect the aquatic resources of the Sultan River downstream from the powerhouse from rapid flow fluctuations when either of the Pelton units trip off-line. The modifications would automatically allow flow continuation through the powerhouse when either unit is shut down by providing independent, controlled operation of the deflector blades and needle closure. The District has been pursuing this improvement on its own accord and notified the FERC by letter filed on January 27, 2010, that these proposed modifications are essentially complete with the exception of testing.

2.2.2 Proposed Project Operations

The District proposes to modify Project operations to enhance aquatic habitat, provide whitewater boating flows, and ensure that environmental, power generation, and water supply needs are appropriately balanced. Proposed measures to achieve these objectives include:

(1) managing releases from Spada Lake in accordance with modified rule curves;

(2) increasing minimum instream flows in affected reaches of the Sultan River;

(3) providing periodic short-term increased flows to promote geomorphologic processes;

(4) providing whitewater boating flow releases;

(5) providing temperature conditioning flows from Culmback Dam to Reach 3 of the Sultan River to enhance the suitability of aquatic habitat upstream of the diversion dam for salmonids;

(6) implementing procedures to reduce downramping rates to minimize the potential for stranding of aquatic organisms;

(7) providing for adaptive management of Spada Lake water in response to anticipated increased domestic water supply demand; and

(8) prioritization of water supply and quality requirements over power generation. These proposed Project operational measures are summarized in the following section and discussed in more detail under each proposed License Article (see Section 6.0).

2.2.3 Proposed Environmental Measures (License Articles) under the Settlement Agreement

The District proposes a comprehensive set of measures covering the full range of resources in the Sultan River watershed. Table 2 summarizes those measures (license articles) proposed under the Settlement Agreement (Snohomish County PUD 2009b).
The Settlement Agreement envisions that all proposed license articles would be included in a new License for the Project. FERC's DEA includes all but the habitat fund.

The District also filed two off-license agreements on October 14, 2009, for the Commission's information (Snohomish County PUD 2009b). Measures associated with these off-license agreements are not intended to be included in a new License for this Project, and are therefore not listed in Table 2. The first agreement is the "Lake Chaplain Tract Management Off-License Agreement between the Public Utility District No. 1 of Snohomish County, City of Everett, and Washington Department of Fish and Wildlife." The second agreement is the "Jackson Off-License Supplementation Program Agreement between Public Utility District No. 1 of Snohomish County, Washington and Washington Department of Fish and Wildlife." Although these agreements would not be included as License Articles, they are analyzed in this BA as interrelated actions, which would not occur apart from the proposed action.

Table 2 Summary of proposed license articles.

License Article included in the Settlement Agreement	Summary of Proposed Environmental Measure
Aquatic License Article A-LA 1: Aquatic Resource Committee	• Establish and convene an Aquatic Resource Committee, consisting of the Tulalip Tribes, NMFS, USFWS, USFS, WDFW, Washington Ecology, the cities of Everett and Sultan, Snohomish County, and American Whitewater, to assist in implementation of aquatic resources License Articles.
A-LA 2: Marsh Creek Slide Modification and Monitoring	• Identify methods and schedule for developing a permanent survey control point, conducting a detailed baseline physical survey at low flow, and modifying the slide to facilitate fish passage. • Identify methods and schedule for monitoring fish use and escapement upstream of the Marsh Creek slide area of the Sultan River, located within Reach 2 about 2 miles downstream of the Sultan River diversion dam. • Identify methods and schedule for conducting surveys of the Marsh Creek slide subsequent to large flow events, and implementing further modifications to the slide subject to the availability of funds in the habitat enhancement account.
A-LA 3: Temperature Conditioning in Reach 3	• Prepare a Water Temperature Conditioning Plan that provides the methods and schedule for a two-phase program to improve water temperature conditions for salmonids and other aquatic resources in Reach 3 between Culmback Dam and the Sultan River diversion dam. • Monitor water temperature and aquatic resource response to temperature conditioning. • Report annually on consultation with the Aquatic Resource Committee.
A-LA 4: Whitewater Boating Flows	• Provide 12 whitewater boating events in Sultan River downstream of Culmback Dam every 3 years. • Prepare a Whitewater Recreation Plan with provisions for: boater notification procedures; methods for assessing boater satisfaction, level of effort, and aquatic resources effects; and dam access.

License Article included in the Settlement Agreement	Summary of Proposed Environmental Measure
A-LA 5: Downramping Rate Conditions	• Staff the powerhouse during potential electrical storms during initial testing of flow continuation system, and until the bypass system proves effective at preventing fish stranding. • Implement a mean daily discharge ceiling of 550 cfs during the fall peak spawning period for Chinook salmon to protect spawning redds. • Implement seasonal ramping rates downstream of Culmback Dam, the Sultan River diversion dam, and powerhouse in accordance with criteria specified in the Settlement Agreement.
A-LA 6: Large Woody Debris	• Prepare a Large Woody Debris (LWD) Plan with provisions for: installing eight LWD structures in the Sultan River within 5 years of plan approval, and up to four additional structures after year 10 of License issuance; and monitoring the effectiveness of the LWD structures.
A-LA 7: Side Channel Projects	• Enhance a minimum of 10,000 linear feet of side channel area to provide a minimum of 3 acres of additional rearing habitat along Reach 1 of the Sultan River downstream of the powerhouse. • Prepare a Side Channel Enhancement Plan that includes provisions for: restoring and maintaining year-round flow connectivity between the Sultan River and identified side channels; enhancing and maintaining other off-channel habitat; using LWD collected at Culmback Dam to add structure and function within the side channels; and monitoring, maintaining, and reporting on side channel enhancement measures.
A-LA 8: Process Flow Regime	• Implement periodic process flows to provide for channel maintenance, channel forming and flushing, and upstream and downstream fish migration flows to the Sultan River. • Prepare a Process Flow Plan with provisions for: Aquatic Resource Committee consultation; timing controlled flow releases with natural flow events and other flow enhancement measures; minimizing adverse flow-related effects on aquatic resources and the City of Sultan; and monitoring and adaptively managing the process flow releases.
A-LA 9: Minimum Flows	• Implement a new minimum instream flow regime for Reach 2 downstream of the Sultan River diversion dam and Reach 1 downstream of the powerhouse. • In consultation with Aquatic Resource Committee, provide an annual water budget of 20,362 acre-feet for flow releases to Reach 3 immediately downstream of Culmback Dam through June 2020. Increase annual budget to 23,831 acre-feet after June 2020.

License Article included in the Settlement Agreement	Summary of Proposed Environmental Measure
A-LA 10: Spada Lake Recreational Fishery	• Develop a Spada Lake Recreational Fishery Plan with provisions for: removing barriers to fish passage in tributaries to Spada Lake; improving the boat launch at the South Fork recreation site on Spada Lake; attempting to maintain a minimum lake elevation above 1,430 feet msl during the summer; preparing a recreational fishing brochure for Spada Lake; and conducting fish sampling in Spada Lake every 5 years.
A-LA 12: Fish Habitat Enhancement Plan	• Develop a Fish Habitat Enhancement Plan with funding provisions for a habitat enhancement account and additional provisions for: potential fish habitat improvement projects primarily in the Sultan River Basin and potentially in the Snohomish River Basin; future modifications to the plan; and evaluation and reporting requirements.
A-LA 13: Diversion dam Volitional Passage	• Construct upstream volitional fish passage at the Sultan River diversion dam if spawning escapement meets the passage trigger. • Facilitate downstream fish passage at the Sultan River diversion dam by curtailing flow diversions from the Sultan River to Lake Chaplain when spawning escapement exceeds certain thresholds. • Develop a diversion dam Volitional Fish Passage Plan with provisions for methods, schedule, and criteria for achieving upstream and downstream fish passage; monitoring annual spawning escapement; testing and verifying fish passage effectiveness at the Sultan River diversion dam; and annual monitoring, reporting, and Aquatic Resource Committee consultation requirements.
A-LA 14: Reservoir Operations	• Implement revised reservoir rule curves with provisions for reporting temporary and emergency modifications.
A-LA 15: Adaptive Management Plan	• Develop an Adaptive Management Plan with provisions for: resolving conflicting water demands; and creating a process for evaluating and managing such conflicts.
A-LA 16: Steelhead Planting Program	• Provide funds to WDFW to annually stock 30,000 steelhead smolts in the Sultan River until volitional fish passage is provided at the Sultan River diversion dam.
A-LA 17: Fisheries and Habitat Monitoring Plan	• Develop a Fisheries and Habitat Monitoring Plan to inform the implementation of other aquatic environmental measures and to provide for monitoring: riverine fish habitat; water temperature; fish spawner abundance, distribution, and timing; and juvenile fish production, distribution, and habitat use.
A-LA 18: Water Supply	• Operate the Project so that the City of Everett's water supply and water quality requirements have precedence over power generation to the extent specified within the Supplemental Agreement Between Public Utility District No. 1 of Snohomish County and the City of Everett, Washington, October 17, 2007, Part E. 1 and Exhibit 1.

License Article included in the Settlement Agreement	Summary of Proposed Environmental Measure
Cultural License Article (C-LA)1: Historic Properties Management Plan	• Implement the Historic Properties Management Plan.
Recreation License Article (R-LA) 1: Recreation Resources Management Plan	• Implement the Recreational Resources Management Plan.
Terrestrial License Article (T-LA) 1: Terrestrial Resource Management Plan	• Implement the Terrestrial Resources Management Plan.
T-LA 2: Noxious Weed Management Plan	• Implement the Noxious Weed Management Plan.
T-LA 3: Marbled Murrelet Habitat Protection Plan	• Implement the Marbled Murrelet Habitat Protection Plan.
Water Quality License Article (W-LA) 1: Water Quality Monitoring License Article	• Develop a Water Quality Protection Plan with provisions for: water quality protection measures for construction or maintenance activities; spill prevention and containment procedures; procedures for application of herbicides, pesticides, fungicides, and disinfectants; compliance monitoring and reporting procedures; water quality sampling parameters; a map of sampling locations; and procedures for quality control.

Not all of the proposed mitigation measures are relevant to this consultation, as they would not likely affect listed species. Measures not discussed further in this Opinion:

- A-LA 10
- C-LA 1
- R-LA 1
- T-LA 1
- T-LA 2
- T-LA 3

A detailed description of each relevant proposed license article summarized in Table 2 and the anticipated effects on listed species is in the Effects of the Proposed Action section of this Opinion.

In addition to the proposed license articles listed in Table 2, the proposed action includes certain interdependent and interrelated off-license agreements in the Settlement Agreement appendices that have the potential to affect listed species or critical habitat. The off-license agreements are also analyzed in the Effects of the Proposed Action section of this Opinion. In this case, the effects of this action are not direct but are interrelated and interdependent.

2.3 Evaluating the Proposed Action

The ESA establishes a national program to conserve threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires

Federal agencies to consult with the U.S. Fish and Wildlife Service (FWS) and NMFS to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. Section 7(b)(4) requires the provision of an Incidental Take Statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

NMFS uses the following five-step approach for applying the ESA Section 7(a)(2) standards when determining what effect a proposed action is likely to have on a given listed species and its critical habitat. A summary of the approach follows.

1. Evaluate biological requirements and current status of the species at the evolutionarily significant unit (ESU) or distinct population segment (DPS) level and within the particular action area (Sections 3 and 4.1).
2. Evaluate the relevance of the environmental baseline in the action area to action-area biological requirements and the species' current range wide and action-area status (Section 4).
3. Determine the effects of the proposed or continuing action on the listed species and on any designated critical habitat (Section 5).
4. Determine and evaluate any cumulative effects within the action area (Section 6).
5. Evaluate whether the effects of the proposed action, taken together with any cumulative effects and added to the environmental baseline, can be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the affected species, or is likely to destroy or adversely modify their designated critical habitat (Section 7). (See CFR §402.14(g).)

In completing step 5, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or adversely modify designated critical habitat. If so, NMFS must identify reasonable and prudent alternatives (RPA) for the action that avoid jeopardy or adverse modification of critical habitat and meet the other agency regulatory requirements of RPAs. (See CFR §402.02.)

This biological opinion does not rely on the regulatory definition of 'destruction or adverse modification' of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

3. BIOLOGICAL INFORMATION

Two anadromous fish species, Puget Sound Chinook salmon and Puget Sound steelhead, and one cetacean, Southern Resident killer whales, listed as threatened and endangered, respectively, under the ESA, could be affected by the proposed action.

NMFS considers the status of listed species, taking into account viability criteria (population size, productivity, population spatial structure, and diversity) and, if available, an assessment of population projections relative to survival and recovery criteria. To assess the status of the listed species, NMFS starts with the determinations made in its decision to list, for ESA protection, the

ESUs and Distinct Population Segment (DPSs) considered in this Opinion, and considers any new data that are relevant to the determination. The primary references containing this information are provided in Table 3. The following sections briefly describe the current status of the species (listing status, general life history, and population dynamics) in a manner that is relevant to each species' biological requirements. Additional information is also available at NMFS Northwest Region website: http://www.nwr.noaa.gov.

Table 3 References to Status Reviews and Federal Register Notices containing additional information concerning listing status, biological information, and critical habitat designations for listed and proposed species considered in this Biological Opinion.

Species (Biological Reference)	Listing Status Reference	Critical Habitat Reference
Chinook Salmon from Washington, Idaho, Oregon and California, (Myers et al. 1998). (Updated Status of Federally listed ESUs of West Coast Salmon and Steelhead) (Good et al., 2005) Southern Resident Killer Whales Puget Sound Steelhead	The Puget Sound ESU is listed as Threatened under the ESA by NOAA Fisheries, (64 FR 14308, NMFS 1999). Endangered & threatened species: final listing determination for 16 ESUs of West Coast Salmon, (70 FR 37160 NMFS 2005a) Endangered & threatened wildlife & plants: endangered status for Southern Resident Killer Whales, (70 FR 69903 NMFS 2005a). Endangered & threatened species: final listing determination for Puget Sound Steelhead, (72 FR 26722 NMFS 2007).	Endangered & threatened species; designation of critical habitat for 12 ESUs of West Coast salmon & steelhead in WA, OR, & ID, (70 FR 52630, NMFS 2005b) Endangered & threatened species; designation of critical habitat for Southern Resident Killer Whales, (71 FR 69054 NMFS 2006b).

3.1 Puget Sound Chinook Salmon

3.1.1 Rangewide Status and Population Trends

Chinook salmon in the Puget Sound ESU were listed as threatened under the ESA on March 24, 1999. This listing was reaffirmed on June 28, 2005 (70 FR 37160 NMFS 2005a). The ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound, including the Strait of Juan de Fuca. This area stretches from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, and includes fish from 26 artificial propagation programs (hatcheries).

NMFS published a technical memorandum summarizing the scientific conclusions of the NMFS Biological Review Teams (BRTs) regarding the updated status of 26 ESA-listed ESUs of salmon and steelhead (and one candidate species ESU) from Washington, Oregon, Idaho, and California (Good et al. 2005). The status review updates were undertaken to consider new data collected since the previous updates and to address issues raised in recent court cases.

As in past status reviews, the BRTs used a risk-matrix method to quantify risks in different categories within each ESU (modified to reflect the four major criteria identified in the NMFS

viable salmonid populations (VSP) document): abundance, growth rate/productivity, spatial structure, and diversity (McElhany et al. 2000). These criteria were used as a framework for formal ESA recovery planning for salmon and steelhead.

Based on genetic and historical evidence reported in the literature, the Puget Sound Technical Recovery Team (TRT) determined that there were 16 additional Chinook spawning aggregations or populations in Puget Sound that are not putatively extinct (Ruckelshaus et al. 2006). It was not possible in most cases to determine whether these Chinook salmon spawning groups historically represented independent populations or were distinct spawning aggregations within larger populations. Regardless of their population status, the losses in these 16 spawning aggregations represent important losses in ESU diversity, especially among early run Chinook salmon forms. The populations presumed extinct were mostly early-returning fish that were from mid-to southern Puget Sound, Hood Canal, and the Strait of Juan de Fuca (Good et al. 2005).

The BRT observed that the current abundance of natural spawners in the ESU remained several orders of magnitude lower than the estimated historical spawner capacity, and well below peak historical abundance (about 690,000 spawners in the early 1900s). Most populations have a recent 5-year mean abundance of fewer than 1,500 natural spawners, with the Upper Skagit population being a notable exception.

In terms of productivity, the BRT found that hatchery programs collectively do not substantially reduce the extinction risk of the ESU . Long-term trends in abundance for naturally spawning populations of Chinook salmon in Puget Sound indicate about half the populations are declining, and half are increasing over the available time series. The median overall long-term trend in abundance is 1.0 (range 0.92-1.2), indicating that most populations are just replacing themselves. Based on these findings, the BRT concluded that the naturally spawned component of the Puget Sound Chinook ESU is ‘‘likely to become endangered within the foreseeable future”.

3.1.2 Life History

Throughout their range, Puget Sound Chinook salmon exhibit diverse and complex life history strategies. Differences exist in age at seaward migration; freshwater, estuarine, and ocean residence; and in age and season of spawning migration (Healey 1991, page 314; Myers et al. 1998, page 9). Most of this variation is exhibited in two distinct behavioral forms commonly referred to as stream-type and ocean-type (Healey 1991, page 314). Stream-type Chinook rear in freshwater for a year or more before migrating to sea, perform extensive offshore migrations, and return to their natal river in spring or summer, several months prior to spawning. Ocean-type Chinook typically migrate to sea in their first year of life, only a few months after emergence, remain in nearby coastal areas, and normally return to their natal river in the late summer or fall, a few days or weeks before spawning. Ocean residence for both stream-type and ocean-type Chinook usually ranges from 1 to 6 years; however, a small proportion of yearling males, called "jacks" mature in freshwater or return to freshwater after 2 to 3 months in salt water. Chinook salmon in the Puget Sound ESU typically exhibit an ocean-type life history; however, a number of spring-run populations in the ESU include a high proportion of yearling smolt emigrants.

Generally, ocean-type Chinook prefer to spawn in the middle and lower mainstem areas of large rivers (Healey 1991, page 318). Often, the preferred spawning sites are located near deep pools

and in areas with abundant instream cover. Adequate spawning area, abundant clean gravel, a relatively stable stream channel (with minimal bedload movement), and sub-gravel flow are very important in the selection of redd sites (Healey 1991, page 323). Depending on water temperature, incubation takes between 90 and 150 days.

While rearing in freshwater, juvenile Chinook are normally associated with low gradient, meandering, unconstrained stream reaches. As they grow, submerged and overhead cover in the form of rocks, submerged aquatic vegetation, logs, riparian vegetation, and undercut banks provide food and shade and protect juveniles from predation. When adult Chinook return to spawn, they often rely on deep pools for resting. These pools provide an energetic refuge from river currents, a thermal refuge from high summer and autumn water temperatures, and protection from potential predators.

Sultan/Skykomish River Chinook are of mixed origin, having originated from native and non-native fish (WDFW 2002). Current production in the basin is sustained by both wild and artificial production, though wild Chinook salmon production in the Snohomish River basin is depressed (NMFS 1999).

Spawning currently occurs in the mainstem Sultan River up to river mile (RM) 9.0. Chinook start returning to the system in June, with a majority of the run entering from mid-August to mid-September. Spawning occurs from September through October, peaking in early-October (CH2M Hill 2005). Chinook salmon smolts use the Snohomish River estuary from March through the end of August and have been observed in the estuaries and nearshore environments nearly every month of the year. Sultan River Chinook salmon return to spawn when they are 2 to 5 years old. These Chinook have coastal-oriented ocean migration patterns (Myers et al. 1998).

3.1.3 Critical Habitat

NMFS designated critical habitat for Puget Sound Chinook salmon on September 2, 2005, effective January 2, 2006 (NMFS 2006a) the Sultan River from its mouth upstream to RM 9.0 is considered critical habitat for Puget Sound Chinook salmon (Figure 8), excluding lands the Washington DNR manages under a Habitat Conservation Plan (HCP).

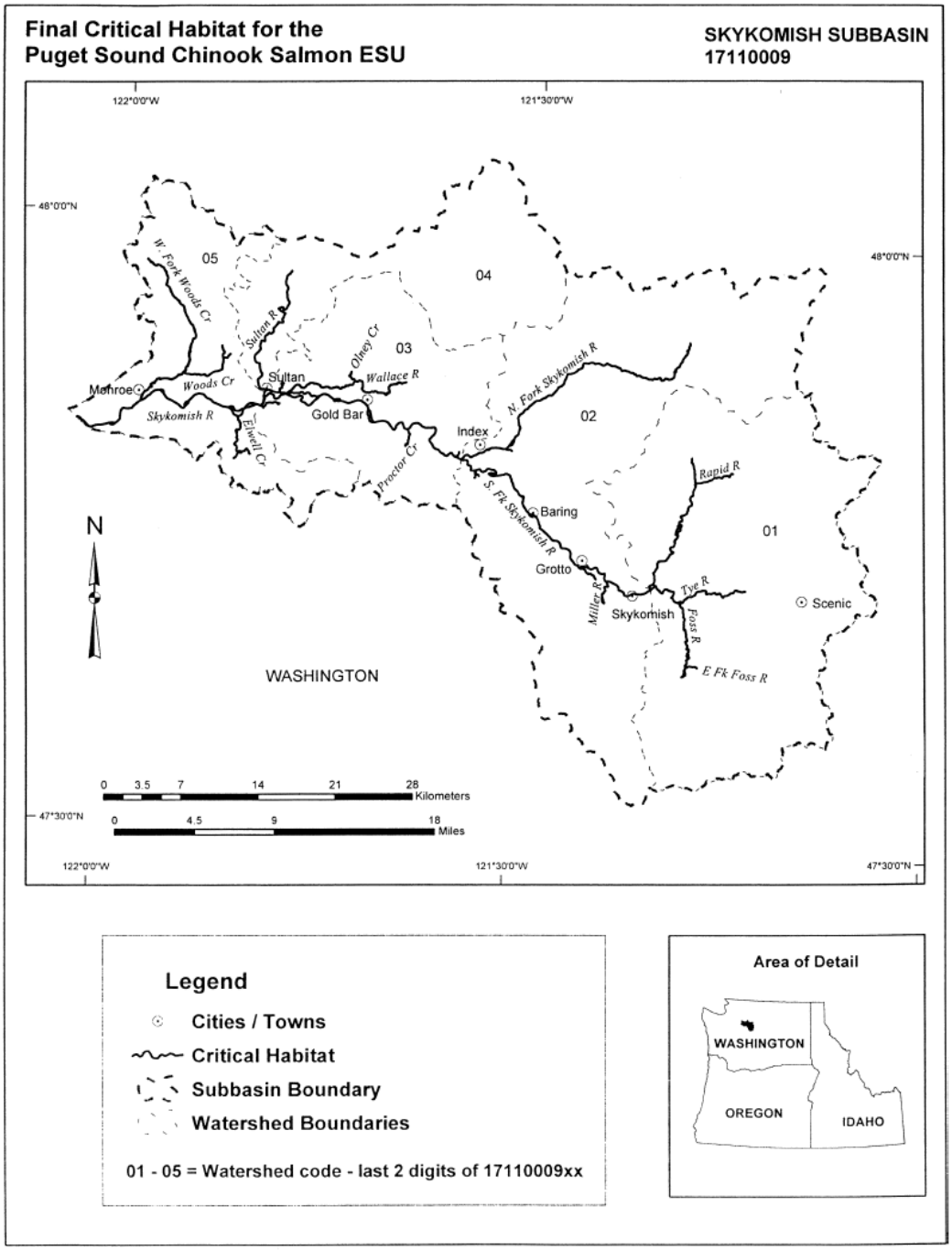


Figure 8 Final critical habitat for the Puget Sound Chinook Salmon ESU (Skykomish Subbasin)

In the September 2, 2005, critical habitat designation (NMFS 2005c), the NMFS further defined Primary Constituent Elements (PCEs) for listed salmon and steelhead as sites essential to support one or more life stages of the ESU (sites for spawning, rearing, migration and foraging). These sites in turn contain physical or biological features essential to the conservation of the ESU (for

example, adequate spawning gravels, water quality and quantity, side channels, forage species). Specifically, the PCEs of critical habitat are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

2) Freshwater rearing sites with:

   (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility,

   (ii) Water quality and forage supporting juvenile development; and

   (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

4) Estuarine areas free of obstruction and excessive predation with:

   (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater,

   (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and

   (iii) Juvenile and adult forage, including aquatic invertebrates and fishes supporting growth and maturation.

5) Nearshore marine areas free of obstruction and excessive predation with:

   (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

   (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

3.1.4 Recovery Plan

The Shared Strategy for Puget Sound published a Puget Sound Chinook Salmon Recovery Plan in December 2007 (Shared Strategy 2007). This plan identifies the Snohomish River basin as

one of five biogeographical regions within the Puget Sound ESU to have unique physical and habitat features that have affected the common evolution of groups of Chinook salmon.

3.2 Puget Sound Steelhead

3.2.1 Range wide Status

NMFS listed Puget Sound steelhead as threatened on May 11, 2007. The Distinct Population Segment (DPS) includes all naturally spawned anadromous winter-run and summer-run steelhead populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive). The majority of hatchery stocks are not part of this DPS because they are more than moderately diverged from the local native populations. Resident *O. mykiss* (rainbow trout) occur within the range of Puget Sound steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 FR 15666; NMFS 2006a). The Puget Sound steelhead DPS includes more than 50 stocks of summer and winter-run fish.

No estimates of historical (pre-1960s) abundance specific to the Puget Sound steelhead DPS are available. Of the 21 independent stocks for which adequate escapement information exists, 17 stocks have been declining and four increasing over the available data series (1977-94) (Busby et al. 1996), with a range from 18 percent annual decline (Lake Washington winter steelhead) to 7 percent annual increase (Skokomish River winter steelhead). The two Basins producing the largest numbers of steelhead (Skagit and Snohomish rivers) both currently have overall increasing population trends.

Hatchery steelhead in this region are widespread, spawn naturally throughout the region, and are largely derived from a single stock (Chambers Creek). Hatchery steelhead are not part of the listed ESU in Puget Sound. The proportion of spawning escapement comprised of hatchery fish has ranged from less than 1 percent (Nisqually River) to 51 percent (Morse Creek) during the period 1984-92 (Busby et al. 1996). In general, hatchery proportions are higher in drainages entering Hood Canal and the Strait of Juan de Fuca than in those entering Puget Sound proper. Most of the hatchery fish in this region originated from stocks indigenous to the DPS, but are generally not native to local river basins (NMFS 2008a).

A majority of the steelhead BRT concluded that Puget Sound steelhead are likely to become endangered within the foreseeable future throughout all or a significant portion of their range (NMFS 2005a) primarily due to habitat degradation, overall low abundance and declining populations trends.

3.2.2 Life Histories and Population Trends

O. mykiss exhibit a remarkable range of life histories. The species can be either anadromous (steelhead) or freshwater resident (rainbow trout), and where the two forms co-occur, the progeny of resident rainbow trout have the potential to become anadromous and the progeny of steelhead have the potential to become resident (Peven 1990). Unlike other species of *Oncorhynchus*, except *O. clarki*, steelhead are capable of spawning more than once before they die (Busby et al. 1996). However, the majority of steelhead spawn only once in their life.

Throughout their range, steelhead populations are regularly classified into two distinct behavioral forms based on the timing of their spawning migration. Summer steelhead enter fresh water in a sexually immature condition and require from several months to a year to mature and spawn. Winter steelhead enter fresh water with well-developed gonads and spawn a short time after river entry. The majority of steelhead in the Puget Sound region are winter steelhead, but summer steelhead are also present in some of the larger river systems (Busby et al. 1996). In basins with both summer and winter steelhead runs, the summer run generally occurs where habitat is not fully utilized by the winter run, or where an ephemeral hydrologic barrier separates them, such as a seasonal velocity barrier at a waterfall. Summer steelhead usually spawn farther upstream.

In general, winter-run steelhead return as adults to the tributaries of Puget Sound from December to April (Washington Department of Fisheries (WDF) et al. 1973). Spawning occurs from January to mid June, peaking from mid April through May. Prior to spawning, maturing adults hold in pools or in side channels to avoid high winter flows. The life history of summer-run steelhead is highly adapted to specific environmental conditions. Because these conditions are not common in Puget Sound, the relative incidence and size of summer-run steelhead populations is substantially less than that for winter-run steelhead. Summer-run steelhead have also not been widely monitored, in part, because of their small population size and the difficulties in monitoring fish in their headwater holding areas.

In the Skykomish River Basin, most winter steelhead spawn in the mainstem Skykomish, North and South Fork Skykomish Rivers, and the Sultan River. Peak spawning generally occurs from mid-February to mid-June (WDFW 2002). The WDFW considers the status of the Skykomish winter steelhead stock to be "depressed" based on chronically low escapements and a long-term negative trend in spawning escapement of adult steelhead. From 1986 to 2003, natural winter steelhead escapement to the Sultan River averaged 567 fish (Table 4). According to WDFW (2002), data are total escapement estimates based on redd counts in index areas on the Sultan River (RM 0.0 to 9.0). Surveys were incomplete due to high water in 1992 and 1993, 1996 and 1997, as well as 2002 and 2003.

Table 4 Natural winter steelhead spawning escapement in the Sultan River

Year	Total Escapement
1986	866
1987	559
1988	742
1989	1,466
1990	333
1991	711
1992	Incomplete survey
1993	Incomplete survey
1994	448
1995	446
1996	Incomplete survey
1997	Incomplete survey
1998	376
1999	311
2000	261
2001	286
2002	Incomplete survey
2003	Incomplete survey
Average	567

(Source: WDFW 2002)

There are no adequate abundance trend data for Skykomish summer steelhead, so their status remained “unknown” in 2002 (WDFW 2002). Escapement is not monitored, nor has an escapement goal been developed. Spawning is thought to take place in the upper reaches of the North and South Forks of the Skykomish River, which would be typical for summer steelhead; however, specific spawning locations are still unknown.

3.2.3 Critical Habitat

Proposed critical habitat for Puget Sound steelhead is currently under review by NMFS. Steelhead use most of the same habitat areas as Chinook salmon, although run timing, time of

spawning, and length of freshwater residence are different. Steelhead are not estuary reliant like Puget Sound Chinook. When Puget Sound steelhead critical habitat is designated, it is likely therefore, to include about the same area as was designated for Chinook, although the estuary may not be included. Our analysis of effects on steelhead includes project effects on possible steelhead PCEs to provide an understanding of the probable effects to potentially designated steelhead critical habitat.

3.3 Southern Resident Killer Whale

The Southern Resident Killer Whale is addressed separately in Appendix 1 at the end of this biological opinion and essential fish habitat consultation.

3.4 Significant Factors Influencing Rangewide Status

Puget Sound Chinook

Factors influencing the rangewide status of Puget Sound Chinook salmon include a variety of human activities that have degraded extensive areas of Chinook salmon spawning and rearing habitat in Puget Sound. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development, water supply, and flood control projects have negatively affected habitat in several basins. Extensive urbanization has caused direct loss of riparian vegetation and soils, significantly altered hydrologic and erosion rates and processes by creating impermeable surfaces (roads, buildings, parking lots, sidewalks, etc.), and polluted waterways. Watershed development has also increased sedimentation, raised water temperatures, decreased LWD recruitment, decreased gravel recruitment, reduced river pools and spawning areas, and dredged and filled estuarine rearing areas. Large areas of lower river meanders (formerly mixing zones between fresh and salt water) have been channelized and diked to protect agricultural, industrial and residential development (NMFS 2008a, page 27). In addition to these habitat impacts, hatchery practices have had adverse genetic and life history effects on listed species, and led to competition between naturally produced and hatchery fish. Over-harvest has also reduced abundance throughout the ESU.

Puget Sound Steelhead

The principal factor leading to the decline of Puget Sound steelhead is the destruction, modification, or curtailment of its habitat or range. Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetland and riparian habitats, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitats in Puget Sound. Existing regulatory mechanisms inadequately protect steelhead habitats, as evidenced by the historical and continued threat posed by the loss and degradation of nearshore, estuarine, and lowland habitats, due to agricultural activities and urbanization. In addition, ocean and climate conditions can have profound impacts on the continued existence of steelhead populations (NMFS 2007).

3.5 Summary of Range wide Species Status

The current status of Puget Sound Chinook salmon and Puget Sound steelhead, as described above, indicates that the species-level biological requirements of these ESUs and DPSs are not being met at this time. The abundance of each of these species remains far below historical levels. This information clearly indicates that substantial improvements in survival rates

(assessed over the entire life cycle and throughout the range of the ESUs and DPSs) are necessary to increase abundance to meet species-level biological requirements of the ESA-listed ESUs and DPSs in the future. Because the effects of hydroelectric and flood control projects have been identified as significant factors for decline, it is reasonable to expect that a portion of the needed survival and recovery improvement should be reflected in future operations at the Jackson Hydroelectric Project.

4. ENVIRONMENTAL BASELINE

4.1 Biological Requirements within the Action Area

NMFS describes the environmental baseline in terms of the biological requirements, and habitat features and processes necessary to support all life stages of each listed species within the action area. Our criteria of biological requirements that describe a VSP include 1) the abundance sufficient to withstand periodic environmental downturns, 2) the productivity (return rate) necessary to maintain or increase a population of fish, 3) the distribution throughout a geographic area that is large enough such that ecological disasters would not likely eliminate the entire population, and 4) a genetic diversity approaching the historical diversity of the population. With the exception of killer whales, each listed species considered in this Opinion resides in or migrates through the Sultan River. Thus, for this action area, the biological requirements for Chinook salmon and steelhead are the habitat characteristics that support successful completion of spawning, rearing, or freshwater migration. Although Southern Resident killer whales are not present in or near the action area, any potential impacts to Chinook salmon or its critical habitat would also indirectly affect the whales because Chinook salmon are preferred prey of killer whales in inland waters of Washington State during spring, summer and early fall.

4.2 Environmental Baseline within the Action Area

The environmental baseline within the action area includes the “past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all the proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR §402.02). The environmental baseline describes the status of the species and the factors currently affecting the species, including the past and present configuration and operation of the Project, within the action area. The resulting "snapshot" of the species' health within the action area provides relevant context for evaluating the anticipated effects of the proposed actions on the ESU's/DPS’s likelihood of survival and recovery relative to its biological requirements.

4.2.1 Habitat and Fish Distribution within the Action Area

The Sultan River has a watershed area of about 110 square miles. The Sultan River Basin is bounded on the east by the Cascade Mountains, on the north and south by lateral ridges extending westward from the Cascade crest, and on the west by the Puget Sound lowlands. Elevations in the basin range from the 6,617-foot summit of Del Campo Peak to 130 feet msl at the confluence of the Sultan and Skykomish rivers.

Downstream of Culmback Dam (RM 16.5), the Sultan River flows through a deep gorge for nearly 14 miles. The steep side-slopes above the channel are densely forested with conifer and

mixed deciduous growth. The river channel in this reach is relatively high gradient and confined, containing numerous cascades and rapids separated by short pool-riffle stretches. Much of the streambank is sheer rock face or large rock cuts. The Sultan River diversion dam is located at RM 9.7 within this confined reach. Near RM 3, the Sultan River emerges from the canyon reach onto a broad, relatively flat valley floor containing intermittent stands or strips of deciduous trees, underbrush and some mixed conifers. The river channel in this reach has a moderate gradient with a number of split channel sections.

Because of the steep topography in much of the basin and intense precipitation, the Sultan River, by nature, is a very "flashy" system, subject to rapid changes in flow The Sultan River basin annually averages 163 inches of rainfall with variations as high as 214 inches and as low as 120 inches. November, December, and January experience the most intense rainfall with monthly averages of 27, 21, and 23 inches, respectively. Daily precipitation in excess of 8 inches is not uncommon. The maximum measured daily rainfall of 11.57 inches was measured on November 11, 1990.

During storm events, the Project is operated such that it provides incidental flood control (i.e., an indirect outcome of the result of operating the Project for the other beneficial purposes). Spada Lake is the only structure on the Skykomish River system that provides flood control and one of only two flood control storage structures in the Snohomish River system. The shapes of the rule curves and the guidelines for operation were specifically designed to minimize flooding on the Sultan River. The resource agencies and the Corps were consulted during the development of the current License's operating plan, which was approved by the FERC in 1996. While the alteration of peak flows in the Sultan River by Project incidental flood control operations has contributed to some undesirable effects on fish habitat (such as narrowing of the channel and loss of some side channel habitat) (Stillwater Sciences and Meridian Environmental, Inc. 2008b, page 14), it has also benefited Chinook and pink salmon through reduced redd scour.

However, in some years, inflow from higher than normal precipitation during August, September, or October can increase the risk of spill in October (rather than in November). These October spill events may disrupt Chinook salmon spawning. However, there is a reduced risk of uncontrolled spill following Chinook salmon fall spawning and steelhead spring spawning.

The frequency, magnitude, and duration of high flow events (peak flood flows) in the Sultan River below Culmback Dam have been reduced under Stage II operations. While this flow regulation has allowed the establishment, persistence, and in some cases proliferation of salmon below the diversion dam, it has also reduced the active channel area and affected the creation and maintenance of side channels in the 3-mile alluvial reach of Sultan River (Reach 1). Specifically, the Physical Processes Study (Stillwater Sciences and Meridian Environmental Inc. 2008b, pages 48 and 49) concluded:

- Vegetation encroachment in the lower alluvial reach has been an unforeseen consequence of flow alteration. Riparian vegetation has reduced the active channel area in the alluvial reach by 32 percent since Stage II operations began.

- Side channels in the Sultan River are relict features, a consequence of vegetation encroachment into formerly active channels of the river.

Under current conditions, the recurrence interval for spill events from October through April is about 2.7 years, or about 37 percent chance of spill each year.

Modeling suggests that in October (the peak of Chinook salmon spawning), spill would occur slightly more frequently under proposed operations than under existing conditions (6 compared to 4 of 109 modeled years), but the magnitude would be smaller, averaging 1,035 cfs under existing conditions, but 785 cfs under proposed operations. The average duration of each spill event would be about the same (4 days) under both existing conditions and proposed operations. Although spill is relatively rare under existing conditions, reducing the average spill magnitude should result in similar or less disruption of Chinook salmon spawning. Steelhead spawn later in the year, but may also benefit from reductions in the average spill magnitude.

The reduction in peak flows has likely benefited pink salmon, as evidenced by the dramatic increasing trend in spawner abundance over the last 20 years. The Sultan River proportion of the total basin run has increased substantially since Stage II construction and spawner density in the Sultan River is greater than for the Snohomish River Basin as a whole, further suggesting the current Project operations benefit pink salmon

The rugged topography of the Cascade Mountains and foothills dominates the Snohomish River Basin, and lands used for timber production or forest recreation account for 74 percent of the basin area. Agriculture comprises 5 percent of the basin area, with farms covering the floodplains of the Snohomish River valley. The second largest land use in the basin (at 17 percent) is rural residential development, which is scattered across the foothills and valleys.

The Sultan River provides spawning and rearing habitat for several listed and non-listed anadromous fish species, including Chinook, coho, pink, and chum salmon; steelhead; and coastal cutthroat trout. Bull trout have not been observed spawning in the Sultan River; however, they are known to use the river as rearing/foraging habitat. Each of these species has access to the Sultan River from its mouth to the City of Everett's diversion dam, a man-made barrier to upstream migration located at RM 9.7. Culmback Dam (RM 16.5) is located upstream of the historical anadromous zone near RM 16 (Ruggerone 2006, page 13). Fish migration has been partially blocked at the Marsh Creek Slide since 2004. Passage at this obstruction is gradually improving according to the District's most recent surveys.

As a component of a 1983 Settlement Agreement with Washington Department of Fish & Wildlife (WDFW), NMFS, the Tulalip Tribes, and the City of Everett, the District agreed to fund WDFW to annually plant 30,000 fin-clipped steelhead smolts in the Snohomish River Basin to compensate for lost anadromous habitat upstream of the diversion dam. Currently, both summer-run and winter-run steelhead smolts are released during the summer near the powerhouse and at the mouth of the Sultan River.

Under existing conditions, listed Chinook and winter-run steelhead spawn and rear in the entire river reach downstream of the diversion dam. Presumably, bull trout could also use the river for foraging and over-wintering.
During Project relicensing, the District completed 12 aquatic resource studies designed to describe the current distribution of anadromous and resident species within Project-area water bodies and to evaluate the quality and quantity of available habitat potentially affected by Project

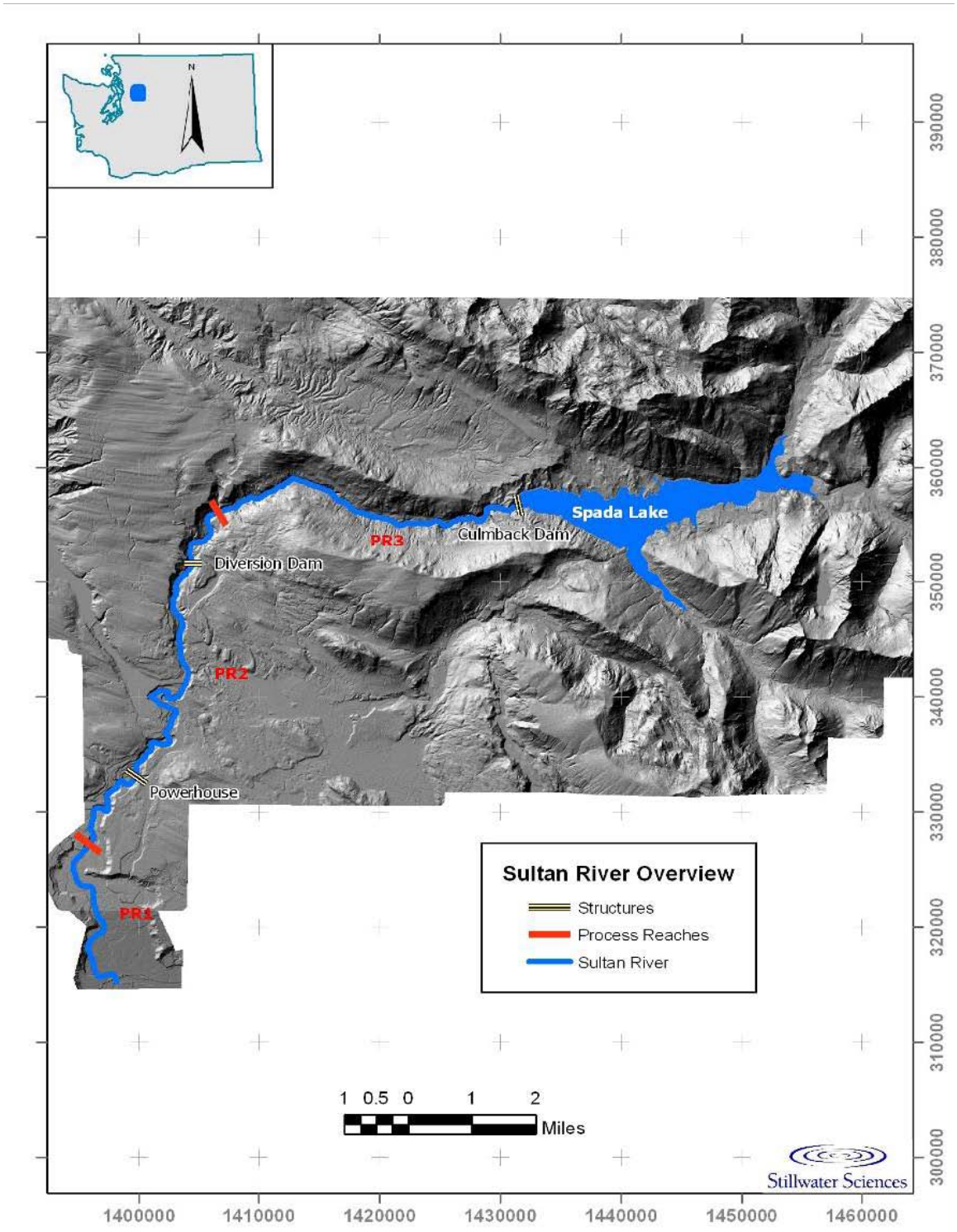
operations in the lower Sultan River. In the following sections, the physical features and aquatic habitat condition in the lower Sultan River and listed fish distribution within the action area are summarized.

Listed Salmonid Habitat

The following description of aquatic habitat in the Sultan River is derived from field surveys conducted in 2007, and unless otherwise cited, is summarized from R2 Resource Consultants (2008a) and Stillwater Sciences and Meridian Environmental (2008a).

The Sultan River from Culmback Dam to its confluence with the Skykomish River flows through three distinct process reaches (PR). The lowermost process reach (PR-1) is a low gradient alluvial valley that includes a broad floodplain (RM 0 to 3) (Figures 9). A terrace-bounded valley process reach (PR-2) extends from RM 3 to RM 11, and a relatively high gradient V-shaped valley reach (PR-3) extends from RM 11 to RM 16.5. The lower Sultan River can also be divided into three operational reaches (Reach 1, Reach 2, and Reach 3) demarcated by physical structures that regulate flow (i.e., the powerhouse, diversion dam, and Culmback Dam), and therefore, aquatic habitat availability in the lower Sultan River. Because Project operations largely dictate habitat quantity within the lower Sultan River, habitat is summarized in this section by operational reach and not by habitat process reach.

The summary below focuses on the type and relative amount of habitat within each operational reach. The effects of Project minimum flows on aquatic habitat quantity are presented in Section 6.1.



Source: Stillwater Sciences and Meridian Environmental (2008b, page 2).

Figure 9 Overview of the Sultan River Basin process reaches and operational reaches (demarcated by the powerhouse, diversion dam and Culmback Dam).

Water Quality and Quantity

Sultan River Flows

Flow data is available from U.S. Geological Survey (USGS) gage no. 12137800 located 900 feet downstream of the Sultan River diversion dam at RM 9.7 (Sultan River diversion dam gage) and from USGS gage no. 12138160 located just downstream of the powerhouse at RM 4.5 (powerhouse gage). Additionally, the District maintains records of reservoir elevations, generation at the powerhouse, and outflows from Culmback dam. Historic flow data is provided in Table 5.

Table 5 Monthly discharge statistics (cfs) for the Sultan River. (Source: USGS, 2009)

USGS gage no. 12137800 Sultan River below Sultan River diversion dam (7/1/1983 – 6/30/2008)

	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Mean	156	117	161	217	349	167	209	217	234	217	217	159
Median	114	115	158	176	134	122	167	173	198	198	195	161
Max.	2,120	260	1,630	4,410	16,600	2,000	6,870	1,520	3,300	980	1,280	473
Min.	96	35	96	133	67	76	79	132	140	173	126	69
10% Exceed.	167	151	190	251	524	270	291	260	270	260	228	209
90% Exceed.	100	98	100	159	101	100	112	155	179	179	179	101

USGS gage no. 12138160 Sultan River below powerhouse (7/1/1984 – 6/30/2008)

Mean	413	273	345	636	1302	1094	1040	891	751	733	718	710
Median	297	225	300	374	1300	1100	928	774	556	575	601	550
Max.	1,910	1,020	1,480	5,500	20,100	3,300	2,680	2,990	4,870	1,980	2,020	1,990
Min.	169	157	159	183	214	183	191	214	210	219	214	188
10% Exceed.	790	385	557	1,530	1,821	1,707	1,707	1,600	1,500	1,470	1,397	1,450
90% Exceed.	194	180	193	238	268	379	368	344	329	312	333	280

Project operations largely control Sultan River flows below Culmback dam, except for additional flows contributed by a few minor tributaries and during large multiple storm events that cause spill. Based on project water routing and minimum stream flow requirements, the Sultan River

basin downstream of Culmback dam can be divided into three distinct operational reaches (Figure 10) from upstream to downstream: operational Reach 3 from Culmback dam (RM 16.5) to the Sultan River diversion dam (RM 9.7); operational Reach 2 from the Sultan River diversion dam (RM 9.7) to the powerhouse (RM 4.5); and operational Reach 1 from the powerhouse (RM 4.5) to the Skykomish River (RM 0.0). Existing minimum stream flow requirements are summarized in Table 6.

Table 6 Sultan River minimum flow requirements. (Source: District 2009)

Date	Point of Compliance [a]	Minimum Stream Flow (cfs)
All Year	Culmback dam valve release	20
11/1 – 1/15	Sultan River diversion dam gage	95
1/16 – 2/28	Sultan River diversion dam gage	150
3/1 – 6/15	Sultan River diversion dam gage	175
6/16 – 9/14	Sultan River diversion dam gage	95
9/15 – 9/21	Sultan River diversion dam gage	145
9/22 – 10/31	Sultan River diversion dam gage	155
6/16 – 9/14	Powerhouse gage	165
9/15 – 6/15	Powerhouse gage	200[b]

(a) There is currently no streamflow gage in the bypassed reach downstream of Culmback dam. Cone valve discharge was verified by the USGS on August 28, 1990 for Culmback dam discharge. Compliance points for minimum flows below the Sultan River diversion dam and project powerhouse are USGS real-time gages 12137800 and 12138160, respectively.

(b) If flows at the powerhouse gage exceed 400 cfs during the Chinook spawning period (9/15 – 10/15), the District releases higher minimum stream flows during the subsequent incubation period to protect spawning redds from being dewatered.

Winter Steelhead Fishery Recreational Flow

In addition to managing flows specifically for aquatic resources, the District provides recreational opportunities for steelhead anglers by controlling flows during winter steelhead

fishing season (December through February). When powerhouse discharges have resulted in flows greater than 700 cfs for 14 consecutive days, as measured at the powerhouse gage, the District reduces the powerhouse discharges in accordance with the downramping requirements to provide a streamflow of 700 cfs or less from noon on Saturday until Sunday midnight. The total flow reduction period is 36 hours and allows steelhead anglers to access the river under favorable flow conditions during the weekend of the flow reduction. Criteria triggering this recreational flow include:

- Spada Lake water surface elevation must be below 1,435 feet and decreasing;
- Meteorological and hydrological forecasts for the Snohomish River Basin must be favorable; and
- The U.S. Army Corps of Engineers (Corps) must not object if Spada Lake will still be in State 2 of the rule curve.

Seasonal Sultan River Flows

The 20 cfs minimum flow release from Culmback dam, infrequent spill events from Spada Lake, and contributions from a few small drainages combine to supply flow to the Sultan River in the 6.8 mile-long bypassed reach (Reach 3). In addition to the constant 20 cfs minimum flow release from Culmback dam, accretion flows in Reach 3 are variable and normally range from about 10 to 2,000 cfs, depending on precipitation and runoff.

Streamflows downstream of the Sultan River diversion dam in Reach 2 are a combination of releases from Culmback dam, accretion flows in the bypassed reach, and return flows from the Lake Chaplain pipeline. Additional flow is contributed to this reach from Marsh and Chaplain Creeks and a few smaller drainages such as Habecker and Cascade Creeks. As shown in Table 5, flows in this reach are relatively consistent and have a limited range of variation between the 90 percent and 10 percent exceedance values.

Downstream of the powerhouse in Reach 1, flows are largely the result of outflow from the powerhouse and inflow from reach 2. Woods, Ames, and Winters Creeks contribute additional flow. As shown in Table 5, flows in this reach have a higher variability than those in reach 2; the lowest flows commonly occur in July through September, and the highest flows occur in November and December. During the past 23 years under existing project operations, peak flows below the powerhouse have exceeded 10,000 cfs twice, reaching 22,300 cfs in water year 1991 and 14,000 cfs in water year 1996.

Flow Fluctuations – Ramping

The District conducted field studies in 1985 and 1986 on the effects of the rate of flow decreases (downramping) on young salmonids. The results of this study were used to set the existing downramping requirements downstream of the powerhouse (Table 7 & 8, later in section 5.1 A-LA 5). In 2004 and 2005, the District conducted an additional assessment of project operational effects on ESA-listed salmonids. Following informal consultation with NMFS, WDFW, and the Tulalip Tribe, ramping rates downstream of the Sultan River diversion dam were voluntarily adopted by the District that range from 1 to 6 inches per hour (Tables 7 & 8).

Most downramping occurs when the reservoir is in state 3, which is the operational discretionary zone. If downramping occurs during the twilight period (one hour before to one hour after sunrise or sunset), the lower of the two stipulated day or night rates is used. This precautionary guideline minimizes the potential for stranding during the twilight hours when the juvenile fish are shifting their diurnal behavior patterns. Additionally, because the project is not operated on a load-following basis, powerhouse discharges to the river do not fluctuate frequently on a daily basis.

Water Use

Project facilities are also used to deliver water supply to the city of Everett's reservoir (Lake Chaplain), in accordance with an agreement between the District and the city. The District holds a water right authorizing diversion of 556 cfs and 240,200 acre-feet per year from the Sultan River for power generation (Certificate No. S1-00732C, priority date May 3, 1946); and the District and the City jointly hold a second water right authorizing diversion of 1,500 cfs and 506,800 acre-feet per year of water from the Sultan River for power generation and municipal water supply purposes (Certificate No.
S1-23398C, priority date June 15, 1979). The current water demand by the city is 84 million gallons per day or about 130 cfs, and that demand is expected to rise in the future. No other substantial use of project-related water occurs in the project area.

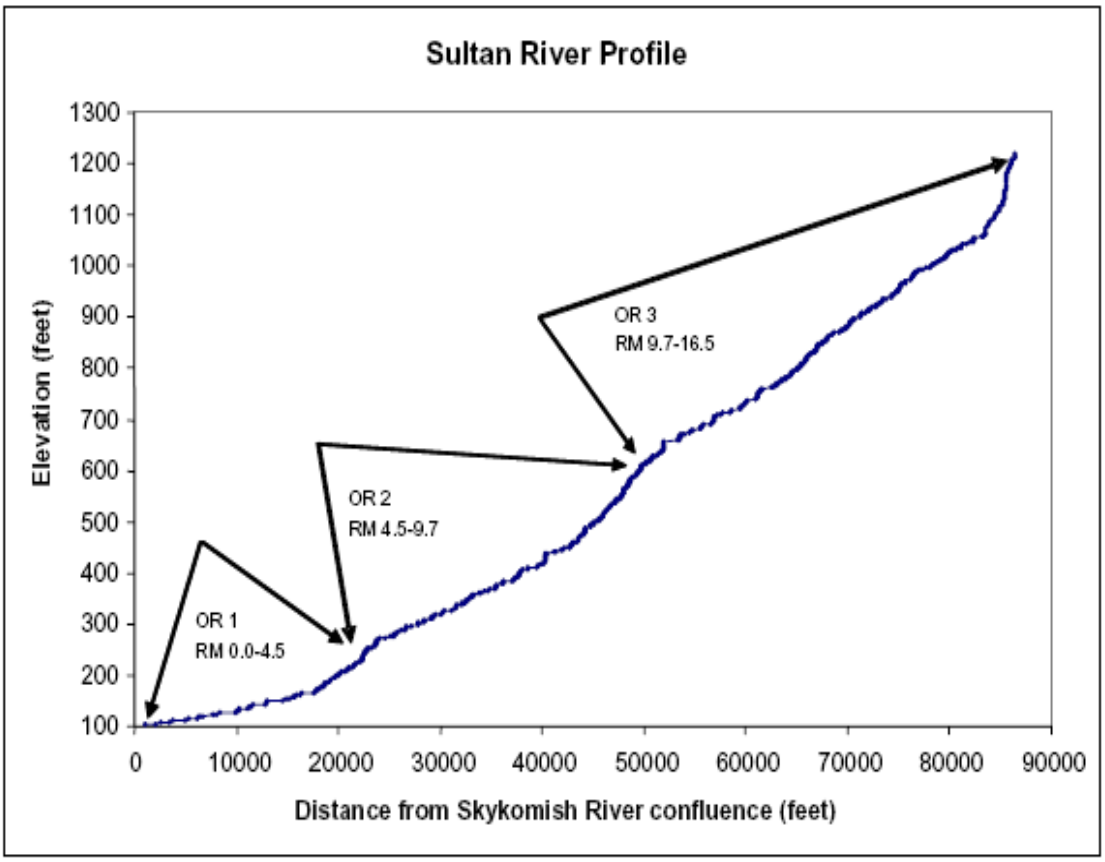
Under existing conditions, the water released to Reach 3 of the Sultan River from the valve at the base of Culmback Dam ranges from 3 to 6 degrees Celsius (ºC) year round. As a result, water temperatures in the upper end of Reach 3 are 5 to 8 ºC colder than optimal for resident rainbow trout during the spring and summer months. The cold-water influence extends downstream almost to the diversion dam. The low densities of rainbow trout in this reach are likely the result of these low temperatures. The reservoir effects on water temperatures are attenuated prior to reaching the diversion dam. Ambient water temperatures in Reaches 1 and 2 are therefore suited to salmonid reproduction and propagation.

Stream flows are mostly regulated by the project. Under the proposed action, the District will release a minimum flow of 20 to 70 cfs to Reach 3 from Culmback Dam to the diversion dam according to time schedule and fish passage, 100 to 200 cfs below the diversion dam depending on season and Spada Lake level, and 300 cfs to Reach 1. Process flows in the form of spill up to 6,500 cfs are planned for 10-year intervals. Flushing flows from 400 to 1500 cfs are planned twice per year. Additional upstream and downstream migration flows ranging from 400 to 1,200 cfs are planned once or twice annually. Unregulated spill is expected to constitute part of the flows in excess of minimum flows, but in the absence of spill, the regulated discharges will be released. Table 5 presents the mean monthly flows in Reaches 1 and 2.

Operational Reach 3

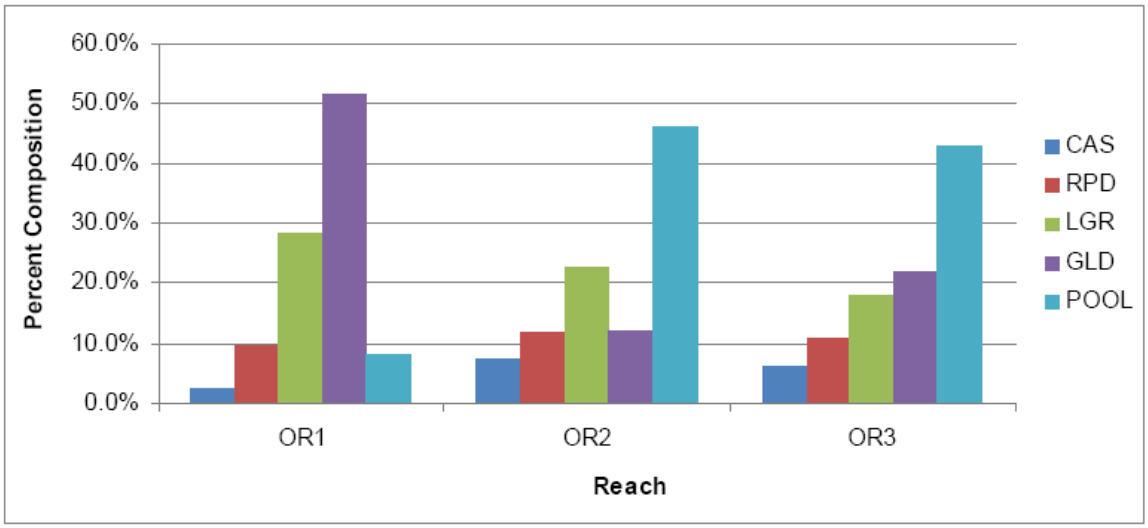
Reach 3 (the Project bypass reach) is best described as a high gradient, highly confined bedrock gorge characterized by higher rates of sediment transport compared to downstream reaches. The channel is about 6.8 miles long and gradients range from 0.7 to 13.7 percent, averaging 1.6 percent. Channel gradient becomes progressively steeper in upper portions of the reach, with the highest gradient near Culmback Dam (Figure 10).

Aquatic habitat within Reach 3 is primarily pool and glide habitat types (65 percent) (Figure 11). Most of the pool habitat units (38 of 45) are controlled by bedrock formations. Channel substrate is generally coarse with boulder, bedrock, cobble, and large gravels as the dominant substrates. Due to safety concerns, the 0.7-mile reach of Reach 3 below Culmback Dam was not examined during the 2007 survey and is therefore not included in the habitat type percentages.



Source: Stillwater Sciences and Meridian Environmental (2008b, page 9)

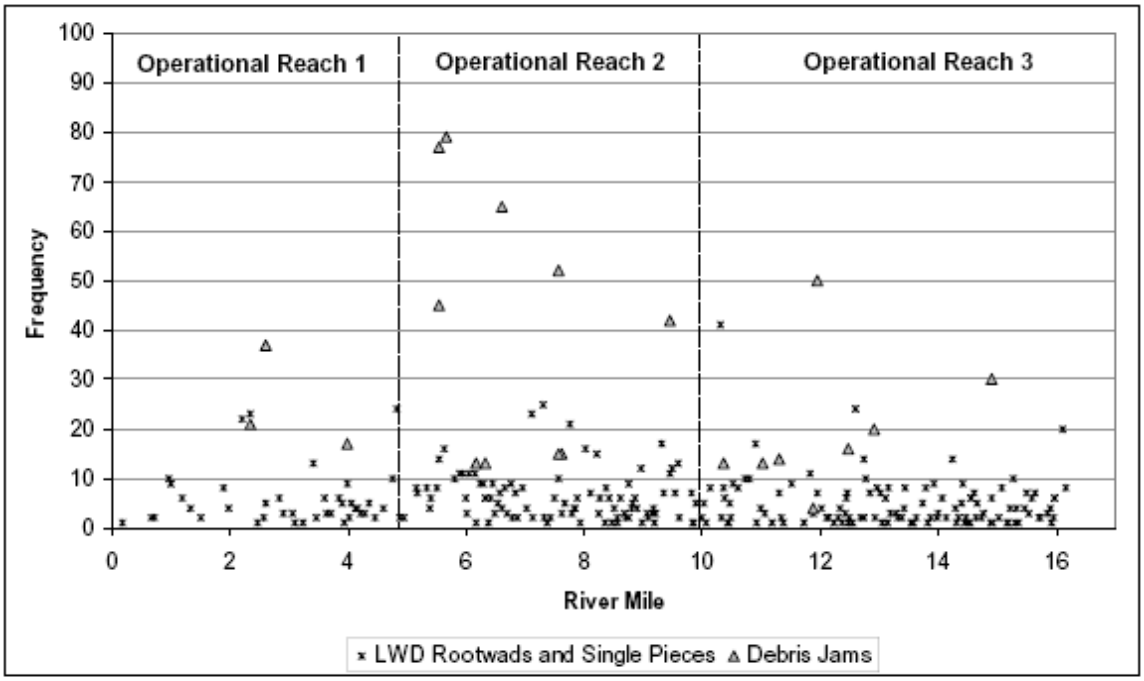
Figure 10 Profile of Sultan River channel gradient from the confluence with the Skykomish River upstream to Culmback Dam



CAS=cascade, RPD=rapid, LGR=low gradient riffle, GLD=glide
Data Source: Stillwater Sciences and Meridian Environmental (2008a, page 21)

Figure 11 Composition of habitat types by operational reaches of the Sultan River

The active channel width in Reach 3 averages about 50 feet. Main channel pools average 263 feet in length, cascades average 140 feet in length, and glides and low gradient riffles average 215 and 250 feet in length, respectively. Islands are rare, likely reflecting the limited tendency of gravel deposits and vegetation to accumulate in this reach that is subject to scouring flood flows. Eight LWD jams are found within Reach 3. Five Hundred Fifty pieces of LWD were noted in Reach 3, but only 112 individual pieces were characterized as over 2 feet in diameter, giving a LWD frequency of 102 pieces per mile. (Figure 12)



Debris jam frequency value indicates the number of individual pieces in each jam.
Source: Stillwater Sciences and Meridian Environmental (2008a, page 28)

Figure 12 Distribution and frequency of surveyed LWD within the Sultan River downstream of Culmback Dam

Operational Reach 2

Reach 2 is about 5.4 miles long and largely confined within a narrow deep canyon with channel gradients ranging from 0.7 to 3.4 percent. Reach 2 was characterized by frequent main channel pools separated by numerous low gradient riffles. Habitat composition is primarily pools (45.9 percent) and low gradient riffles (22.7 percent) (Figure 11). More than two-thirds (43 of 60) of the pool habitat units were controlled by bedrock and boulder substrates. Channel substrates were primarily boulder, bedrock, cobble, and large gravels. The active channel width averaged nearly 70 feet. Main channel pools averaged 318 feet long. On average, low gradient riffles were 230 feet long. Glides and rapids averaged 190 and 201 feet long, respectively.

Of the 10 LWD jams found in Reach 2, two were notably large (each containing nearly 80 pieces) with 586 pieces of woody debris (Figure 12). Only 55 individual pieces were characterized as over 2 feet in diameter. LWD frequency was 196 pieces per mile in Reach 2.

On December 11, 2004, a landslide occurred within a narrow canyon segment of Reach 2 just downstream from Marsh Creek at RM 7.6. The landslide, referred to as the Marsh Creek slide, temporarily blocked or reduced the upstream passage of adult anadromous salmonids. Two high-flow events of up to 3,560 cfs subsequently occurred in the river in November 2006 and March 2007. The high flows from these events cleared some of the rocks and all of the exposed woody debris from the slide area, and somewhat improved fish passage conditions. However, the slide remains an impediment to Chinook passage and the unstable slope that created the slide remains prone to future mass-wasting events. Ruggerone (2008, page 1) suggests that steelhead, Chinook and coho salmon could potentially swim through the cascade created by the landslide when flows are at least 107 cfs. Analysis indicates that pink and chum salmon are unlikely to be able to pass through this area. Ruggerone (2008, page 14 to 16) concluded:

- The present configuration of the Marsh Creek cascade appears to block the migration of most Chinook salmon as evidenced by the presence of Chinook below the slide at flows that previously allowed passage (105 to 165 cfs and above), but absent upstream. Summer steelhead have the greatest opportunity to pass the Marsh Creek cascade because they encounter the slide under favorable passage conditions during their upstream migration period. Although the cascade may hinder summer steelhead migration, it is likely that most are able to negotiate the cascade in its present configuration.

- Many winter steelhead are likely to negotiate the cascade, but additional observations of spawning steelhead during spring are needed for verification.

- It is likely that the Marsh Creek cascade is a modest impediment to coho salmon, but some coho pass above the cascade.

- Pink and chum salmon are unlikely to pass over the cascade.

- Significant changes occurred at the Marsh Creek cascade following high flow events in November 2006 and March 2007. Additional change is possible at flows exceeding 3,500 cfs.

- The right bank cliff above Marsh Creek cascade, which rises vertically in unconsolidated material about 200 feet, remains unstable. It is probable that another large landslide will occur in the Marsh Creek area and that fish migration would be further affected until high flows remove soil, boulders, and large wood.

Operational Reach 1

Reach 1 is about 4.3 miles long. The upper-most 1.6 miles are deeply incised and largely confined within a bedrock canyon. Widths in this section range from 40 to 160 feet and channel gradients range from 0.7 to 2.9 percent (Figure 10). The lower 2.7 miles of the reach are largely unconfined within a broad floodplain and a number of split channel sections have formed. Channel gradients range from 0.2 to 0.7 percent. Active channel widths range from 60 to over 200 feet.

Aquatic habitat within Reach 1 was comprised mostly of glide (51.7 percent) and low gradient riffle types (28.4 percent) (Figure 11). Glides and low gradient riffles averaged 463 and 295 feet in length, respectively. Channel substrate in the lower portion of Operational Reach 1(OR-1)

was predominately large and small cobble, coarse gravel, and boulder. The number of LWD pieces was lower per mile than the two upstream reaches; 35 individual pieces over two feet in diameter were identified and the frequency of LWD was 80 pieces per mile.

Reach 1 is the only reach that contains side channel habitat. There are three major (over 1,000 feet long) and several minor side channels within Reach 1. Only the three large side channels support unrestricted fish access (R2 Resource Consultants 2008a, page 3-5). The total length of all side channel habitats is about 0.9 miles and accounts for 4.7 percent of the length of all riverine habitat surveyed. Side channel habitat was composed nearly equally of glides (54 percent) and low-gradient riffles (46 percent).

Listed Salmonid Distribution

Puget Sound Chinook

Information describing the spatial and temporal distribution of Chinook salmon in the Sultan River was collected in the mainstem Sultan River in 2007 and 2008 as part of the Sultan River Juvenile Fish Occurrence, Life History and Distribution study (R2 Resource Consultants 2009, page 53). In total, over 134,000 juvenile salmonids were observed in the lower Sultan River during the fall survey periods. Only two of these were juvenile Chinook salmon. This finding strongly suggests that a stream-type (over-wintering) life history is absent or uncommon in the Sultan River or that the majority of juvenile Chinook freshwater over-wintering behavior takes place downstream in the Skykomish or Snohomish rivers. Chinook spawning occurs throughout the Sultan River up to the diversion dam, but the highest concentration of redds is observed in Reach 1.

Puget Sound Steelhead

Steelhead spawn and rear in the mainstem Sultan River below the diversion dam. Wild (non-hatchery) steelhead spawn primarily in April and May. The few tributaries in this reach are small and short, thus containing very limited steelhead rearing habitat (CH2M Hill 2005, page 3-9). Hatchery steelhead usually return to the basin from June through January. Steelhead smolts out-migrate from the Sultan River from April through May (CH2M Hill 2005, page 3-9). Based on data collected during the Sultan River Juvenile Fish Occurrence, Life History and Distribution study from 2007 and 2008, the highest densities of juvenile "trout" occurred in July and September in mainstem and side channel sites in Reach 1 (R2 Resource Consultants 2009).

4.2.2 Fish Population Trends within the Action Area

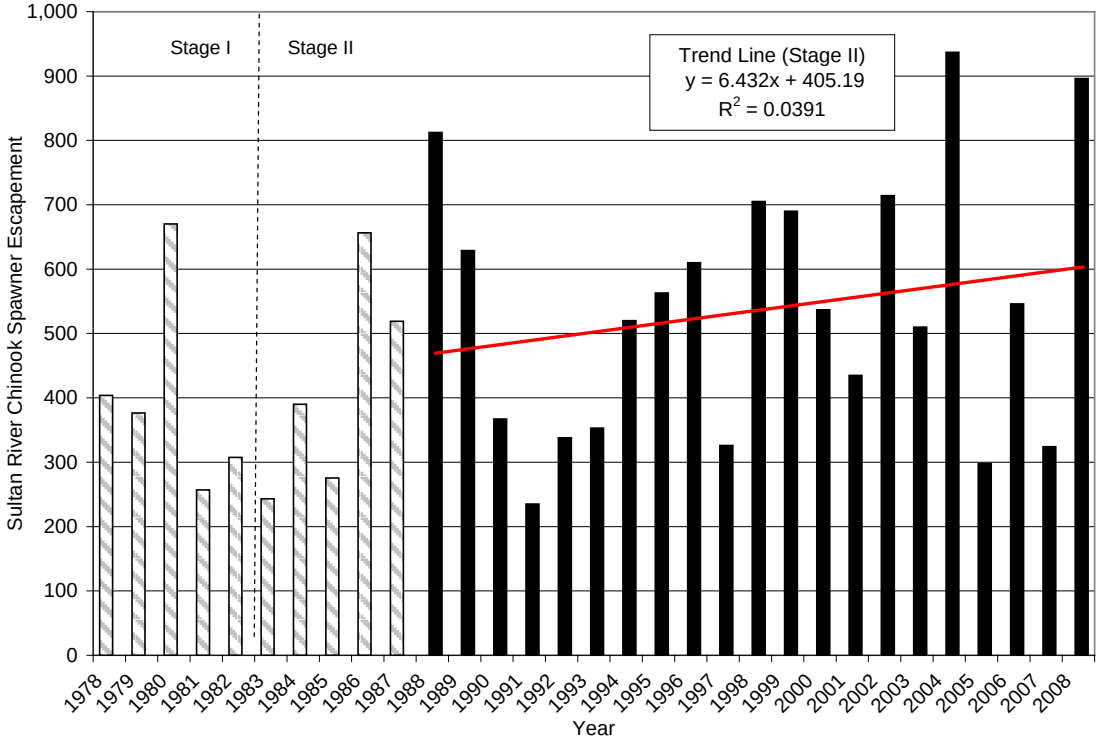
Puget Sound Chinook

The current flow regime in the Sultan River downstream of the diversion dam was implemented in June of 1984 (Stage II of the Project). Chinook spawning in that year were the first brood year influenced by Stage II flows. The adult progeny of spawners from this brood began to return to the Sultan River in 1988. From 1988 to 2008, the Chinook spawner escapement to the Sultan River averaged 540 fish annually (Figure 13), or about 9 percent of the total escapement to the Snohomish River Basin[2], even though the Sultan River contains only about 6 percent known

[2] Based on data from 1988 through 2007.

Chinook spawning habitat in the Snohomish River Basin (Snohomish PUD 2005). From 1978[3] to 1987 (prior to Stage II operations), the Chinook spawner escapement to the Sultan River averaged 410 fish annually (Figure 13).

Although average annual Chinook escapement to the Sultan River has been slightly higher under Stage II operations, the difference observed between Stage I and Stage II (from 410 to 540 fish) is not statistically significant at $p<0.05$ (P-value = 0.0691, two-tailed T-test assuming unequal variance), due to the high annual variability observed under both stages and the small sample size associated with Stage I monitoring. Comparing Stage I and Stage II escapements is confounded by environmental factors such as water year type, harvest rates, hatchery fish influence, and marine productivity/survival, which vary through time.



Note: Hatched bars depict escapement during Stage I; solid bars show Stage II.

Figure 13 Total Sultan River Chinook spawner escapement 1978-2008.

The Sultan River Chinook escapement data suggest a slightly increasing trend under Stage II conditions over time (Figure 14), although the weak correlation coefficient (R = 0.197) indicates substantial annual variation. In addition, the trend analysis shown in Figure 14 is confounded by stray hatchery fall Chinook derived from programs elsewhere in the Snohomish River Basin. In the late 1990s, the District cooperated with WDFW and the Tulalip Tribes to study stray rates of hatchery-origin fall Chinook salmon in the Snohomish River. Results showed that from 1990 through 2001, about 41 percent of spawning Chinook in the Snohomish River Basin were of hatchery origin. Since production of fall Chinook at the Wallace River Hatchery was curtailed in

[3] Data collection started in 1978.

1998, the natural-origin Chinook trend has increased at a greater rate with less annual variability than suggested by total Sultan River Chinook escapement trends presented in Figure 14, which includes hatchery fish.

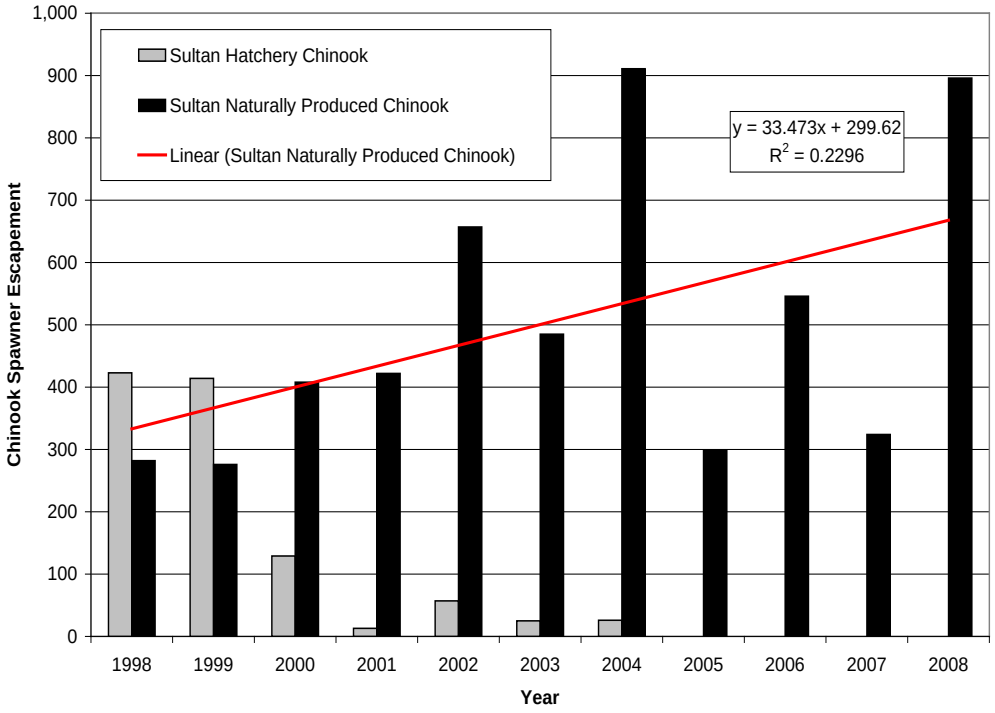


Figure 14 Natural-origin Chinook spawner escapement 1998-2008.

Puget Sound Steelhead

The District and WDFW conduct annual wild winter run steelhead spawning surveys in index reaches between RM 0.0 and RM 9.7. Between 1993 and winter of 2007/2008, annual escapement estimates have ranged from 66 to 574 adult spawners (Figure 15). Although the period of record is short, the Sultan River winter steelhead escapement averages about 4 percent of the total Snohomish River Basin escapement (range 2 to 9 percent), while the Sultan provides about 5.4 percent of the available steelhead spawning habitat in the Snohomish River Basin.

Available data suggest that both Sultan River and Snohomish River Basin steelhead escapement have declined since regular surveys began in 1993 (Figure 15 and 16), and the escapement goal of 6,500 spawners for the entire Snohomish River Basin has not been achieved since 1995. From 1989 to 2006 (with 12 years of data), Sultan River and Snohomish River Basin steelhead escapement estimates have only a moderate degree of correlation (correlation coefficient [R] = 0.50), i.e., trends in yearly variation between the Sultan River and Snohomish River Basin steelhead escapement do not closely follow each other (Figure 16).

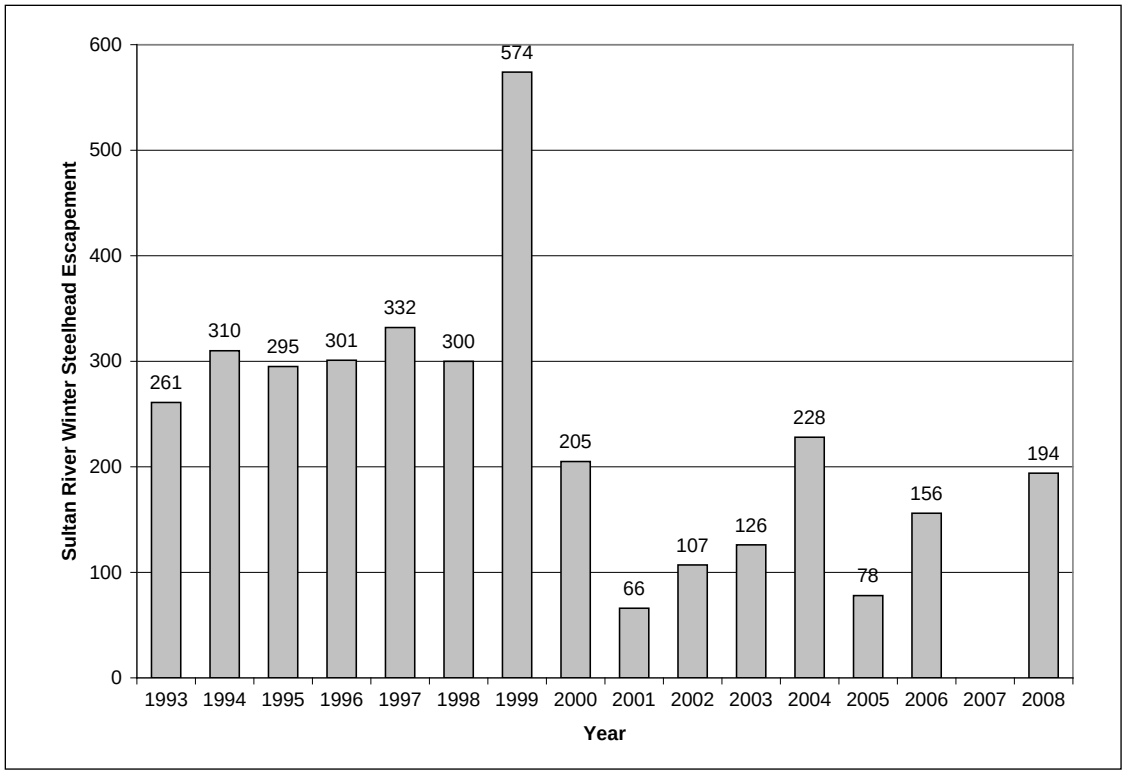


Figure 15 Sultan River steelhead spawning escapement 1993-2008 (no data for 2007).
Source: Snohomish PUD 2009a

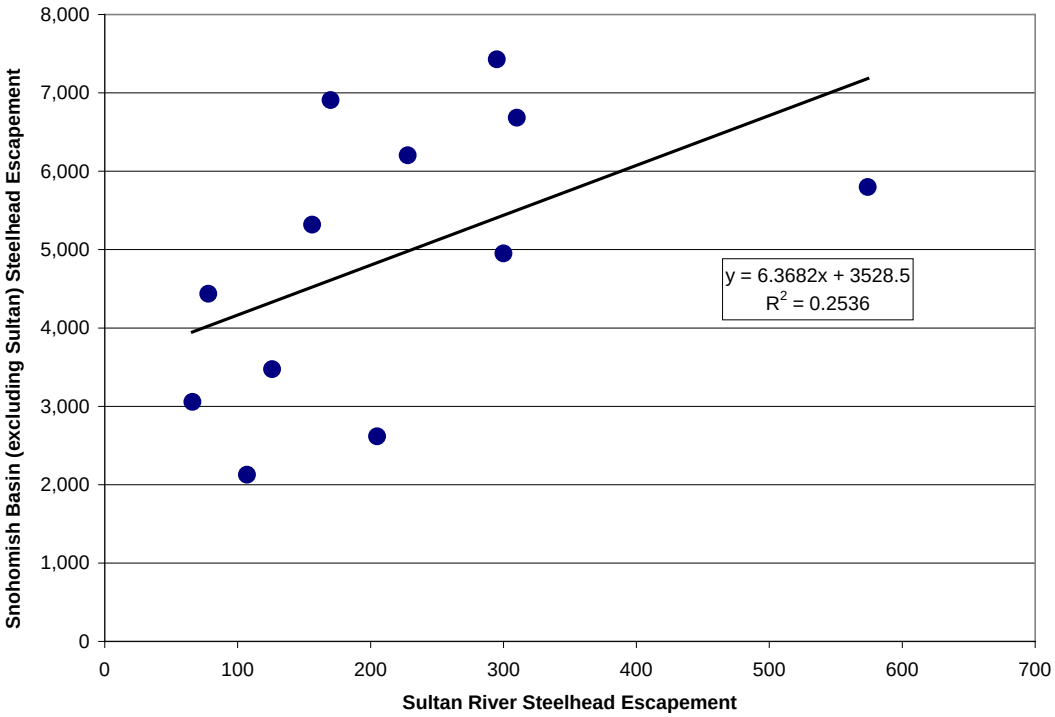


Figure 16 Sultan River vs. Snohomish River Basin (excluding Sultan River) steelhead correlation under Stage II conditions (1989-2006); no data for some years. (Source Snohomish PUD 2005)

In 2007, the District conducted a cutthroat trout population survey the Sultan River bypass reach (Reach 3) (Normandeau and TRPA 2008). Subsequent genetic analysis confirmed that all sampled trout were rainbow trout (no cutthroat trout were observed during sampling). Based on these study results, there appears to be a self-sustaining and naturally reproducing population of rainbow trout in the bypass reach. Studies have shown that resident rainbow can produce anadromous off-spring (Burgner et al. 1992, p. 6), which could contribute to steelhead recruitment downstream of the diversion dam. However, Mullan et al. (1992, page K-427) found evidence that in very cold streams, juvenile steelhead had "difficulty attaining mean threshold size for smoltification" and concluded that "most fish in their sampling area [Methow River, Washington] that did not emigrate downstream early in life were thermally fated to a resident life history regardless of whether they were the progeny of anadromous or resident parents."

4.2.3 Factors for Decline within the Action Area

Puget Sound Chinook

Abundance of Chinook in the Sultan River is driven by several environmental factors within and outside the action area, such as water year type, harvest rates, hatchery fish influence, and marine productivity/survival. Within the Sultan River, Project operations have affected the quality and quantity of Chinook spawning and rearing habitat. Land use development has constrained the

lower Sultan River floodplain. Timber harvesting in the basin has likely increased fine sediment in spawning reaches and reduced large woody debris recruitment potential from the riparian zone. The City of Everett's diversion dam and Culmback Dam block access to historical spawning habitat. The Marsh Creek slide currently hinders Chinook upstream migration to spawning habitat. Regardless of these factors, over the last decade, abundance data indicate an overall increasing trend of natural-origin Chinook spawners in the Sultan River (see Figure 14).

Puget Sound Steelhead

Similar to Chinook, steelhead abundance in the Sultan River is driven by several environmental factors within and outside the action area, such as water year type, harvest rates, hatchery fish influence, and marine productivity/survival, and the factors for decline in the Sultan River are likely the same as listed for Chinook. However, the causes for the recent reduction in steelhead escapement to the Sultan River are unknown (see Figure 15).

4.3 Status of Critical Habitat within the Action Area

4.3.1 Chinook Salmon

In this section, we assess the function of the Sultan River in the action area at providing Chinook critical habitat PCEs (shown below in italics) related to freshwater. Estuarine and marine PCEs are not present within the action area and are not influenced by the Project. The existing condition of the Sultan River is rated as "properly functioning", "impaired", or "not properly functioning". The effect of the proposed action on the critical habitat PCE conditions is further assessed in Section 5.3.

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development

Chinook successfully spawn in the lower Sultan River and display an increasing trend in natural-origin adult spawner abundance over the last decade. However, Project operations have reduced the quantity and quality of Chinook spawning habitat in the Sultan River. The Marsh Creek slide reduced access to spawning habitat. Therefore, this PCE is impaired in the Sultan River.

2) Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility

(ii) Water quality and forage supporting juvenile development

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks

Chinook rear seasonally in the Sultan River before outmigration, and habitat either in the Sultan and/or the Snohomish/Skykomish rivers downstream is currently functioning at a level sufficient to sustain an increasing trend in natural-origin adult spawner abundance over the last decade.

However, existing Project operations have reduced side channel habitat quantity and quality, and floodplain connectivity. Woody debris and complexity is relatively low. Therefore, this PCE is impaired in the Sultan River.

3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival

This PCE is apparently functioning at a level that supports an increasing trend in natural-origin adult spawner abundance over the last decade. However, the Marsh Creek slide blocks access to spawning and rearing habitat upstream. Large woody debris abundance is relatively low. Side channel habitat connectivity is impaired by existing Project operations. Therefore, this PCE is impaired in the Sultan River.

4.3.2 Steelhead

Critical habitat for Puget Sound steelhead has not yet been designated.

4.4 Climate Change

Unless otherwise cited, the following section is adapted from NMFS (2008a).
Ongoing and future climate change has the potential to alter aquatic habitat throughout the Puget Sound. These effects would be expected to be evidenced by alterations of water yields, peak flows, and stream temperatures. Other effects, such as increased vulnerability to catastrophic wildfires, may occur as climate change alters the structure and distribution of forest and aquatic systems. Given the increasing certainty that climate change is occurring and accelerating (IPCC 2007, page 98; Battin et al. 2007, 6720), one can no longer assume that climate conditions in the future will resemble those in the past.

In Washington State, most models predict warmer air temperatures, increases in winter precipitation, and decreases in summer precipitation. Average temperatures are likely to increase between 1.7°C and 2.9°C (3.1°F and 5.3°F) by 2040 (Casola et al. 2005, page 10). Warmer air temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes, seasonal hydrology will shift to more frequent and severe early large storms, changing streamflow timing and increasing peak river flows, which may limit salmon survival (NMFS 2008a).

In a study to predict impacts of climate change on salmon habitat in the Snohomish River Basin, model results indicate a large negative effect on freshwater salmon habitat driven by increased winter peak flows that scour the streambed and destroy salmon eggs (Battin et al. 2007, page 6722). Higher water temperatures, lower spawning flows, and higher magnitude of winter peak flows are all likely to decrease salmon productivity in the Snohomish River Basin and in hydrologically similar watersheds throughout the region. This is expected to make recovery targets for these salmon populations more difficult to achieve. Recommendations to mitigate the adverse impacts of climate change on salmon include 1) restoring connections to historical floodplains and freshwater and estuarine habitats to provide refugia for fish and storage for excess floodwaters; 2) protecting and restoring riparian vegetation to ameliorate stream

temperature increases; and 3) purchasing or applying easements to lands that provide important cold water or refuge habitat (ISAB 2007, pages 85 and 86; Battin et al. 2007, page 6723). Higher ambient air temperatures will likely cause water temperatures to rise (ISAB 2007, page 16). Salmon and steelhead require cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. In addition, as climate change progresses and stream temperatures warm, thermal refugia will be essential to persistence of many salmonid populations. Thermal refugia provide important patches of suitable habitat for salmon and steelhead that will allow them to undertake migrations through or to make foraging forays into areas with greater than optimal temperatures. To avoid waters above summer maximum temperatures, juvenile rearing may increasingly be found only at the confluence of colder tributaries or other areas of cold-water refugia.

There is still a great deal of uncertainty associated with the timing, location and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007, page 12); however, several studies indicate that climate change has the potential to affect ecosystems in nearly all tributaries throughout the state (ISAB 2007, page 29; Battin et al. 2007, page 6722; Rieman et al. 2007, page 1560). The cumulative effects from land use change combined with climate change may further hinder salmon survival and recovery. Additionally, these effects may reduce prey availability for Southern Resident killer whales.

The City of Everett has analyzed the impacts of the various climate change scenarios. This analysis indicates that the proposed rule curves along with adaptive management should allow the District to respond to the uncertainties of climate change.

5. ANALYSIS OF EFFECTS OF THE PROPOSED ACTION TO ISSUE A NEW FERC LICENSE

Effects of the Proposed Action

Effects of the action' means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

We evaluated the effects of the proposed action on listed Puget Sound Chinook and Puget Sound steelhead in the context of their biological requirements, as described in Section 3, including the effects of the Proposed Action on individual members of and on the Sultan River populations as a whole, as well as on the primary constituent elements of critical habitat designated for Puget Sound Chinook.

As stated earlier, we are providing a more detailed explanation of the proposed action in this section so the reader can more easily follow the discussion of the effects since they are specific to each proposed license article.

5.1 Effects on Listed Fish Species

As described in Section 2.2.3, 24 proposed measures described in the DEA/Settlement (Table 2) have the potential to modify how the Project affects listed fish species and their designated or proposed critical habitat as described in the environmental baseline. The following sections discuss the anticipated effects of each of the measures specified in Table 2, as well as the effects of the Jackson Off-License Supplementation Program Agreement and Lake Chaplain Tract Land Management Off-License Agreement on ESA listed Chinook and steelhead, actions that are considered interrelated with the proposed action.

A-LA 1 Aquatic Resource Committee

Any new license issued by FERC for the Jackson Hydroelectric Project will include a number of protections, mitigation, and enhancement measures intended to enhance aquatic habitat and biota in the Sultan River (i.e., minimum instream flows, fish passage, LWD enhancement, side channel enhancement, etc). The implementation of these measures has the potential to affect ESA listed Chinook, steelhead, and bull trout; the City of Everett's dependable water supply; recreational fishing; whitewater boating; public and private property; and other resources.

Under A-LA 1 of the Settlement Agreement, the District establishes an Aquatic Resource Committee (ARC) for the purpose of consultation during the development and implementation of environmental measures pertaining to aquatic resources. The proposed ARC consists of representatives from the Settlement Parties; however, the Settlement Agreement provides that the committee may grant any other entity membership status on the committee by unanimous agreement.

Development of the ARC would create a forum in which representatives from various stakeholder groups share their expertise in developing and implementing management and monitoring plans, interpreting monitoring results, and adapting management strategies based on the monitoring results and regional salmon recovery efforts. The proposed composition of the ARC would include representatives of the District, Federal, State, and local agencies, the Tulalip Tribes, and American Whitewater. These entities have participated in the ILP and are familiar with the issues and deliberations regarding proposed environmental measures. Because the ARC includes members representing NMFS and USFWS, we expect that this measure will be beneficial to listed Chinook, steelhead, and bull trout. No quantitative estimate of the effect of this measure is possible.

A-LA 2 Marsh Creek Slide Modification and Monitoring

On December 11, 2004, the Marsh Creek landslide blocked or reduced the upstream passage of adult anadromous salmonids upstream of RM 7.6 in Reach 2 of the Sultan River. The Marsh Creek slide deposited a significant volume of large rock and debris in the river, temporarily blocked flows, and created a high-gradient constricted channel at the debris location that blocked or severely reduced upstream fish passage. Two high-flow events of up to 3,560 cfs subsequently occurred in the river in November 2006 and March 2007. The high flows from these events cleared some of the rocks and all of the exposed woody debris from the slide area, and some limited improved fish passage conditions through the original slide area occur under these existing conditions. However, the slide remains an impediment to Chinook population growth and the unstable slope that created the slide remains prone to future mass-wasting events.

As a component of the Settlement Agreement, the District filed a Marsh Creek Slide Modification and Monitoring Plan (A-LA 2). This plan was developed in consultation with the settlement group and includes: provisions for establishing a permanent survey control point or benchmark within the Marsh Creek slide area of the Sultan River, a schedule and methods for conducting a detailed baseline physical survey at low flow, provisions for establishing a schedule and methods for modifications of the size and location of specific rocks in the slide area if the committee determines modifications are necessary to enhance fish passage, provisions for continuation of annual spawner escapement monitoring upstream of the slide area to evaluate fish passage following implementation of any modifications within the slide area, provisions for conducting visual inspections of the slide area following flow events exceeding 4,000 cfs, provisions for conducting post-modification physical surveys, a schedule and provisions for conducting future modifications after the initial modification, and provisions to file a post-modification report with the FERC that documents methods used to modify the slide.

Under A-LA 2, the District's obligations would be limited to a one-time effort to improve fish passage past a periodically occurring natural barrier. If this effort is not effective (as defined by the License Article), the ARC would have the ability to approve funding for additional corrective measures through the Fish Habitat Enhancement Plan's Habitat Enhancement Account (A-LA 12).

The District would use funds from the habitat enhancement account to implement additional modifications if: (1) the Aquatic Resource Committee concludes more changes are necessary to enhance fish passage; (2) initial or subsequent modifications cause further slides or blockages; or (3) the annual escapement of Chinook salmon and steelhead in the Sultan River diversion dam index area (RM 9.2 to 9.7) does not exceed 10 percent of the total annual escapement of Chinook salmon or steelhead in all four index areas in the Sultan River below the Sultan River diversion dam in any one year. This second criterion would also be used to trigger the design of the initial slide modification method. Any additional modifications would be subject to availability of habitat enhancement account funds and if the ARC determine there is a Project nexus to the barrier.

Under existing conditions, Project operations may limit flows that would be high enough to flush large rocks from the slide area and restore fish passage. The primary impediment to upstream fish migration within the slide area is a turbulent, 16-foot-long, two-step chute/small pool/falls with a 46-percent gradient and a channel width of 10 to 20 feet. Effective modification of the slide would provide safe, timely, and effective access to 2.1 miles of salmon and steelhead habitat up to the diversion dam, and an additional 6.6 miles of historically available habitat upstream of the diversion dam after passage is provided at that structure (as described in A-LA 13). If successful, NMFS expects that this measure would increase Chinook salmon and steelhead production in the Sultan River by allowing these species to fully use available habitat and production capacity upstream of the Marsh Creek slide.

However, implementation of physical modifications to the channel would require some instream and slope stabilization work. Disturbance or modification of the channel could result in short-term turbidity and sedimentation, at a minimum, and depending on the method chosen for channel modification, may result in disturbance, injury, or mortality to listed Chinook salmon and steelhead. The District would employ best management practices to control turbidity and

sedimentation during instream work and timing this work to avoid periods when more sensitive life stages of fish are present to reduce the potential for take.

The District has monitored spawner escapement since the 1990s, and proposes to continue to monitor escapement and conduct smolt trapping throughout the term of a new License (fish and fish habitat monitoring are discussed in detail later in this section). The monitoring data would serve as the basis for detailed planning for the initial physical modifications of the slide area. In addition, the monitoring data would determine if escapement upstream of the Marsh Creek slide area increases as a result of the initial physical modifications. The District's proposed approach to triggering initial and future physical modifications would be based on measurable biological criteria. If the criteria are met, then potential environmentally disruptive instream work could be avoided.

While the Settlement Parties developed proposed A-LA 2 to work in conjunction with the habitat fund established pursuant to A-LA 12 (which was not recommended by the FERC in the DEA), the source of funds used to maintain fish passage at the Marsh Creek slide would have no effect on ESA-listed fish species. In addition, the USFS includes A-LA 12 in preliminary 4(e) condition 2. Consequently, unless the USFS modifies this condition, funding for future Marsh Creek slide modifications (if deemed necessary) would be included in any new License issued for this Project.

Slightly modifying the Settlement Agreement's Marsh Creek Slide Monitoring and Modification Plan to include provisions for filing a report within 180 days of completion of the initial 6-year slide modification monitoring period specifying whether additional slide modifications are proposed (as recommended by the FERC) would also have no effect on ESA-listed fish species.

Slide modification may cause an insignificant amount of take during work, but the net effect will be either neutral, if passage is not improved, or beneficial, if passage is improved. Additional Chinook and steelhead production in the stream reach between the Marsh Creek slide and the diversion dam has the further potential of triggering provision of fish passage at the diversion dam and increased instream flows in the bypass reach, further enhancing Chinook and steelhead production in the Sultan River.

A-LA 3 Temperature Conditioning in Reach 3

Under the Settlement Agreement, the District proposes to develop and implement a Water Temperature Conditioning Plan to provide more seasonally appropriate water temperatures for spawning and rearing salmonids and other aquatic biota in Reach 3 (A-LA 3). The plan would include temperature conditioning regime targets for the water release points and the downstream end of Reach 3 (i.e. near the diversion dam) from April through October. These targets would be set at the suitable temperature ranges to benefit salmonids and other aquatic resources, and would comply with applicable state water quality standards. The District would also monitor the biological response of salmonids and other aquatic resources (including other fishes and macroinvertebrates) to the temperature conditioning for the term of the License.

The water temperature-conditioning program would be implemented in two phases:

Phase I would begin immediately upon License issuance and would consist of modifying some of the existing flow release structures at the base of Culmback Dam to release up to 70 cfs through the 10-inch cone valve (45 cfs), hydro unit (5 cfs), and new 12-inch cone valve on the existing auxiliary water line (20 cfs). Due to constraints on the intake elevation of the existing auxiliary water line, Phase I conditioning could only occur when reservoir elevations are greater than 1,410 feet msl, and during periods of reservoir stratification, typically April through October.

Phase II would consist of installing a floating inlet collector combined with a flexible conveyance system that would allow water withdrawal from the top of the Spada Lake to provide greater flow release and temperature conditioning opportunities than would be possible under Phase I. The Phase II improvements would allow for temperature conditioning when the reservoir is stratified and at an elevation greater than 1,380 feet msl. The Phase II improvements would be designed to accommodate a minimum 165-cfs release of temperature-conditioned water when the reservoir elevation is at 1,430 feet msl. Phase II is intended to condition the higher minimum flows that would be provided in Reach 3 following the construction of any volitional fish passage facilities at the Sultan River diversion dam. Accordingly, Phase II would be implemented by the earlier of: (1) 2 years after the date that volitional fish passage modifications are completed at the Sultan River diversion dam; or (2) January 1, 2020.

The temperature conditioning blending ratios for both phases would be determined by temperature monitoring at the water release points, the downstream end of Reach 3, Spada Lake, and other suitable locations.

The District used the Stream Segment Temperature Model (CH2MHill, 2009) to evaluate the potential effects of the proposed conditioning measure on water temperatures in Reach 3. The model results indicate that conditioned releases from Culmback Dam would raise the daily mean water temperatures during the summer under existing conditions from 5.5ºC to about 14ºC below Culmback Dam, and from about 11.8ºC to as much as 13.3ºC at RM 9.8 just upstream of the Sultan River diversion dam. These temperatures would be within the optimum conditions for salmonid growth. The results of the modeling also indicate that the summer 7-DADMax water temperatures throughout Reach 3 would be less than the state criterion for Core Salmonid Habitat of 16°C during typical summer conditions.

Under current conditions, the year-round water temperatures downstream of Culmback Dam range between 3 and 6°C. These low water temperatures may prolong egg incubation, delay larval development, and retard rainbow trout growth throughout most of Reach 3. Improved water temperatures under Phase I would likely increase macroinvertebrate production and improve fish growth, condition, and survival. If fish passage facilities are eventually constructed at the diversion dam (see A-LA 13), the improved water temperatures realized under Phase II would also improve habitat conditions for ESA-listed steelhead and Chinook salmon.

The effectiveness of water temperature conditioning in Reach 3 would be determined by the monitoring of both water temperature and the aquatic community included in the Water Temperature Conditioning Plan. The effect of A-LA 3 is beneficial and essential to realizing the productivity value of Reach 3.

A-LA 4 Whitewater Boating Flows

Under A-LA4, the District will develop and implement a plan to provide flows for 12 viable whitewater boating events every 3 years for the duration of a new License with sufficient advance notice to whitewater boaters. Proposed whitewater flows would range from 600 to 2,000 cfs for at least 3 hours. During each 3-year period, the District would provide a firm total water budget of 2,100 acre-feet of water to ensure that 12 viable whitewater events occur. If the 2,100 acre-feet of water budget in combination with controlled and uncontrolled flow releases (i.e., spill) and accretion flows is not sufficient to achieve 12 viable whitewater events during each 3-year period, the District would provide a reserve budget of 1,200 acre-feet to ensure that such events occur.

The ARC would annually coordinate scheduling of the April, May, and September whitewater flow releases and the proposed process flows discussed in A-LA 8. Any combination of the proposed whitewater recreation flows could be used to satisfy the requirements of the proposed process and migration flows, as long as the timing, duration, and magnitude are greater than or equal to the proposed process and migration flows, and vice versa.

Operations to facilitate whitewater boating could affect listed anadromous fish in two ways: By stimulating migrations, or by causing entrapment and stranding by rapidly reducing flows. By following the proposed downramping schedule, whitewater boating operations are expected to minimize entrapment and stranding of salmonids. Overall, both the whitewater recreation flows (600 to 2,000 cfs for 3 hours) and the process flows (400 to 1,500 cfs for 3 to 6 hours) would not adversely affect migratory salmonids (including ESA-listed Chinook, steelhead, and bull trout) and aquatic habitat in the Project-affected reaches. Any potential adverse effects of the whitewater flow releases on Federally listed fish will be reduced by using timing restrictions developed in consultation with the Aquatic Resource Committee. The effect of A-LA 4 is expected to be neutral to Chinook and steelhead.

A-LA 5 Downramping Rate Conditions

Rapid reductions in river flow associated with hydroelectric Project operations have the potential to strand fish and other aquatic organisms in pools, off-channel habitats, and low-gradient gravel bars (often resulting in immediate or delayed mortality) (Hunter 1992, page 5). Fry and juvenile fish less than 2 inches long are particularly vulnerable to stranding due to their weak swimming ability; preference for shallow, low-velocity habitat, and side channels; and a tendency to burrow into the substrate. In addition to stranding, Project-related flow change can also dewater redds, alter habitat use, and adversely affect the production of macroinvertebrates.

Limits governing the rate, timing, and number of Project-induced flow changes are often established at hydroelectric projects to protect aquatic organisms, including ESA-listed fish species. Different ramping rate requirements are appropriate for different times of the year depending on the species and life stages present and the prevailing flows.

Releases from the Jackson powerhouse (i.e. discharge through the Pelton turbines) largely control flow levels in the Sultan River downstream of RM 4.5. Historically, if the turbines were tripped off line due to mechanical/electrical failure or load rejection, a rapid reduction in flow would occur in Reach 1 of the Sultan River. To address this source of rapid downramping in

Reach 1, the District recently installed and is currently testing a new Pelton unit flow continuation system. This new automated system is designed to minimize the risk of excessive downramping events during an emergency shutdown.

Under A-LA5, the District will operate the Project within specified downramping rate limitations to reduce the potential for harmful effects on aquatic resources. These downramping rates would not apply to power-generation equipment failures, forced outages, or modification to flow releases when downstream flood conditions are occurring. However, the District plans to maintain staff at the powerhouse during potential electrical storms, the event most likely to trigger an emergency powerhouse shutdown, until the new Pelton bypass system has proven to be effective.

In addition to the above measures, the District proposes to institute a salmon ceiling flow of 550 cfs (mean daily discharge measured at the powerhouse gage) during the September 15 to October 15 period of peak spawning for Chinook salmon, unless natural accretion flows or Spada Lake inflow supersedes the District's hydraulic control of the Project. This ceiling would ensure that redds remain wetted should Project flows be reduced to the minimum flow of 300 cfs before the end of the egg incubation and fry emergence period.

The District would use spawner survey information on an annual basis to determine the highest elevation and the corresponding flow at which spawning has occurred during the Chinook salmon and steelhead spawning seasons. Based on this information, the District would attempt to keep redds covered with water until fry emergence has occurred. The Aquatic Resource Committee can adjust the spawning flow ceiling and corresponding minimum flow based upon approval.

The District would track downramping rates in Reaches 1 and 2 on a 15-minute basis by monitoring the Sultan River diversion dam gage and powerhouse gage. No one 15-minute downramping value would exceed half the hourly rate shown in the specified downramping schedules (Tables 7 and 8). In addition, no four consecutive 15-minute downramping rates, in total, would exceed the hourly rates shown in the schedules.

Table 4 provides the schedule for the powerhouse downramping rates when the flow is less than 1,500 cfs (the Critical Flow below which stranding is likely to occur) as measured at the powerhouse gage. The District would coordinate the proposed process, special purpose, and whitewater recreation flows to ensure compliance with this schedule.

If river flow prior to downramping exceeded 1,000 cfs for more than 72 hours from January 1 to September 15, the District would downramp through the 750 to 600 cfs flow range only after holding flow constant between 750 and 850 cfs for at least 6 hours of daylight and one overnight period.

With A-LA 5, the District would formally adopt its existing downramping rates for Reach 2 (Table 8). Note that flows below 300 cfs would only be released during drought conditions. The proposed Reach 2 downramping rates would not apply to flushing flows, which would require manual operation of the sluice gate at the Sultan River diversion dam.

Table 7 Downramping rates at the powerhouse gage when total Sultan River flow is less than 1,500cfs.

Flow Range (cfs)	Day (inches per hour)a	Night (inches per hour)
January 1 to May 31		
1,500 - 750	4	4
750 - 600	2	2
600 - 300	2	4
300 - minimum	2	2
June 1 to September 15		
1,500 - 750	2	1
750 - 600	2	1
600 - minimum	2	1
September 16 to October 31		
1,500 - 750	2	1
750 - 600	2	1
600 - minimum	2	2
November 1 to December 31		
1,500 - 750	4	6
750 - 600	2	2
600 - minimum	4	4

Source: District, 2009d

Table 8 Sultan River diversion dam gage downramping rate schedule (inches/hour).[a]

	Day	Night
Jan. 1[b] to May 31	3	3
Jun. 1[b] to Sep. 15[c]	3	1.5
Sep. 16 to Oct. 31	3	3
Nov. 1 to Dec 31	6	6

[a] For normal operations in the flow range between 95 cfs (minimum streamflow) and 300 cfs, not during power generating equipment failures, forced outages, or gravel flushing/enhancement actions requiring manual operation of the sluice gate at the Sultan River diversion dam. Rates are tracked on a 15-minute basis at the Sultan River diversion dam gage. No single 15-minute downramping value should exceed one-half the hourly value shown in the table. The average of four consecutive 15-minute downramping rates should not exceed the hourly rate shown in the table.

[b] Chinook salmon fry emergence schedule is determined yearly in consultation with WDFW.

[c] Avoid any scheduled flow reduction.

The District would limit powerhouse downramping to no more than a total of 48 hours from January 1 through May 31, and no more than 16 hours of the seasonally allotted 48 hours will be allowed in any consecutive 30-day period during the January 1 through May 31 period. The downramping frequency limitations will apply when downramping is greater than 1 inch per hour and flow measured at the powerhouse gage is less than 750 cfs. Ramping will occur for the proposed scheduled high flow events (i.e., process, special purpose, and whitewater recreation flows), but the time required to complete the ramping is not included in the downramping frequency limitations.

For flow releases from Culmback Dam (into Reach 3), the District will attempt, within the constraints of the Project's existing equipment, to limit the downramping rate to no more than 0.5 feet per hour when the proposed process, special purpose, and whitewater recreation flows cause the flow range at the Sultan River diversion dam gage to be greater than 300 cfs but less than 1,000 cfs.

The District will file with the FERC a downramping rate report within 1 year of the completion of the side channel enhancement projects, discussed later in this section. The report would be developed in consultation with the Aquatic Resource Committee, and will evaluate whether additional ramping rate restrictions are necessary to protect juvenile salmonids from stranding.

If Project operations result in an exceedance of the above downramping rate schedules or downramping rate restrictions, the District will notify the members of the ARC and FERC no later than 10 business days after such an incident.

Historically, any emergency shutdown of the Pelton units at the powerhouse had the potential for stranding fry and juvenile salmonids that may have been present in the lower Sultan River – particularly during March through August. Pelton unit shutdown can decrease flow by as much as 650 cfs per Pelton wheel unit over a short period of time in Reach 1 downstream of the powerhouse. Over the last 10 years, there have been nine occurrences of shutdown of the Pelton units; only one of these instances involved both Pelton wheels. During that same 10-year period, there was one occurrence of shutdown from the power tunnel over-velocity sensor that shut down both Pelton wheels and three incidents when the proposed downramping rates were exceeded within a 15-minute period during needle valve changes.

The newly installed Pelton turbine flow continuation system should allow the District to bypass water when the Pelton units are required to shut down operation. The system will also allow the other Pelton unit, if operating or in standby mode, to be operated to reduce rapid flow decreases from a single unit outage (8 of the 10 Pelton unit outages in the last decade were single unit outages). These efforts will help prevent dewatering of redds or stranding of fry during power outages.

The District's proposed mean daily discharge ceiling of 550 cfs during the peak Chinook salmon spawning period (September 15 to October 15) should prevent Chinook spawning in stream areas that could subsequently be dewatered if Project flows are reduced to 300 cfs. The District would use the annual Chinook salmon and steelhead spawning survey and flow data to attempt to keep redds covered with water until fry emergence has occurred. The District's proposed annual downramping report will quantify how successful the District has been in its attempts to keep redds submerged, so that the need for additional protective measures can be identified, if appropriate.

The Aquatic Resource Committee will use the annual downramping report to determine whether additional ramping rate restrictions are necessary to protect fish from stranding in the side channels, once the proposed access to those side channels is restored. With the provisions for ramping rate monitoring and reporting, the specified downramping rate should decrease the

potential for juvenile Chinook, steelhead, and possibly bull trout stranding and mortalities as a result of flow fluctuations.

The District's proposal to measure ramping rates in Reaches 1 and 2 at the existing Sultan River diversion dam and powerhouse gages should be sufficient to document compliance with the proposed ramping rates. Additionally, the District will be able to rely upon USGS Gaging Station No. 12137800, immediately downstream of the diversion dam, to monitor and document compliance with the downramping rate associated with operational releases in Reach 3.

The downramping restrictions are expected to minimize stranding of fish, but incidental stranding occurs because of powerhouse discharge changes even at the lowest downramp rates (R.W. Beck 1989). Mortalities are expected from downramping any time that vulnerable salmonid fry (55 mm length or less) are present. On average, the number of mortalities is expected to be insignificant and negligible, but the cumulative mortalities over the season may not be. Chinook fry emerge from January through April, with most emerging in March. Peak abundance of the most vulnerable juveniles is in March and April. With average Chinook escapements of 567 adults and a range of Chinook smolts from 15,120 to 90,720, as many as 22,000 vulnerable fry may be present during March and April, depending on how rapidly juveniles emigrate downstream. We estimate that a severe downramp event, although not expected, could strand as much as five percent of the fry present in the affected stream reach, or 1134 juvenile Chinook.

The average steelhead escapement of 236 adults could result in about 71,000 fry annually. Juvenile steelhead emerge from July into early October, with most in the vulnerable size range in August and September. Few downramping events are expected during this time period. However, at the same five percent estimate of effect, a severe downramping event could strand up to 1775 juveniles. The important difference between steelhead and Chinook effects from stranding is that juvenile steelhead set up rearing territories within the affected river reach, while juvenile Chinook rear briefly and continue migrating downstream, leaving the potentially affected area.

The effect of A-LA 5 is beneficial to Chinook and steelhead and is expected to minimize losses that in a potentially worst case could approach 1.25% of the Chinook and 1.6% of the steelhead juvenile populations.

A-LA 6 Large Woody Debris

Large woody debris (LWD) is an important component of a healthy river ecosystem and anadromous fish habitat. Large trees that fall into rivers perform an important role in forming pools, regulating storage and routing of sediment, and trapping spawning gravel. LWD also provides complex fish habitat that increases carrying capacity, high-flow refugia for fish, and substrate for macroinvertebrates. The delivery and routing of LWD in the Sultan River has been altered by the presence of Culmback Dam. LWD of sufficient size is either not being recruited from the older second-growth stands found in the bypass reach or it is recruited but not being delivered from stands upstream of Culmback. As a result, the wood loading rate in the lower 3 miles of the Sultan River is substantially less than that observed in unregulated rivers in Washington, and much of the LWD is small- to medium-sized and positioned along the channel

margins (Stillwater Sciences and Meridian Environmental Inc. 2008b). Overall, its role in forming habitats (especially pool habitat) is very limited and there is little wood of suitable size to provide the needed structural complexity that would lead to pool formation. Installing sufficiently-sized LWD structures in the lower river would reduce stream power and create higher-value habitat for resident and anadromous salmonids and other aquatic biota.

A lack of in-channel LWD has also been identified as a major salmonid habitat-limiting factor in the mainstem Skykomish and Snohomish Rivers. According to the Snohomish River Basin Salmon Conservation Plan (Snohomish Basin Salmon Recovery Forum 2005), mainstem channels in the watershed have low levels of LWD and debris jams, contributing to a lack of pools and side channels. The Conservation Plan also notes that it would take at least 50 years for newly established riparian forests to contribute LWD. As a result, structural remedies (engineered logjams and other features designed to increase habitat complexity) are recommended in some locations.

In A-LA 6, the District proposes to develop and implement a LWD Plan that places LWD in the Sultan River, both in the form of engineered structures and by placement of LWD collected at Culmback Dam at appropriate downstream locations. The plan will describe: (1) the design and location of each LWD structure; (2) the LWD installation schedule; (3) the restrictions necessary to minimize adverse effects to public safety and property; (4) the method and schedule for monitoring the effectiveness of the LWD structures; and (5) the method and schedule for moving woody debris accumulated in Spada Lake between Culmback Dam and the log boom to areas targeted for restoration.

Within five years of licensing, and after gaining regulatory approval and legal access, the District would install five to eight LWD structures in the lower Sultan River (RM 0 to 16). Up to five of the initial eight LWD structures would be designed to improve main channel habitat complexity, re-direct flow, carve and create habitat, add diversity, retain and sort sediment, provide salmonid rearing habitat, and provide a medium for use by macroinvertebrates. Up to three of the eight structures would be associated with side channels and would be designed to improve mainstem/side channel connectivity by directing flow into up to three of the five prominent side channels (see Figure 17). The District would install up to four additional LWD structures in the Sultan River beginning 10 years after License issuance.

The specific locations and designs of the LWD structures would be based on the probability of retention and possible risk to property, and would be developed in consultation with the ARC. Each LWD structure would include 5 to 30 structural pieces of fir, hemlock, or cedar of about 24 to 36 inches in diameter (at breast height) and 35 to 40 feet in length (with intact rootwads); larger structural pieces would be used within the transport capabilities of trucks or a Chinook helicopter. The structures would be designed to develop logjams over time. LWD from Spada Lake would be used to build the structures and to provide material for the proposed side channel enhancement projects discussed in the previous section.

As described in Stillwater Sciences and Meridian Environmental, Inc. (2008a, page 37), under existing conditions, the wood loading rate in the lower 3 miles of the Sultan River is substantially less than that observed in unregulated rivers in Washington. While this is likely the

consequence of long-term salvage logging dating back to the late 1800s (Stillwater Sciences and Meridian Environmental, Inc. 2008a, page VI), operation of the Project would continue to block the downstream recruitment of LWD.

Whereas the function of LWD upstream of RM 3.0 is unlikely to change in the foreseeable future (due to the channel's high stream power, confinement, and the small size of available trees), an increase in the quantity of wood downstream of RM 3.0 would likely increase overall physical heterogeneity in that reach, benefiting resident and anadromous salmonids. The LWD structures are expected to increase Chinook and steelhead productivity in the lower Sultan River, which would provide additional forage for bull trout and may increase smolt and spawner escapement.

Most of the LWD structure construction could be accomplished from outside the active channel or when the side channels are dewatered. However, some streambank and in-water work would be needed to secure the structures. In-water work would likely cause short-term turbidity plumes and sedimentation, and may result in limited injury or mortality to fish, particularly young-of-the-year. Settlement Agreement proposed measure W-LA 1, below, includes measures for implementing best management practices to minimize the adverse effects of any instream and upland construction and maintenance activities on aquatic resources, including designated Chinook salmon critical habitat and the potential take of ESA-listed Chinook salmon and steelhead.

Placement of LWD also has the potential to conflict with whitewater boating opportunities by blocking channels or creating conditions that could be unsafe for boaters. This is expected to be a consideration of the ARC, which would include representatives of American Whitewater, during the development of the proposed LWD Plan.

The effect A-LA 6 is expected to be beneficial to Chinook and steelhead.

A-LA 7 Side Channel Projects

Side channels in the lower alluvial reach of the Sultan River provide important spawning and rearing habitat for several species of resident and anadromous salmonids. Juvenile coho in particular are known to make widespread use of off-channel habitats, often gaining access to small streams and backwater environments that are either inaccessible to adult coho or unsuitable for spawning. Side channels are also recognized for their value as summer and winter rearing habitat for cutthroat trout and when regularly and permanently available, provide high quality protected spawning habitat, especially for coho, chum, and pink salmon. In addition, the results of Relicensing Study Plan
(RSP 5) (R2 2009) substantiate the importance of these areas as rearing habitat in the Sultan River for coho, Chinook, and steelhead (R2 Resource Consultants 2009). Annual escapement surveys have also documented the use of side channels for spawning, primarily by chum salmon. As articulated in the Physical Processes Study (Stillwater Sciences and Meridian Environmental 2008b, page 29), flow regulation has reduced the active channel area and affected the creation and maintenance of side channels in the lower Sultan River. The results of the Instream Flow Study (RSP 3) (R2 2008a) indicate that the upstream ends of the three prominent side channels in the lower Sultan River become disconnected from the mainstem at flows < 200 cfs for Side Channel 3, <300 cfs for Side Channel 2, and < about 375 cfs for Side Channel 1. Between 1957

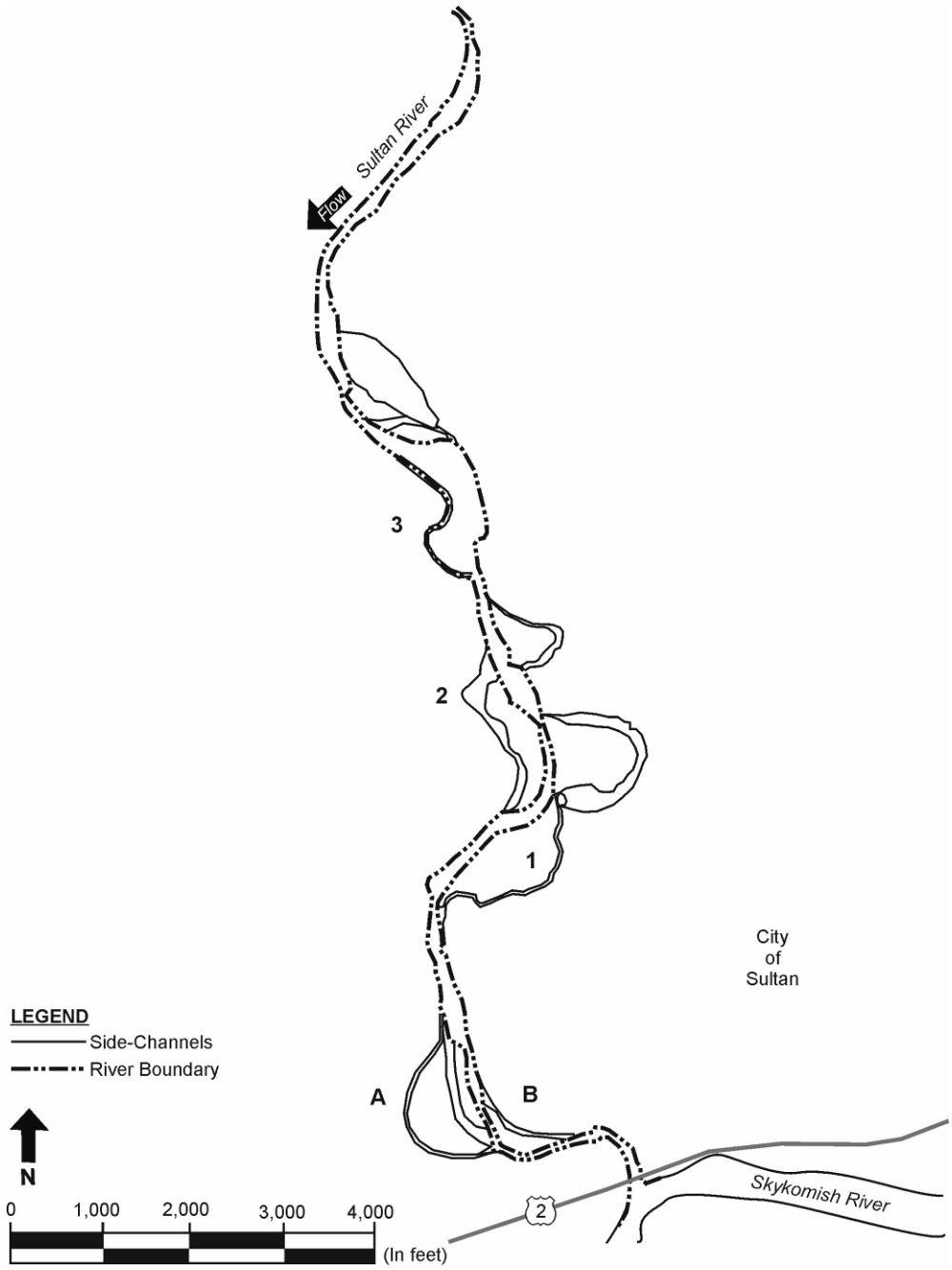
and 2003, the total area of active channel in the lower portion of Reach 3 has diminished from 125 to 61 acres due to vegetation encroachment.

In addition (R2 Resource Consultants 2008a, page 4-49) concluded that increasing the minimum flows to Reach 1 would have minimal effect on the side stream habitat in side channels 1 and 2, unless physical modifications to the side channels or mainstem to enhance connectivity to the side channels are implemented.

Implementation of A-LA 7 calls for a Side channel Enhancement Plan to address the loss of this type of habitat from vegetation. Under this measure, the District would enhance a minimum of 10,000 linear feet of side channel area to provide a minimum of 3 acres of salmonid rearing habitat. This habitat would be located within the wetted area defined by a Sultan River flow of 4,100 cfs, as measured at the USGS gage downstream of the powerhouse. The Settlement Agreement targets five specific side channels (Figure 17). The enhancement projects would be designed to improve flow connectivity and include other habitat modifications such as the placement of LWD. The proposed plan would outline the methods and schedules for monitoring, reporting, and maintaining side channel enhancements throughout the term of the License.

As a provision of the Side Channel Enhancement Plan, the District would restore and maintain flow connectivity between the mainstem Sultan River and the five targeted side channels at flows greater than 300 cfs (the proposed minimum flow to Reach 1). The District would excavate the inlets of the side channels, or use other means such as LWD structures to redirect and maintain flow to ensure that flow connectivity and habitat values are achieved, and that flow connectivity is self-maintaining. LWD collected at Culmback Dam would also be used to increase cover and complexity in the side channels.

In the Settlement Agreement, the District noted that implementation of the proposed side channel projects would be subject to obtaining regulatory approval and legal access to any property necessary to carry out the enhancements. Adverse effects on surrounding properties, including the City of Sultan's recreational properties, would be avoided. The District proposes to develop other similar projects in the Sultan or Skykomish river systems to meet the linear and areal objectives specified in this proposed measure, in consultation with the ARC, if property easements or regulatory approval cannot be obtained.



Source: R2 Resources Consultants, 2009b

Figure 17 Location of Jackson Hydroelectric Project side channels along Reach 1 of the Sultan River.

Overall, the District's proposed side-channel modifications, if properly implemented, would enhance the availability of side channels for salmonid spawning and rearing, and would complement the proposed increase in minimum flows. The proposed side channel habitat enhancements are expected to increase the production of resident and anadromous salmonids (including ESA-listed Chinook and steelhead) that could also increase the prey base for bull trout

that forage in the lower river. Species receiving the greatest benefit are expected to include Chinook, coho, chum, pink salmon, and cutthroat trout. We expect that A-LA 7 would provide immediate benefits to fish, but the exact gains will not be known until monitoring is conducted over a period of several years. Such monitoring would be specified in A-LA 17 (Fisheries and Habitat Monitoring Plan).

Installation of the structures, channel excavation, and other instream work related to the proposed side channel enhancement projects would likely cause short-term turbidity plumes, sedimentation, and could cause mortality of eggs, fry, and juvenile fish due to crushing or abrasion. However, Settlement Agreement proposed measure W-LA 1 includes provisions for implementing best management practices to minimize the adverse effects of construction and maintenance activities on aquatic resources.

While the FERC staff recommends that the District be obligated to only implement the side channel projects described as Side Channels 1, 2, 3, A, and B, and does not recommend inclusion of any contingency for other enhancement projects (FERC 2010), the District has recently learned that an easement for development of the Side Channel B enhancement project cannot be obtained. Based upon this, the District, in consultation with the ARC, has identified a number of other projects on other properties located within the lower 3 miles of the Sultan River that in various combinations can achieve the 10,000 linear feet of side channel habitat stipulated in the Settlement Agreement. These projects would be located within the geographic area defined by a mainstem flow of 4,100 cfs (USGS Gaging Station No. 12138160) and would remain wetted and hydraulically connected with the mainstem at flows greater than 300 cfs in Reach 1. The District has tentatively identified 19,614 linear feet that may be suitable for treatment by reconnection or excavation to meet the 10,000 linear feet requirement (Figure 18).

Slightly modifying the Settlement Agreement's Side Channel Enhancement Plan to include a provision to file a report within 180 days of the completion of the five side channel enhancement projects that documents the amount of habitat enhanced and specifies any proposed additional side channel enhancement projects (as recommended by the FERC) would have no direct or indirect effects on ESA-listed fish species. However, it would help to keep the FERC informed regarding the status of A-LA7.

Implementing Settlement measure A-LA 7 would increase productivity for Chinook and, to a lesser extent, steelhead.

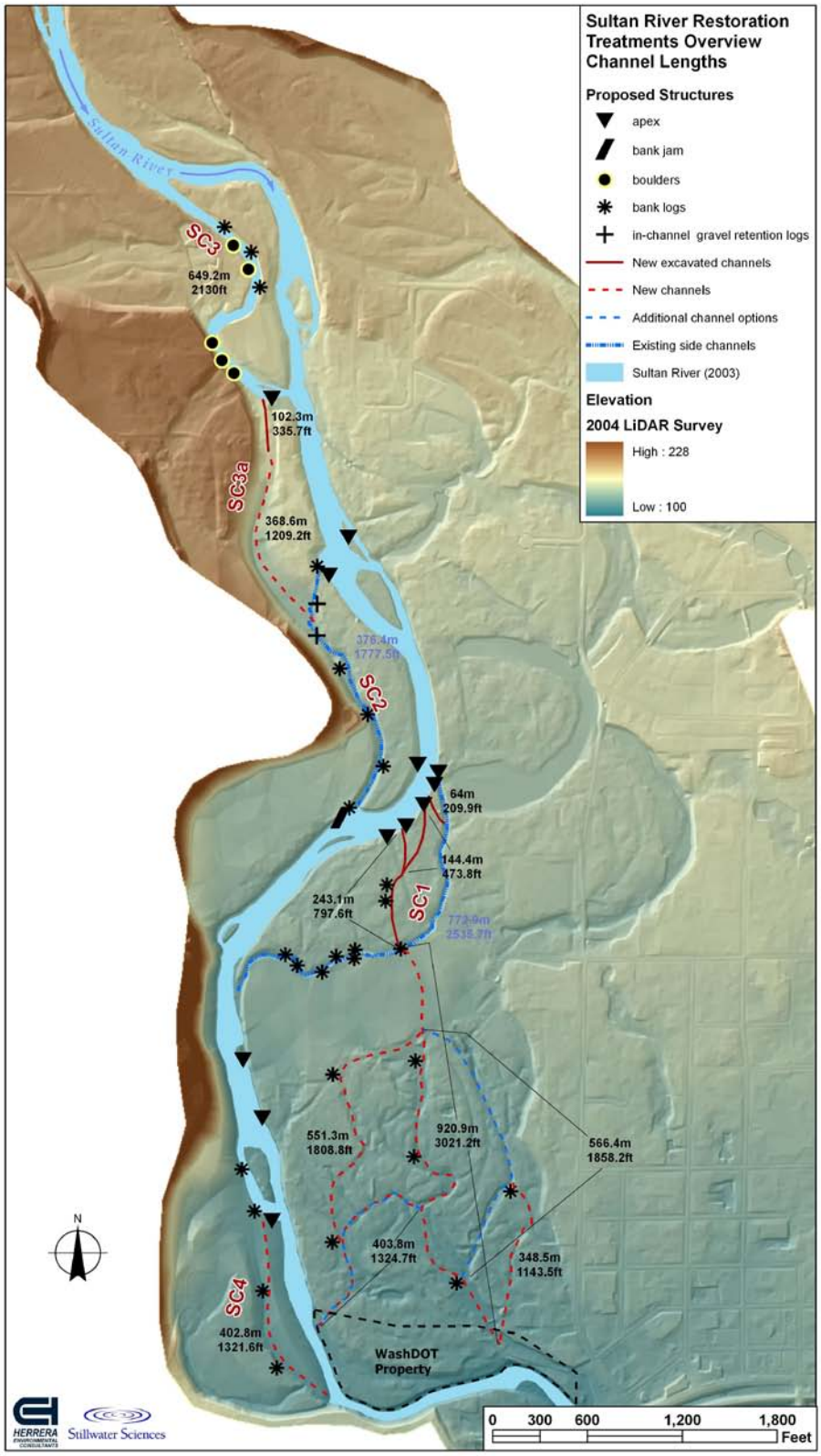


Figure 18 Sultan River restoration treatment overview channel lengths

A-LA 8 Process Flow Regime

Under the proposed action, the District would develop and implement a Process Flow Plan to provide flushing, maintenance, channel forming, and fish migration flows throughout the Project reaches (Settlement Agreement proposed measure A-LA 8). The plan would document how the District would implement a program for periodic, controlled flow releases from the powerhouse, the outlet pipe located adjacent to the Sultan River diversion dam, and Culmback Dam. Specifically, the plan would describe: (1) the frequency, magnitude, duration, and timing of process flow components; (2) the on-going involvement of the ARC in implementing this program; (3) the mechanism for timing controlled flow releases including whitewater boating releases (discussed later in this section) to coincide with natural rainfall events or uncontrolled flow releases to achieve the flow frequency, magnitude, and duration for each of the process flow components; (4) the timing and other restrictions necessary to minimize effects on aquatic resources and not exacerbate downstream flood damage in the City of Sultan; (5) the method, locations, and schedule for monitoring and measuring process flow components; (6) the method and schedule for studying the necessity of flushing flow for supporting the geomorphic process goals; (7) the method and schedule for studying the necessity of upstream migration flow and out-migration flow for providing timely and effective upstream and downstream migration of anadromous fishes; and (8) the method and schedule for monitoring the effects of process flows on aquatic resources.

The proposed process flows would consist of the components specified in Table 9. Unless otherwise provided, the magnitude, duration, timing, and frequency of the process flows may be achieved through any combination of uncontrolled spills, controlled flow releases such as whitewater boating releases, and accretion flows.

Table 9 Proposed process flow components.

Process Flow	Magnitude and Duration	Frequency
Channel Maintenance and Channel Forming Flows		
Reach 1 channel maintenance flow measured at USGS gage 12138160 just downstream of the powerhouse at RM 4.5	Channel maintenance flow would be achieved when: (a) a target flow of at least 4,100 cfs is maintained for 24 hours; or (b) a target flow of at least 4,100 cfs is achieved and the District provides a maximum release flow at the time when flow drops below 4,100 cfs for a total duration (including the target flow and maximum release) of 24 consecutive hours.	Four times every 10 years but not less than once every 4 years.

Process Flow	Magnitude and Duration	Frequency
Reach 1 channel forming flow measured at USGS gage 12138160	Channel forming flow would be achieved when: (a) a target flow of at least 6,500 cfs is maintained for 24 consecutive hours; or (b) a target flow of 6,500 cfs is achieved and the District provides a maximum release flow at the time when flow drops below 6,500 cfs for a total duration (including the target flow and maximum release) of 24 consecutive hours, or (c) the District provides a maximum release flow for 24 consecutive hours that is timed to achieve, to the extent feasible, a target flow of 6,500 cfs.	Once every 10 years.
Flushing Flows		
Reach 1 flushing flows measured at USGS gage 12138160	Reach 1 flushing flow would be achieved when 1,500 cfs is maintained for 6 consecutive hours. If Spada Lake is below elevation 1,420 feet msl, Reach 1 flushing flow would be achieved when a 1,200-cfs instantaneous minimum flow is maintained for 6 consecutive hours.	Twice a year; once in September and once between April 1 and May 31.
Reach 2 flushing flow measured immediately upstream of the powerhouse at RM 4.7	Reach 2 flushing flow would be achieved when: (a) a 500-cfs instantaneous minimum flow is maintained for 6 consecutive hours; or (b) a 700-cfs instantaneous minimum flow is maintained for 3 consecutive hours.	Twice a year; once in September and once between April 1 and May 31.
Reach 3 flushing flow measured immediately upstream of the Sultan River diversion dam at RM 9.8	Reach 3 flushing flow would be achieved when: (a) a 400-cfs instantaneous minimum flow is maintained for 6 consecutive hours; or (b) a 600-cfs instantaneous minimum flow is maintained for 3 consecutive hours.	Twice a year; once in September and once between April 1 and May 31.
Upstream Migration Flows		
Reach 1 upstream migration flow measured at USGS Gage 12138160	Reach 1 upstream migration flow would be achieved when a minimum flow between 800 and 1,200 cfs is maintained or exceeded for 6 consecutive hours.[a]	Once per year in September

Process Flow	Magnitude and Duration	Frequency
Reach 2 upstream migration flow measured immediately upstream of the powerhouse at RM 4.7	Reach 2 upstream migration flow would be achieved when a flow between 400 and 600 cfs instantaneous minimum flow is maintained for 6 consecutive hours.[a]	Once per year in September.
Reach 3 upstream migration flow measured immediately upstream of the Sultan River diversion dam at RM 9.8	Reach 3 upstream migration flow would be achieved when a minimum flow between 300 and 500 cfs is maintained or exceeded for 6 consecutive hours.[a]	Once per year in September after completion of Sultan River diversion dam volitional fish passage modification.
Out-migration Flows		
Reach 1 out-migration flow measured at USGS gage 12138160	Reach 1 out-migration flow would be achieved when a minimum flow of between 800 and 1,200 cfs is maintained or exceeded for 6 consecutive hours.[a]	Twice a year; once in April and once in May.
Reach 2 out-migration flow measured immediately upstream of the powerhouse at RM 4.7	Reach 2 out-migration flow would be achieved when a minimum flow of between 400 and 600 cfs is maintained or exceeded for 6 consecutive hours.[a]	Twice a year; once in April and once in May.
Reach 3 out-migration flow measured immediately upstream of the Sultan River diversion dam at RM 9.8	Reach 3 out-migration flow would be achieved when a minimum flow of between 200 and 400 cfs is maintained or exceeded for 6 consecutive hours.[a]	Twice a year; once in April and once in May after volitional fish passage and the Aquatic Resource Committee determine need.

[a] Actual upstream and out-migration flows would be determined by the Aquatic Resource Committee.

If necessary, the District would develop a drought-controlled process flow release schedule in consultation with the ARC Committee when: (1) a drought event resulting in voluntary reductions in domestic water consumption (defined as a stage 2 response to a drought event) is occurring; (2) the process flows require interim modification including changes in timing or reductions in flow magnitude to manage water supply during periods of weather-related shortages; and (3) the drought release schedule would not undermine the purposes of this measure. The District would notify the FERC and would implement the drought release schedule within 7 days of providing such notice, unless otherwise directed by the FERC.

In year 10 of a new License and every 10 years thereafter, the District, in consultation with the ARC, would file with FERC, a process flow effectiveness report based on the proposed fisheries

and habitat monitoring program (discussed later in this section) and the best available information.

The characteristics and geomorphic processes that form channel features are based on complex interactions between channel gradient, confinement, discharge, sediment load, LWD, and riparian vegetation. Project operations have decreased the frequency of channel forming and channel-maintaining floods to once every 20 years compared to about once every 2 years under unregulated conditions.

Flushing flows are high-flow pulses that provide sufficient flow depth and velocity for fish migration, flushing organic matter and fine sediment from the channel, renewing spawning habitat, and maintaining juvenile rearing habitat. The mean annual or average discharge on unregulated streams in Washington typically has sufficient depth and velocity to provide both fish passage functions and the force necessary for flushing organic matter and fine-grained sediment from the channel.

Channel maintenance flows are small floods that provide geomorphic and ecological functions, such as sediment transport and maintenance of streamside vegetation. They scour the channel bed to reshape alluvial features, provide lateral migration and periodic inundation of the floodplain, and protect and sustain channel banks and the floodplain by maintaining healthy streamside vegetation. Channel maintenance flows mobilize sand and larger sediments, scour streambeds, undercut banks, relocate LWD, prevent riparian encroachment, maintain floodplain connectivity, and provide access to side channels and other important rearing habitat for juvenile salmon.

Channel forming flows are large floods that create and sustain channel patterns and floodplain morphology, form and maintain side channels, scour floodplain surfaces, refill off-channel wetlands, and recharge groundwater storage near the river. Large floods transport significant amounts of sediment, recruit and transport LWD from the floodplain, and maintain riparian habitat. The District developed the proposed Reach 1 channel forming flows to mimic the channel forming flows on unregulated streams that have a recurrence interval of 10 to 25 years.

The proposed process flow regime would generally increase the flushing and fish migration flows for all three reaches downstream of Culmback Dam as compared to existing conditions (Table 10) (R2 Resource Consultants 2008b).

Table 10 Comparison of the proposed flushing and migration flows (in cfs) to current Project flows.

	Flushing		Upstream Migration		Downstream Migration	
Reach	Current Project Median	Proposed	Current Minimum Flow[a]	Proposed	Current Minimum Flow	Proposed
1	1,194	1,200 or 1,500	165 to 200	800 to 1,200	200	800 to 1,200
2	530	500 or 700	145 to 155	400 to 600	175	400 to 600 cfs
3	2,723	400 or 600	20	300-500	20	200 to 400

[a] If flows >400 cfs occur during Chinook salmon spawning (September 15-October 15) the District increases the minimum flow during incubation to prevent redd dewatering

Reach 1 Channel Flushing, Maintenance, and Forming Flows

The alluvial channel in the Sultan River between RM 0 and RM 3 requires periodic large and small floods to maintain channel geometry, side channels, floodplain connectivity, riparian health, substrate diversity, and LWD recruitment, and to prevent vegetative encroachment. About one-third of the active channel in Reach 1 has been lost because Project-regulated flows have substantially decreased the magnitude, frequency, and duration of the small and large floods that formed and maintained this reach historically. However, sediment transport in the lower 3 miles of Reach 1 has remained high, despite the decreased flow regime, because the channel has narrowed in response to vegetation encroachment. The narrower channel has increased sediment transport capacity, despite the reduced flood magnitude, duration, and frequency.

The proposed channel flushing flows would increase the frequency of April flushing flows from about once every other year under current conditions to every year under proposed conditions. The proposed September flushing flows would occur every year as compared to about once every 20 years under current conditions. The proposed channel maintenance flows would occur four times every 10 years as compared to slightly more than two times every 10 years under current conditions. The proposed channel forming flows would occur once every 10 years, similar to the average frequency under current conditions. Combined, these flows would likely maintain more normative channel processes in Reach 1 benefiting aquatic habitat for ESA-listed Chinook and steelhead.

Reach 2 and Reach 3 Channel Flushing Flows

The magnitudes of the proposed Reach 2 flushing flows would be 41 to 57 percent of the median magnitude of current high flow pulses (Table 10). The proposed timing of the flushing flows (once in September and once between April 1 and May 31) differs seasonally from the median dates of current high flow pulses that typically occur during the winter months. The annual frequency of the proposed flushing flows (twice per year) is half of the median of current high flow pulses (four per year). The proposed durations of the flushing flows (3 or 6 hours depending on magnitude) are substantially less than the median duration of current high flow pulses (1.3 days).

Flushing flow releases in September and again in April or May would scour fine-grained sediment and organic matter from spawning gravel prior to the onset of the primary salmon and steelhead spawning seasons, respectively. Under current conditions, most high flow pulses occur during winter, which would tend to enhance spawning gravel prior to the steelhead-spawning season, but would do little to enhance spawning habitat prior to the fall salmon spawning season. Although the magnitude and duration of the proposed flushing flows might be less than under current conditions, the flows nevertheless would likely be sufficient to mobilize fine-grained sediment and organic matter from spawning gravel. The District's proposed fish and habitat monitoring program would provide a means to verify that spawning habitat under the proposed flow regime would be protected or enhanced.

The magnitudes of the proposed Reach 3 flushing flows would be 15 and 22 percent of the current median high flow pulses. The frequency of the proposed flushing flows (two per year) would be in sharp contrast to current conditions, where the median annual number of high flow pulses is zero. The proposed duration of the flushing flows (3 or 6 hours) would be substantially lower than the median duration under current conditions (2.5 days). The proposed timing of the flushing flows (once in September and once between April 1 and May 31) differs seasonally from the median dates of current high flow pulses that occurred during the late fall and winter months. As with the analysis of proposed flushing flows in Reach 1, the key attribute is considered the shift in timing of flushing flow events to the period prior to the peak spawning period for salmon, steelhead, and rainbow trout. This shift would enhance spawning habitat for resident trout and anadromous salmonids following the provision of upstream fish passage at the Sultan River diversion dam.

Channel forming and channel maintenance flows were not proposed for reaches 2 and 3 because these are moderate-gradient, bedrock-controlled channels that are inherently stable and do not require 2-year return interval small floods to maintain their channel geometry. However, high flows are needed to recruit and transport LWD and sediment, form log jams, and sort bedload. From RM 3 to Culmback Dam (RM 16.1) the river has excess capacity to transport all of the supplied sediment due to moderately high gradients and channel confinement, despite reduced flood frequencies and magnitude. Therefore, the proposed flushing flows to reaches 2 and 3 may facilitate the transport of LWD and sediment to the lower 3 miles of the river where it would enhance aquatic habitat.

Fish Upstream Spawning and Out-Migration Flows

The timing of anadromous fish migrations evolved in response to the historic Sultan River hydrograph. Frequent, short-duration, lower-magnitude flushing and migration flows can trigger juvenile salmonid out-migration, increase the survival of smolts, initiate the upstream migration of adult salmon, limit straying to other river basins, and facilitate swimming past natural and artificial barriers, especially during drought years. Juvenile salmon, especially coho salmon, often delay downstream migration to the ocean until they encounter a moderate increase in flow.

Current Project operations minimize uncontrolled spill over Culmback Dam and store some of the spring runoff for municipal water supply and instream flow augmentation during the summer months, so that the magnitude, frequency, duration, and seasonality of peak flows have been altered. This may delay salmonid migrations. Chinook salmon and pink salmon that normally

migrate upstream and spawn in September and early October are especially vulnerable to migration delays.

Reaches 1 and 2

The proposed September flushing flows and upstream migration flows would be of similar duration, and the magnitudes of both of these flows would be substantially greater than the current September minimum flows (Table 5). Therefore, both of these flows would better facilitate Chinook salmon spawning migrations up to the Marsh Creek slide area and, after proposed modifications to the slide are implemented, up to the Sultan River diversion dam. Pink and chum salmon spawning migrations that primarily use the lower 2.7 river miles of Reach 1 would likely be enhanced. Coho salmon may also benefit, although coho salmon spawning is initiated later (early November) than the other species.

The proposed spring flushing and out-migration flows are of similar duration, and would occur in April and May. The magnitudes of both these flows would be substantially greater than the current April and May minimum flows (Table 5). Therefore, it is anticipated that all three of these flows would better facilitate Chinook and coho salmon and steelhead smolt out-migrations, as well as steelhead and cutthroat trout spawning migrations. Any remaining pink and chum fry would also benefit from the flushing and out-migration flows.

Reach 3

The proposed September flushing flows and the upstream migration flows are of similar duration, and the magnitudes of both these flows are substantially greater than the current minimum flows, as are the proposed April or May flushing flows and out-migration flows (Table 9). The upstream migration and downstream migration flows would not be implemented until after completion of the volitional fishways at the Sultan River diversion dam to facilitate anadromous fish access to Reach 3. Both the proposed flushing and migration flows would better facilitate Chinook salmon spawning and out-migrations once the volitional fish passage modifications are completed. After the fish passage modifications are completed, it is likely that the April or May flushing flows and the spring out-migration flows would facilitate steelhead smolt out-migrations, steelhead spawning migrations, and gene flow between resident rainbow trout and anadromous steelhead.

The Process Flow Plan and the proposed fisheries and habitat monitoring program include provisions to focus habitat monitoring on the lower 3 miles of Reach 1 to determine the need and effectiveness of the proposed channel forming and channel maintenance process flows. Spawning escapement surveys and smolt trapping would continue throughout the term of a new License at previously defined index reaches from the Sultan River diversion dam to near the mouth of Sultan River. The purpose of these surveys would be to assess spawner abundance, distribution, and timing so that trends in anadromous fish habitat use and reproductive success can be evaluated. This monitoring could form the basis for refining the timing, magnitude, and duration of the process flow releases.

The net effect of A-LA 8 is beneficial to designated Chinook critical habitat and to steelhead habitat, but may result in a minor amount of take of individual juvenile Chinook and steelhead.

As explained above, more frequent but controlled events are expected to result in significantly lower losses of listed fish than unregulated natural high flow events would.

A-LA 9 Minimum Flows

Minimum instream flow levels affect water temperature, the availability of spawning and rearing habitat, main channel and side channel connectivity, and fish migration. Project operations directly affect Sultan River instream flows throughout the entire 16.5-mile reach downstream of Culmback Dam. The District proposes the following seasonally shaped minimum instream flow schedule for all three reaches of the Sultan River downstream of Culmback Dam:

Reach 1 - The District would release water from the powerhouse to maintain instantaneous minimum flows of 300 cfs.

Reach 2 - The District would release water from the outlet pipe located adjacent to the Sultan River diversion dam to maintain instantaneous minimum flows according to the schedule shown in Table 11.

Table 11 Proposed Reach 2 instantaneous minimum flows.

Instantaneous Minimum Instream Flow (cfs)	Spada Lake Level (feet msl)	Date
100	---	November 1 through March 15
140	---	March 16 through June 15
100	---	June 16 through September 14
200	Above 1,415	September 15 through October 31
175	1,415 to 1,405	September 15 through October 31
150	Below 1,405	September 15 through October 31

Reach 3 - The District would provide an annual water budget of 20,362 acre-feet for release from Culmback Dam until 2020. The District would provide an additional 3,469 acre-feet to the water budget for a total annual water budget of 23,831 acre-feet beginning during the July 2020 to June 2021 water year, and for the remaining term of a License, unless the ARC decides to delay or postpone this increase.

The District would release the annual water budget as instantaneous minimum flows with a release schedule developed prior to each water budget year (July 1 to June 30) in consultation with the ARC. In the event that the ARC is unable to reach consensus regarding the release of the water budget 15 days prior to the beginning of the water budget year, the default Reach 3 flow regimes shown in Table 12 would be implemented beginning the first day of the water budget year.

Table 12 Default Reach 3 instantaneous minimum monthly flow releases.

Month	Minimum Flow Releases		
	Prior to the 3,469-acre-foot water budget increase and the date the District completes the diversion dam's volitional fish passage modifications (cfs)	Prior to the 3,469-acre-foot water budget increase, but after the date the District completes the diversion dam's volitional fish passage modifications (cfs)	After the 3,469-acre-foot water budget increase beginning July 2020 (cfs)
July	20	30	40
August	20	35	45
September 1-15	20	45	55
September 16-30	20	55	65
October 1-15	20	65	70
October 16-31	20	50	60
November	20	20	20
December	20	20	20
January	20	20	20
February	25	20	20
March	30	20	20
April 1-15	45	20	20
April 16-30	55	20	20
May 1-15	65	20	30
May 16-31	50	20	30
June	35	25	35

The objectives of this instream flow PME are to protect, mitigate, and enhance fish and wildlife resources, riparian vegetation, and water quality in the Sultan River.

The proposed seasonal allocation of minimum instream flows in the Sultan River were developed in collaboration with the resource agencies and the Tribe, are based on the habitat flow relationships determined during the District's Instream Flow Study (R2 Resource Consultants 2008a). The proposed minimum instream flow schedule would, in most cases, substantially increase existing minimum flows in the Sultan River (Table 10). Tables 13 and 14 present the percent of maximum spawning and juvenile rearing habitat in terms of weighted usable area, or WUA (the output from the instream flow incremental methodology model), for each species at the current and proposed minimum flows.

Although the primary objective of this section is to analyze the effects of the proposed minimum flows on ESA-listed Chinook and steelhead, also included is an analysis of effects on coho, chum, and pink salmon, and resident rainbow and cutthroat trout.

Reach 1 - Reach 1 contains the most productive Chinook, steelhead, coho, chum, pink salmon, rainbow trout, and cutthroat trout habitat in the Sultan River downstream of Culmback Dam. Spawning flows in this reach are generally not limiting, with the potential exception of pink and chum salmon. The proposed 300-cfs minimum flow would increase the amount of spawning habitat for Chinook (by 25 percent) and steelhead (by 30 percent). Although not listed under the ESA, the proposed minimum flow would also increase the amount of spawning habitat for coho (by 7 percent), chum (by 6 percent), and rainbow trout (by 25 percent), compared to current conditions (Table 13). Pink salmon and cutthroat trout spawning habitat would decrease by 15 and 17 to 27 percent, respectively, compared to current conditions.

The proposed 300-cfs minimum flow would also increase the amount of juvenile rearing habitat for Chinook salmon (by 8 to 11 percent) and steelhead (by 16 to 24 percent), and rainbow (by 8 to 15 percent) in Reach 1 compared to current conditions (Table 14). The amount of cutthroat trout rearing habitat would remain essentially unchanged. The amount of mainstem coho salmon juvenile rearing habitat would decrease by 12 to 15 percent, compared to current conditions. However, the proposed minimum flows are expected to increase the amount of side channel habitat in Reach 1, which is highly productive coho salmon rearing habitat.

Reach 2 - Reach 2 receives moderate use by spawning steelhead, Chinook, and coho salmon, and the confined nature of the channel makes the availability of fish habitat less sensitive to flow changes. Spawning flows in this reach are generally not limiting. The District, in consultation with the resource agencies and other stakeholders, used steelhead spawning criteria to determine preferred winter and spring minimum flows, and coho rearing criteria to determine summer minimum flows. The proposed seasonal range of minimum flows would increase the amount of spawning habitat for fall spawning Chinook salmon by 3 to 18 percent compared to current conditions (Table 13). The amount of habitat for pink salmon and spring spawning steelhead would decrease by 12-14 percent and 17-43 percent, respectively. Significant accretion during steelhead spawning season would mitigate reductions in spawning habitat associated with the minimum flow regime. Chum salmon, rainbow and cutthroat trout spawning habitat would remain essentially the same. Juvenile rearing habitat for all modeled species would remain essentially the same (Table 14).

Table 13 Percent of maximum salmonid spawning habitat (as measured by weighted usable area) under existing and proposed flows in Reaches 1, 2, and 3.

Reach	% of Maximum Chinook Salmon	% of Maximum Steelhead	% of Maximum Coho Salmon	% of Maximum Chum Salmon	% of Maximum Pink Salmon	% of Maximum Rainbow Trout	% of Maximum Cutthroat Trout
1: Existing	58	58	93	83	94	52	78-87
1: Proposed	83	88	100	89	79	77	61
2: Existing	38-72	81	87	87	94-96	48-82	83-100
2: Proposed	41-90	38-64	89	88	82	50-70	92-100
3 (before fishway): Existing	9	8	---	---	---	20	31
3 (before fishway): Proposed	9	14-24	---	---	---	32-56	31-83
3 (after fishway): Existing	9	8	---	---	---	20	31
3 (after fishway): Proposed	9-29	8-11	---	---	---	20-22	31-42
3 (beginning in 2020): Existing	9	8	---	---	---	20	31
3 (beginning in 2020): Proposed	9-31	8-16	---	---	---	20-32	42-67

Table 14 Percent of maximum juvenile rearing habitat (as measured by weighted usable area) under existing and proposed flows in Reaches 1, 2, and 3.

Reach	% of Maximum Chinook Salmon	% of Maximum Steelhead	% of Maximum Coho Salmon	% of Maximum Rainbow Trout	% of Maximum Cutthroat Trout
1: Existing	83-86	58-66	71-74	85-92	96-99
1: Proposed	94	82	59	100	98
2: Existing	80-96	47-73	63-81	64-84	79-98
2: Proposed	80-96	49-78	59-80	66-88	87-99
3 (before fishway): Existing	16	18	---	27	16
3 (before fishway): Proposed	16-54	18-37	---	27-55	16-62
3 (after fishway): Existing	16	18	---	27	16
3 (after fishway): Proposed	16-42	18-33	---	27-48	16-53
3 (beginning in 2020): Existing	16	18	---	27	16
3 (beginning in 2020): Proposed	22-54	22-37	---	33-55	25-62

Reach 3 – Under existing conditions, Reach 3 is inaccessible to anadromous fish and has a small population of resident rainbow trout. The proposed initial default minimum flows would increase spawning habitat for resident rainbow and cutthroat trout, depending on the month (Table 13). After completion of volitional fish passage at the diversion dam, contingent on successful passage at the Marsh Creek Slide, and again in 2020, the default minimum flows would either retain the existing amount of spawning habitat for rainbow and cutthroat trout or increase it from 2 to 36 percent, depending on the month (Table 10). Rearing habitat for rainbow and cutthroat trout under the initial default minimum flows would either remain the same or increase by up to 28 and 46 percent (Table 14). After completion of volitional fishways, rearing habitat for rainbow and cutthroat trout would either remain the same or increase by up to 21 and 37 percent, respectively, depending on the month. After 2020, rearing habitat for rainbow and cutthroat trout would increase by up to 6 to 28 percent and 9 to 46 percent, respectively, depending on the month. Although not modeled during relicensing studies, the increased minimum flows in Reach 3 would also likely benefit ESA-listed Chinook and steelhead that may spawn and rear in this reach. Providing passage, in and of itself, would increase habitat availability for anadromous fish, compared to existing conditions, as described in the analysis of A-LA 13.

The District proposes to submit a final flow report for Reach 3 no later than 15 days prior to the beginning of each water budget year to document that flows are meeting the objectives of A-LA 9.

Drought-Controlled Minimum Flow Releases

During drought conditions, releases from the Project facilities account for the vast majority of flows within the Sultan River. Under the Settlement Agreement, the District would implement a contingency minimum flow-release protocol for drought conditions. These contingency flow releases would generally allow for interim modifications to the proposed release schedule to manage water supply during periods of drought (Everett 2007.)

If the District, in consultation with the ARC, decides that a "Stage 1 response to a drought event" is needed, the District would implement the flow release schedule shown in Table 15 for Reach 1.[4]

[4] A Stage 1 response to a drought event would result in advisories about the potential for a future domestic water shortage. A Stage 1 response to a drought event is defined in the 2007 City of Everett, Drought Response Plan on pages 3 and 4.

Table 15 Reach 1 flow release schedule during Stage 1 drought event.

Instantaneous Minimum Instream Flow Releases (cfs)	Spada Lake Water Level (feet msl)	
	September 15 through October 31	November 1 through September 14
300	Above 1,420	Above 1,420
275	1,420 to 1,410	1,420 to 1,415
250	1,410 to 1,405	1,415 to 1,410
225	---	1,410 to 1,405
200	Below 1,405	Below 1,405

In addition to the drought provisions described in Table 15 for Reach 1, the District, in consultation with the ARC, would develop a drought-controlled flow release schedule for minimum flows to Reaches 2 and 3, if necessary, when: (1) a drought event resulting in voluntary reductions in domestic water consumption (defined as a Stage 2 response to a drought event[5]) is occurring; (2) the release schedule described in this measure requires interim modification to manage water supply during periods of weather-related shortages; and (3) the drought release schedule would not undermine the purposes of proposed measure A-LA 9. The District would notify the FERC and would implement the drought release schedule within 7 days of providing such notice, unless otherwise directed by the FERC.

Implementation of a drought-controlled minimum flow release schedule, in consultation with the ARC, would allow for interim modifications to the minimum flow regime in all three reaches during periods of weather-related shortages. This flexible approach would allow the District and stakeholders the opportunity to provide as much flow as possible to protect aquatic resources (including ESA-listed Chinook and steelhead) while accounting for the severity of the drought coupled with anticipated voluntary and involuntary municipal water use reductions.

The effect of A-LA 9 increases available rearing habitat for Chinook and steelhead, and maintains or increases spawning habitat. It also facilitates higher than unregulated egg to fry survivals for both species.

A-LA 10 Spada Lake Recreational Fishery

Under A-LA 10, the District proposes to develop and implement a Spada Lake Recreational Fishery Plan in consultation with the ARC. Because there are no Chinook, steelhead, or bull trout present in Spada Lake, this measure would have no effect on listed Chinook or steelhead.

A-LA 12 Fish Habitat Enhancement Plan

Under A-LA 12, the District proposes to develop a comprehensive Fish Habitat Enhancement Plan to guide the implementation of aquatic habitat enhancement projects beyond those specified

[5] A Stage 2 response to a drought event would result in voluntary steps to lower domestic water consumption. A Stage 2 response to a drought event is defined in the 2007, City of Everett, Drought Response Plan on pages 4 and 5.

in other proposed environmental measures[6]. The plan would be funded by a habitat enhancement account with a $2.5-million initial deposit, with subsequent deposits of $200,000 starting the tenth year following License issuance and then annually for the term of the License. Potential projects that would be funded by the District through the plan could include: instream structure enhancements; side channel habitat development; LWD projects; fish passage barrier removal; gravel augmentation; land purchases for aquatic habitat enhancement; up to $3,000 in annual funding for the National Resources Conservation Service's hydrological monitoring equipment; and other unspecified projects throughout the Sultan River and Snohomish River basins.

If available funds remain within this account, the District would implement other appropriate aquatic habitat enhancement and restoration projects developed by the ARC within the Snohomish River Basin; however, any measures identified in the plan for implementation in a location that is both (1) outside the Sultan River Basin, and (2) outside of the existing Project boundary, would be limited to actions that do not result in an expansion of the Project boundary. In the event that a future landslide causes a barrier to upstream migration, and the District and the ARC determine that there is a relationship between the Project and the barrier, the District would prioritize the use of funds to study and, if necessary, modify such landslide to remove the barrier to upstream migration.

Overall, we expect that this measure would likely benefit ESA-listed fish species in the Sultan River and other rivers in the Snohomish River Basin through the implementation of projects designed to enhance or increase the amount of habitat for these species.

In its DEA, the FERC did not recommend implementation of a Fish Habitat Enhancement Plan (and it's associated funding). Its rationale for not recommending this Settlement Agreement measure was that it did not provide any specificity as to the measures that would be implemented using the funding commitment. Without specific measures, FERC staff indicated they could not evaluate the environmental effects or the relationship of the unidentified measures to the Project (FERC 2010). However, the FERC also noted that the USFS includes this measure in preliminary 4(e) condition 2. Consequently, unless the USFS modifies this condition, it would be included in any new License issued for this Project.

A-LA 13 Diversion Dam Volitional Passage

The Sultan River diversion dam at RM 9.7 prevents fish from accessing about 6.6 miles of historical spawning and rearing habitat above the dam. The only fish species currently known to occur in Reach 3 (diversion dam to Culmback Dam) are resident rainbow trout, mountain whitefish, and unidentified sculpin.

The District proposes to provide volitional fish passage at the Sultan River diversion dam; the timing of which would be based on future index area spawning surveys. The District would make structural modifications to the diversion dam to provide for the safe, timely, and effective

[6] USFS 4(e) condition no. 2 also requires that the District implement its proposed Fish Habitat Enhancement Plan.

upstream and downstream volitional fish passage to reintroduce anadromous fish to the river above the dam. The District's design for any upstream fishway at the diversion dam or installation of a fish screen would conform to criteria in NMFS' Anadromous Salmonid Passage Facility Design Manual (NMFS 2008a).

The District would file a Volitional Passage Plan with the FERC within 1 year of License issuance. This plan would include: (1) the conceptual design drawings and cost estimates of the proposed upstream and downstream fishways; (2) the method and schedule for implementing the fishways in the event that the passage triggers occur; (3) the method and the schedule for monitoring annual spawning escapement within the Sultan River index areas and above the diversion dam; (4) the method and schedule for testing and verifying fish passage effectiveness at the diversion dam; and (5) annual monitoring, reporting, and ARC consultation requirements.

The District, in consultation with the ARC, would file the final design for the diversion dam modifications with the FERC and apply for all necessary permits within 6 months after the fish passage trigger occurs. The District would not begin construction of the fishways until the ARC, USFWS, NMFS, and FERC approve the final design and plan, and all the necessary permits have been obtained. The District would complete the fishways no later than two full construction seasons after Commission approval of the final design and plan and obtaining all necessary permits.

The District's obligation to construct, maintain, and operate such fishways would be subject to the USFWS and NMFS determination, in consultation with the ARC, that spawning escapement of either Chinook salmon or steelhead in the diversion dam index area (RM 9.2 to 9.7), located immediately downstream of the dam, equals or exceeds 10 percent of the combined total spawning escapement for either Chinook salmon or steelhead within the four index areas further downstream of the diversion dam in any one year. These escapement levels are defined as the upstream passage trigger.

After upstream fishways have been implemented, the District would not divert water directly from the river to Lake Chaplain from the diversion dam in any year in which more than six anadromous salmonid redds occur above the diversion dam, unless no other means are available to meet the City of Everett's water supply requirements. If this water supply requirement were triggered, the District would take appropriate measures to protect Federally listed fish in consultation with the ARC. In the event that the District installs and operates a fish screen at the entrance to the tunnel from the diversion dam to Lake Chaplain, the District may resume the direct diversion of Sultan River water to Lake Chaplain at any time.

Providing access to this historical spawning and rearing habitat between the diversion dam and Culmback Dam and implementing the proposed interrelated environmental measures (i.e., water temperature improvements, instream and process flows, and downramping rate control) would likely increase the production of Chinook salmon, steelhead, and possibly bull trout in the Sultan River. The potential increase in Chinook, steelhead, and bull trout production would benefit these listed species.

Fish passage at the diversion dam would not likely provide many benefits to coho, pink, or chum salmon production. Pink and chum salmon preferentially spawn in the low-gradient main channel and side channels in Reach 1, and their young out-migrate as fry to rear in estuarine environments. Coho salmon are generally small- to medium-sized tributary spawners, and juvenile coho salmon preferentially rear in side channel habitats that do not exist in Reach 3. Further, the District's habitat modeling indicates that there is little coho salmon spawning habitat upstream of the diversion dam (R2 Resource Consultants, 2009a).

NMFS recommends a conventional pool and weir fish ladder, or modification of the slide-gate slot to facilitate fish passage. Downstream passage for anadromous fry would not be a problem except on the rare occasions (i.e., drought conditions) when the District would be required to release flows for the City of Everett's municipal water supply from Culmback Dam rather than through the powerhouse. In this situation, water would flow from the Sultan River back to Lake Chaplain through the inlet pipe. NMFS determined that entrainment may not be a substantial problem, because juvenile fish generally do not out-migrate during the time period when drought conditions are likely; therefore, a NMFS-criteria fish screen may not be necessary at the outset of the volitional fish passage implementation, particularly considering the flow restrictions on diverting water that the District proposes to put in place. The diversion dam passage plan A-LA 13 includes a provision that the District would consult with NMFS regarding appropriate measures at this site.

This proposed measure would be either neutral if the passage triggers do not occur, or beneficial if they do. The habitat character of Reach 3 favors steelhead over Chinook, so estimated increases in Chinook productivity are low and for steelhead, they are fair.

A-LA 14 Reservoir Operations

The proposed reservoir management framework would allow the Project to provide water allocations for all of the needs in the Sultan River Basin. These include municipal water supply, electricity production, recreation, ecosystem function, and incidental flood control. Benefits associated with implementing the reservoir management framework include the ability to provide a balance of reliable municipal water supply, instream flows to provide for aquatic habitat, incidental winter flood storage, high lake levels for early summer recreation, and reduced risk of uncontrolled spill following Chinook salmon fall spawning and steelhead spring spawning. The effects of managing the reservoir to provide for instream flows, water temperature conditioning downstream of Culmback Dam, and water supply on listed fish and critical habitat are discussed under proposed Water Temperature Conditioning, Minimum Flows, and Water Supply plans. This section analyzes the effects of managing the reservoir for incidental flood control on ESA-listed fish species in the Sultan River.

Under the proposed action, Spada Lake storage would be ramped up and down more frequently to provide other water resource management benefits (e.g. increased minimum stream flows). To reduce the risk of spill under the proposed operations, the District proposes to alter the State 3-4 rule curves to be a straight line from elevation 1,438.5 feet msl on July 1 to 1,410 feet msl on October 1 (Figure 6). This would expand the State 3 operating zone from July through

September, providing options to reduce Spada Lake water levels and the risk of a spill that would have the potential for undesirable effects on spawning salmon.

Under current conditions, the recurrence interval for spill events from October through April is about 2.7 years, or about 37 percent chance of spill each year. Modeled operations under the proposed reservoir rule curves suggest the recurrence interval for spill events would be about 2.5 years, or a 40 percent chance of spill each year from April through October, about the same as existing conditions.

One expected effect of this article will be the mortality of an unknown number or percent of the Sultan River Chinook population due to redd scour and egg and yolk-sac fry mortality during flood flows (steelhead eggs are not affected by winter floods because they are spring spawners) . Mortality occurs in relation to water depth, water velocity, substrate composition, and redd depth. This estimate is based on the inference drawn from survival and mortality estimates of Chinook in the Skagit River (Seiler 2004) caused by flooding. Largely unregulated Skagit floods at the extreme level can reduce egg to smolt survival from 12 percent to as low as two percent. The planned spill and flood flows for the Sultan are expected to cause some degree of redd scour that causes egg and fry mortality, but they will mostly be regulated flows, and only a fraction of the magnitude of unregulated flood flows. For the larger fraction of the population spawning downstream of the powerhouse, flows greater than about 1,500 cfs generally begin an overbank flood condition, which attenuates water depth and velocity increase, which are the factors that determine redd scour and fish mortality. Because of that attenuation in depth and velocity, the expected mortality from simulating this natural flood condition is expected to be less than one-quarter of the 88% to 98 % of incubating eggs or fry that would be lost due to natural unregulated floods. For the purpose of this analysis, NMFS expects less than 25% as much loss as would occur under the unregulated condition for Chinook. This may appear to be a high amount of take of listed incubating eggs or fry, but it is substantially less than losses of up to 98% that are correlated with the frequency and magnitude that would be caused by natural unregulated flooding associated with the Sultan River. Further, some loss of production during flushing flows is requisite to restoring the habitat processes of sediment transport, habitat unit formation, and LWD recruitment, and channel complexity, which will better support egg to smolt survival of the remaining eggs and fry (and thus abundance and productivity of each species) in the long term.

The effects are best illustrated by an example. In the presence of unregulated flooding, natural Chinook egg to smolt survivals in the range of 2% to 12% are expected based on data collected on the Skagit River (Seiler 2004). The average escapement of natural Chinook spawners to the Sultan River is 540. At an average female ratio of 40% and fecundity of 3,500 eggs per female, 756,000 eggs are deposited in Sultan River Chinook redds annually. With unregulated flows, and 2 -12% egg to smolt survival rates; a range of 15,120 to 90,720 smolts would be expected. As ocean type Chinook with a smolt to adult survival rate (SAR) of 0.5% would produce 75 to 454 adult recruits, respectively. (The difference between the observed escapements –after harvests- and expected recruitment attest to improved survival from flood regulation, and are also explained by the presence of stray hatchery Chinook spawning in the Sultan River.)

However, the expected losses of eggs and yolk-sac fry due to flood scour are offset by the benefits of stream channel maintenance and habitat formation, which could be important enough to maintain or improve the existing range of egg to smolt survivals.

In their DEA, FERC staff recommended the Commission adopt a requirement for the maintenance of minimum impoundment elevations during State 3 of the operational rule curve. The FERC staff-recommended Draft Article 409 includes this minimum impoundment requirement:

> *When Spada Lake is in State 3, as defined in Article 408, the licensee shall maintain a minimum impoundment water surface elevation in Spada Lake above 1,430 feet mean sea level (msl) between July 1 and August 15. Until the temperature conditioning structure . . . is installed and operational, the licensee shall maintain a minimum impoundment water surface elevation in Spada Lake Reservoir at or above 1,420 feet msl from August 16 through September 15. After the temperature conditioning structure is installed and operational, the license [sic] shall maintain a minimum impoundment water surface elevation in Spada Lake above 1,415 feet msl from August 16 through September 15.*

This aspect of the proposed action varies from the license terms proposed by the Settlement. The Settlement Parties designed the State 3 Rule Curve to provide the District with broad flexibility in Project operations while the reservoir elevation was within State 3.

This proposal would reduce operational flexibility and could increase conflicts between meeting Sultan River instream flow needs and the City of Everett's water demand. Resolution of such conflicts would likely result in reduced instream flows, thereby reducing Chinook and steelhead habitat area.

Overall, the proposed reservoir rule curves would be beneficial to both Chinook and steelhead by improving the likelihood of meeting proposed minimum instream flows for Chinook spawning and juvenile steelhead rearing, while slightly increasing the risk of spill and spill-related effects.

A-LA 15 Adaptive Management Plan

The District proposes to consult with the ARC to develop an Adaptive Management Plan (AMP). The District would file the AMP with the FERC within 180 days of License issuance, and would implement the plan upon Commission approval. The goal of the AMP would be to address key operational constraints over the term of a new License. The AMP would document how the District will: (1) address water use issues (specifically relating to Spada Lake) when refill, Project operations, flow releases, and Spada Lake water surface elevations may conflict; and (2) address the process for evaluating and adaptively managing within the constraints of the specific License Articles.

Operational and environmental conditions in the Project area and the Sultan River Basin are likely to change through the term of a new License, as a result of natural processes, increased

demand for water, and implementation of the License Articles. Developing and implementing the AMP would provide a structured, iterative process that the District and the ARC can follow to make decisions regarding Project operations in the face of uncertainty, with an aim to reduce uncertainty over time via monitoring. The AMP is expected to result in the most effective resource protection through the term of the Project License.

The District's modeling demonstrates that with increased City water demand (see A-LA 18, Water Supply, below) there is potential for Spada Lake to fall below elevation 1,380 feet msl, at which water temperature conditioning control is lost and release of cold bottom waters from Spada Lake would occur to meet City water demand and instream flow requirements. However, the circumstances that could lead to conflicts with the ability to refill Spada Lake (for the purpose of proposed Project operations, flow releases, and maintaining Spada Lake levels, and water conditioning control) would likely be seasonally predictable within a given water year. Establishing specific protocols for evaluating and adaptively managing the consequences of such conflicts, as the District proposes, would minimize adverse effects on the various beneficial uses of Project waters, ultimately minimizing any adverse effects to Chinook and steelhead and designated critical habitat.

A-LA 16 Steelhead Planting Program

Under the proposed action, the District proposes to continue funding the planting of about 30,000 steelhead smolts in the Sultan River until the District implements fish passage at the diversion dam.

Currently, the release of 30,000 adipose fin-clipped steelhead into the Sultan River contributes to a larger ongoing fishery enhancement effort in the Snohomish River system that includes enhancements on the Pilchuck, Wallace, and Skykomish rivers. The hatchery steelhead returns to the Sultan River contribute to a relatively small recreational fishery; it averaged 84 harvested fish per year between 1995 and 2003. The proposed steelhead planting would be a continuation of the existing program and would likely maintain this level of recreational harvest.

The effects of all hatchery programs in the Puget Sound region, including the steelhead programs in the Snohomish River Basin, are being addressed through separate consultations during the development and evaluation of specific Hatchery Genetic Management Plans, and through NMFS' ongoing evaluation of Puget Sound hatchery programs. Consequently, the effects of the proposed hatchery supplementation program on ESA-listed Chinook and steelhead are expected to be negligible.

A-LA 17 Fisheries and Habitat Monitoring Plan

The District proposes to consult with the ARC to develop a Fisheries and Habitat Monitoring Plan (FHMP). Specifically, the FHMP would include provisions to (1) periodically monitor and characterize riverine fish habitat (including side channel, riparian, and floodplain habitats) in the Sultan River to determine how habitat restoration efforts and Project operations affect fish habitat conditions; (2) monitor water temperature in the Sultan River to help analyze the biological information collected through separate monitoring efforts (i.e., spawning timing,

emergence timing, juvenile size or growth rates, distribution, habitat utilization, and species interactions); (3) conduct annual surveys using standard methods employed in the region to assess spawner abundance, spawner distribution, spawning timing, and species composition; and (4) install and operate a juvenile fish trap in the lower Sultan River to assess juvenile salmonid production, distribution, and habitat utilization.

The District would file with the FERC, by June 30 of each year, an annual report fully describing the monitoring efforts of the previous calendar year. By December 1 of each year, the District would file an annual plan with the FERC describing the monitoring activities required for the following year. The District would also provide copies of the annual report and annual plan to the ARC. Monitoring long-term changes in fish habitat, water temperatures, adult salmon and steelhead distribution and abundance, and juvenile salmonid production, distribution and habitat utilization over the term of a new License would enable the District and the ARC to evaluate the effectiveness of the habitat modifications and/or alterations in Project operations outlined in the aquatic resource License Articles. In addition, information resulting from monitoring would generate data that could be used to inform decisions about Project operations throughout the next License period, and to evaluate the need for future habitat enhancements or modifications.

Monitoring the response to the proposed aquatic environmental measures would be necessary to determine if the specified measures are effective at meeting defined resource objectives. In many instances, the timing or magnitude of some of the proposed measures would be dependent on the success of other actions. For example, the proposed measure to provide Sultan River diversion dam volitional fish passage and the corresponding increase of proposed minimum flows and implementation of migration flows in Reach 3 (discussed under A-LA 13, above) would be contingent upon obtaining increased escapement of Chinook salmon or steelhead upstream of the Marsh Creek slide area. This increased escapement would in turn be dependent upon effective implementation of the proposed Marsh Creek slide physical modifications. Consequently, continued monitoring of spawning escapement in all index areas would be necessary to determine when or if fishways would be built at the Sultan River diversion dam. Monitoring of fish use of side channels that would become more accessible under proposed environmental measures would dictate whether or not adjustments needed to be made to the proposed ramping rates in Reach 1. Proposed water temperature monitoring and fisheries monitoring would enable the District to evaluate the effectiveness of the proposed temperature conditioning measure and implement adjustments, if needed. Finally, the biological response of process flows would need to be monitored to ensure that the flow releases would accomplish the intended purposes, or whether they should be modified or discontinued.

Overall, the expected effect is that the monitoring regime would provide useful information that can be used by fisheries managers to evaluate aquatic resource measures to ensure that all listed fish and their habitat conditions would be improved in the Sultan River as rapidly as is practicable.

In the DEA, FERC staff recommended the District also include in the annual fisheries and habitat monitoring report, documentation of measures that were implemented to protect Chinook

spawning. Inclusion of this measure in a new License would further benefit Chinook by providing fisheries managers with additional information related to the protection of Chinook salmon spawning in the Sultan River.

FERC staff further recommend that the District develop and implement an Operational Compliance Monitoring Plan that specifies the methods that would be used to measure minimum flows and ramping rates in Reach 3, ensures continued operation of two Sultan River USGS gages, and provides for filing an annual compliance monitoring report. This measure would further benefit listed fish by providing managers with important data regarding flow and ramping conditions and overall License compliance.

A-LA 18 Water Supply

The District's proposed A-LA 18 provides that water supply and quality requirements take precedence over power generation. This measure is based on a long-standing contractual understanding between the City of Everett and the District that was most recently re-stated in the Supplemental Agreement between Public Utility District No. 1 of Snohomish County and the City of Everett, Washington. The agreement defines the relationship between Jackson Project hydropower operations and the City's water supply and water quality requirements (except to the extent that power operations are simultaneously necessary to comply with the FERC-prescribed environmental requirements). Specifically, the agreement states:

> *The parties hereby expressly agree that the requirements of the City within the water supply service area shall have precedence over any Sultan Project requirement for power generation purposes for the term of this Agreement up to a maximum water requirement equal to the City's existing certificated state water rights as of February 27, 2007, provided the City stays within the service area described in Exhibit A. The parties agree that they will cooperate in the storage and release of waters from Spada Lake and from Lake Chaplain so that the water supply requirements of the City may be met.*

The City is the wholesale water supplier for 80 percent of Snohomish County and has rights for the use of 380 cfs (245.6 million gallons per day [MGD]) of Sultan River water for municipal supply, with a pending application for an additional 200 cfs (129.3 MGD). The City projects that its water supply demand will increase from 2008 to 2060 and the District is obligated by agreement with the City to operate the Jackson Project to meet the City's water supply demands.

As part of this agreement, the District lists the following constraints on Project operations arranged by priority:

1. Water supply needs for the City of Everett.

2. Minimum flow requirements downstream of Culmback Dam, the Diversion Dam, and the Powerhouse.

3. During the primary fall Chinook salmon spawning season (September 15 to October 15), regulate the maximum flow in the Sultan River to protect any redds below the Powerhouse from dewatering if the Project is operated at minimum instream flows during the egg incubation period (September 15 to January 31 depending on the temperature conditions of the water).

4. When the water level of Spada Lake Reservoir drops to elevation 1,380 feet msl, restrictions are needed in flow through the power tunnel to avoid vortex conditions that can cause negative pressures and structural concerns in the power tunnel.

The combination of higher minimum flow releases, as proposed under A-LA 9, and the projected increase in future water demand for the City's municipal supply will have a substantial effect on water storage in Spada Lake Reservoir, and consequently, on Project operations. The effects on the water level in Spada Lake Reservoir of other proposed measures (such as the proposed process, whitewater, and temperature conditioning flows) will be relatively minor in comparison to the effects of releasing higher minimum flows and projected increases in water demand. The two major consequences will be: (1) that the City's future water supply could be jeopardized; and (2) water levels in Spada Lake Reservoir could be susceptible to dropping below elevation 1,380 feet msl, the power-off elevation. At lake levels below elevation 1,380 feet msl, water from Spada Lake Reservoir is released from Culmback Dam to meet the City's water demand, without passage through the Powerhouse.

Under these low water circumstances, the District's ability to provide flow-related aquatic resource enhancements in the Sultan River below Culmback Dam will be compromised. In addition to a potential inability to provide minimum flows, the District will lose the ability to mix the cold low-level releases from Culmback Dam with warmer surface water if the water level is below the upper intake location. Aquatic resources will be adversely affected if larger quantities of cold water were released to meet instream flow requirements and to convey flows to Lake Chaplain from the Diversion Dam to meet obligations to the City.

The District analyzed the ability of the Project to supply the City's future water demands by using a model with 109 years of historical daily hydrologic data. Three average water demand scenarios were evaluated; 84 MGD (130 cfs), 144 MGD (223 cfs), and 192 MGD (298 cfs). At current demand levels (84 MGD) and proposed minimum flows, the model indicated that the level of Spada Lake Reservoir would fall below elevation 1,380 feet msl in only 3 of the 109 modeled years. Under the 144 MGD demand scenario, reservoir elevations could be below elevation 1,380 feet msl in about 28 of the 109 modeled years. Under the maximum projected water demand scenario of 192 MGD, the minimum annual reservoir elevations could drop below elevation 1,380 feet msl in about 53 of the 109 modeled years.

In summary, as the City's water demand increases, the available water budget decreases, and water available for instream needs also decreases. Given the Project's operational constraints, particularly the limited ability of the reservoir to capture runoff during peak flows, Project operations cannot be designed to completely mitigate the effects of increased City demand over

the long term. As demand increases, minimum stream flow triggers will be implemented more frequently, the reservoir will be drawn down longer and further each year, the incidents of Spada Lake Reservoir levels falling below elevation 1,380 feet msl each year will increase, and the chance of Spada Lake Reservoir totally draining during a severe drought (assuming no water supply demand management) also will increase.

Under the proposed action, as City water demand increases, Chinook and steelhead spawning and rearing habitat will decrease. With a potential future demand of 192 MGD (projected demand beyond the term of a new License), the amount of Chinook spawning and rearing habitat area will be about the same or slightly more than occurs under existing conditions. As demand increases, modeling indicates the reservoir will be more frequently drawn down below elevation 1,380 feet msl during the fall, which is the Chinook salmon spawning period. This will result in the release of colder water during the Chinook spawning and early incubation period, which could lower egg survival, delay emergence, and affect juvenile Chinook survival. These 6 to 7°C cooler temperatures will likely affect Chinook salmon spawning success in the lower Sultan River and could delay fry emergence. Although these temperature-related effects could be substantial, actively managing reservoir levels in consultation with the ARC under the AMP (A-LA 15), and making necessary adjustments in flow to protect aquatic resources (especially listed Chinook and steelhead) will likely reduce these adverse effects.

Although implementation of the District's proposed environmental measures is expected to benefit aquatic resources in the long term, projected increases in the City's water demand will cumulatively affect seasonal fish habitat availability. The decline in aquatic habitat area with the higher future water demands and the proposed minimum flows will depend on the affected species, life stage, and water year type. However, these changes in aquatic habitat will generally remain within about 15 percent of what will be available under the City's current water demand level.

Hydroelectric energy from the Jackson Project is secondary to municipal water supply for the City of Everett. Increasing water demand by Everett over time has the greatest potential for adverse effects on Chinook and steelhead. The potential habitat reduction of 15 percent will translate into something less than a 15 percent reduction in each species productivity. Water diversion by Everett is not within jurisdiction of the Jackson FERC license.

C-LA 1 Historic Properties Management Plan

The proposed action would require the District to implement its Historic Properties Management Plan (HPMP). Implementation of C-LA 1 is expected to have no effect on listed fish species or their critical habitat.

R-LA 1 Recreation Resources Management Plan

The District proposes to implement the Recreation Resources Management Plan (RRMP). The majority of the recreation facilities and actions addressed by the RRMP would occur within the watershed upstream of Culmback Dam, outside the action area considered for ESA-listed fish species, and therefore, would have no effect on Chinook or steelhead. However, seven

recreation access sites are located on the Sultan River downstream of Culmback Dam within the action area.

The RRMP was prepared in consultation with several agencies, including WDFW. Nearly all the actions of the RRMP would involve maintaining existing facilities. Only minor modification and construction would occur. These activities would involve a small and temporary disturbance to aquatic habitat (e.g., removal of a few boulders that impede use of the boat launch) and would be expected to have a negligible impact on aquatic habitat quality and quantity.

Regardless, a Hydraulic Project Approval (HPA) from WDFW would be required for any in-water work. Any additional fish and habitat protection measures necessary to minimize or avoid impacts to listed fish and their critical habitat (if necessary) would be identified through the HPA process. Other regulations (e.g., the Snohomish County Critical Areas ordinance) would apply to work within the Sultan River, its buffer zone, and wetlands and their associated buffer zones. This plan is not expected to adversely affect ESA listed Chinook or steelhead.

T-LA 1 Terrestrial Resource Management Plan

T-LA 1 would require the District to implement the Terrestrial Resources Management Plan (TRMP). The TRMP is not applicable to listed Chinook and steelhead.

T-LA 2 Noxious Weed Plan

This plan would require the District to implement the Noxious Weed Management Plan (NWMP). Similar to the TRMP analysis, most of the Project lands managed under the NWMP are upstream of Culmback Dam, outside the action area, and therefore, would have no effect on listed fish species or their critical habitat.

T-LA 3 Marbled Murrelet Habitat Protection Plan

This plan would require the District to implement the Marbled Murrelet Habitat Protection Plan (MMHPP). The MMHPP is not applicable to listed Chinook or steelhead.

W-LA 1 Water Quality Protection Plan

Under the proposed action, the District would develop and file for Commission approval, a Water Quality Protection Plan, specifying how compliance with applicable state water quality standards would be demonstrated. This plan would specify: (1) water quality protection measures related to Project construction or maintenance activities (including best management practices for in-water and upland construction and maintenance activities); (2) spill prevention and containment procedures; (3) procedures for application of herbicides, pesticides, fungicides, and disinfectants; and (4) compliance monitoring and reporting procedures for select water quality parameters, such as stream flow, temperature, and turbidity. The District would develop this plan in consultation with the ARC.

The Water Quality Protection Plan would establish protective measures that would be implemented where there is potential for water quality degradation. The plan is expected to

indicate whether generic or site-specific best management practices are warranted at construction or maintenance sites. The plan would also indicate what water quality monitoring would be undertaken to document compliance with applicable water quality standards. Elements of other proposed measures (i.e., flow and mainstem continuous water temperature monitoring) would supplement the monitoring that would be specified in this plan. The plan would be developed in consultation with the ARC. Included on that committee would be representatives of the City of Everett, WDFW, and Ecology. Consequently, the City would be afforded an opportunity to provide input regarding measures that could protect the quality of its municipal water supply. Similarly, consultation with WDFW and Ecology could assist in the identification of measures that would be protective of water quality and designated uses, including Core Summer Salmonid Habitat.

The Core Summer Salmonid Habitat designated use criteria were developed by Ecology through input of various fisheries management stakeholders and approved by the Environmental Protection Agency. The standards were designed to be protective of Chinook and steelhead spawning, rearing, and migration. As the Water Quality Protection Plan (WQPP) would be developed to support the Core Summer Salmonid Habitat designated use in the Sultan River and because the water quality compliance criteria for this designated use support Chinook and steelhead, the WQPP would protect water quality associated with Project actions in the Sultan River sufficiently to support the continued successful use of the river by these listed species.

USFS 4(e) Condition 3 – Implementation of Activities on National Forest System Lands

USFS 4(e) condition 3 specifies that the District should coordinate with the USFS for any portion of the Project area that is under Federal authorization for other activities and permitted uses. This condition also specifies that the District should develop site-specific plans for habitat and ground-disturbing activities on NFS lands in accordance with criteria designated in the condition.

Portions of the Sultan River downstream of Culmback Dam (within the action area for listed fish species) are located on NFS lands. Review of ground-disturbing activities would likely incorporate protection measures to avoid and minimize effects to listed fish and their critical habitat, which would benefit listed Chinook, steelhead, and bull trout.

Jackson Off-License Supplementation Program Agreement

In addition to the improvements to Spada Lake contained in the Settlement Agreement, WDFW requested that the District mitigate the Project's effects on the trout population and the loss of recreational fishing in Spada Lake. The effects of this program on ESA-listed Chinook, steelhead, and bull trout are expected to be negligible.

Lake Chaplain Tract Land Management Off-License Agreement

The Project lands managed under the Lake Chaplain Tract Land Management Off-License Agreement are outside the habitat area for ESA listed fish, and therefore, would have no effect on ESA listed fish species or their critical habitat.

5.2 Summary of Project Effects on Listed Species and their Habitat

While the proposed action still impacts listed species and their habitat, the measures contained in the proposed action mostly add small, incremental beneficial effects to Chinook and steelhead productivity and diversity, compared to the existing project. Minimum instream flows increase spawning habitat and provide incubation protection from dewatering. The high flow limit and flood control attributes of the project would significantly reduce flood scour losses of Chinook eggs, alevins, and fry, and extend to steelhead to a lesser extent. The flow continuation feature added to the powerhouse would protect all species from the risk of dewatering in Reach 1.

Managing the water supply and adding facilities and operations that improve reliability, control water temperature, and address drought conditions all contribute to improved protection of Chinook and steelhead resources.

The majority of the measures contained in the Proposed Action would directly benefit listed Puget Sound Chinook and steelhead. Each of the species would benefit from the increased and improved instream flow regime and habitat improvements, enhancing all four VSP criteria (abundance, productivity, diversity, and spatial structure). Chinook and steelhead would additionally benefit by further increased population abundance and spatial structure by having access to Reach 3 if fish passage at the diversion dam is triggered.

5.3 Effects on Designated Critical Habitat

5.3.1 Chinook

As described in Section 3.1.3, the Sultan River is designated critical habitat for Chinook salmon from its confluence with the Skykomish River to the diversion dam.

This section analyzes the effect of the proposed action on Chinook salmon designated critical habitat. NMFS determines the effects of a proposed action on critical habitat through an analysis of critical habitat PCEs. PCEs are physical or biological features that are essential for the species to complete each life stage and are essential to its conservation. In the final critical habitat designation for Puget Sound Chinook salmon, NMFS developed a list of PCEs based on Chinook salmon and steelhead unique life history needs. As the PCEs developed by NMFS are applicable to steelhead, this analysis would serve to determine Project effects on critical habitat for Puget Sound steelhead, should such be designated before a new Project License is issued.

Three primary freshwater habitat elements are essential to the conservation of salmon and steelhead: properly functioning spawning, rearing, and migration corridor habitats. The existing condition of each PCE in the Sultan River was described in Section 4.3 (Status of Critical Habitat within the Action Area). The focus of this analysis is to determine whether the proposed

action would adversely modify the existing condition of each PCE or continue to impair the attainment of properly functioning conditions over the long-term in the action area. The proposed action would have the following effects on Chinook salmon critical habitat PCEs:

Spawning PCE

Although Chinook successfully spawn in the lower Sultan River, existing Project operations have affected the amount and quality of Chinook spawning habitat in the Sultan River. In addition, the Marsh Creek slide restricts access to spawning habitat, which results in an "impaired" rating for this PCE under existing conditions.

The spawning PCE would improve under the proposed action because the Project would continue to provide beneficial water temperature conditioning in Reach 1 and Reach 2, and the overall Chinook spawning habitat would increase by about 12 percent compared to existing conditions (refer back to instream flow effects section). In addition, modeling suggests that spill events would continue to be limited, reducing redd scour potential. Ample gravel currently exists to support an increasing naturally produced Chinook population in the Sultan River. Such gravel quantity and quality is expected to be maintained over the long term, as overall gravel recruitment to Reach 1 and Reach 2 does not appear to be adversely affected by the Project.

In addition, the Marsh Creek slide would be modified to improve Chinook salmon passage, and fish passage would be added at the diversion dam, if triggers were met, to increase the amount of accessible spawning habitat in the Sultan River. However, the area upstream of the diversion dam is not designated critical habitat for Chinook salmon. Reach 3 upstream of the diversion dam would also benefit from proposed water temperature conditioning, and if passage were to be provided at the diversion dam, this water temperature improvement would improve conditions for Chinook incubation and rearing.

Rearing PCE

Existing Project operations have contributed to reduced side channel habitat quantity and quality and floodplain connectivity. Woody debris quantity and complexity is also relatively low in Reach 1. Therefore, this PCE is impaired in the Sultan River.

The rearing PCE would improve under the proposed action as a result of increasing minimum flows, providing access to side channels, installing LWD, providing beneficial water temperature control in Reach 1 and Reach 2, and implementing more restrictive ramping rates.

Migration Corridor PCE

The Marsh Creek slide restricts access to upstream spawning and rearing habitat. Cover for migrating fish, such as LWD, is relatively limited in Reach 1. Side channel habitat connectivity is also impaired by existing Project operations. Therefore, this PCE is impaired in the Sultan River.

The migration corridor PCE would be improved under the proposed action by increasing the minimum stream flow requirements, providing pulsed flows for adult upstream migration, by providing beneficial water temperature control in Reach 1 and Reach 2, and by improving side channel connectivity.

Estuarine Habitat PCE

The critical habitat designation defines an estuarine habitat PCE, which includes "*estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation*". The estuary is outside the Project Action Area and would not be affected by the Proposed Action in any measurable way.

Summary of Effects on Designated Chinook Critical Habitat

The proposed action would improve the spawning, migration, and rearing PCEs in the Sultan River. However, the Project would continue to impair peak flow and floodplain connectivity (although floodplain connectivity would be improved compared to existing conditions). Habitat enhancement (i.e., side channels and LWD) and implementation of process flows in combination with the beneficial effects of reduce peak flows (i.e., reduced redd scour) are expected to result in habitat conditions that would fully support and improve Chinook salmon spawning and rearing over the long term. These habitat conditions are expected to support a continued increasing trend in naturally produced Chinook salmon spawner escapement in the Sultan River, as has occurred over the last decade under existing Project operations.

6. CUMULATIVE EFFECTS

'Cumulative effects' are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

The Endangered Species Consultation Handbook (USFWS and NMFS 1998) describes this standard as follows:

> *Indicators of actions "reasonably certain to occur" may include, but are not limited to: approval of the action by State, Tribal, or local agencies or governments (e.g., permits, grants); indications by State, Tribal, or local agencies or governments that granting authority for the action is imminent; project sponsors' assurance the action will proceed; obligation of venture capital; or initiation of contracts. The more State, Tribal, or local administrative discretion remaining to be exercised before a proposed non-Federal action can proceed, the less there is a reasonable certainty the project will be authorized.*

There are numerous non-Federal activities that have occurred in the Action Area in the past, which have contributed both adverse and positive effects to the environmental baseline. This step of the analysis for application of the ESA Section 7(a)(2) standards requires the consideration of those activities which are "reasonably certain to occur" in the future within the Action Area.

Any action that would require future Federal approval, funding, or other involvement is not included within the "cumulative effects" for this analysis (see ESA definition, above). Federal involvement of this type would trigger ESA Section 7(a)(2) consultation in the future which, when completed, would result in the action being considered part of the environmental baseline for later consultations and its effects analyzed accordingly. Thus, for example, State efforts to improve water quality in compliance with the Federal Clean Water Act (CWA) are not considered, because of the involvement of the Environmental Protection Agency (EPA), until EPA completes consultation with NMFS. Other examples might include irrigation water withdrawals involving the USFS (right-of-way permits for irrigation canals) and agricultural practices that receive Federal funding through the U.S. Department of Agriculture.

Given the moderate growth of human population in the vicinity, it is also likely that future private and State actions will continue in the Action Area at the same pace. In contrast to adverse effects that increasing population pressures are expected to put on aquatic resources, there is a large-scale initiative under way that may benefit Puget Sound Chinook habitat in the Sultan/Snohomish River Basin. The Shared Strategy for Puget Sound has prepared a Draft Puget Sound Salmon Recovery Plan (Shared Strategy 2007). The Shared Strategy is a collaboration of Federal, State, and local governments, Tribes, and organizations. The draft plan proposes doubling funding for salmon recovery from $60 million/year to $120 million/year. Although it is likely that many of the prospective recovery actions will be implemented, all are uncertain.

NMFS anticipates that impacts would be moderate because of the expectation that land along the mainstem Sultan would continue to be largely rural and therefore not result in major habitat changes.

6.1 ESA-Listed Fish

The Jackson Hydroelectric Project and the associated City of Everett water supply system is the only water resource development located on the Sultan River. Under existing and proposed conditions, the storage and diversion of water associated with the Project alters the natural hydrology, geomorphology, and water quality in the Sultan River downstream of Culmback Dam, which in turn affects the quality and quantity of aquatic habitat for resident and anadromous fish, including ESA-listed Chinook and steelhead. In addition to these Project effects, municipal water withdrawals, the Sultan River diversion dam, agriculture, timber harvest, rural development, flood control, commercial and recreational fish harvest have adversely affected and would continue to adversely affect aquatic habitat and fish community structure.

Implementation of the District's proposed water temperature conditioning, Marsh Creek slide modification, downramping rates, Sultan River diversion dam volitional fish passage, minimum instream flows, process flows, side channel enhancements, culvert removals, and LWD enhancements would substantially improve aquatic habitat in the lower Sultan River compared to existing conditions and is expected to increase the productivity of ESA-listed fish species. The District would continue to monitor steelhead and Chinook, pink, and chum salmon annual escapement in the Sultan River. The data would be used to make informed management decisions regarding Spada Lake and the Sultan River, which in turn would aid Snohomish River Basin-wide salmon and steelhead recovery efforts.

Although implementation of the District's proposed environmental measures is expected to benefit aquatic resources in the long-term, projected increases in the City of Everett's water demand could cumulatively affect seasonal fish habitat availability. In general, and without taking into account possible additional water conservation measures implemented by the City, as its water demand increases beyond current levels (84 MGD) and the remaining water budget for Spada Lake decreases, the amount of water available for instream flows would be reduced, thereby reducing available fish habitats. However, under the most likely growth scenario losses in aquatic habitats would generally remain within about 15 percent of what would be available under the City's current water demand level.

The District's operations model also indicates that the level of Spada Lake would drop below elevation 1,380 feet msl (the depth when flow through the power tunnel becomes problematic) on a more frequent basis as the City's water demand increases. As demand increases to 144 MGD, Spada Lake would drop below elevation 1,380 feet msl in 28 of the 109 modeled years and 53 of the 109 modeled years at the projected water demand of 192 MGD in the year 2060. A combination of emergency water conservation measures which would likely be implemented by the City and the District's proposed conservation flow triggers would likely moderate these worst-case scenarios. However, dropping below elevation 1,380 feet msl in the fall would reduce the Project's ability to enhance the water temperature regime, resulting in cooler releases during the Chinook salmon spawning and incubation periods and would delay fry emergence. Although these temperature-related effects could be substantial, actively managing reservoir levels in consultation with the ARC, and making necessary adjustments in flow to protect aquatic resources may reduce these effects.

7. CONCLUSIONS

This section presents NMFS' Biological Opinion regarding whether, in aggregate, the effects analyzed under the environmental baseline (Section IV), the effects of the proposed action (Section V), and the cumulative effects (Section VI) in the action area, when considered in the context of the current range-wide status of the species (Section III), are likely to jeopardize the continued existence of the listed species considered in this Opinion. This section also presents NMFS' Biological Opinion regarding whether the proposed action is likely to result in the destruction or adverse modification of designated critical habitat.

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' Biological Opinion that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon, Puget Sound steelhead, or Southern Resident killer whales, or to destroy or adversely modify their designated critical habitat. These conclusions are based on the following considerations.

7.1 Determination of Effects on Listed Fish Species and Critical Habitat

Under the proposed action, the Henry M. Jackson Hydroelectric Project would continue to adversely affect both Puget Sound Chinook salmon and Puget Sound steelhead, through operations-induced reductions in spawning, incubation, and rearing habitats. By increasing minimum instream flows, investigating improved passage, providing pulsed-flows and increasing large woody debris for aquatic habitat improvement, the proposed action would substantially reduce these adverse effects. Recent population trends of these species show that the requirements for viable salmonid populations (McElhany et al. 2000) are not currently being met. However, because the proposed action improves fish habitat conditions and may expand accessible habitat in the action area, it is expected to improve the viability of the species.

While the proposed action is expected to have a net beneficial effect on listed Chinook and steelhead and would likely improve or at least maintain designated Chinook critical habitat PCEs, the risk of infrequent incidental adverse effects on individual fish cannot be entirely discounted. For example, short-term harm or harassment may be caused by side channel and LWD enhancement construction activities (i.e., the short-term displacement or removal of fish from in-water work areas), and during monitoring activities that would result in capture and handling of listed fish. Consequently, following the guidance presented in NMFS (1996), the proposed action is "likely to adversely affect" listed Chinook salmon and steelhead.

As the proposed action is expected to improve or at least maintain critical habitat PCEs in the action area, the proposed action (including the two off-License agreements) is not likely to adversely modify designated Chinook salmon critical habitat.

Based on these determinations, NMFS determines that the Proposed Action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon or steelhead nor destroy or adversely modify designated Chinook critical habitat. In regard to conclusions concerning Southern Resident Killer Whales, please see Appendix 1.

8. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise legal agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

8.1 Amount or Extent of Anticipated Take

Under the proposed licensing action, NMFS expects that incidental take would occur as a result of the continued existence and operation of the Henry M. Jackson Hydroelectric Project. It is not possible to quantify the amount of take. The extent of take may extend from the upstream limit of anadromous fish use of the Sultan River to the river's confluence with the Skykomish River. During the prospective license term, increasing water supply demand and diversion by the City of Everett may increase the cumulative effects on critical habitat and Chinook and steelhead and cause additional take. Although described in this Opinion and listed as an off-license agreement between the District and Everett, take due to water diversion is not covered by this Incidental Take Statement. FERC is the Federal agency consulting on the proposed action, and water diversion is not subject to the FERC license and FERC's jurisdiction. Therefore, it is not possible to cover take caused by an action outside the purview of the Federal action agency.

8.1.1 Juvenile Salmonids

Process and flushing flows may scour a small proportion of redds and displace juvenile Chinook and steelhead; NMFS expects these would reduce the mortality of the eggs and pre-emergent fry in spawning areas of the Sultan River by more than 75 percent compared to that of unregulated natural flood flows, as explained in the reservoir operations section A-LA 14. Take of juvenile Chinook and steelhead could also occur as an effect of handling during fish population and habitat monitoring. Short-term construction impacts may take small numbers of juvenile fish or reduce habitat use as a result of blockage or sediment release during activities such as installation of LWD and side channel enhancement, although these actions would be beneficial overall.

NMFS estimates that that take of juvenile salmonids from handling during monitoring would be one percent, or less, of Chinook and steelhead. If monitoring indicates that take is greater than one percent, then the Licensee must make facility or operational improvements to bring survival into compliance. Additionally, NMFS estimates the annual take of juvenile salmon from extreme downramping would not exceed 1.25% of the Chinook and 1.6% of the steelhead fry population, of each listed species, in any one year, as described in section 5.1, A-LA 5. Flood

scour loss of eggs and alevins is a form of natural mortality, with or without the project, and is not covered by this take statement.

Take is expected to be minimal, and is not expected to limit Chinook or steelhead productivity in the Action Area.

8.1.2 Adult Salmonids

Construction activities may temporarily displace adults or modify their behaviors in a manner similar to those described for juveniles above. The analysis of effects on marine mammals in Appendix 1 estimates short term incidental take at no more than 10 adult Chinook salmon by extrapolating the smolt to adult survival rate to juvenile take. No direct take is expected.

8.2 Reasonable and Prudent Measures

Reasonable and prudent measures' are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). 'Terms and conditions' implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in Section 7(o)(2) to apply. FERC has the continuing duty to regulate the activities covered in this Incidental Take Statement. If FERC fails to require the Licensee to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are in the license, or fails to retain the oversight to ensure compliance with these Terms and Conditions, the protective coverage of Section 7(a)(2) would lapse. Activities carried out in a manner required by these RPMs, except those otherwise identified, would not necessitate further site-specific consultation.

The following RPMs are necessary and appropriate to minimize the effect of anticipated incidental take of Puget Sound Chinook and Puget Sound steelhead. FERC must require the Licensee to:

1. Minimize incidental take from the operation of the Project by following all the actions described in the proposed license articles of the Jackson Settlement Agreement as incorporated by FERC in the Project license that relate to Puget Sound Chinook and Puget Sound steelhead.
2. Minimize incidental take during monitoring of listed species when handling juvenile and or adult anadromous fish during fish population monitoring activities.
3. Minimize incidental take from construction activities in or near watercourses.

9. TERMS AND CONDITIONS

To be exempt from the prohibitions of Section 9 of the ESA, FERC must ensure that the Licensee fully implements the conservation measures in the License, and include in the License the following terms and conditions that implement the reasonable and prudent measures described above. Partial compliance with these terms and conditions may result in more take than anticipated, and would invalidate this take exemption. These terms and conditions are consistent with the basic design of the proposed action (USFWS and NMFS 1998). Though requiring some minor modifications in

operations and equipment, the terms and conditions would not substantially interfere with the Project's capacity to provide electric energy to help meet regional energy demands.
FERC should issue a new License to:

1. Require the Licensee to monitor fish populations and habitat and passage as described in the appropriate license articles. The Licensee must report all incidental take that occurs during monitoring activities to NMFS. The Licensee must report the results of monitoring of fish and water quality annually to NMFS. This may be concurrent with the Project annual reports to FERC and shall be provided to NMFS by March 31 for take which occurred in the prior calendar year. Listed fish must be handled with extreme care and kept in water, with adequate circulation, to the maximum extent possible during sampling and monitoring. When a mix of species are captured or collected, ESA-listed fish must be processed first, to the extent possible, to minimize stress. Listed fish must be transferred using a sanctuary net (which holds water during transfer) whenever practical to prevent the added stress of being dewatered. Require the Licensee to monitor juvenile and adult mortality to ensure that incidental take levels are not exceeded. The Licensee must develop the monitoring measures in conjunction with NMFS, and receive their approval of the monitoring plan.

   Incidental take should be reported to:

   National Marine Fisheries Service
   Hydropower Division, FERC and Water Diversions
   Attention: Keith Kirkendall, Branch Chief
   1201 NE Lloyd Blvd., Suite 1100
   Portland, OR 97232

2. Require the Licensee to use best management practices in all construction work, including adhering to certain timing restrictions. Spill control equipment must be on site and in quantities sufficient to effectively contain and recover accidental release of chemicals. Project personnel must be familiar with spill control equipment operation and procedures prior to the initiation of work. Instream work shall be conducted according to BMPs, consistent with WDFW's Hydraulic Code (RCW 77-55) by conforming to a Hydraulic Project Approval (WAC 220-110) obtained from WDFW. In the event that the regulations are significantly modified or repealed during the license term, the terms in effect in 2010 shall continue in force for the term of the license to protect fish and their habitat.

3. FERC shall include the standard license reopener clause in any license issued for this project to ensure continuing agency discretion throughout the life of the license as may be necessary to protect species listed under the ESA.

10. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggest to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information. NMFS has no conservation recommendations to make at this time.

11. REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

12. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

12.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2));
NMFS must provide conservation recommendations for any Federal or State action that would adversely affect EFH (§305(b)(4)(A)); Federal agencies must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations. (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR §600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), or site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR §600.810).

EFH consultation with NMFS is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

12.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Federally managed Pacific salmon: Chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Habitats for Chinook salmon and coho salmon would be affected by the proposed action. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable manmade barriers (as identified by the Pacific Fishery Management Council ((PFMC) 1999)), and long-standing, naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based, in part, on this information.

12.3 Proposed Actions

The proposed action and action area are detailed in this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of coho salmon and Chinook salmon.

12.4 Potential Effects of the Proposed Action on Salmonids

The anticipated effects of the proposed action on EFH for Chinook and coho salmon would be the same. The effects include:

- Modification of the natural hydrologic regime,
- Reduced flows at some times and increased flows at others,
- Downramping,
- Water temperature modification,
- Stream channel homogeneity,
- Fish passage enhancements,
- Habitat improvement projects.

12.5 Conclusion

NMFS concludes that the proposed action would adversely affect designated EFH for coho salmon and Chinook salmon.

12.6 EFH Conservation Recommendations

Pursuant to Section 305(b)(4)(A) of the MSA, NMFS is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NMFS understands that the conservation measures described in the Biological Assessment (BA) would be implemented by FERC and, through its licensee, Snohomish PUD, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above.

However, the Terms and Conditions outlined in Section 9 are generally applicable to designated EFH for coho salmon and Chinook salmon, and address these adverse effects. Consequently, NMFS recommends that they be adopted as EFH conservation measures.

12.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR §600.920(j), Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations (16 U.S.C. 1855(b)(4)(B). The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

12.8 Supplemental Consultation

FERC must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR §600.920(k)).

13. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (the Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: This document records the results of an interagency consultation. The information presented in this document is useful to two agencies of the Federal government (NMFS and FERC); and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information is beneficial to citizens of Snohomish County because the underlying project affects natural resources at a site within that county. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Northwest Region website. The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this biological opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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APPENDIX 1. MARINE MAMMAL EFFECT DETERMINATIONS

Section 2 of the opinion defines the proposed actions as the amended project license consistent with the October 2009 settlement agreement.

Species Determination, Southern Resident Killer Whales

The Southern Resident killer whale DPS composed of J, K, and L pods was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). The final rule listing Southern Resident killer whales as endangered identified several potential factors that may have caused their decline or may be limiting recovery. These are: quantity and quality of prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessel traffic. The rule also identified oil spills as a potential risk factor for this species. The final recovery plan (NMFS 2008) includes more information on these potential threats to Southern Resident killer whales.

Most of the direct effects of the proposed actions on listed salmonids occur within the freshwater system of the Sultan River; effects experienced by Southern Residents in marine waters are indirect. That is, the proposed actions may affect the abundance of killer whale prey in marine waters. Changes in prey abundance would affect the entire DPS of Southern Resident killer whales.

The best available information indicates that salmon are the preferred prey of killer whales (96 percent of prey consumed during spring, summer and fall, from long-term study of resident killer whale diet; Ford and Ellis 2006), and that Chinook are the preferred salmon species (Ford and Ellis 2006, Hanson et al. 2010). In inland waters from May to September, Southern Residents' diet consists of a high percentage of Chinook, with an overall average of 82% Chinook across the timeframe and monthly proportions as high as >90% Chinook (i.e., July: 96% and August: 91%, see Table 2 of Hanson et al. 2010). Killer whales also capture larger Chinook (primarily age 3-5 years; Ford and Ellis 2006). Southern Resident killer whales likely consume both natural and hatchery salmon (Hanson et al. 2010).

Effects Analysis

This analysis focuses on the effects of the proposed actions on quantity of Chinook available to the whales, because Chinook are their preferred prey and the other affected salmonids, chum and steelhead, are small components of the whales' diet. To survive in the near term, Southern Residents require regular supplies of adult Chinook prey in marine waters, and to recover over the longer term, Southern Residents require abundant Chinook stocks across their range (from the Queen Charlotte Islands south to Central California and inland waters of Washington State and British Columbia), including stocks from the Puget Sound (Hanson et al. 2010). This analysis considers the short-term and long-term effects of the proposed actions.

Our analysis of effects on Southern Residents follows from the salmon analysis on listed Puget Sound Chinook in this opinion.

Short-term Effects –
Project operations cause mortality of natural juvenile Chinook during outmigration from the Sultan River system as a result of managing instream flow releases in the form of downramping violations or the project tripping off line. At most, 1.25 percent of the natural juvenile Chinook would be killed by such operations annually. No losses of natural or hatchery fish in the Skykomish River are attributable to project operations. Based on estimated smolt to adult recruitment, these losses would amount to an annual estimate of less than 10 adult Chinook that would have otherwise been prey available to Southern Resident killer whales.

Long-term Effects – We rely on the salmon determinations to evaluate effects on Southern Residents in the long term. The effects analysis of this opinion for Puget Sound Chinook finds that the proposed actions result in some short-term negative effects, but will likely meet the biological requirements of the ESU within the action area (Sections 5 and 7). The majority of the proposed measures will improve the status of Puget Sound Chinook by addressing passage and habitat issues that are current limiting factors for natural production. The analysis concludes that the proposed actions are not likely to appreciably reduce the likelihood of survival and recovery or adversely modify critical habitat of Puget Sound Chinook and the other listed salmonids addressed (Section 7). Additionally, as articles in the proposed license are implemented, the natural-origin Chinook are expected to increase, offsetting the short-term effects and expanding the Chinook population, which would increase the prey base for Southern Resident killer whales.

To summarize, in the short-term project operations result in an insignificant reduction in adult Chinook otherwise available as prey for Southern Resident killer whales. The proposed actions will not appreciably reduce the likelihood of survival and recovery or adversely modify critical habitat of Puget Sound Chinook and other affected salmonids, and are anticipated to improve the status of Puget Sound Chinook and increase prey available to Southern Residents in the long term.

Therefore, NMFS concurs with the FERC determination that the proposed actions may affect, but are not likely to adversely affect Southern Resident killer whales.

Critical Habitat Determination, Southern Resident Killer Whales

NMFS published the final rule designating critical habitat for Southern Resident killer whales on November 29, 2006 (71 FR 69054). Critical habitat includes approximately 2,560 square miles of inland waters including Puget Sound, but does not include areas with water less than 20 feet deep relative to extreme high water. The primary constituent elements (PCEs) of Southern Resident killer whale critical habitat are: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

Effects Analysis
The proposed actions may affect the quantity of prey available in critical habitat. The proposed actions are not expected to have an effect on water quality or passage of the whales. The

previous discussion of the effects on whales as a result of change in prey availability is also relevant to effects on the prey feature of critical habitat. As described previously, project operations are expected to result in an insignificant loss of prey. Additionally, NMFS concluded that the proposed actions are not likely to jeopardize the continued existence of listed salmon, including Puget Sound Chinook, or destroy or adversely modify their critical habitat. Therefore, NMFS concurs with the FERC determination that the proposed actions may affect, but are not likely to adversely affect critical habitat of Southern Resident killer whales.

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