Process Flow Plan

Henry M. Jackson Hydroelectric Project
(FERC No. 2157)

Public Utility District No. 1 of Snohomish County

November 2023

TABLE OF CONTENTS

APPENDICES

ACRONYMS

A-LA	Aquatic License Article
ARC	Aquatic Resource Committee
cfs	cubic feet per second
CM	channel maintenance
FERC	Federal Energy Regulatory Commission
LiDAR	Light Detection and Ranging
LWD	Large woody debris
MW	Megawatt
msl	mean sea level
PF	Process flow
PFP or Plan	Process Flow Plan
PM&E	Protection, mitigation, and enhancement
Project	Henry M. Jackson Hydroelectric Project, FERC No. 2157
RSP	Revised Study Plan
Snohomish PUD	Public Utility District No. 1 of Snohomish County
USGS	United States Geological Survey

1. INTRODUCTION

1.1. Background

On September 2, 2011, Public Utility District No. 1 of Snohomish County (Snohomish PUD) received from the Federal Energy Regulatory Commission (FERC) a new license (License) for the existing 111.8-megawatt (MW) Henry M. Jackson Hydroelectric Project (FERC No. 2157) (Project). The License expires on August 31, 2056. The Project is located on the Sultan River in Snohomish County, Washington, near the City of Sultan. The Project was originally licensed in 1961 and amended in 1981. In 1964, construction of Culmback Dam was completed to create Spada Reservoir – the source of the majority of drinking water supplied to Snohomish County by the City of Everett. In 1984, construction of the Project's major hydroelectric facilities was completed. The Project includes a 262-foot high rock-fill dam (Culmback Dam); a 1,870-acre reservoir (Spada Reservoir) operated for the City of Everett's water supply, fisheries habitat enhancement, hydroelectric power, and incidental flood control; power tunnel and pipelines; a Powerhouse and various other facilities; wildlife mitigation lands; and several developed and undeveloped lake recreation and river access sites.

On October 14, 2009, Snohomish PUD filed a comprehensive settlement agreement (Settlement Agreement) on behalf of itself, National Marine Fisheries Service, United States Forest Service, United States Fish and Wildlife Service, United States National Parks Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, the Tulalip Tribes of Washington, the City of Everett, Snohomish County, the City of Sultan and American Whitewater (collectively referred to as "Settlement Parties"). The Settlement Agreement resolved among the signatories all issues associated with issuance of a new license for the Project, including reservoir operation, minimum instream flows, process flows, whitewater boating flows, ramping rates, fish passage, fish habitat improvements, wildlife habitat management, marbled murrelet protection measures, recreation, historic properties and license term.

The Settlement requested that the Commission adopt, without material modification, several Proposed License Articles. These Proposed License Articles would implement a complex and interrelated suite of protection, mitigation and enhancement measures that would result in improved resource conditions and ecological processes in the Sultan River over the term of a new license. The Proposed License Articles mainly addressed flows, fish passage, fish and wildlife habitat enhancement and protection, water quality, municipal water supply, rule curves for reservoir operation, fish supplementation, recreation, historic properties, and noxious weeds.

Proposed Aquatic License Article (A-LA) 8 from the Settlement Agreement led to the development of the Process Flow Plan (PF Plan, or Plan); A-LA 8 is included as Appendix 1 for historic reference. FERC approved the PF Plan as Article 416 in the License. Snohomish PUD consulted with the Aquatic Resource Committee (ARC) on the original Plan's development and implementation during the first 10 years of the new License, 2011-2021. The ARC consists of representatives from the Tulalip Tribes, U.S. Forest Service, U.S. Fish and Wildlife Services, National Marine Fishery Services, Washington State Department of Fish and Wildlife, Washington State Department of Ecology, Snohomish County, City of Everett, City of Sultan, and American Whitewater.

Following Year 10 of License implementation and consistent with Section 5.1 of the Plan, Snohomish PUD presented to the ARC a 10-Year Process Flow Effectiveness Report. Based on monitoring results from the initial 10-year period, Snohomish PUD presented its recommendations to the ARC for the next 10-year cycle. Comments received from the ARC indicated a need to discuss the proposed modifications further to reach an agreement towards modifying and implementing the Plan for the next 10-year period. After a series of collaborative workshops, meeting discussions, and emailed feedback (Appendix 3), a consensus among the ARC was reached which resulted in minor revisions. These are presented in this updated version of the Plan, and which will be used in conjunction with release data to evaluate the effectiveness of process flow objectives, as defined in Section 1.3., during the new 10-year cycle (July 1, 2023 – June 30, 2033. Documentation of consultation with the ARC on the updated Plan is included in Appendix 4.

1.2. Purpose

This PF Plan is based primarily on the results of the Revised Study Plan 22 Physical Process Study (Stillwater 2009), Revised Study Plan 23 Indicators of Hydrologic Alteration/Range of Variability in the Sultan River (R2 2008), development of protection, mitigation, and enhancement (PM&E) measures during settlement agreement negotiations, and the 10-Year Process Flow Effectiveness Report (Snohomish PUD 2023). Updates to the original PF Plan for the next 10-year cycle were based on a series of ARC workshops and consultation discussing results from the first 10-year period (2011-2021). While changes to this Plan are minor, they are based in large part on data collected in the first 10-year period and knowledge gathered through implementation. The purpose of the Plan is to outline the schedule and frequency for providing flows of specific magnitude and duration to meet desired aquatic resource objectives. These flows will be met primarily through periodic controlled Project releases from Culmback Dam, the City of Everett's Diversion Dam, and the Powerhouse. When possible, these releases will be sequenced to occur with heavy rainfall (accretion) to achieve flows of greater magnitude. Spill events may also contribute to achieving the aquatic resource objectives.

This PF Plan includes provisions that describe:

1. the frequency, magnitude, duration, and timing (seasonality) of process flow components;
2. the ongoing involvement of the ARC in implementing this program;
3. the mechanism for timing-controlled flow releases (including whitewater boating releases pursuant to the Whitewater Recreation Plan) to coincide with rainfall events or uncontrolled flow releases to achieve the frequency, magnitude, and duration for each of the process flow components;
4. the timing and other restrictions necessary to minimize impacts to aquatic resources and to 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 the implementation of flushing flows for supporting the geomorphic process goals;
7. the method and schedule for studying the timing of upstream migration flow and outmigration flow for providing upstream and downstream migration of anadromous fish; and
8. the method and schedule for monitoring the impacts of process flow upon physical habitat and aquatic resources.

1.3. Goals and Assumptions

When developing the proposed process flow PM&E during settlement negotiations, there was scientific uncertainty among the Aquatic Resource Settlement Group on the need for, the magnitude, and the duration of various process flow components requiring releases above and beyond what already occurs from the Project and what occurs naturally. The following assumptions were made during settlement negotiations and through the monitoring components will be studied to determine the cost/benefit and necessity of providing or modifying such flows to improve habitat conditions in the Sultan River.

The channel forming, channel maintenance, and flushing flows outlined in the proposed license article will likely contribute to the:

- formation and re-distribution of physical habitat features including riffles, pools, runs, and point bars;
- effective transport, sorting, and distribution of large woody debris (LWD) and sediment,
- alteration of channel features including increased lateral channel movement and improved connectivity between mainstem and side channel habitats,
- creation of undercut banks; and
- the removal of interstitial fine sediment from spawning gravels.

In addition to initiating changes to in-channel habitat, regular process flows are expected to slightly alter the channel form, and limit riparian vegetation encroachment (Leopold 1964). The magnitude, duration, and frequency of flows required to achieve the desired resource objectives are not an exact certainty. Monitoring will provide information on effectiveness and the interplay of these three flow parameters in meeting the intent of the license article. Where possible, and subject to regulatory approval, Snohomish PUD will implement physical interventions agreed to by the ARC as part of the Fish Habitat Enhancement Plan and Side Channel and Large Woods Debris Plan to further promote geomorphic activity and enhance the effectiveness of flow releases in achieving desired habitat objectives.

Although extreme high magnitude flow events during the salmon and steelhead incubation period have been linked with reduced egg-to-fry survival, short duration flow events of lesser magnitudes (pulsed flows) in the spring may trigger juvenile salmonid outmigration. Short duration pulsed flow events in the late summer and fall are known to initiate the upstream migration of adult salmon, and may facilitate swimming past natural and artificial barriers where they may become present. Overall, implementing the juvenile outmigration and adult upstream migration flow releases aim to provide hydrologic pulses similar to those associated with the seasonal hydrology found in unregulated rivers in the Snohomish Basin and the IHA analysis for the lower Sultan River. While accurate quantification is a challenge, these elements may promote an increase in survival of juvenile salmon and steelhead outmigrants and may also facilitate upstream migration of returning adults.

Effective upstream migration flow (A-LA 8 Section 4) and outmigration flow (A-LA 8 Section 5) can occur over a wide range of magnitudes. For example, A-LA 8 Section 4.1 specifies that the upstream migration within Reach 1 is achieved when a minimum flow between 800 and 1,200 cfs as determined by the ARC is maintained or exceeded for six (6) consecutive hours. By providing a range, the Settlement Parties intended that Snohomish PUD, in consultation with the

ARC, will test different flow magnitudes within that range during the first ten years of the License. At the end of this initial period and based upon that testing, the Settlement Parties intended that Snohomish PUD, in consultation with the ARC, would recommend for FERC approval a permanent flow level within the range specified in the flow component. This level of discernment on flow magnitude was not possible during the first 10 years of program implementation because of the merging of process, special purpose, and recreational flow releases. Adoption and implementation of the revised program with releases and objectives parsed out will allow for the level of discernment necessary to move towards development of a permanent flow levels. Release timing has been the area of focus for refined / revised program, and is reflected in this updated PF Plan for FERC's approval.

1.4.Coordination and Integration

1.4.1. District's Role

Snohomish PUD has the responsibility to implement the PF Plan as required by the License issued by FERC; Snohomish PUD will be responsible for:

- funding to carry out the measures as described herein;
- coordinating with surrounding landowners regarding land management in or near the Project boundary that may affect or be affected by the measures provided;
- consulting with appropriate stakeholders, the ARC, and the FERC as needed;
- monitoring resource effects; and
- reporting to FERC.

1.4.2. ARC Involvement

Snohomish PUD will meet with the ARC on a quarterly basis to discuss relevant topics regarding the implementation of this Plan as described in the various sections below. On an annual basis, Snohomish PUD will discuss with the other ARC members that year's potential process flow events. Specific to the flow releases required for channel maintenance, Snohomish PUD will provide monthly biological updates to the ARC during the October to February timeframe. These updates will include information on the run size, brood year, redd distribution, and the developmental stage of incubating eggs which will support collaborative decision making and help avoid unintended resource impacts while not comprising attainment of the desired habitat objectives. A template for these monthly biological updates and a tool for decision making is provided in Appendix 2 to help guide the ARC discussion on whether or not a channel maintenance release is warranted.

Several ARC members have expressed an interest in receiving advance notice when a process flow will be released so they may observe and monitor the release. Snohomish PUD will strive to notify those ARC members 48 hours prior to the release via email or phone. Notices of process flows will be posted to Snohomish PUD's web site, and mining claimants will be notified via email/phone. After a process flow release occurs, Snohomish PUD will notify the ARC within 5 business days via email or phone, regarding the timing, duration, and magnitude of the compliance events.

1.4.3. Resources

Due to the natural setting of the Project recreation facilities and the complicated interaction of natural resources, unintended effects may occur without close monitoring and consideration of

resource interactions and other PM&E measures. Snohomish PUD will coordinate the actions of the PF Plan with the actions of the various Project resource management plans including the:

- Marsh Creek Slide Plan – for cross reference to high flow event creation and monitoring to assess success of modifications to the Marsh Creek Slide.
- Whitewater Recreation Plan – for cross reference to timing, magnitude, and duration of scheduled and unscheduled viable whitewater events.
- Adaptive Management Plan – for cross reference to the process for modifying this Plan within the constraint of the license article based on monitoring results.
- Fisheries and Habitat Monitoring Plan - for cross reference to monitoring components (such as habitat surveys, redd surveys and smolt traps).
- Rule curves and downramping requirements.

Snohomish PUD's resource specialists will be consulted as needed. Operational staff will be trained on the unique requirements of the PF Plan.

2. PROCESS FLOW DETAILS

Snohomish PUD will discharge water from the Project into the Sultan River to ensure that the magnitude, duration, timing, and frequency of the process flow components specified are achieved.[1] The magnitude, duration, timing, and frequency of the process flow components may be achieved through any combination of controlled flow releases (including whitewater boating releases pursuant to the Whitewater Recreation Plan) and uncontrolled flow releases (i.e. spill) and accretion. Figure 1 identifies the locations of United States Geological Survey (USGS) and Snohomish PUD's stream gages that will be used for measuring compliance.

2.1. Channel Forming Flow

One (1) time every ten (10) years, for the term of the License, Snohomish PUD will discharge water from the Project if necessary to ensure that a channel-forming flow is achieved. A channel-forming flow is achieved when:

(a) a target flow of at least 6,500 cfs instantaneous flow is maintained for twenty-four (24) consecutive hours at USGS Gaging Station No. 12138160 (below the Powerhouse), or

(b) a target flow of 6,500 cfs is achieved but not sustained for a 24-hour duration and Snohomish PUD demonstrates a good faith effort by providing a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the 48-inch cone and 42-inch slide valves) for twenty-four (24) consecutive hours at the time when flow drops below 6,500 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours as measured at USGS Gaging Station No. 12138160, or

[1] To account for monitoring and release equipment imprecision and accretion flow variability, process flow compliance shall have been achieved when the average component flow is achieved notwithstanding temporary fluctuations of up to ten (10) percent of the required flow levels for so long as the average over the process flow duration is greater than or equal to the specified process flow target level.

(c) Snohomish PUD provides a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the 48-inch cone and 42-inch slide valves) for twenty-four (24) consecutive hours that is timed to achieve, to the extent feasible, a target flow of 6,500 cfs at USGS Gaging Station No. 12138160.

This channel-forming flow obligation shall be in addition to the required channel maintenance flow obligation.

2.2. Channel Maintenance Flow

Four (4) times per every ten (10) years (but not less than once every four (4) years), for the term of the License, Snohomish PUD will discharge water from the Project if necessary to ensure that a channel maintenance flow is achieved within Reach 1. Achievement of a qualifying channel maintenance event relies heavily upon the use the valves located at Culmback Dam. However, poorly timed valve related releases can have a disproportionate influence or impact on fish utilizing the upper reaches of the river. As such and related to the continued decline of ESA-listed stock status and trends, for timing, Snohomish PUD will invoke an ARC process for "real-time" recovery-based resource protective decisions for fish utilizing Reach 2 and Reach 3. See Appendix 2 to help guide the ARC discussion on whether or not a channel maintenance release is warranted. A channel maintenance flow is achieved when:

(a) a target flow of at least 4,100 cfs instantaneous minimum flow is maintained for twenty-four (24) consecutive hours at USGS Gaging Station No. 12138160 (below the Powerhouse), or

(b) a target flow of at least 4,100 cfs is achieved but not sustained for a 24-hour duration and Snohomish PUD demonstrates a good faith effort by providing a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the 48-inch cone and 42-inch slide valves) at the time when flow drops below 4,100 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours as measured at USGS Gaging Station No. 12138160. (See footnote 1 above.)

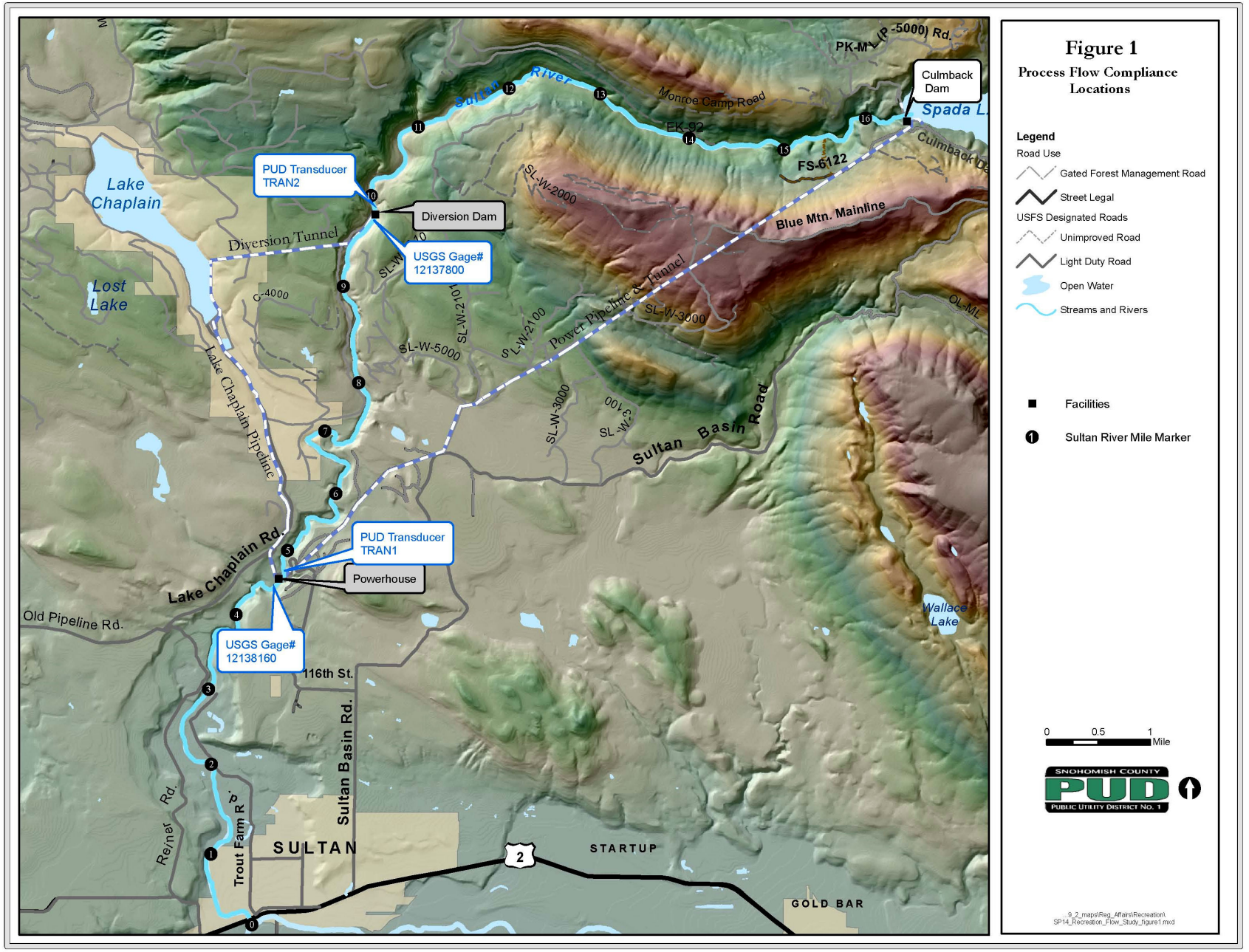
Figure 1
Process Flow Compliance Locations
Legend
Road Use
Gated Forest Management Road
Street Legal
USFS Designated Roads
Unimproved Road
Light Duty Road
Open Water
Streams and Rivers
Facilities
Sultan River Mile Marker
0 0.5 1 Mile
SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1
PUD Transducer TRAN2
Diversion Dam
USGS Gage# 12137800
PUD Transducer TRAN1
Powerhouse
USGS Gage# 12138160
Culmback Dam
Lake Chaplain
Lost Lake
Diversion Tunnel
Lake Chaplain Pipeline
Power Pipeline & Tunnel
Blue Mtn. Mainline
Monroe Camp Road
FS-6122
Sultan Basin Road
Lake Chaplain Rd.
Old Pipeline Rd.
116th St.
Sultan Basin Rd.
Trout Farm Rd.
Reiner Rd.
SULTAN
STARTUP
GOLD BAR
Wallace Lake
Spada L.
Sultan River
SL-W-2000
SL-W-2100
SL-W-3000
SL-W-5000
C-4000
PK-ML (P-5000) Rd.
EK-92
OL-ML

2.3. Flushing Flows

2.3.1. Reach 1 (River Mile (RM) 0.0 to RM 4.5)

Two (2) times every year, Snohomish PUD will discharge water from the Powerhouse if necessary to ensure that spring and fall flushing flows are achieved. One (1) of the annual flushing flows shall occur between March 15 and April 30. If the spring flushing flow is not provided naturally within the 4 weeks preceding April 15, Snohomish PUD will conduct an intentional release during last 2 weeks of April. One (1) of the annual flushing flows shall occur between August 1 and September 15. A flushing flow in this reach is achieved when a minimum of 1,500 cfs is maintained for six (6) consecutive hours at USGS Streamflow Gage No. 12138160. In the event that the elevation of Spada Reservoir is below 1,420 feet msl at the time of a scheduled flushing flow, a flushing flow will be achieved when a minimum of 1,200 cfs is maintained for six (6) consecutive hours at USGS Streamflow Gage No. 12138160. (See footnote 1 above.)

2.3.2. Reach 2 (RM 4.5 to RM 9.7)

Snohomish PUD will discharge water from the outlet pipe located adjacent to the City of Everett's Diversion Dam if necessary to ensure that two (2) flushing flows are achieved annually. One (1) of the annual flushing flows shall occur between March 15 and April 30. If the spring flushing flow is not provided naturally within the 4 weeks preceding April 15, Snohomish PUD will conduct an intentional release during last 2 weeks of April. One (1) of the annual flushing flows shall occur between August 1 and September 15. A flushing flow is achieved in this reach when either (a) a minimum of 500 cfs is maintained for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7 or (b) a minimum of 700 cfs is maintained for three (3) consecutive hours immediately upstream of the Powerhouse at RM 4.7. (See footnote 1 above.)

2.3.3. Reach 3 (RM 9.7 to RM 16.1)

Snohomish PUD will discharge water from Culmback Dam if necessary to ensure that two (2) flushing flows are achieved per year. One (1) of the annual flushing flows shall occur between March 15 and April 30. If the spring flushing flow is not provided naturally within the 4 weeks preceding April 15, Snohomish PUD will conduct an intentional release during last 2 weeks of April. One (1) of the annual flushing flows shall occur between August 1 and September 15. A flushing flow is achieved in this reach when either a minimum of 400 cfs is maintained for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8 or b) a minimum of 600 cfs is maintained for three (3) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8. (See footnote 1 above.)

2.4. Upstream Migration Flow

2.4.1. Reach 1

Snohomish PUD will discharge water from the Powerhouse if necessary should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that one (1) upstream migration flow per year is achieved. The upstream migration flow shall occur between September 1 and October 15. If not provided naturally during September, Snohomish PUD will conduct an intentional release during the first 2 weeks of October. An upstream migration flow is

achieved when a flow between 800 and 1,200 cfs is maintained or exceeded for six (6) consecutive hours at USGS Gaging Station No. 12138160. (See footnote 1 above.)

2.4.2. Reach 2

Snohomish PUD will discharge water from the Project if necessary should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that one (1) upstream migration flow per year is achieved. The upstream migration flow shall occur between September 1 and October 15. If not provided naturally during September, Snohomish PUD shall conduct an intentional release during the first two (2) weeks of October. An upstream migration flow is achieved when a flow between 400 and 600 cfs is maintained or exceeded for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7. (See footnote 1 above.)

2.4.3. Reach 3

Snohomish PUD will discharge water from Culmback Dam, if necessary, should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that one (1) upstream migration flow per year is achieved. The upstream migration flow shall occur between September 1 and October 15. If not provided naturally during September, Snohomish PUD shall conduct an intentional release during the first two (2) weeks of October. An upstream migration flow is achieved when a flow between 300 and 500 cfs is maintained or exceeded for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8. (See footnote 1 above.)

2.5. Outmigration Flow

2.5.1. Reach 1

Snohomish PUD will discharge water from the Powerhouse if necessary should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that two (2) outmigration flows per year are achieved. Snohomish PUD will target one (1) of the annual outmigration flows to occur in March and one (1) to occur in April, with a minimum of seven days separation between events. If the March event does not manifest through accretion, then both events will occur in April, one (1) in early April and one (1) in late April separated by two (2) weeks. Both outmigration flows will occur during nighttime hours to best protect juvenile salmonids from predation and potential stranding. An outmigration flow is achieved when a flow between 800 and 1,200 cfs, as determined by the ARC, is maintained or exceeded for six (6) consecutive hours at USGS Gaging Station No. 12138160. (See footnote 1 above.)

2.5.2. Reach 2

Snohomish PUD will discharge water from the Project if necessary should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that two (2) outmigration flows per year are achieved. Snohomish PUD will target one (1) of the annual outmigration flows to occur in March and one (1) to occur in April, with a minimum of seven days separation between events. If the March event does not manifest through accretion, then both events will occur in April, one (1) in early April and one (1) in late April separated by two (2) weeks. Both outmigration flows will occur during nighttime hours to best protect juvenile salmonids from predation and potential stranding. An outmigration flow is achieved when a flow between 400 and 600 cfs, as determined by the ARC, is maintained or exceeded for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7. (See footnote 1 above.)

2.5.3. Reach 3

Snohomish PUD will discharge water from Culmback Dam if necessary should a natural event not occur during the calendar days mentioned in this paragraph, to ensure that two (2) outmigration flows per year are achieved. Snohomish PUD will target one (1) of the annual outmigration flows to occur in March and one (1) in April, with a minimum of seven days separation between events. If the March event does not manifest through accretion, then both events will occur in April, one (1) in early April and one (1) in late April separated by two (2) weeks. Both outmigration flows will occur during nighttime hours to best protect juvenile salmonids from predation and potential stranding. An outmigration flow is achieved when a flow between 200 and 400 cfs, as determined by the ARC, is maintained or exceeded for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8. (See footnote 1 above.)

3. SCHEDULING FLOWS

3.1. Timing/Sequencing

Snohomish PUD can achieve these process flow components through any combination of controlled (including whitewater boating releases and coordination with other process flows) and uncontrolled flow releases (i.e. spill), and accretion provided the flows occur within the correct time of year as described in Section 2. When possible, Snohomish PUD may coordinate and sequence releases to achieve multiple resource objectives in the interest of conserving water resources. The controlled flow releases shall be consistent with the Licensee's obligation pursuant to other License Articles and agreements with the City of Everett pertaining to its municipal water supply needs. Snohomish PUD, in consultation with the ARC, will schedule the timing of the controlled flow releases for any process flow component to avoid the exacerbation of any downstream flooding, and take into account Project maintenance needs and aquatic resource (including fish and macroinvertebrates) management concerns. See Appendix 2 for guided discussion for channel maintenance flows.

Snohomish PUD intends to maximize the use of water resources by sequencing any annual releases in Reach 2 and 3 for whitewater flow with releases for other objectives such as upmigration, outmigration, and channel flushing identified in this Plan. To the extent possible, this sequencing will occur by scheduling these recreational events during the spring (March/April), summer, and early fall (September to October 15). Once scheduled, the dates for these multiple objective releases will be presented to the ARC. Additionally, whitewater opportunities may be possible on the ascending or descending limbs of the channel maintenance or forming flows when they occur.

Snohomish PUD monitors meteorological and streamflow forecast service reports which tend to be reliable looking forward for up to 5 days, and marginally reliable for up to 10 days. This information coupled with local stream and rainfall gages will allow Snohomish PUD to opportunistically plan certain process flow events when it anticipates a viable event is likely based on the prediction of significant accretion. If the actual accretion flow is insufficient to meet the criteria of a process flow event, Snohomish PUD may release water from Culmback Dam in order to meet the requirements.

Snohomish PUD has a good understanding of the interaction between the rainfall and streamflow in the Sultan basin and downstream influence on the water levels near the confluence of the Sultan and Skykomish rivers. Snohomish PUD will monitor stage and discharge at the Skykomish River near the Gold Bar Gaging Station (USGS No. 12134500) to ensure that process flow releases in the Sultan River do not exacerbate flooding in the City of Sultan.

3.2. Restrictions

When evaluating potential constraints, there are three fundamental considerations related to process flow releases; volume of discharge, duration, and season. Constraints should be evaluated relative to a single event.

In general, the volume of water associated with a single short duration release for upstream migration, outmigration or channel flushing will have negligible impact on water supply. The volume for a single event is between 200 and 300 acre feet depending on release magnitude and duration. Seasonally, the likely only release of any potential concern to water supply would be the September or October release and only under drought conditions. In addition to fishery benefits, the September or October release may dovetail with a viable whitewater recreation event. Despite these considerations, the drought provision within the A-LA 8 was intended to address sensitivities associated with releases during drought conditions. Interim modifications during drought conditions include flow reductions or postponement of releases (see section 3.3. below). Snohomish PUD will implement a drought-controlled flow schedule if necessary during the course of a water year; this schedule can include delaying, reducing, or changing the timing of process flow components based on the severity of the drought.

Similarly, the volume of water associated with a single short duration release for process flow purposes will have an impact on generation. The foregone generation associated with a single event is between 200 and 300 megawatt hours depending on release magnitude and duration. Depending on variable market conditions, the financial implications tied to a process flow release can be significant and should be considered during scheduling. When possible, releases will be scheduled to coincide with large accretion flow events.

Potential impacts to aquatic resources need consideration when scheduling process flow releases. While short in duration, the impacts from a relative increase in discharge coupled with a disruption to the thermal regime must be considered. As a general rule, cold-water releases from the Culmback Dam valve chamber should be avoided during the summer months outside the typical annual process flow window and only scheduled to occur between August 1 and April 30; Snohomish PUD will seek input from the ARC if Snohomish PUD decides to release a process flow event sometime during May 1 through July 31.

Potential impacts to flooding in the City of Sultan also must be taken into account. Snohomish PUD will strive to avoid releases when the potential for flooding in the City of Sultan is apparent and a release by Snohomish PUD would exacerbate flooding that is already occurring.

3.3. Drought Years

During the course of a water year, if necessary, Snohomish PUD, in consultation with the ARC, will develop a drought-controlled flow release schedule for process flow components when:

(1) a drought event resulting in voluntary reductions in domestic water consumption (as described by the 2020 City of Everett's Drought Response Plan (or most recent version) as a Stage 2 response to a drought event) is occurring;
(2) the process flow components described in this Plan 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 shall not undermine the purposes of this Plan.

Snohomish PUD will notify the FERC and implement the drought release schedule within seven (7) days of providing such notice, unless otherwise directed by the FERC.

Snohomish PUD intends that that any drought release schedule for modification of process flow components prepared by Snohomish PUD will be proportionate to the severity of the drought. For example, Snohomish PUD, in consultation with the ARC, will have flexibility to respond to drought events, depending upon the drought's severity, by delaying, reducing, or changing the timing of process flow components. Snohomish PUD intends that the drought release schedule will take into account the efficacy of voluntary reductions in domestic water consumption, and will consider contingencies if the consumption reductions do not materialize.

4. MONITORING

4.1. Channel Forming and Channel Maintenance

Figure 2 provides the locations of permanent reference transects within each operational reach of the Sultan River , which includes include riparian and side channel habitats with horizontal and vertical control. The established transects by operational reach and river mile are as follows:

- Reach 3 – RM 14.3 and RM 9.8
- Reach 2 – RM 9.5 and RM 4.9
- Reach 1 – RM 4.5, RM 2.5, RM 1.5, RM 0.5

Snohomish PUD will collect physical habitat measurements following channel forming and channel maintenance events. The measurements are to be collected under summer low flow conditions (target 300 to 400 cfs) at each of the eight reference transects and will include the following:

- Water surface elevation;
- Cross sectional profiles, 20 standardized measurements of depth / bed elevation across transect at evenly spaced, fixed cell locations;
- Underwater (and above water, if gravel bar is exposed under summer low flow conditions) photo reference shots with scale at a minimum of 5 uniformly spaced, fixed cell locations per transect with standardized point of view upstream oriented at top of photo);
- One pebble count (Wolman 1954) per transect; and
- Photo documentation of riparian conditions at fixed cell locations with standardized point of view as noted in field notes (e.g. looking upstream or downstream).

For channel forming flows exclusively, Snohomish PUD will conduct additional enhanced documentation of habitat changes, incorporating the use of aerial photography and/or Light

Detection and Ranging (LiDAR), of lower mainstem and side channel areas during summer low flow conditions (300 to 400 cfs) after the occurrence of a channel forming flow:

- Aerial photography will duplicate previous efforts for comparability (photo scale will be approximately 1" to 500' with 60% forward overlap),
- Low level aerial photography may also be used, and
- Prior mapping efforts using LiDAR technology will be replicated for change detection purposes.

4.2. Flushing Flows

The channel flushing flow program is intended to annually provide up to two releases of a specific magnitude and duration with one occurring in advance of the spring and one occurring in advance of the fall spawning seasons. These releases will flush the streambed of fines and organic matter. An attempt was made during the initial 10-year cycle (2011-2021) to use turbidity as a surrogate to inform and indicate when effective flushing occurred. It was discovered early on that use of the deep-water 48-inch valve may pass sediment from Spada Reservoir into Reach 3 thereby introducing potential for a false indication of flushing based on artificially high turbidity levels. For this reason and through the remainder of the initial 10-year period, it was inferred that effective flushing was occurring at the prescribed magnitude and duration described in Section 2.3 of this Plan.

4.3. Upmigration

As described in Section 2.4 above, upmigration flows may be provided as necessary, when not provided naturally. As described in the Fishery and Habitat Monitoring Plan, annual fall spawning surveys will be conducted throughout the term of the license to provide data for determining the need for and effectiveness of upmigration flows. Fall surveys of salmon escapement will be initiated in late August / early September prior to the scheduled release for upmigration. Per existing protocols, surveys will be conducted at ten-day intervals through the spawning season, as conditions allow. The benefit provided by the release will be assessed by looking at the temporal distribution of fish and the presence of redds through the spawning season. This distribution with the release program in place will be compared with the historic distribution without an upmigration release program, and also compared to results from the first 10-year implementation period. After the conclusion of this proposed 10-year cycle (January 2024-December 2033), these data will be presented to the ARC in a new 10-Year Process Flow Effectiveness Report.

4.4. Outmigration

As described in Section 2.5 above, pulse flow releases, intended to stimulate outmigration, will occur twice annually targeting the months of March and April. Both events will occur during nighttime hours. If the March event does not manifest through a combination of accretion and power generation, two (2) outmigration flows will occur in April; one (1) event in early April and one in late April separated by two (2) weeks. As described in the Fishery and Habitat Monitoring Plan, a juvenile trap is operated in the lower Sultan River to assess natural salmonid production. During the first six years after License issuance, the screw trap was operated on an annual basis throughout the outmigration period between the months of February and June. The trap will be operated at least 30 and 40 percent of the hours in any given week and scheduled to sample four (4) day and four (4) night periods per week. The screw trap will be operated the days

before, during, and after the pulse flow release with distinct day/night sampling periods, when possible. Trap catch will be correlated with discharge throughout the outmigration period. After the conclusion of this new 10-year cycle (January 2024 – December 2033), these data will be presented to the ARC in a new 10-Year Process Flow Effectiveness Report.

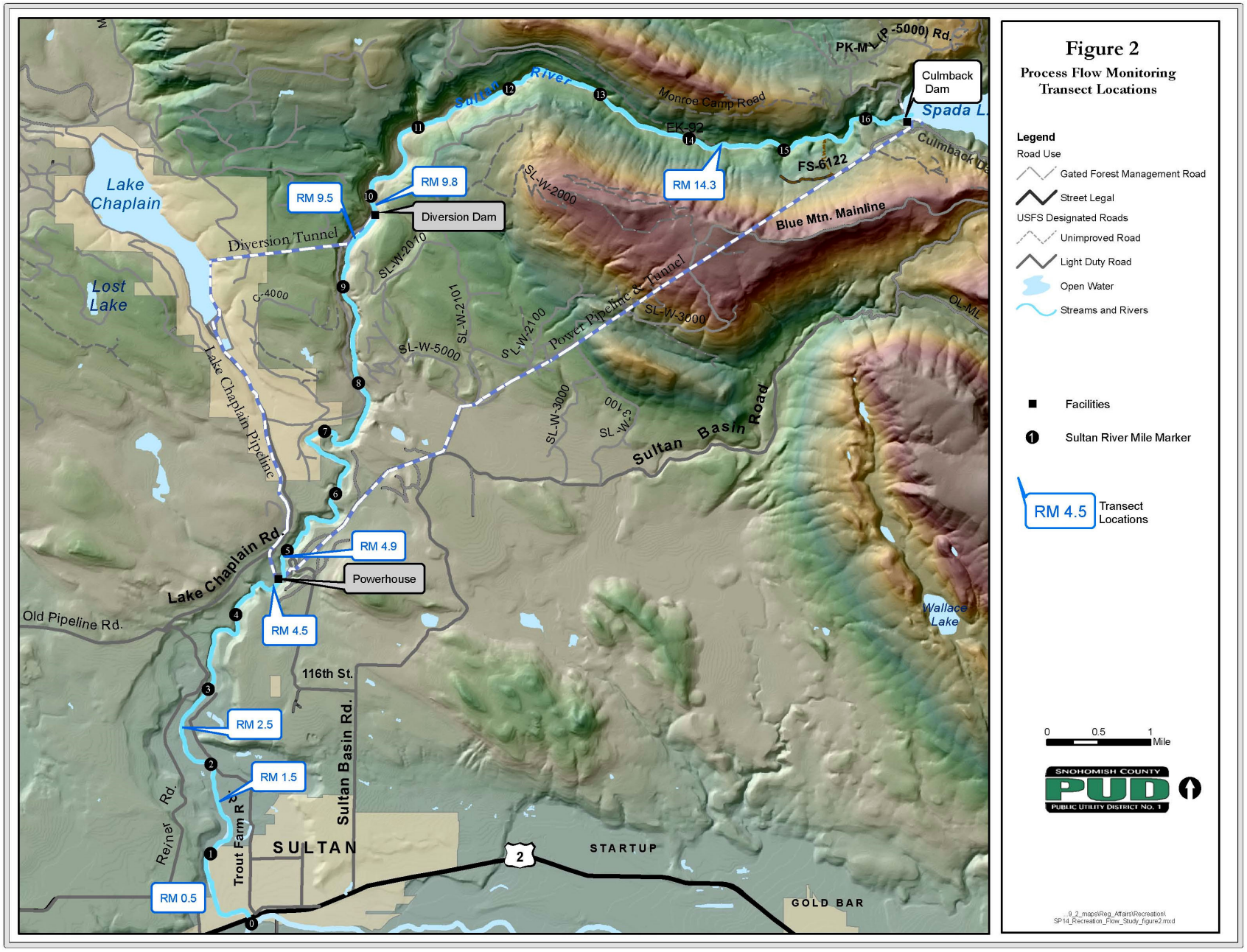
Figure 2
Process Flow Monitoring
Transect Locations
Legend
Road Use
Gated Forest Management Road
Street Legal
USFS Designated Roads
Unimproved Road
Light Duty Road
Open Water
Streams and Rivers
Facilities
Sultan River Mile Marker
RM 4.5
Transect Locations
0 0.5 1 Mile
SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1
Lake Chaplain
Lost Lake
Diversion Tunnel
Diversion Dam
Culmback Dam
Spada L.
Monroe Camp Road
EK-92
FS-6122
Blue Mtn. Mainline
Power Pipeline & Tunnel
Sultan Basin Road
Lake Chaplain Pipeline
Lake Chaplain Rd.
Old Pipeline Rd.
Powerhouse
Wallace Lake
116th St.
Sultan Basin Rd.
Trout Farm R
Reiner Rd.
SULTAN
STARTUP
GOLD BAR
RM 14.3
RM 9.8
RM 9.5
RM 4.9
RM 4.5
RM 2.5
RM 1.5
RM 0.5

5. REPORTING

5.1. Schedule and Contents

An annual log will be maintained that documents the details of all counted (natural or released) process flow events. For each event, this log will include: date, time, duration, magnitude, portion of release from accretion, as well as notes on timing/sequencing with natural or recreation events, Project maintenance activities, and aquatic resource response (see Appendix 5).

Every ten years, Snohomish PUD will develop a Process Flow Effectiveness Report. This report will analyze the results of the monitoring components of the Fisheries and Habitat Monitoring Plan in conjunction with the release data. This information will be reviewed in light of the objectives defined in Section 1.3 above.

A recap of notifications and consultation with the ARC is as follows in Table 1.

Table 1. Notification and Consultation with the ARC regarding process flow events.

Activity	Timeframe
Meet with the ARC (Section 1.4.2)	Quarterly
Provide annual potential process flow event schedule (Section 1.4.2)	Annually
Provide monthly biological updates (Section 1.4.2)	October to February
Notify ARC of upcoming process flow release (Section 1.4.2)	At least 48 hours prior to the event
Notify ARC of process flow event (Section 1.4.2)	Within 5 business days of the event
Consult with ARC: • for real-time decisions (Section 3.1) • flow releases between May 1 through July 31 (Section 3.2) • drought schedule (Section 3.3)	As needed
Provide 10-Year Process Flow Effectiveness Report (Section 5.1)	By December 31, 2034
Provide recommendations, if any, and consult regarding changes to the PF Plan (Section 5.2)	By March 31, 2035

5.2. Plan Review and Updates

In conjunction with the Process Flow Effectiveness Report, Snohomish PUD will review the details of this PF Plan. Based upon this review, Snohomish PUD may make recommendations to the ARC for alteration or refinement of the process flow components. If the ARC concurs with the proposed alteration or refinement of the process flow components is appropriate, Snohomish PUD will submit an updated PF Plan to the FERC for approval.

6. REFERENCES

City of Everett. 2020. City of Everett's Drought Response Plan.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology. San Francisco: W.H. Freeman.

R2 Resource Consultants. 2008. Indicators of Hydrologic Alteration/Range of Variability Analysis (IHA/RVA) in the Sultan River Downstream of Culmback Dam. Prepared for Snohomish County PUD.

Stillwater Sciences and Meridian Environmental. 2008. Sultan River Physical Process Studies. Prepared for Snohomish County PUD.

Snohomish PUD. 2023. 10-Year Process Flow Effectiveness Plan, 2011-2022, for the Jackson Hydroelectric Project (FERC No. 2157).

Wolman, M.G. 1954. A method of sampling coarse river-bed material Transactions American Geophysical Union. Volume 35. Number 6. Pp. 951-956.

Appendix 1

Settlement Agreement Proposed License Article 8

A-LA 8: Process Flow Regime

The Licensee shall discharge water from the Project into the Sultan River to ensure that the magnitude, duration, timing and frequency of the process flow components specified within sections 1 through 5 of this License Article are achieved. However, unless otherwise provided by this License Article, the magnitude, duration, timing and frequency of the process flow components may be achieved through any combination of controlled (including whitewater boating releases pursuant to A-LA 4) and uncontrolled flow releases (i.e. spill) and accretion flow.

The controlled flow releases shall be consistent with the Licensee's obligation pursuant to other License Articles and agreements with the City of Everett pertaining to its municipal water supply needs. The Licensee, in consultation with the Aquatic Resources Committee (ARC), shall schedule the timing of the controlled flow releases for any process flow component to avoid exacerbation of any downstream flood damage, and take into account maintenance and real-time aquatic resource (including fish and macroinvertebrates) concerns.

During the course of a water year, if necessary, the Licensee, in consultation with the ARC, shall develop a drought controlled flow release schedule for process flow components when: (1) a drought event resulting in voluntary reductions in domestic water consumption (as described by the 2007 City of Everett's Drought Response Plan as a Stage 2 response to a drought event) is occurring; (2) the process flow components described in this LA 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 shall not undermine the purposes of this LA. The Licensee shall notify the Commission and shall implement the drought release schedule within seven (7) days of providing such notice, unless otherwise directed by the Commission.

With respect to the maintenance flows (section 1), the flushing (section 3), upstream migration (section 4), and outmigration (section 5) process flow components, for compliance purposes (to account for monitoring imprecision and release equipment variability and accretion flow variability), a component flow is achieved notwithstanding temporary fluctuations of up to ten (10) percent of the required flow levels for so long as the average over the process flow component duration is above the specified process flow component flow level.

Based upon A-LA 17 monitoring and the best available information, in year ten (10) of this License and every ten (10) years thereafter, the Licensee shall file a process flow effectiveness report with the Commission for its approval, after consultation with the ARC. The report will evaluate the effectiveness of each process flow component in achieving its designated objective.

A-LA 8 Table 1. Process Flow Components Summary

Process Flow Component	Magnitude and Duration	Frequency
Component 1: Channel Maintenance Flow (measured at USGS Streamflow Gage No. 12138160)	Component Flow achieved when: (a) a target flow of at least 4100 cfs is maintained for twenty-four (24) hours; or (b) a target flow of at least 4100 cfs is achieved and the Licensee provides a maximum release flow at the time when flow drops below 4100 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours.	Four (4) times every ten (10) years (but not less than once every four (4) years).
Component 2: Channel Forming (measured at USGS Streamflow Gage No. 12138160)	Component flow is achieved when: (a) a target flow of at least 6500 cfs is maintained for twenty-four (24) consecutive hours; or (b) a target flow of 6500 cfs is achieved and the Licensee provides a maximum release flow at the time when flow drops below 6500 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours, or (c) the Licensee provides a maximum release flow for twenty-four (24) consecutive hours that is timed to achieve, to the extent feasible, a target flow of 6500 cfs.	One (1) time every ten (10) years.

Component 3.1: Reach 1 Flushing Flows (measured at USGS Streamflow Gage No. 12138160)	Component flow is achieved when 1500 cfs is maintained for six (6) consecutive hours. If the Spada Reservoir is below 1420 feet, component flow is achieved when a 1200 cfs instantaneous minimum flow is maintained for six (6) consecutive hours.	Two (2) times every year (with one occurring in September and one occurring between April 1 and May 31).
Component 3.2: Reach 2 Flushing Flows(measured immediately upstream of Powerhouse at RM 4.7)	Component flow achieved when: (a) a 500 cfs instantaneous minimum flow is maintained for six (6) consecutive hours; or (b) a 700 cfs instantaneous minimum flow is maintained for three (3) consecutive hours.	Two (2) times every year (with one occurring in September and one occurring between April 1 and May 31).
Component 3.3: Reach 3 Flushing Flows (measured immediately upstream of City's Diversion Dam at RM 9.8)	Component flow achieved when: (a) a 400 cfs instantaneous minimum flow is maintained for six (6) consecutive hours; or (b) a 600 cfs instantaneous minimum flow is maintained for three (3) consecutive hours.	Two (2) times every year (with one occurring in September and one occurring between April 1 and May 31).
Component 4.1: Reach 1 Upstream Migration Flow (measured at USGS Streamflow Gage No. 12138160)	Component flow achieved when a minimum flow between 800 and 1200 cfs as determined by the Aquatic Resource Committee (ARC) is maintained or exceeded for six (6) consecutive hours.	One (1) time per year (occurring in September).
Component 4.2: Reach 2 Upstream Migration Flow (measured immediately upstream of the Powerhouse at RM 4.7)	Component flow is achieved when a flow between 400 and 600 cfs instantaneous minimum flow, as determined by the ARC, is maintained for six (6) consecutive hours.	One (1) time per year (occurring in September).

Component 4.3: Reach 3 Upstream Migration Flow (measured immediately upstream of the City's Diversion Dam at RM 9.8)	Component flow achieved when a minimum flow between 300 and 500 cfs as determined by the ARC is maintained or exceeded for six (6) consecutive hours.	One (1) time per year (occurring in September) after completion of Diversion Dam volitional fish passage modification.
Component 5.1: Reach 1 Outmigration Flow (measured at USGS Streamflow Gage No. 12138160)	Component flow is achieved when between 800 and 1200 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours.	Two (2) times per year (one occurring in April and one occurring in May).
Component 5.2: Reach 2 Outmigration Flow (measured immediately upstream of the Powerhouse at RM 4.7)	Component flow is achieved when between 400 and 600 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours.	Two (2) times per year (one occurring in April and one occurring in May).
Component 5.3: Reach 3 Outmigration Flow (measured immediately upstream of the City's Diversion Dam at RM 9.8)	Component flow is achieved when between 200 and 400 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours.	Two (2) times per year (one occurring in April and one occurring in May) after volitional fish passage and the ARC determines need.

Within ninety (90) days of issuance of the License, the Licensee shall file with the Commission for approval, a PF Plan. This PF Plan shall document how the Licensee shall implement a program for periodic controlled flow releases from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam. The PF Plan shall include provisions that describe: (1) the frequency, magnitude, duration, and timing of process flow components consistent with this License Article; (2) the ongoing involvement of the ARC in implementing this program; (3) the mechanism for timing controlled flow releases (including whitewater boating releases pursuant to A-LA 4) 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 impacts to aquatic resources, to 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 outmigration flow for providing timely and effective upstream and downstream migration of anadromous fish; and (8) the method and schedule for monitoring the impacts of process flow upon aquatic resources.

The Licensee shall develop the PF Plan in consultation with the ARC. The Licensee shall allow a minimum of thirty (30) days for members of the ARC to comment and make recommendations before submitting the PF Plan to the Commission. When filing the PF Plan with the Commission, the Licensee shall include documentation of consultation, copies of comments and recommendations, and specific descriptions of how comments and recommendations from the ARC are accommodated by the Licensee's plan. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons based upon Project-specific information.

Upon Commission approval, the Licensee shall implement the PF Plan.

The process flow regime specified by this License Article has the following components:

1. Channel Maintenance Flow: Four (4) times per every ten (10) years (but not less than once every four (4) years) for the term of the License, the Licensee shall discharge water from the Project if necessary to ensure that a channel maintenance flow is achieved. A channel maintenance flow is achieved when (a) a target flow of at least 4100 cfs instantaneous minimum flow is maintained for twenty-four (24) consecutive hours at USGS Streamflow Gage No. 12138160 or (b) a target flow of at least 4100 cfs is achieved and the Licensee provides a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the Howell Bunger and 42-inch slide valves) at the time when flow drops below 4100 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours as measured at USGS Streamflow Gage No. 12138160.

2. Channel Forming Flow: Once (1) every ten (10) years for the term of the License, the Licensee shall discharge water from the Project if necessary to ensure that a channel-forming flow is achieved. A channel-forming flow is achieved when (a) a target flow of at least 6500 cfs instantaneous minimum flow is maintained for twenty-four (24) consecutive hours at

USGS Streamflow Gage No. 12138160 or (b) a target flow of 6500 cfs is achieved and the Licensee provides a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the Howell Bunger and 42-inch slide valves) for twenty-four (24) consecutive hours at the time when flow drops below 6500 cfs for a total duration (including the target flow and maximum release) of twenty-four (24) consecutive hours as measured at USGS Streamflow Gage No. 12138160, or (c) the Licensee provides a maximum release flow from the Powerhouse, the outlet pipe located adjacent to the City of Everett's Diversion Dam, and Culmback Dam (via the Howell Bunger and 42-inch slide valves) for twenty-four (24) consecutive hours that is timed to achieve, to the extent feasible, a target flow of 6500 cfs at USGS Streamflow Gage No. 12138160. This channel-forming flow obligation shall be in addition to the channel maintenance flow obligation required by section 1.

3. Flushing Flow

   3.1. Reach 1 (River Mile (RM) 0.0 to RM 4.5) Flushing Flows: Two (2) times every year for the term of the License, the Licensee shall discharge water from the Powerhouse if necessary to ensure that a flushing flow is achieved. One (1) of the annual flushing flows shall occur in September and one (1) of the annual flushing flows shall occur between April 1 and May 31. A flushing flow is achieved when a 1500 cfs instantaneous minimum flow is maintained for six (6) consecutive hours at USGS Streamflow Gage No. 12138160. In the event that the Spada Reservoir is below 1420 feet at the time of a scheduled flushing flow, a flushing flow is achieved when a 1200 cfs instantaneous minimum flow is maintained for six (6) consecutive hours at USGS Streamflow Gage No. 12138160.

   3.2. Reach 2 (RM 4.5 to RM 9.7) Flushing Flows: The Licensee shall discharge water from the outlet pipe located adjacent to the City of Everett's Diversion Dam if necessary to ensure that two (2) flushing flows are achieved. One (1) of the annual flushing flows shall occur in September and one (1) of the annual flushing flows shall occur between April 1 and May 31. A flushing flow is achieved when either (a) a 500 cfs instantaneous minimum flow is maintained for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7 or (b) a 700 cfs instantaneous minimum flow is maintained for three (3) consecutive hours immediately upstream of the Powerhouse at RM 4.7.

   3.3. Reach 3 (RM 9.7 to RM 16.1) Flushing Flows: The Licensee shall discharge water from Culmback Dam if necessary to ensure that two (2) flushing flows per year are achieved. One (1) of the annual flushing flows shall occur in September and one (1) of the annual flushing flows shall occur between April 1 and May 31. A flushing flow is achieved when either a 400 cfs instantaneous minimum flow is maintained for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8 or b) a 600 cfs instantaneous minimum flow is maintained for three (3) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8.

4. Upstream Migration Flow

4.1. Reach 1 Upstream Migration Flow: The Licensee shall discharge water from the Powerhouse if necessary to ensure that one (1) upstream migration flow per year is achieved in Reach 1. The upstream migration flow shall occur in September. An upstream migration flow is achieved when a minimum flow between 800 and 1200 cfs as determined by the ARC is maintained or exceeded for six (6) consecutive hours at USGS Streamflow Gage No. 12138160.

4.2. Reach 2 Upstream Migration Flow: The Licensee shall discharge water from the Project if necessary to ensure that one (1) upstream migration flow per year is achieved in Reach 2. The upstream migration flow shall occur in September. An upstream migration flow is achieved when a flow between 400 and 600 cfs instantaneous minimum flow, as determined by the ARC, is maintained for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7.

4.3. Reach 3 Upstream Migration Flow: Upon the date that the Licensee completes the Diversion Dam's volitional fish passage modifications, the Licensee shall discharge water from Culmback Dam if necessary to ensure that one (1) upstream migration flow per year is achieved in Reach 3. An upstream migration flow is achieved when a flow of between 300 and 500 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8.

5. Outmigration Flow

5.1. Reach 1 Outmigration Flow: The Licensee shall discharge water from the Powerhouse if necessary to ensure that two (2) outmigration flows per year are achieved. One (1) of the annual outmigration flows shall occur in April and one (1) of the annual migration flows shall occur in May. An outmigration flow is achieved when between 800 and 1200 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours at USGS Streamflow Gage No. 12138160. The PF Plan shall address the proportion of the outmigration flow that must occur during nighttime hours to best protect juvenile salmonids from predation.

5.2. Reach 2 Outmigration Flow: The Licensee shall discharge water from the outlet pipe located adjacent to the City of Everett's Diversion Dam if necessary to ensure that two (2) outmigration flows per year are achieved. One (1) of the annual outmigration flows shall occur in April and one (1) of the annual migration flows shall occur in May. An outmigration flow is achieved when between 400 and 600 cfs minimum flow as determined by the ARC is maintained or exceeded for six (6) consecutive hours immediately upstream of the Powerhouse at RM 4.7. The PF Plan shall address the proportion of the outmigration flow that must occur during nighttime hours to best protect juvenile salmonids from predation.

5.3. Reach 3 Outmigration Flow: Upon Commission approval after the ARC determines that an outmigration flow in Reach 3 is needed for timely and effective anadromous fish outmigration, the Licensee shall discharge water from Culmback Dam if necessary to ensure that two (2) outmigration flows per year are achieved. One (1) of the annual outmigration flows shall occur in April and one (1) of the annual migration flows shall occur in May. An outmigration flow is achieved when between 200 and 400 cfs minimum flow as determined by the ARC is

maintained or exceeded for six (6) consecutive hours immediately upstream of the City of Everett's Diversion Dam at RM 9.8. The PF Plan shall address the proportion of the outmigration flow that must occur during nighttime hours to best protect juvenile salmonids from predation.

Below is an excerpt from the Settlement Agreement's Joint Explanatory Statement discussing the proposed license article for the Process Flow Plan.

The process flow regime proposed within the Process Flow Regime License Article (A-LA 8) is considerably more robust than the process flow regime presented in the License Application (*see* Appendix B at 17). A-LA 8 specifies that the District will discharge water from the Project to ensure that the magnitude, duration, timing and frequency of the process flow components specified within Section 1 through 5 of the Article (as summarized in A-LA 8 Table 1) are achieved. Except as provided within the Article, the District can achieve these components through any combination of controlled (including whitewater boating releases) and uncontrolled flow releases (i.e. spill), and accretion flow downstream of Culmback Dam.

The intent of A-LA 8 is the same as the Process Flow Release Plan PM&E presented in the License Application, but it does not include a water budget. A-LA 8 includes flows to periodically mobilize bedload and stream bank materials. In addition, A-LA 8 provides for timing of events to use or augment naturally-occurring accretion events, a more detailed definition of flow levels in specific reaches and frequency, and a discussion of how these special purpose flow releases will be coordinated with other License Articles. Flows provided in A-LA 8 can be released by existing Project facilities.

A-LA 8 includes provisions which will allow for interim modifications (including changes in timing or reductions in flow magnitude) to the process flow components described in the Article to manage water supply during periods of weather-related shortages. The Settlement Parties intend that that any drought release schedule for modification of process flow components prepared by the District will be proportionate to the severity of the drought. For example, the District, in consultation with the ARC, will have flexibility to respond to drought events, depending upon the drought's severity, by delaying, reducing, or changing the timing of process flow components. The Settlement Parties intend that the drought release schedule takes into account the efficacy of voluntary reductions in domestic water consumption, and consider contingencies to address lower than expected voluntary reductions in domestic water consumption. Regardless, any drought release schedule may not undermine the stated purposes of this License Article.

With respect to A-LA 8 Upstream Migration Flow Component (A-LA 8 Section 4) and Outmigration Flow Component (A-LA 8 Section 5), each of these components includes a range of flow magnitudes. For example, A-LA 8 Section 4.1 specifies that the upstream migration flow is achieved when a minimum flow between 800 and 1,200 cfs as determined by the ARC is maintained or exceeded for six (6) consecutive hours. By providing a range, the Settlement Parties intend that the District, in consultation with the ARC, will test different flow magnitudes within that range during the first ten years of the License. At the end of this initial period and based upon that testing, the Settlement Parties intend that the District, in consultation with the

ARC, will recommend a permanent flow level within the range specified in the flow component for FERC approval. Upon approval, the District will implement that permanent flow level.

The channel maintenance, channel forming, and sediment flushing flows outlined in A-LA 8 will likely contribute to the formation and movement of physical habitat features in the Sultan River including riffles, pools, runs, and point bars; increase LWD and sediment transport; remove interstitial fine sediment from spawning gravels; and maintain connectivity to existing side channels. In addition to initiating significant changes to in-channel habitat, regular process flows are expected to slightly alter the channel form, and limit riparian vegetation encroachment.

Although extreme high magnitude flow events during the salmon and steelhead incubation period have been linked with reduced egg-to-fry survival, short duration flow events of lesser magnitudes (pulsed flows) in the spring may trigger juvenile salmonid outmigration and increase the survival of juvenile out-migrants. In addition to benefiting juvenile outmigrants, short duration high flow events in the late summer and fall are known to initiate the upstream migration of adult salmon, limit straying to other river basins, and facilitate swimming past natural and artificial barriers. Overall, implementing the District's proposed juvenile outmigration and adult upstream migration flow releases will result in a more normative hydrograph in the lower Sultan River compared to existing conditions. This more normative hydrograph is expected to increase the survival of juvenile salmon and steelhead outmigrants during drought years and may also facilitate upstream migration of returning adults.

APPENDIX 2

Decision Guidance Regarding Timing of Channel Maintenance Flows

Decision Guidance Regarding Timing of Channel Maintenance Flows

For compliance purposes, Channel Maintenance (CM) events are defined to be at least 24 hours in duration and over 4,100 cfs at the USGS Gaging Station located downstream of the Powerhouse (Reach 1). These events must be sequenced to occur during a period of heavy accretion and/or spill because the compliance magnitude is greater than the operational capabilities of the Project alone. In the Sultan watershed, the most rainfall has historically occurred within 15 days of November 20. However, the reality is that the weather we rely upon is highly unpredictable, although with advancing of climate change, we can expect that intense fall/winter hydrologic events are more likely to occur in the future.

First 10-Year Experience:

Since issuance of the new License, Snohomish PUD has seen the span between CM events range from 7.5 months to 3 years with 9.5 months as the average. In the first 10-year accounting cycle, 3 events occurred over a 1-year and 8-month period. From a compliance standpoint, indicates that for planning CM event timing in the years following the initial CM event for a particular four-year period, some flexibility exists for the first and second years but rapidly diminishes after that. Waiting for spill during the first- and second-year post CM event makes sense since the ascending and descending limbs associated with these events is less dramatic than when the slide valve is called upon. By the third or fourth year after the initial CM event occurs, the options for how the subsequent CM event occurs are less flexible.

Primer regarding Use of Slide Valve:

Channel maintenance actions would specifically relate to use of the Slide Valve, a butterfly valve with only an “open” or “closed” option for its use. The foundational concern is that an ill-timed, intentional, and abrupt release of 1,165 cfs (capacity at full pool) from this valve can induce scour and be destructive to incubating eggs. A release provided without the slide valve still provides 60 to 80% of bankfull discharge providing channel maintenance functions (Potyondy).

Decision-Making Tools:

To achieve the CM requirement, Snohomish PUD wants to fully engage the ARC in near real-time decisions around use of the valves located at Culmback Dam with the intent to balance fish protection in potentially vulnerable locations with river-wide habitat maintenance. Decisions will incorporate information on brood year, run size, redd distribution, and developmental stage of incubating eggs. As instituted in early 2023, Snohomish PUD will provide the ARC with the necessary information for members to engage, including monthly reach-specific vulnerability assessments (example attached), during the October to February timeframe when the hydrologic probability of achieving the magnitude and duration for a CM event is greatest. The objective is to closely review climatic and hydrologic conditions and carefully tailor and sequence operations to balance habitat and fish needs during recovery.

Within season and real-time, decisions must consider hydrology, habitat needs, and fish sensitivity as follows:

Hydrologic Considerations:

- What is the current type of Water Year? Wet-Normal-Dry
- What is the general projected probability of spill within the season? In terms of timing, what is the probability of spill in the 10-day forecast?
- Temperature of Skykomish and Sultan rivers
    - If the probability of spill is high, can the projected reservoir elevation be determined to see if the event would meet intended targets?
    - If the probability of spill is high at some point during the late fall, winter season, avoid premature actions / intentional use of valves especially on the heels of a relatively recent CM event (1 or 2 years prior).
- If the probability of spill is low but a significant accretion event is manifesting, use the following guidance (habitat and fish considerations) for decision related to use of the slide valve.

Habitat Considerations:

- Recognizing the license mandated 4 in 10-year frequency for CM Flows, how much time has passed since the last CM Flow (1 year, 2 years, or 3 years ago)?
- Depending on when the last CM Flow occurred, avoid premature actions / intentional use of valves especially during potentially sensitive periods in years that come within 1 or 2 years of the last CM event if the ARC concurs.

Fish Considerations:

- What is the current escapement estimate for Chinook in the Sultan? If whole river escapement is above the 10-year average, avoid use of the slide valve or give careful consideration to when it is used. Considerations include: the size of the fish return relative to Skykomish Basin recovery targets, brood year, brood year experience, pre-spawning thermal experience, the spatial distribution of redds, temperature conditions during incubation, the level of egg sensitivity, and the level of developmental sensitivity. Need to look at the entire population for frame of reference.
- What is the reach-specific distribution of Chinook redds? If the redd distribution in the reaches upstream of the Powerhouse (those more prone to scour) is greater than 60% and/or in Reach 3 is greater than 40%, give careful consideration to when a CM is provided. Considerations include: where Skykomish basin Chinook numbers are relative to basin recovery target and the relative size of the Sultan population of returning adults, the spatial distribution of redds, the level of egg sensitivity, and the level of developmental sensitivity.
- What is the reach-specific developmental stage and vulnerability to scour? If water temperature records indicate a particular sensitivity, avoid use of the slide valve.

Table 1. Sideboards, with monthly timing considerations.

Month	Brood Year	Run Size	Redd Distribution	Egg Development
	Known in advance	Informed by surveys	Informed by surveys	Regularly updated based on temperature
	Can lead to a pre-season "call'	If forecast and/or basin specific surveys indicate that Chinook escapement is below a pre-defined threshold, based on the 10-year average, a "call" can be made, either pre-season or in late November	If the late November survey results indicate that over 40% of the total in-river Chinook escapement occurs in Reach 3, a "call" can be made.	If the average accumulated temperature units (ATUs) for Chinook spawning in Reach 3 indicate that over 50% of the eggs are at a particularly vulnerable stage, a "call" can be made.
October		Forecasted	Unfolding through surveys	Sensitivity updated regularly as season progresses
November		Known by late November	Known by late November	Sensitivity updated regularly as season progresses
December		Known	Known	Sensitivity updated regularly as season progresses
January		Known	Known	Sensitivity updated regularly as season progresses
February		Known	Known	Sensitivity updated regularly as season progresses

Snohomish PUD will conduct an evaluation of the conditions and based on the guidance above will recommend to the ARC a course of action. The ARC will have 3 business days to submit their objection of the recommendation at which time the ARC will convene to discuss. If there

are no objections, Snohomish PUD will implement their recommendation as proposed, notify the ARC of the event, and add it to the Process Flow Log.

Appendix 3

Consultation Documentation Regarding Potential Updates to Process Flow Plan

Appendix 4

Consultation Documentation Regarding Updated/Redlined Draft Process Flow Plan

Appendix 5

Process Flow Events Log

Process Flow Log

Date[1]	Time[2]	Magnitude[3] (cfs)	Duration[4] (hrs)	Accretion[5] (cfs)	Notes[6]	Counts as PF Type[7]
		R1- R2- R3-		R1- R2- R3-		

For each event, attach graph of flow at each compliance point.

[1] Start Date of Event (MM/DD/YYYY)
[2] Start Time-End Time
[3] Magnitude of the Event for Each Compliance Location (R1-Reach 1, R2-Reach 2, R3-Reach 3)
[4] Duration of Event
[5] Portion of Event Attributed to Accretion Flows
[6] Notes of Day's Event, Sequencing with Other Flow Events/Maintenance, Released or Natural
[7] Channel Forming (CF), Channel Maintenance (CM), Flushing (F), Outmigration (O), Upmigration (U)