SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1

Your Northwest renewables utility

October 31, 2013

VIA ELECTRONIC FILING

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission (FERC)
888 First Street NE
Washington, DC 20426

Re: Jackson Hydroelectric Project, FERC No. 2157
Side Channel Enhancement Ramp Rate Evaluation Report
License Article 405

Dear Secretary Bose:

Enclosed is Public Utility District No. 1 of Snohomish County's Side Channel Enhancement Ramp Rate Evaluation Report pursuant to License Article 405 for the Jackson Hydroelectric Project. The draft report was provided to the Aquatic Resource Committee for a 30-day review and comment period. The report was updated based on comments received; consultation documentation is included in the report's appendices.

If you have any questions on this report, please contact Keith Binkley, Natural Resources Manager, at (425) 783-1769 or KMBinkley@snopud.com.

Sincerely,

Kim D. Moore, P.E.
Assistant General Manager of Generation, Water, and Corporate Services
KDMoore@snopud.com
(425) 783-8606

Enclosed: SCE RRE Report

Jackson Hydroelectric Project
(FERC No. 2157)

Side Channel Enhancement Ramp Rate Evaluation Report (License Article 405)

Prepared by:

SNOHOMISH COUNTY PUD
PUBLIC UTILITY DISTRICT NO. 1

Everett, WA

October 2013

This report has been prepared for color, double-sided printing.

EXECUTIVE SUMMARY

This study effort and evaluation followed the procedures articulated in the Side Channel Enhancement Ramp Rate Evaluation Plan (License Article 405) filed with the Federal Energy Regulatory Commission (FERC) by Public Utility District No. 1 of Snohomish County (the District) on January 23, 2013, and approved by the FERC on March 19, 2013, pertaining to the Jackson Hydroelectric Project (Project).[1]

During 2013, the District conducted detailed quantitative and qualitative surveys of side channels in the lower Sultan River to assess flow behavior and distribution and to determine whether additional ramping rate restrictions were necessary to prevent juvenile fish stranding within existing and newly constructed side channel habitats. The surveys included measurements of: 1) topography at side channel inlets, 2) water surface and channel elevation at point of hydraulic control near inlet, 3) flow routing and distribution into and within side channels under conditions of low to moderate mainstem discharge, 4) wetted width and depth at systematic intervals along each channel, and 5) photo documentation of low flow habitat conditions along the length of each side channel. The objective of this study was to assess functionality of the side channels over the range of normal flow conditions. This data collection effort supplemented data collected as part of the full engineering survey for hydraulic modeling and project construction. That effort included characterization of channel morphology, channel gradient, and thalweg profiles.

The results of the 2013 surveys indicate that connectivity between the mainstem and side channel habitat is maintained over the range of normal operational flow conditions. The surveys also documented sufficient flow volume over the range of normal operational conditions although within channel flow splits will require additional monitoring related to racking of woody debris.

Complementary low flow habitat surveys along the length of each channel indicated the delivery of adequate flow volumes to maintain toe-width and the presence of suitable and diverse physical habitat conditions in terms of depth and flow/ exchange. Existing information support the conclusion that stranding potential is extremely limited under the range of conditions observed. Surveys were conducted post-construction but, prior to being subjected to flows greater than 2,300 cfs. Several side channels, most notably SC4 and SC1 are still undergoing adjustments to the Sultan River flow regime. It is expected that these adjustments will continue especially in relation to implementation of the Process Flow Plan where releases for either channel formation (6,500 cfs for 24 hours) and channel maintenance (4,100 cfs for 24 hours) will occur on every two years, on average. These adjustments are and will continue to be evident at the inlets, at within channel flow splits, and along the length of each channel. All side channels, but especially the extension to SC1, warrant revisiting after the occurrence of a significant high flow event.

Surveys were not conducted at flows below 300 cfs. These flows are outside the range of normal Project operations and would only occur under a formally declared drought, initiated by the City of Everett. A cautious approach should be employed when downramping below 300 cfs. Until surveyed for stranding potential, the District recommends adopting a 1 inch per hour rate when minimum flows are reduced below 300 cfs during a formally declared drought.

[1] Public Utility District No. 1 of Snohomish County, Project No. 2157-213, 142 FERC ¶ 62,223 (2013)

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List of Acronyms and Abbreviations

A-LA	Aquatic License Article
ARC	Aquatic Resource Committee
cfs	cubic feet per second
District	Public Utility District No. 1 of Snohomish County
ELJ	engineered log jam
FERC	Federal Energy Regulatory Commission
G.H.	Gage Height
LWD	large woody debris
PM&E	protection, mitigation and enhancement
Project	Henry M. Jackson Hydroelectric Project (FERC No. 2157)
Q	discharge
RM	river mile
SC	side channel
SCE	side channel enhancement
USGS	U.S. Geological Survey
WSE	water surface elevation

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1. STUDY OBJECTIVES AND DESCRIPTION

This technical report presents the results of Side Channel Enhancement Ramp Rate Evaluation Plan (RRE Plan) pursuant to License Article 405 filed with the Federal Energy Regulatory Commission (FERC) by Public Utility District No. 1 of Snohomish County (the District) on January 23, 2013, and approved by the FERC on March 19, 2013, pertaining to the Jackson Hydroelectric Project (Project).[2] The report addresses the evaluation of ramping rates in Reach 1 of the Sultan River, downstream of the Project powerhouse (Figure 1-1). This reach is directly under the influence of powerhouse discharge and exhibits the habitat characteristics of an alluvial system that may add to fry vulnerability. While the existing rates were developed through detailed studies and are protective of the resource, recent changes in habitat associated with side channel enhancement efforts have prompted this supplemental evaluation.

The objective of this study is to assess functionality, by both quantitative and qualitative methods, of the side channel enhancements over a range of flow conditions, to determine whether additional ramping rate restrictions are necessary to prevent juvenile fish stranding in the reconnected side channels.

This report is organized in six main sections:

Section 1 – STUDY OBJECTIVES AND DESCRIPTION (this section): provides the context for the study, lists study objectives.
Section 2 – BACKGROUND INFORMATION: provides a summary of background information relevant to the RRE Plan study including a description of the study area.
Section 3 – METHODS: describes the major steps involved in completing the study.
Section 4 – RESULTS: presents the overall results of the ramping rate evaluation.
Section 5 – DISCUSSION AND CONCLUSIONS: presents the conclusion for ramping rate modifications.
Section 6 – REFERENCES: provides citation information.

The report also contains the following appendices:

Appendix 1. Photo Documentation of Surveyed Conditions
Appendix 2. Field Data Collected During Systematic Inventory of Habitat Conditions
Appendix 3. Consultation Documentation Regarding RRE Plan and Draft Report
Appendix 4. Responses to Comments Regarding Draft Report

[2] Public Utility District No. 1 of Snohomish County, Project No. 2157-213, 142 FERC ¶ 62,223 (2013)

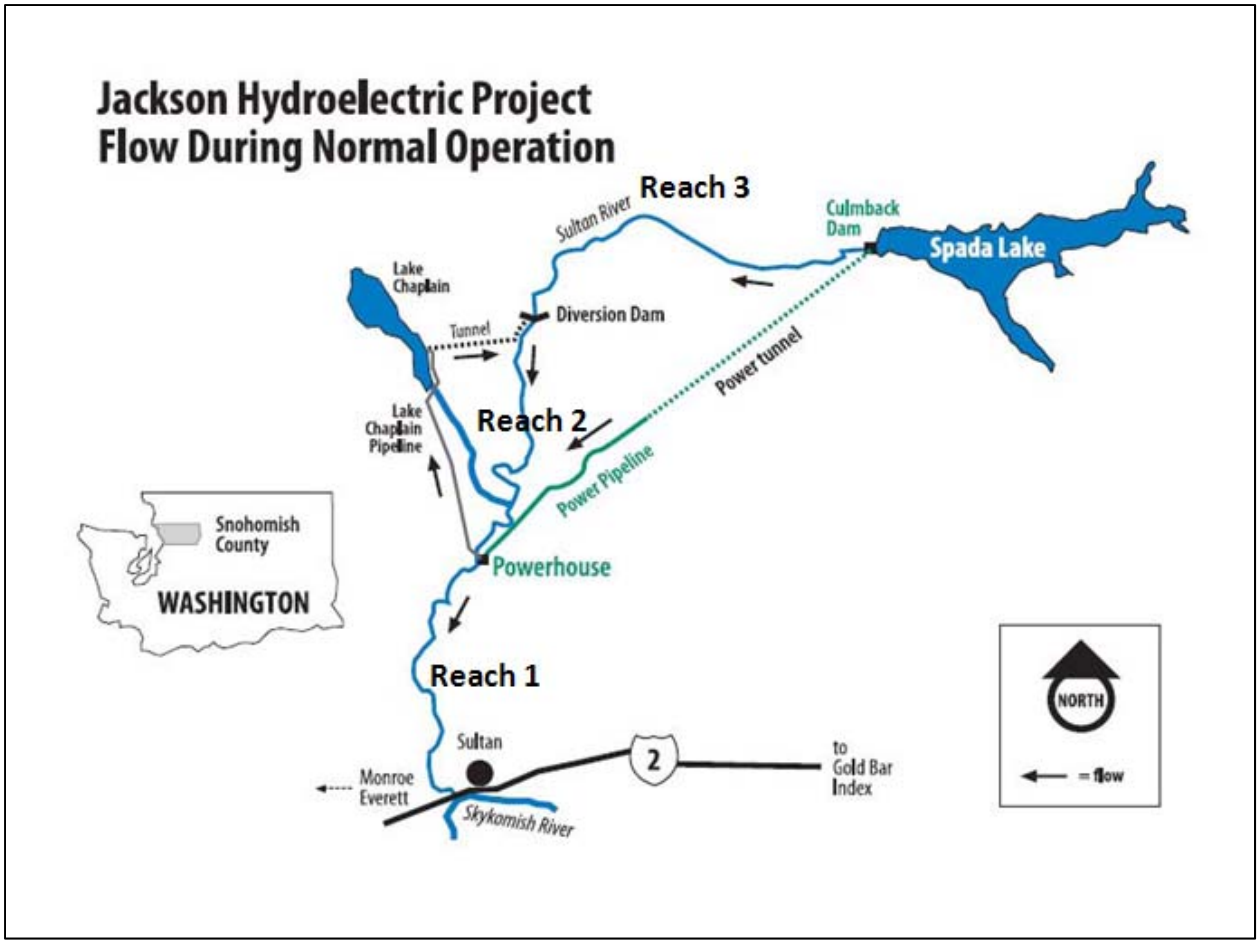

Figure 1-1. Reach designations, Sultan River downstream of Culmback Dam.

2. BACKGROUND

2.1. Introduction

The District is the licensee for the Project under a license issued by the FERC on September 2, 2011 (License). The Project is located on the Sultan River in Snohomish County, Washington, near the City of Sultan. The original Project license was issued in 1961 and amended in 1984. In 1964, construction of Culmback Dam was completed to create Spada Lake Reservoir – the major source of Snohomish County drinking water. In 1984, the construction of the hydroelectric facilities and raising of Culmback Dam were completed, creating the Project as it essentially exists today. The Project includes a 262-foot high rock-fill dam (Culmback Dam); a 1,870-acre reservoir (Spada Lake Reservoir) operated for the City of Everett's water supply, fisheries habitat enhancement, hydroelectric power, incidental flood control and recreational opportunities; a 111.8 megawatt nameplate capacity powerhouse; an 8-mile long power penstock; and associated facilities. Figure 2-1 shows the Project facilities, reaches, and flow inputs.

Included in the License are various articles identifying protection, mitigation and enhancement measures for water quality, fishery, terrestrial, recreation and cultural resources. License Article

405 and its corresponding RRE Plan require the District to conduct a ramping rate evaluation based on the reconnected side channels (pursuant to License Article 404).

2.2. Relevant License Articles

To address habitat concerns in the lower Sultan River, included in the License requirements is License Article 404 Side Channel Enhancement (SCE) Plan (FERC 2011). The SCE Plan documents how the District would implement a program to: 1) restore and enhance the salmonid rearing habitat function along a negotiated minimum length of 10,000 linear feet of side channel (SC) habitat (and with a minimum surface area of 3 acres achieved through an average channel width of 13.1 feet), and 2) enhance adult and juvenile salmon habitat by the strategic placement in the main river channel of up to 12 engineered large woody debris (LWD) structures. The District constructed the side channel enhancements pursuant to the SCE Plan in 2012 (see Figure 2-2) (District 2013).

Aquatic License Article 5 (A-LA 5) establishes downramping rate schedules for the Project. These schedules were established for the protection of salmonid fry that may be vulnerable to stranding associated with changes in water surface elevation (stage) during operation of the Project. Seasonal schedules apply to Reaches 1 and 2 of the Sultan River. These are highly specific to time of day and flow range in the Sultan River. Further upstream in Reach 3, flow adjustments are made infrequently and not tied to changes in generation as in Reach 1 and to a lesser extent in Reach 2. In Reach 3, specific downramping rates apply only to flow releases directly from Culmback Dam. Table 2-1 depicts the applicable downramping schedule in Reach 1 when the flow range is between 600 and 300 cfs (minimum instream flow), as measured at USGS Streamflow Gage No. 12138160. Ramping rates extended down to a minimum instream flow 165 cfs in the previous license.

Table 2-1. Downramping rate schedule, 600 to 300 cfs flow range, Reach 1, lower Sultan River (per License Appendix G, A-LA 5).

SEASON	DAY RATE	NIGHT RATE
January 1 to May 31	2 inches per hour	4 inches per hour
June 1 to September 15	2 inches per hour	1 inch per hour
September 16 to October 31	2 inches per hour	2 inches per hour
November 1 to December 31	4 inches per hour	4 inches per hour

License Article 405 requires the District to conduct this evaluation and submit a report to the FERC within one year of completing the side channel enhancements.

2.3. Consultation

This report has been prepared in consultation with the members of the Project's Aquatic Resource Committee (ARC).[3] The ARC was provided a copy of the draft report for a 30-day review and comment period. Consultation documentation regarding the RRE Plan and the draft report, including the emails requesting comments and comments received from the ARC, is included in Appendix 3; responses to the comments received are included in Appendix 4.

[3] The ARC consists of: the Licensee, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, the City of Everett, the Tulalip Tribes, Snohomish County, the City of Sultan, and American Whitewater

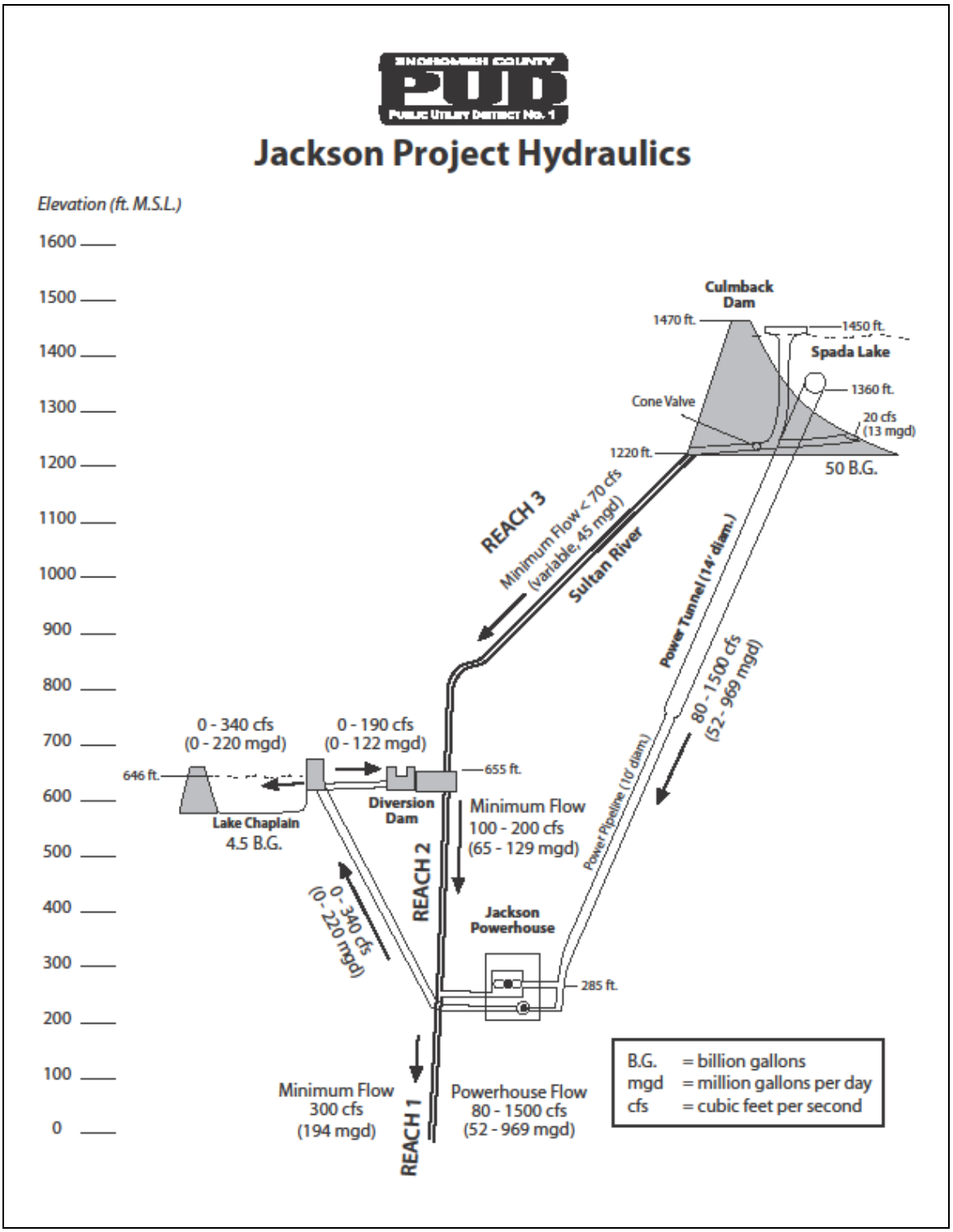

Figure 2-1. Schematic of water conveyance system associated with the Project.

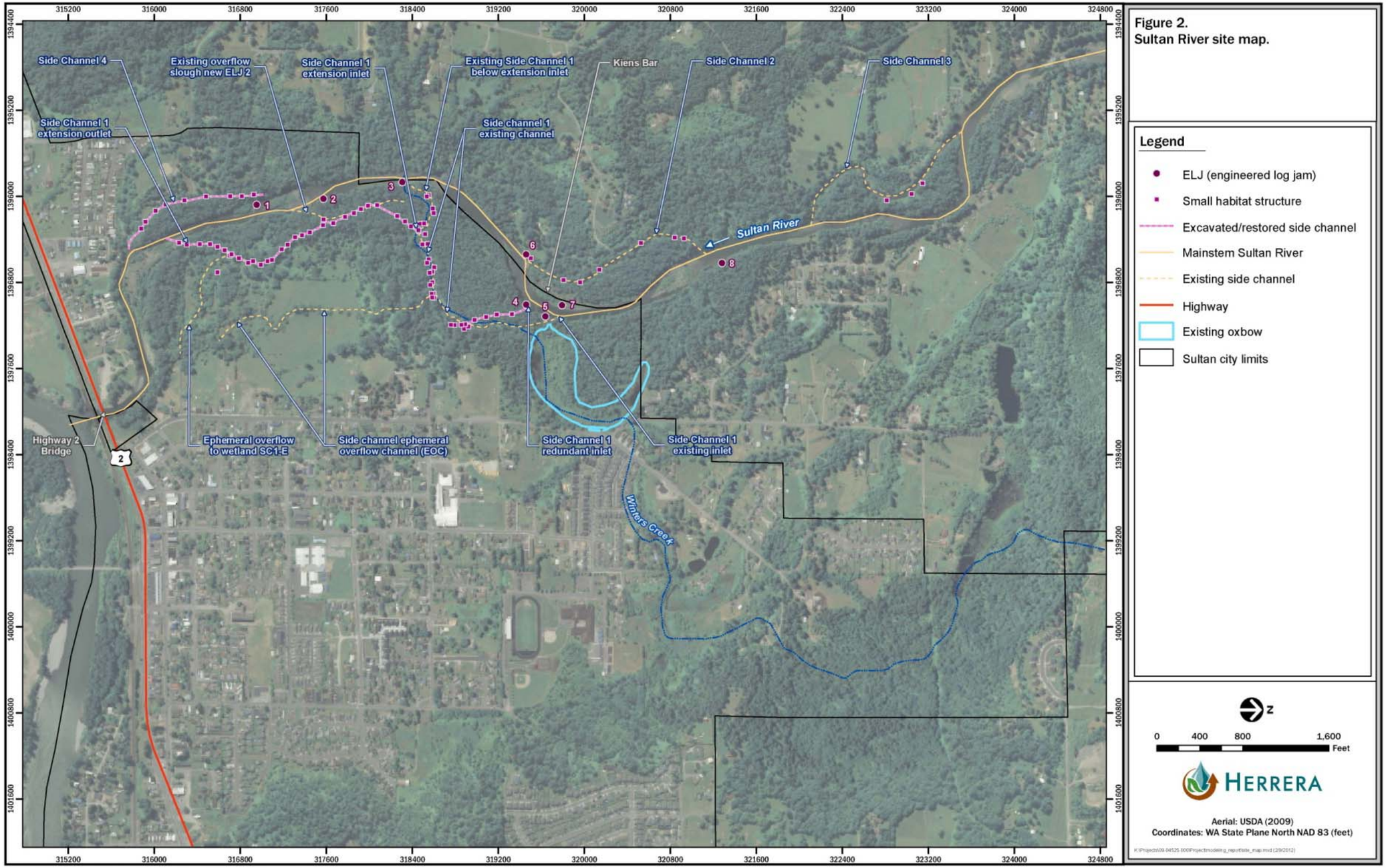

Figure 2.
Sultan River site map.

Figure 2-2. Side channel enhancements in the lower Sultan River in Reach 1.

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3. STUDY METHODOLOGY

During summer 2013, District biologists evaluated patterns of flow behavior in four distinct side channels in the lower Sultan River (Figure 2-2). These side channels – SC1, SC2, SC3, and SC4 – had each undergone varying degrees of construction during summer 2012 to restore and/or enhance salmonid habitat; some channels were newly created while others just received large woody debris (LWD) and boulder treatments. Each side channel is unique in terms of length, gradient, flow volume and flow distribution. For instance, SC1 has two inlets ("historic" and "redundant") and two outlets ("historic" and "extension"), SC2 and SC3 each have one inlet and one outlet, and SC4 has one inlet and two outlets ("primary" and "secondary").

Since construction, side channel habitats have been routinely monitored to qualitatively assess functionality over the full range of flow conditions. Qualitative surveys rely on field observations and photo documentation. For this evaluation, qualitative surveys were complemented by focused quantitative surveys. These surveys were conducted as mainstem flows dropped below 600 cfs, as measured at United States Geological Survey (USGS) Streamflow Gage No. 12138160. This flow range, below 600 cfs and extending down to the Project minimum of 300 cfs, was selected for this evaluation to be consistent with prior survey efforts related to Project downramping (CH2MHill 1990).

Quantitative surveys documented flow volume at the inlets and outlets of each of the four side channels within the 600 to 300 cfs flow range. This information was collected to define flow connectivity and the relationship between mainstem and side channel flow and habitat. During 2013, three to four site visits were made to survey conditions and bracket this flow range. For each side channel, discharge readings were collected along an established transect near the inlet(s) and outlet(s) using a FlowTracker velocity meter. Benchmarks for horizontal and vertical control were also established near the inlet(s) and outlet(s) to each side channel. During each survey, bed elevation and water surface elevation were recorded at inlet and at the hydraulic control downstream. Water surface elevation (stage) was recorded at each outlet.

During low flow conditions, physical habitat measurements were collected along the length of each channel including the measurement of select habitat characteristics (width, width in relation to toe-width, water depth (maximum and average), substrate, presence of woody debris, and riparian condition) and systematic intervals. Measurement stations were consistent with the engineering survey and monumented (latitude, longitude) at 100 foot intervals within each side channel. A hip-chain was used to establish the between monument stations. During this longitudinal survey, representative photos were taken at regular intervals and distance referenced to document habitat conditions during low flow (Appendix 1).

4. RESULTS

Surveys were conducted during the months of June, July, and August 2013. Over the summer, side channels were surveyed when flows were within the target flow range. Surveys included a topographic survey of each inlet and hydraulic control, discharge measurements, and a low flow survey of habitat conditions within each side channel. The results are organized by side channel in the following sections with photo documentation and systematic inventories of low flow conditions presented in the Appendix 1 and 2, respectively.

4.1 Side Channel 1

As previously stated, SC1 is unique among the Sultan River side channels in that it has two inlets and two outlets. The constructed, redundant inlet (Figure 4-1) works in concert with the historic inlet (Figure 4-2) to ensure the adequate delivery of sufficient flow volumes throughout the side channel network. Downstream, streamflow is split and routed down one of two pathways: 1) down the historic channel to its outlet (Figure 4-3), or 2) down the constructed extension to SC1 to its outlet (Figure 4-4). Management of the flow split for proper flow routing is a focal point of ongoing monitoring. Racking of woody debris and evolution of the split under high flows will be closely observed.

Figure 4-1. Redundant inlet to SC 1, looking downstream with Engineered Log Jam (ELJ) 4 on the right, mainstem discharge of 581 cfs.

Figure 4-2. Historic inlet to SC 1, looking downstream into side channel from main river, mainstem discharge of 400 cfs.

Figure 4-3. Historic outlet to SC 1, looking downstream with main channel in background, mainstem discharge of 400 cfs.

Figure 4-4. Extension to SC1, looking downstream from near new pedestrian bridge within Osprey Park, mainstem discharge of 400 cfs.

During summer 2013, the SC1 complex was surveyed on four occasions. During these surveys, mainstem discharge, as measured at USGS Gaging Station No. 12138160, ranged between 338 and 581 cfs (Table 4-1). Total inflow to SC1 ranged between 9.2 and 19 cfs during the surveys with similar volumes observed in both the historic and redundant inlets. The redundant inlet accounted for between 41 and 53% of the total inflow to SC1 during the surveys. The portion of mainstem flow entering SC 1 ranged between 2.3 and 3.5%. Inflow and distribution was variable due to human disturbance (damming with rocks and logs) at both locations. Measurements of outflow were consistent with inflow ranging between 9.2 and 18.9 cfs (Table 4-1). Distribution between outlets was also variable attributable to inconsistent routing at the flow split with between 69 and 81% routed down the historic outlet.

During the summer, bed elevation was surveyed at the inlet connection with the main river and at the hydraulic controls further downstream for the historic channel (Figures 4-5, 4-6, and 4-7) as well as the redundant inlet (Figure 4-8 and 4-9). Survey at the river interface was to document anticipated channel changes tied to the deformation of a small island at the head of the historic inlet (Figure 4-6 and 4-7) as well as other anticipated high flow induced changes to both the historic inlet and redundant inlet (Figure 4-9). Water surface elevation, relative to bed elevation, was also measured and recorded during each survey. Across the control for the historic inlet, water depth averaged 0.43 feet with a maximum of 0.63 feet at a mainstem discharge of 338 cfs (Table 4-2). At the control for redundant inlet, water depth averaged 0.38 feet with a maximum of 0.46 feet (Table 4-2).

Table 4-1. Water surface elevation (WSE) and discharge at inlets and outlets to SC1 under varying mainstem discharge.

Date	Mainstem Discharge (cfs)	Relative WSE at Side Channel Inlet (ft)	Discharge at Inlet (cfs)	Discharge at Redundant Inlet (cfs)	Discharge (G.H.) at Historic Outlet (cfs)	Discharge (G.H.) at Secondary Outlet (cfs)
6/25/13	338	95.80	6.2	5.6	8.5 (2.375")	3.7 (3")
7/25/13	369	95.86	6.0	4.2	8.0 (2.25")	1.9 (2.5")
8/22/13	581	96.27	9.4	9.6	13.1 (4.0")	5.8 (7.5")
8/27/13	400	96.01	4.3	4.9	7.3 (2.125")	1.9 (2.5")

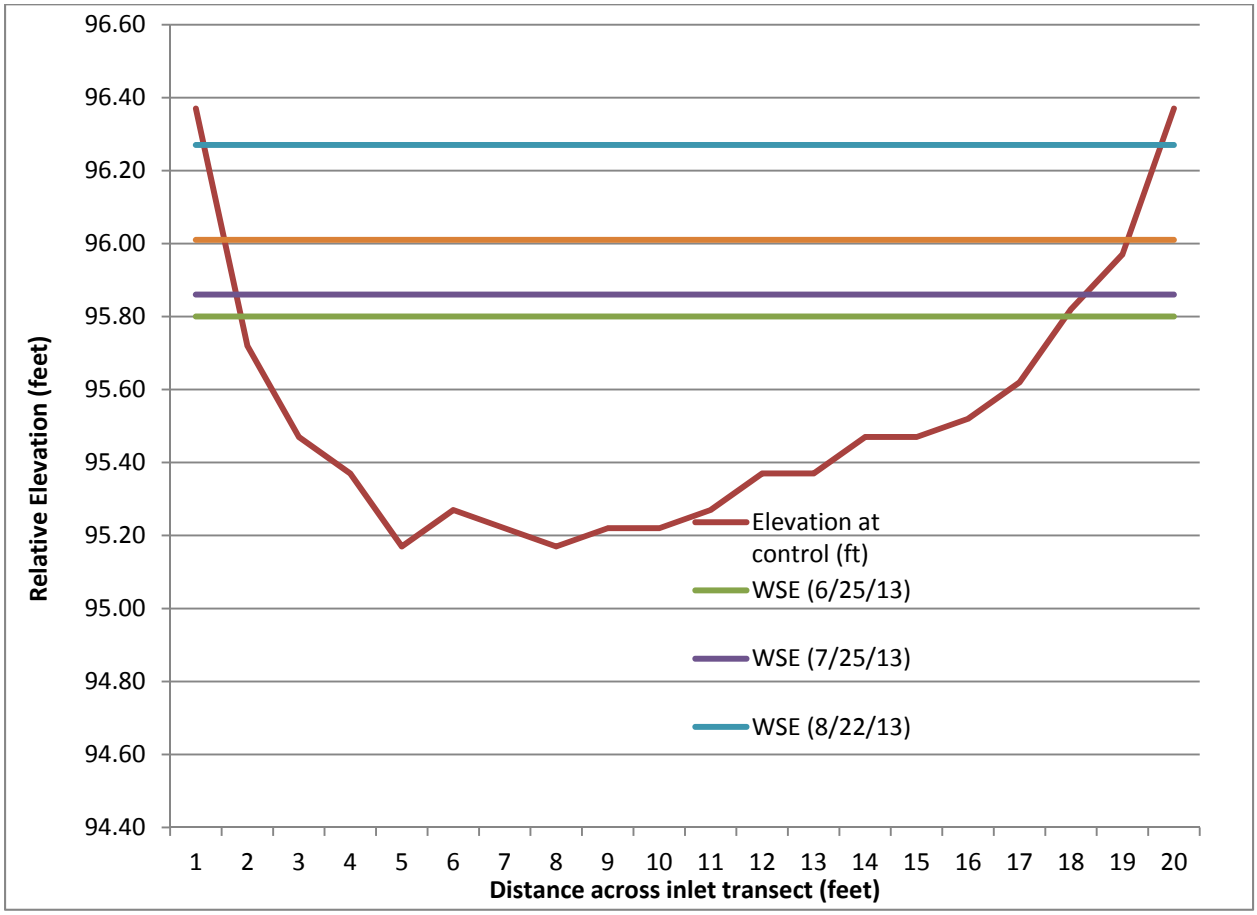


Figure 4-5. Bed and water surface elevations at control for historic inlet to SC1, summer 2013.

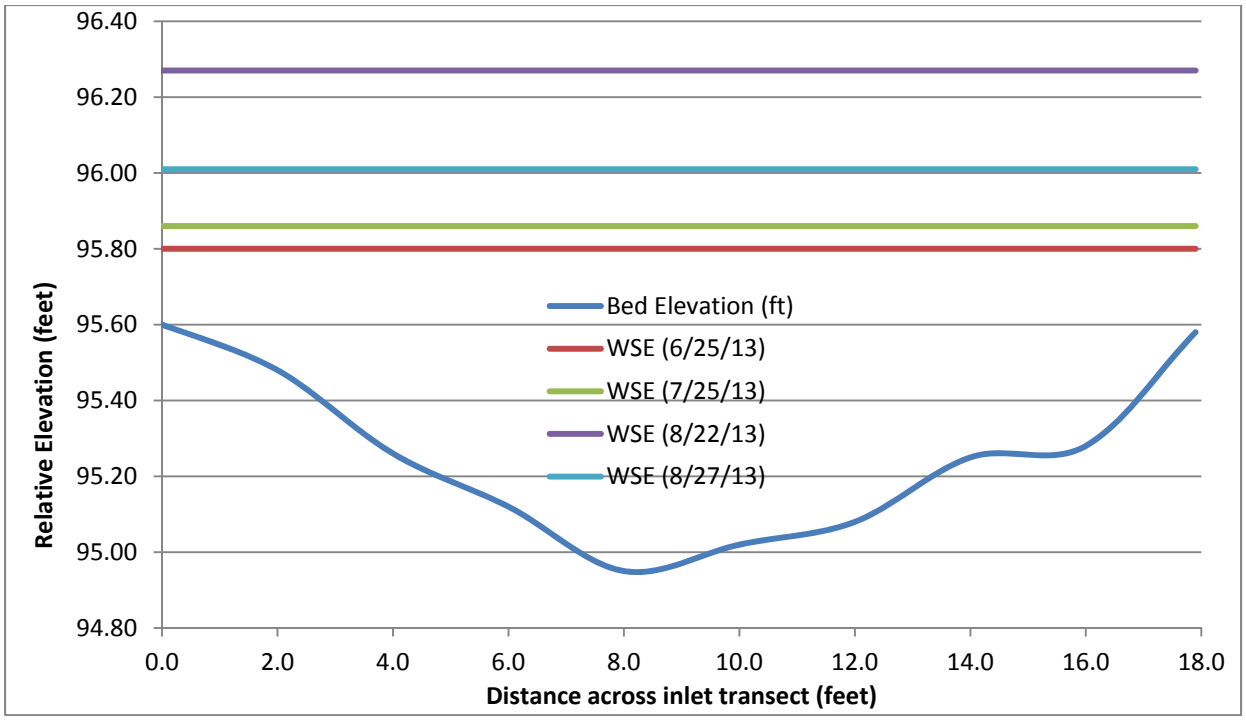


Figure 4-6. Bed and water surface elevations, historic inlet (left side) to SC1, summer 2013.

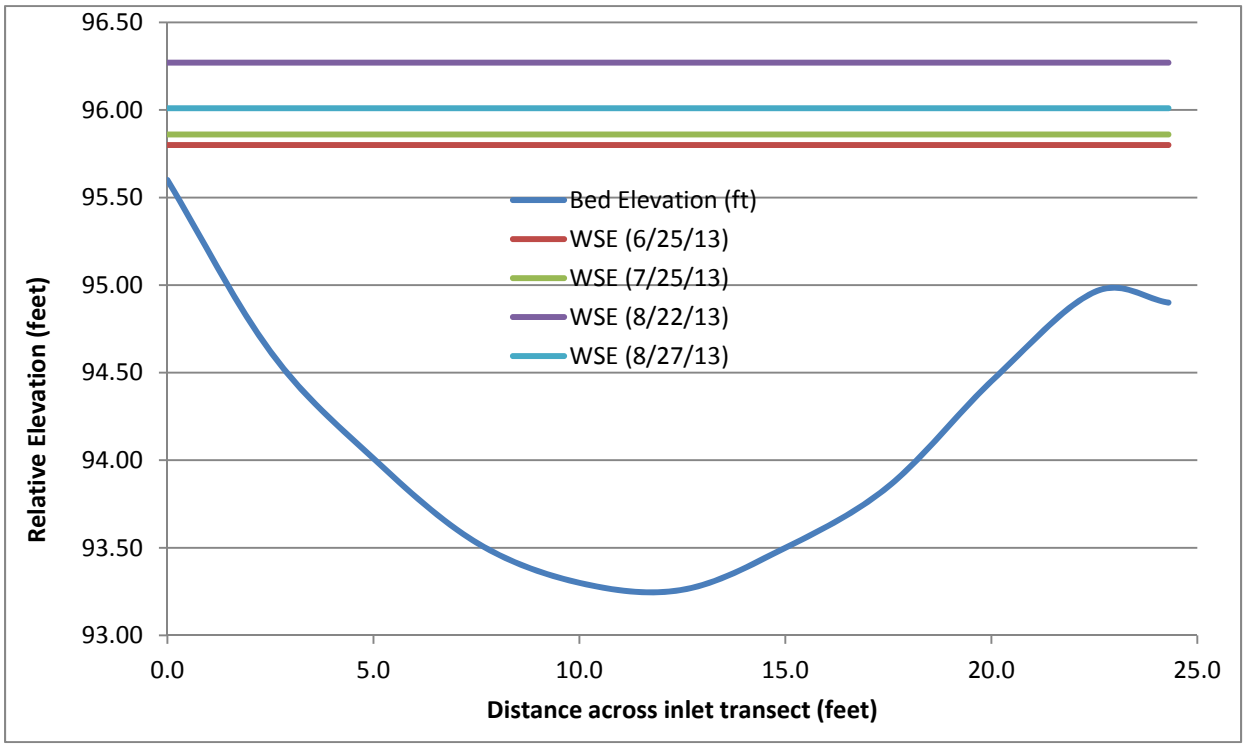


Figure 4-7. Bed and water surface elevations, historic inlet (right side) to SC1, summer 2013.

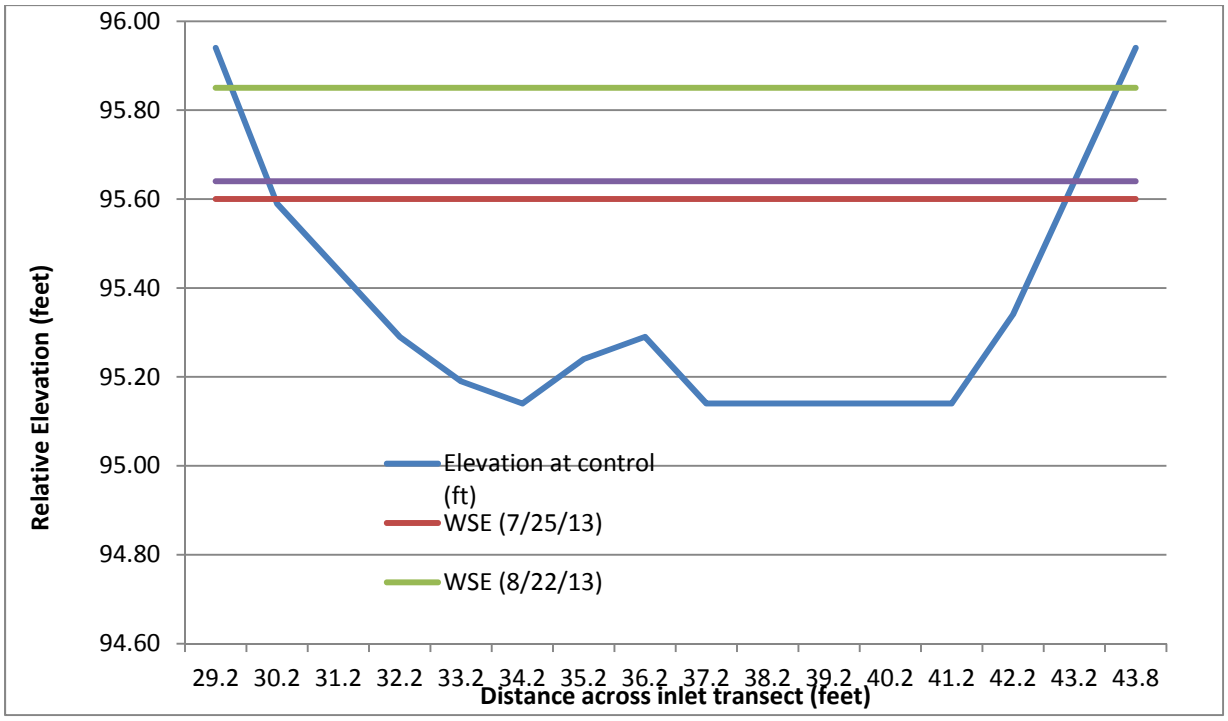


Figure 4-8. Bed and water surface elevations, control for redundant inlet to SC1, summer 2013.

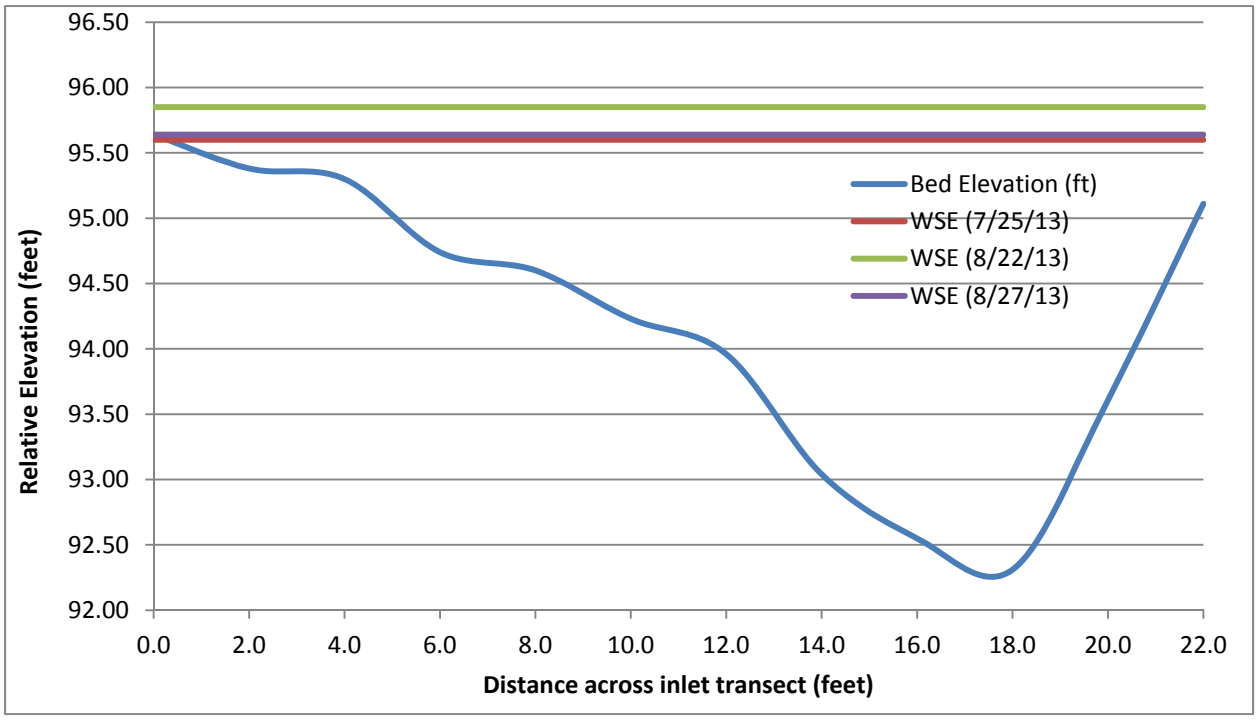


Figure 4-9. Bed and water surface elevations, redundant inlet to SC1, summer 2013.

Table 4-2. Minimum, maximum, and mean water depth measured across each side channel inlet control during the lowest mainstem discharge surveyed of 338 cfs.

Side Channel	Minimum Depth (feet)	Maximum Depth (feet)	Average Depth (feet)
1 – Historic	0.08	0.63	0.43
1 - Redundant	0.16	0.46	0.38
2	0.56	0.69	0.63
3	0.48	1.98	1.40
4	0.29	1.96	1.18

The longitudinal survey of the SC1 included photo documentation and systematic collection of physical habitat measurements (Appendix 1 and 2). The historic channel, defined as the channel that existed prior to the 2012 restoration project, was 2,550 feet in length with an average gradient of 0.29 percent. Channel width in the historic channel ranged between 7.5 and 38.0 feet with a mean measured width of 18.6 feet (Table 4-3). All low flow width measurements within the historic channel were equivalent to the toe-width, as documented in Appendix 1. Maximum water depth measured at each station ranged from 0.45 to 3.5 feet (Figure 4-10). Under low flow conditions, the average depth of measured cross sections in the historic channel ranged between 0.1 and 2.9 feet, with a mean of 1.0 feet (Table 4-3).

Table 4-3. Length, width, gradient, and depth measurements from systematic survey of SC 1 complex under low flow conditions.

Side Channel	Length (feet)	Width (feet)			Elevation / Gradient			Average Depth (feet)		
		Mean	Min	Max	Inlet	Outlet	%	Mean	Min	Max
SC1 – Historic	2,550	18.6	7.5	38.0	119.74	112.28	0.29	1.0	0.1	2.9
SC1 – Redundant inlet	600	11.5	9.0	15.0	119.21	117.95	0.21	0.8	0.5	1.9
SC1- Extension	2,575	12.7	4.3	21.6	114.49	103.25	0.42	0.6	0.1	1.9

Channel width in the 600' created redundant inlet to SC1 ranged between 9.0 and 15.0 feet with a mean measured width of 11.5 feet (Table 4-3). Gradient was relatively uniform at 0.21 percent. All low flow width measurements within the redundant inlet were equivalent to the toe-width, as documented in Appendix 1. This reflects the post- construction uniformity of the channel prior to exposure to a high flow. Maximum water depth measured at each station ranged from 0.6 to 2.0 feet (Figure 4-11). Under low flow conditions, the average depth of measured cross sections in the redundant inlet ranged between 0.5 and 1.9 feet, with a mean of 0.8 feet.

Similarly, channel width in the created extension to SC1 ranged between 4.3 and 21.6 feet with a mean measured width of 12.7 feet. All low flow width measurements within the historic channel were not equivalent to the toe-width, as documented in Appendix 1 and Appendix 2. Deposition has been documented in the wide portion of the extension near the wetland and Stations 9+00 to 10+00 (Figure 4-12). This area will be monitored and may be a location for the longitudinal placement of LWD to retain appropriate confinement of the channel. Maximum water depth

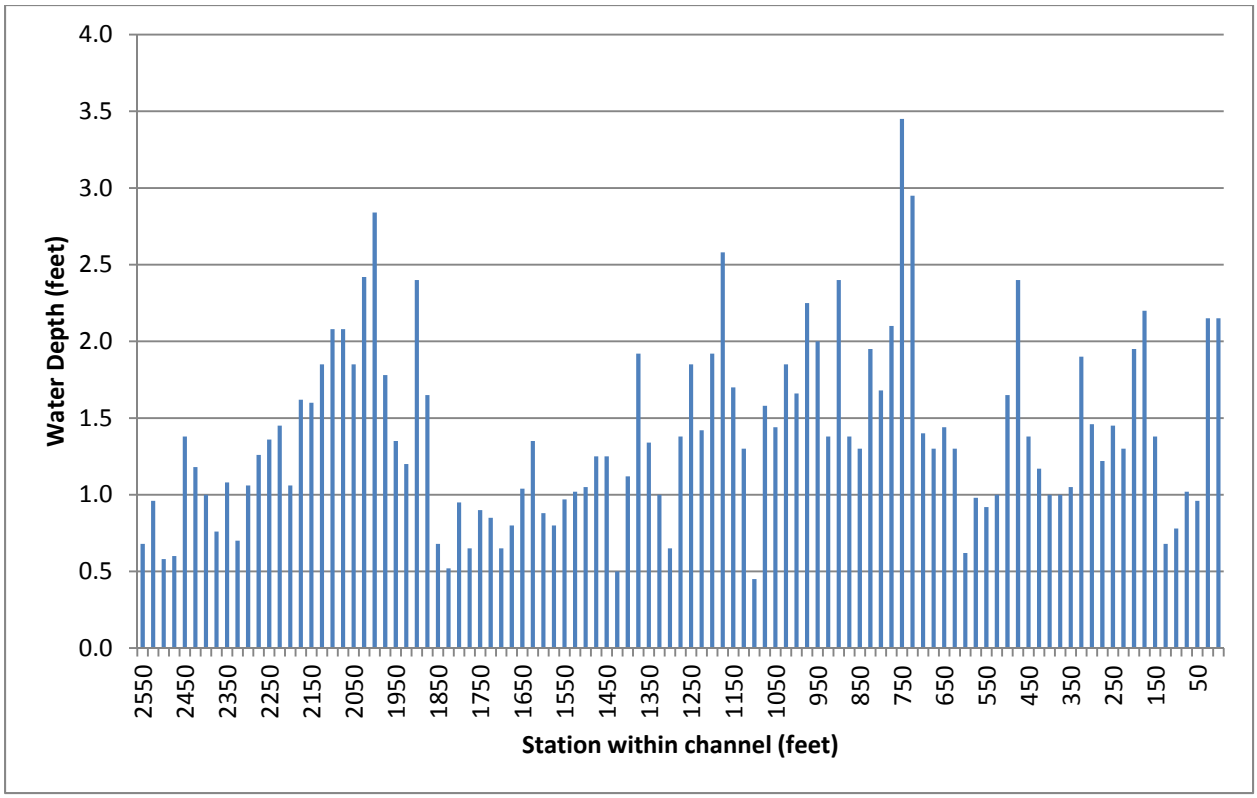


Figure 4-10. Thalweg profile, Side Channel 1 Historic Channel.

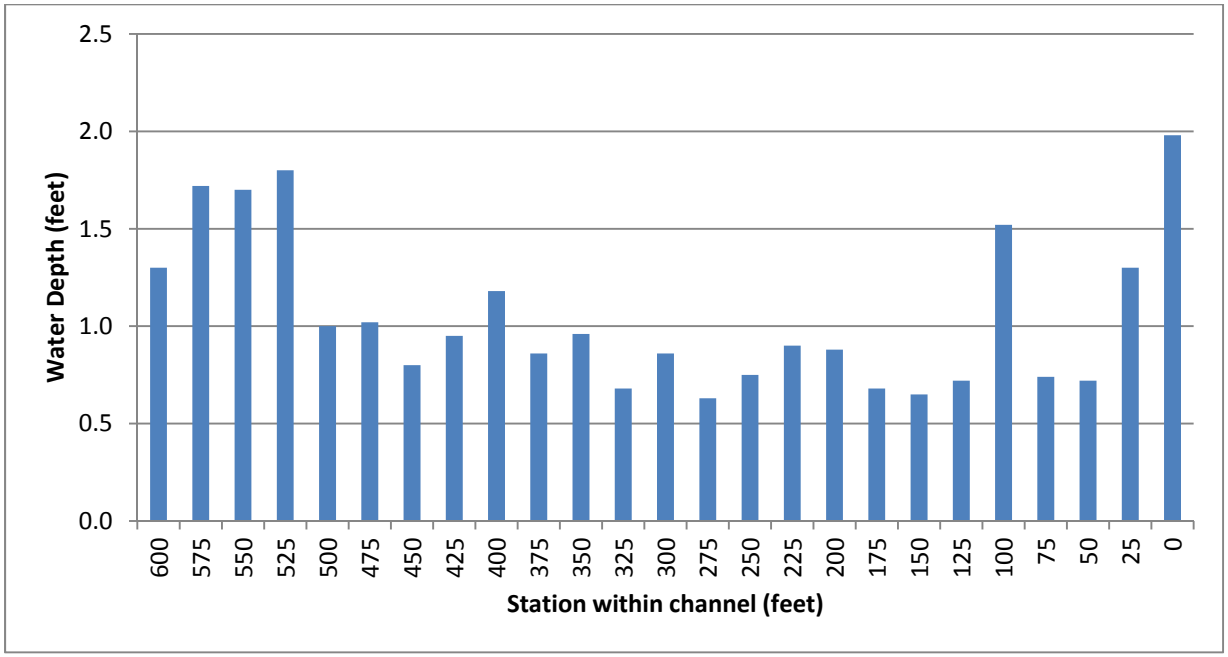


Figure 4-11. Thalweg profile, Side Channel 1 Redundant Inlet.

Figure 4-12. Deposition within SC1 Extension near wetland crossing.

measured at each station ranged from 0.3 to 2.8 feet (Figure 4-13). Shallow water depths were observed in the lower 175 feet of the channel between Stations 24+00 and 25+75. Substrate in this area is comprised predominantly of sand and silt. Deposition in this area may be exacerbated by backwatering from the main river channel under conditions of high flow and transport. This area will also be an area of focused evaluation under ongoing monitoring efforts. Under low flow conditions, the average depth of measured cross sections in the extension ranged between 0.1 and 1.9 feet, with a mean of 0.6 feet.

Substrates were predominantly fine grained in the newly created extension and redundant inlet (Appendix 2). Relatively larger substrate material was present in the historic channel dominated by rubble, cobble, and gravels (coarse and fine). LWD was well distributed throughout the SC1 complex including the newly created and historic channels. The riparian community within the historic channel was well established but heavily impacted by the presence of knotweed (Appendix 1). Evidence of the first year of knotweed treatment efforts, financed through the Fish Habitat Enhancement Plan's Habitat Enhancement Account, was notable. Riparian vegetation planted along the banks of the extension and redundant inlet was well established with excellent survival noted after year 1.

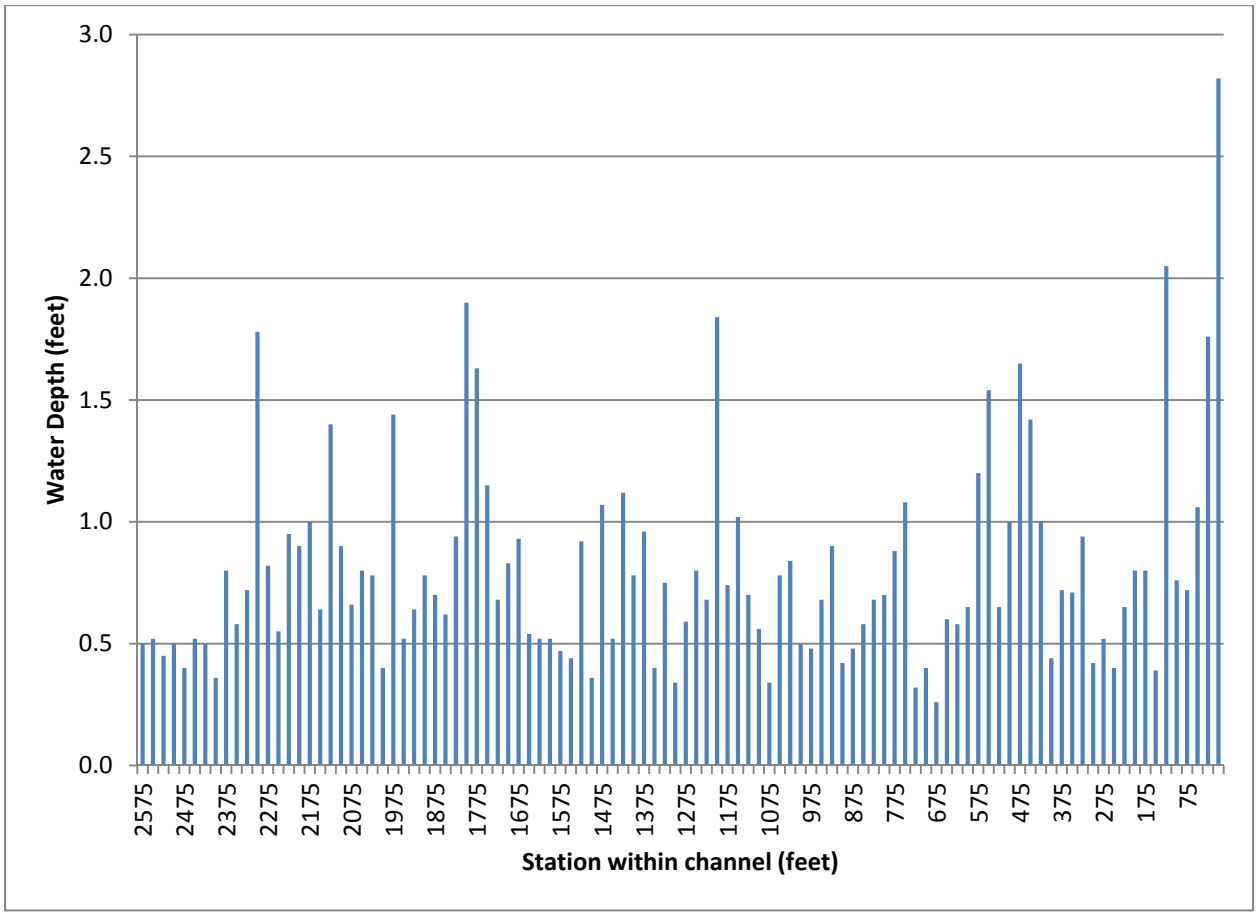


Figure 4-13. Thalweg profile, Side Channel 1 Extension.

4.2 Side Channel 2

Construction within SC2 focused on enhancing functionality through improved flow connectivity at the inlet coupled with strategic placements of large woody debris downstream (Figure 4-14 and 4-15). During summer 2013, SC2 was surveyed on three occasions (Figure 4-16). During these surveys, mainstem discharge, as measured at USGS Gaging Station No. 12138160, ranged between 369 and 581 cfs (Table 4-4). Total inflow to SC1 ranged between 8.0 and 21 cfs during the surveys accounting for between 2.1 and 3.6% of the mainstem flow. Measurements of outflow were within 2% of inflow and ranged between 7.9 and 20.6 cfs (Table 4-4).

Figure 4-14. Inlet to SC 2, looking downstream from main channel, mainstem discharge of 369 cfs.

Figure 4-15. SC2 with wood treatments installed during summer 2012, mainstem discharge of 369 cfs.

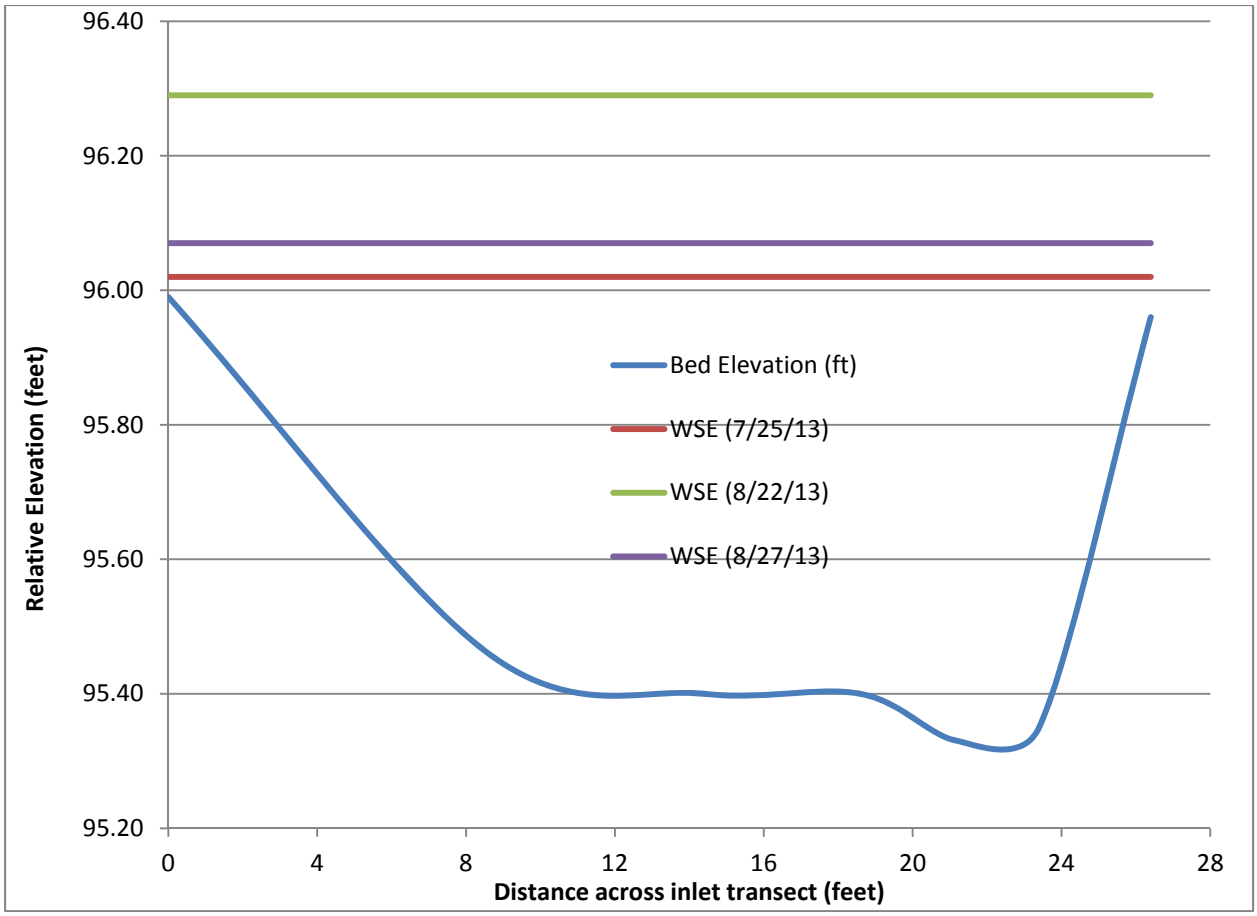


Figure 4-16. Bed and water surface elevations, inlet to SC2, summer 2013.

Table 4-4. Water surface elevation and discharge at inlets and outlets to SC2 under varying mainstem discharge.

Date	Mainstem Discharge (cfs)	Relative Water Surface Elevation at Side Channel Inlet (ft)	Discharge at Inlet (cfs)	Discharge (G.H.) at Outlet (cfs)
7/25/13	369	96.02	8.0	7.9 (6")
8/22/13	581	96.29	21.0	20.6 (8.5")
8/27/13	400	96.07	8.4	8.5 (6.125")

As previously stated, longitudinal surveys included photo documentation and systematic collection of physical habitat measurements (see Appendix 1 and 2). SC2 was measured at 1,966 feet in length with an average gradient 0.48 percent (Table 4-5). Channel width in the SC2 ranged between 11 and 48 feet with a mean measured width of 28.2 feet (Table 4-5). All low flow width measurements within the historic channel were equivalent to the toe-width, as documented in Appendix 1. Maximum water depth measured at each station ranged from 0.6 to 2.8 feet (Figure 4-17). Under low flow conditions, the average depth of measured cross sections ranged between 0.3 and 2.2 feet, with a mean of 0.9 feet (Table 4-5). The presence of some shallow areas in the lower portion of the channel, as depicted in Figure 4-18, is reflective areas were mass spawning occurs by chum salmon. A high flow may redistribute the coarse gravel and cobbles present in these areas.

Substrate within SC2 was predominantly cobble and gravel (coarse and fine) providing for ideal spawning conditions. LWD was well distributed with the inclusion of wood placed during the 2012 restoration work. As before the restoration work, the riparian community was well established with mature canopy providing a heavily shaded environment (Appendix 1).

Table 4-5. Length, width, gradient and depth measurements from systematic survey of SC2 under low flow conditions.

Side Channel	Length (feet)	Width (feet, rounded)			Elevation / Gradient			Average Depth (feet)		
		Mean	Minimum	Maximum	Inlet	Outlet	%	Mean	Minimum	Maximum
SC2	1,967	27.9	11.0	48.0	125.38	115.85	0.48	0.9	0.3	2.2

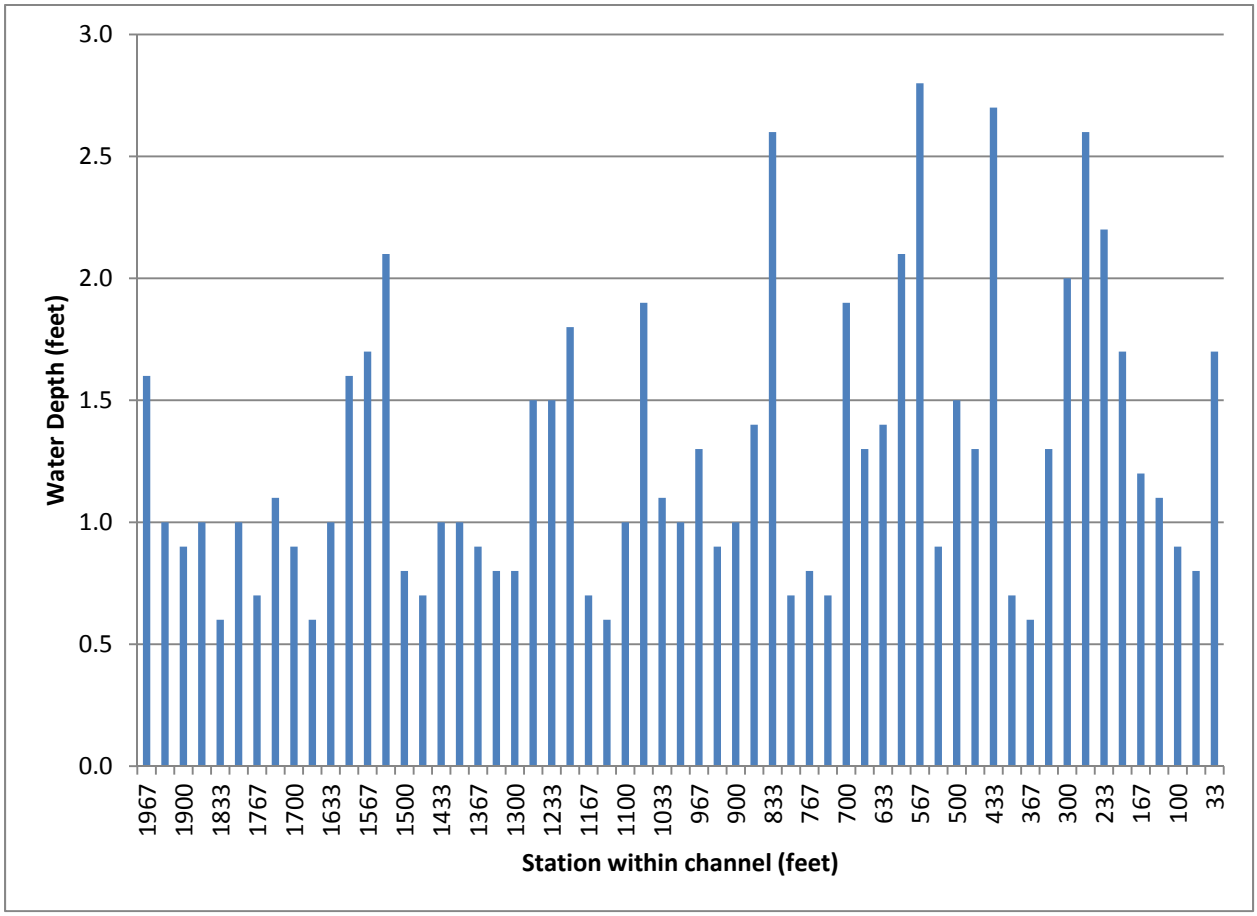


Figure 4-17. Thalweg profile, Side Channel 2.

Figure 4-18. Outlet to SC2, mainstem discharge of 369 cfs.

4.3 Side Channel 3

Construction within SC3 focused solely on enhancing habitat quality through strategic placements of large woody debris along the banks of the channel and within channel boulder placements. SC3 was surveyed on three occasions. During these surveys, mainstem discharge, as measured at USGS Gaging Station No. 12138160, ranged between 369 and 581 cfs (Figure 4-19, Figure 4-20, Table 4-6). Total inflow to SC3 ranged between 22.5 and 40.0 cfs during the surveys accounting for between 6.1 and 6.9% of the mainstem flow. Measurements of outflow were within 2.7% of inflow and ranged between 21.9 and 39.8 cfs (Table 4-6).

Figure 4-19. Inlet to SC3, looking downstream, mainstem discharge of 369 cfs.

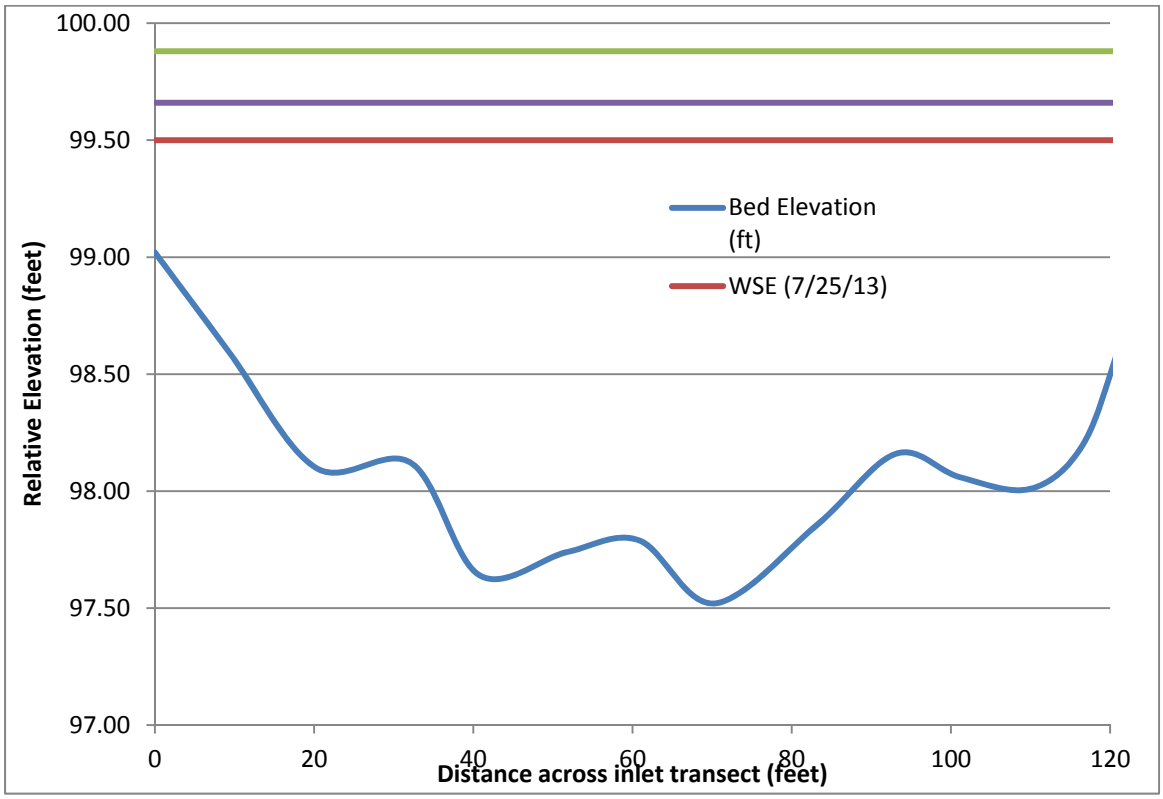


Figure 4-20. Bed and water surface elevations, inlet to SC3, summer 2013.

Table 4-6. Water surface elevation and discharge at inlets and outlets to SC3 under varying mainstem discharge.

Date	Mainstem Discharge (cfs)	Relative Water Surface Elevation at Side Channel Inlet (feet)	Discharge at Inlet (cfs)	Discharge (G.H.) at Outlet (cfs)
7/25/13	369	99.50	22.5	21.9 (6")
8/22/13	581	99.88	40.0	39.8 (9.25")
8/27/13	400	99.66	26.1	26.5 (7")

SC3 was measured at 2,266 feet in length with an average gradient of 0.58 percent (Table 4-7). Channel width in the SC3 ranged between 28 and 92 feet with a mean measured width of 54.6 feet (Table 4-7). All low flow width measurements within the historic channel were equivalent to the toe-width with the exception of the most downstream stations near the high gradient delta of the channel. Maximum water depth measured at each station ranged from 0.7 to 5.8 feet (Figure 4-21). Under low flow conditions, the average depth of measured cross sections ranged between 0.4 and 3.8 feet, with a mean of 1.2 feet (Table 4-7).

In contrast to other side channels, the substrates within SC3 were larger and predominantly rubble and boulder. LWD was more sparsely distributed in SC3 compared to other side channels. The riparian community was well established particularly along the lower portion of the channel. The upper portion of the channel was wider with a less developed riparian community resulting in greater exposure than observed in other side channels.

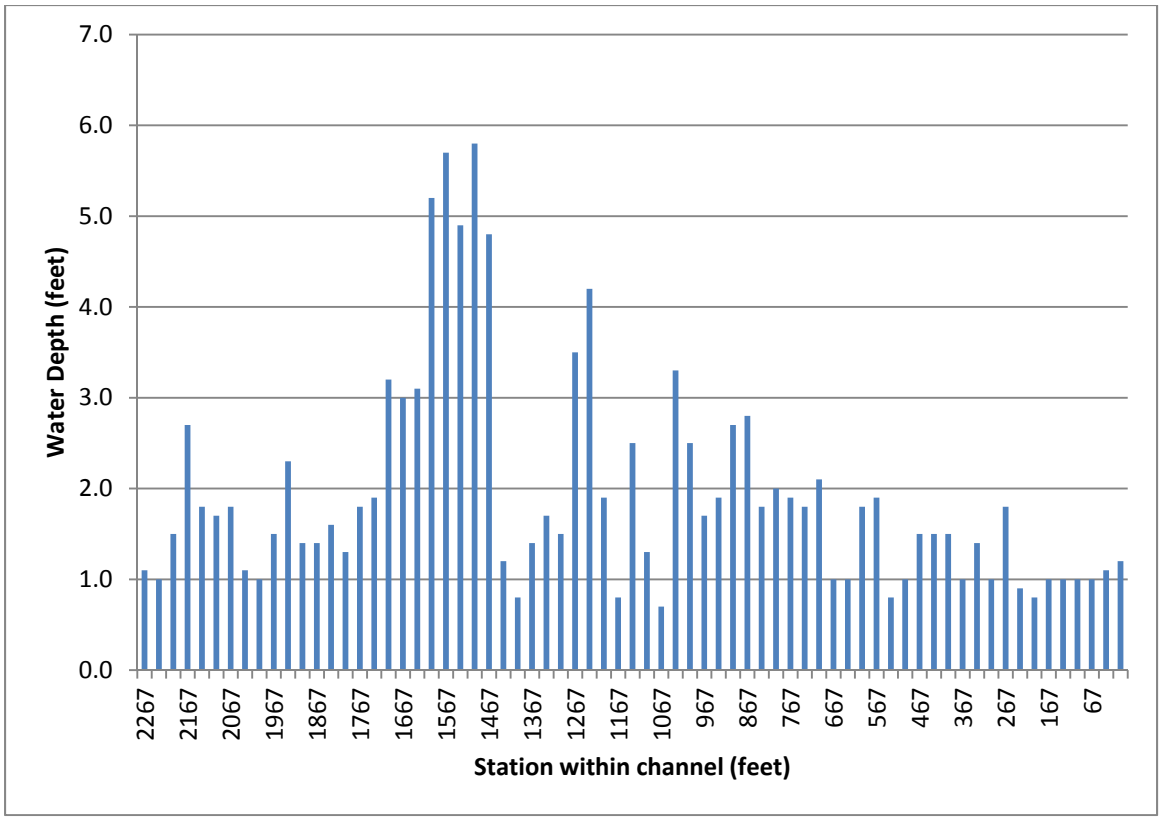


Figure 4-21. Thalweg profile, Side Channel 3.

Table 4-7. Length, width, gradient and depth measurements from systematic survey of SC3 under low flow conditions.

Side Channel	Length (feet)	Width (feet, rounded)			Elevation / Gradient			Average Depth (feet)		
		Mean	Minimum	Maximum	Inlet	Outlet	%	Mean	Minimum	Maximum
SC3	2,266	54.6	28.0	92.0	140.74	127.5	0.58	1.2	0.4	3.8

4.4 Side Channel 4

SC4 is unique among the Sultan River side channels in that it has one inlet and two outlets. The constructed starter channel (Figure 4-22) routes flow from the inlet to an ELJ (ELJ 1) where streamflow is split and routed down one of two pathways: 1) a primary route to the right of the ELJ and through the length of Reese Park before returning to the main channel (Figure 4-23, 4-24), and 2) a secondary route to the left of the ELJ down a short channel that immediately returns to the river (Figure 4-25).

Figure 4-22. Starter channel to SC4, looking d/s to ELJ 1, mainstem Q of 357 cfs.

Figure 4-23. SC4 within Reese Park, looking d/s, mainstem discharge of 357 cfs.

Figure 4-24. Outlet to SC4, looking downstream, mainstem discharge of 357 cfs.

Figure 4-25. SC4 secondary channel / return route to river (picture taken from top of ELJ 1, mainstem discharge of 357 cfs).

SC4 was surveyed on three occasions during summer 2013 (Figure 4-26). During these surveys, mainstem discharge, as measured at USGS Gaging Station No. 12138160, ranged between 338 and 657 cfs (Table 4-8). Total inflow to SC4 ranged between 61.3 and 130.7 cfs during the surveys. The portion of mainstem flow entering SC 4 averaged at approximately 20%. Measurements of total outflow were consistent with inflow. Distribution of outflow was variable between the primary and secondary outlet over the range of conditions due to backwatering by the presence of the ELJ. The presence of a significant amount of racking material at the ELJ enhances this backwatering effect and will likely lead to the continued evolution of this side channel. Human disturbance (damming) at the secondary outlet has also impacted flow routing, although temporary in nature.

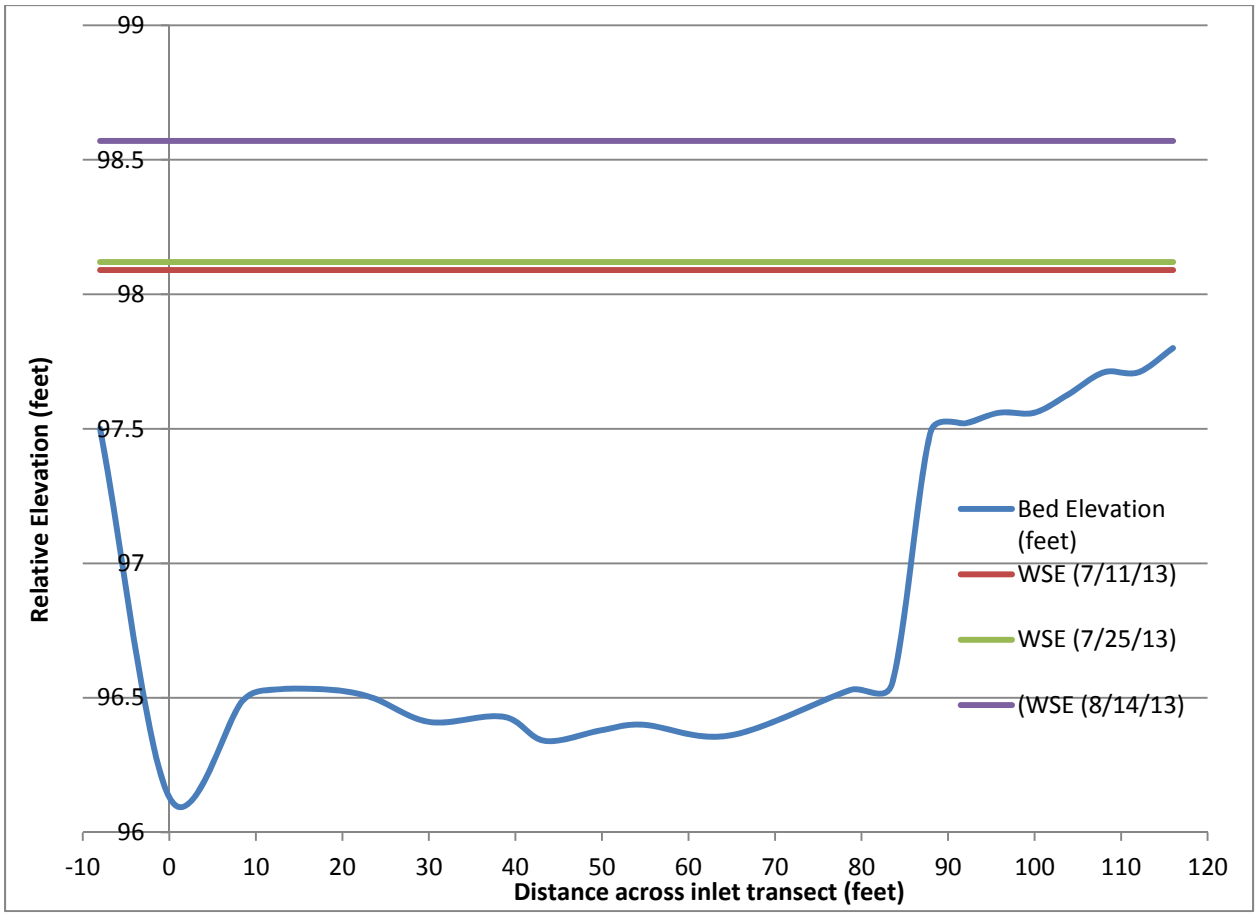


Figure 4-26. Bed and water surface elevations, inlet to SC4, summer 2013.

Table 4-8. Water surface elevation and discharge at inlets and outlets to SC4 under varying mainstem discharge.

Date	Mainstem Discharge (cfs)	Relative Water Surface Elevation at Side Channel (ft)	Discharge at Inlet (cfs)	Discharge (G.H.) at Primary Outlet (cfs)	Discharge at Secondary Outlet (cfs)
7/11/13	338	98.09	68.5	60.1 (23")	7.7
7/25/13	369	98.12	61.3	54.2 (24.25")	7.0
8/14/13	657	98.57	130.7	89.3 (26.5")	39.0

SC4 was measured at 1,500 feet in length with an average gradient of 0.25 percent (Table 4-9). Channel width in the primary channel of SC4 ranged between 16.5 and 64.0 feet with a mean measured width of 23.5 feet (Table 4-9). All low flow width measurements within starter, primary, and secondary channels were equivalent to the toe-width. Maximum water depth measured at each station ranged from 0.7 to 5.8 feet (Figure 4-27). Under low flow conditions, the average depth of measured cross sections ranged between 0.7 and 2.5 feet, with a mean of 1.7 feet (Table 4-9).

Table 4-9. Length, width, gradient, and depth measurements from systematic survey of SC4 under low flow conditions.

Side Channel	Length (feet)	Width (feet, rounded)			Elevation / Gradient			Average Depth (feet)		
		Mean	Minimum	Maximum	Inlet	Outlet	%	Mean	Minimum	Maximum
SC4 - Primary[4]	1,500	22.6	16.5	52.0	106.50	102.75	0.25	1.6	0.7	2.6
SC4 - Secondary	133	14.6	11.0	24.0	Not measured			1.4	0.9	2.6

Channel width in the secondary channel of SC4 ranged between 11 and 24 feet with a mean measured width of 14.6 feet (Table 4-9). Under low flow conditions, the average depth of measured cross sections ranged between 0.9 and 2.6 feet, with a mean of 1.4 feet (Table 4-9). The substrate conditions within this secondary channel were predominately larger sized substrates (cobble and rubble). LWD was absent as this channel traverses a gravel bar that is routinely subjected to active and dynamic sediment transport.

The substrate conditions within SC4 were variable with fine grained substrates found in the lower portion of the channel and larger sized substrates (cobble and rubble) found upstream. LWD was sparsely distributed in SC4 compared to the smaller side channels. The riparian community was well established beyond the area impacted during construction. Riparian vegetation planted along the banks during construction was well established with excellent survival noted after year 1.

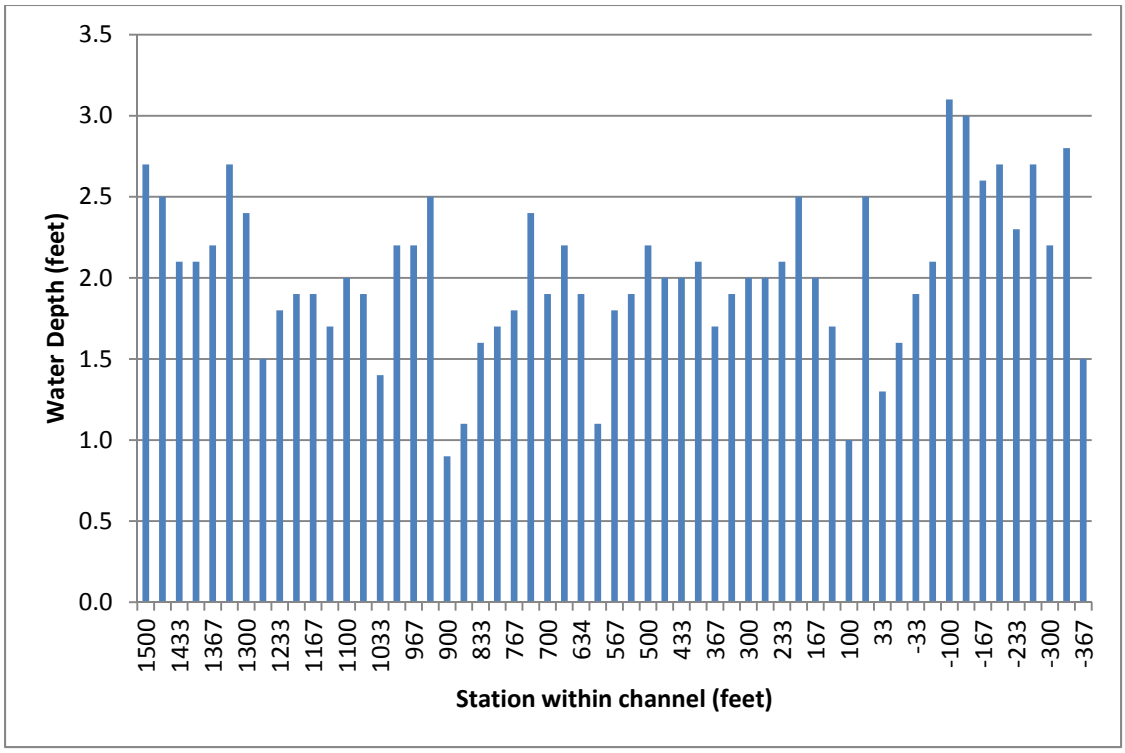


Figure 4-27. Thalweg profile, Side Channel 4.

[4] Primary channel excludes 367 feet of starter channel upstream

5. DISCUSSION AND CONCLUSIONS

The objective of this study was to assess functionality of the side channels over the range of normal flow conditions and identify areas, based on channel morphology, where salmon fry may be subjected to stranding or isolation during project downramping. This data collection effort supplemented data collected as part of the full engineering survey for hydraulic modeling in advance of project construction. That effort included characterization of channel morphology, channel gradient, and thalweg profiles.

The results of the 2013 surveys indicate that connectivity between the mainstem and side channel habitat is currently maintained over the normal range of operational flow conditions. SC1, SC2, and SC3 are behaving close to predicted performance based on hydraulic modeling. The island at the inlet to the historic channel of SC1 will be monitored as deformation under high flow may impact downstream habitats although most likely in a beneficial way. SC4 is currently very active both at the head of the starter channel and at ELJ 1. Flow volumes in SC4 are well above those predicted by the hydraulic model. Continued racking of material at the ELJ 1 may bring flow behavior more in line with model predictions. Intervention may be required to reduce flow within the SC4. The surveys also documented sufficient flow volume over the normal range of operational conditions although with channel flow splits in SC1 and SC4 warrant monitoring related to racking of woody debris.

Complementary low flow habitat surveys along the length of each channel indicated the delivery of adequate flow volumes to maintain toe-width and the presence of suitable and diverse physical habitat conditions in terms of depth and flow/ exchange. Maintenance of toe-width is critical to an evaluation of the potential for classic bar stranding. The probability of fry stranding greatly diminishes when fluctuations in river stage occur within the zone where wetted perimeter is maintained. The behavior of coho salmon, the primary species utilizing these side channels, and their affinity for and association with large organic debris makes them less susceptible to gravel bar stranding. Coho are more prone to pothole entrapment. Existing information support the conclusion that both stranding potential and pothole entrapment are limited under the range of normal conditions observed although some areas within the extension to SC1 warrant additional monitoring.

Of additional relevance is the fact that surveys were conducted post-construction but, prior to being subjected to flows greater than 2,300 cfs. Several side channels, most notably SC4 and SC1 are still undergoing adjustments to the Sultan River flow regime. It is expected that these adjustments will continue especially in relation to implementation of the Process Flow Plan where releases for either channel formation (6,500 cfs for 24 hours) and channel maintenance (4,100 cfs for 24 hours) will occur on every two years, on average. These adjustments are and will continue to be evident at the inlets, at within channel flow splits, and along the length of each channel. All side channels, but especially the extension to SC1, warrant revisiting after the occurrence of a significant high flow event.

Based on the results of the both the quantitative and qualitative surveys conducted during 2013, the District is confident that the current ramping rate program is adequate in ensuring the protection of aquatic resources during Project downramping.

Surveys were not conducted at flows below 300 cfs. These flows are outside the range of normal Project operations and would only occur under a formally declared drought, initiated by the City of Everett. A cautious approach should be employed when downramping below 300 cfs. Until surveyed for stranding potential, the District recommends adopting a 1inch per hour rate when minimum flows are reduced below 300 cfs during a formally declared drought.

6. REFERENCES

District. 2013. Side Channel Enhancement and Large Woody Debris Placement Construction Report (License Article 404) for the Jackson Hydroelectric Project, FERC No. 2157. April 2013.

District. 2013. Side Channel Enhancement Ramp Rate Evaluation Plan (License Article 405) for the Jackson Hydroelectric Project, FERC No. 2157. January 2013.

FERC. 2011. Order Issuing New License. Project No. 2157-188. 136 FERC ¶ 62,188. September 2, 2011.

APPENDIX 1

Photo Documentation of Surveyed Conditions

Appendix 1

Longitudinal Habitat Survey Photos

Appendix A Table of Photos

Side Channel 1: Redundant Inlet at mainstem discharge of 373 cfs

Side Channel 1 (Redundant):Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):30 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):60 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):90 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):120 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):150 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):175 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):200 feet upstream of Redundant Outlet, looking downstream.

Side Channel 1 (Redundant):Redundant Inlet, looking downstream.

Side Channel 1:
Extension at mainstem discharge of 357 cfs

Side Channel 1 (Extension): Extension Outlet, looking downstream.

Side Channel 1 (Extension): 50 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 150 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 175 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 200 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 225 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 250 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 275 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 300 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 325 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 350 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 375 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 400 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 425 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 450 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 475 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 500 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 525 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 550 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 575 feet upstream of Extension Outlet, looking upstream.

Side Channel 1 (Extension): 600 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 675 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 700 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 725 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 750 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 775 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 800 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 825 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 850 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 900 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 950 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,000 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,050 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,100 feet upstream of Extension Outlet.

Side Channel 1 (Extension): 1,200 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,250 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,300 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,350 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,400 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,500 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,700 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,800 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 1,900 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 2,000 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 2,100 feet upstream of Extension Outlet, looking downstream.

Side Channel 1 (Extension): 2,200 feet upstream of Extension Outlet at flow split.

Side Channel 1 (Extension): 2,300 feet upstream of Extension Outlet at flow split, looking downstream.

Side Channel 1:
Historic Channel at mainstem discharge of 357 cfs

Side Channel 1 (Historic): Historic Outlet.

Side Channel 1 (Historic): 50 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 100 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 200 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 300 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 400 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 500 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): 600 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 625 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 685 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 745 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 805 feet upstream of Historic Outlet.

Side Channel 1 (Historic): Historic 865 feet upstream of Historic Outlet.

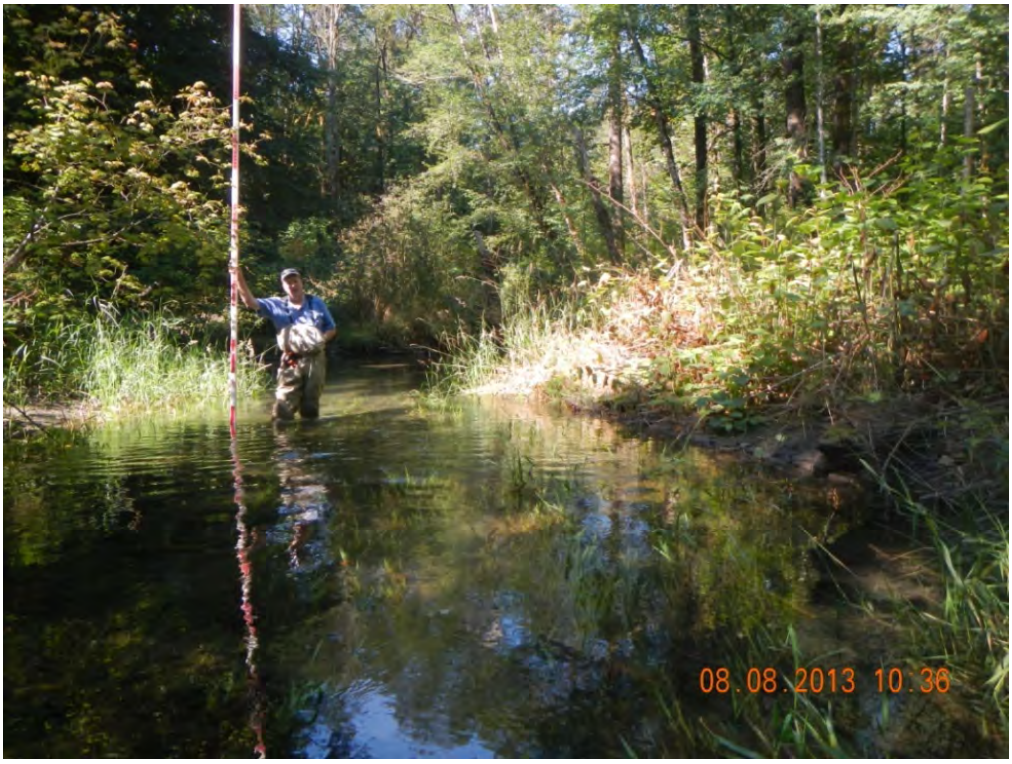
Side Channel 1 (Historic): Historic 925 feet upstream of Historic Outlet.

Side Channel 1 (Historic): Historic 985 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,045 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,105 feet upstream of Historic Outlet, looking downstream.

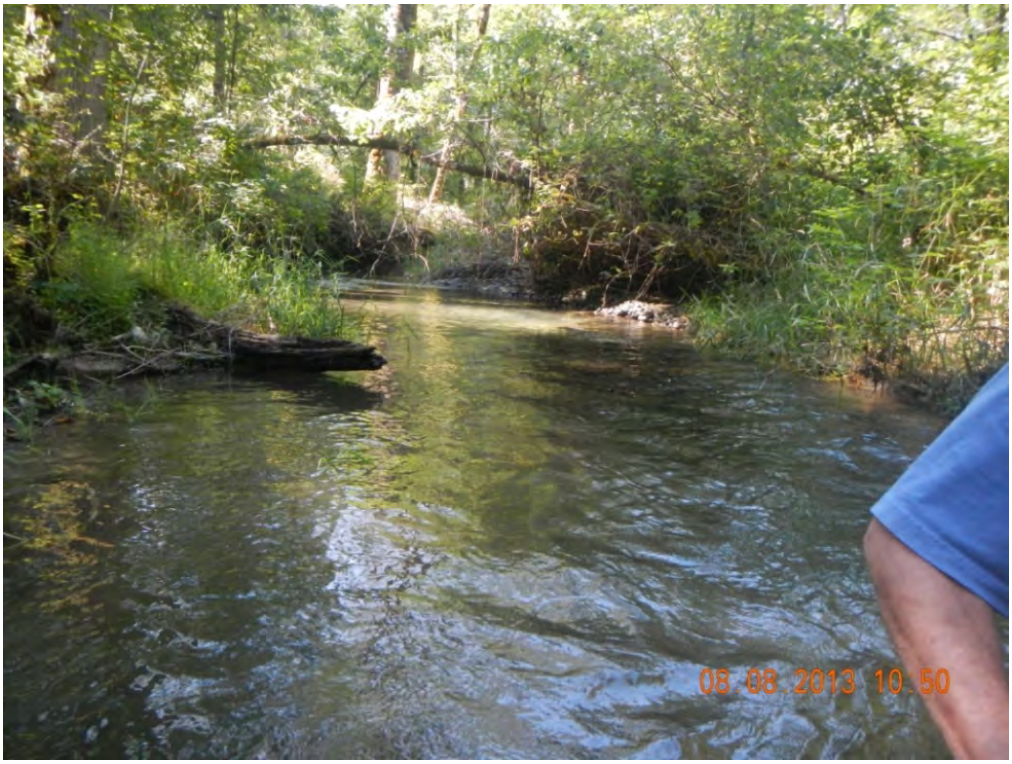
Side Channel 1 (Historic): Historic 1,165 feet upstream of Historic Outlet, looking downstream.



Side Channel 1 (Historic): Historic 1,225 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,285 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,345 feet upstream of Historic Outlet, looking downstream.



Side Channel 1 (Historic): Historic 1,405 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,465 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,525 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,585 feet upstream of Historic Outlet at confluence with Redundant Inlet.

Side Channel 1 (Historic): Historic 1,645 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,765 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,825 feet upstream of Historic Outlet.

Side Channel 1 (Historic): Historic 1,885 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 1,945 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,065 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,125 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,185 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,245 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,305 feet upstream of Historic Outlet, looking downstream.

Side Channel 1 (Historic): Historic 2,365 feet upstream of Outlet, 30 feet downstream of Inlet.

Side Channel 1 (Historic): Island at Historic Inlet, looking upstream.

Side Channel 2

Side Channel 2: Outlet, looking downstream.

Side Channel 2: 80 feet upstream of Outlet, looking downstream.

Side Channel 2: 160 feet upstream of Outlet, looking downstream.

Side Channel 2: 240 feet upstream of Outlet, looking downstream.

Side Channel 2: 320 feet upstream of Outlet, looking downstream.

Side Channel 2: 400 feet upstream of Outlet, looking downstream.

Side Channel 2: 480 feet upstream of Outlet, looking downstream.

Side Channel 2: 560 feet upstream of Outlet, looking downstream.

Side Channel 2: 640 feet upstream of Outlet, looking downstream.

Side Channel 2: 720 feet upstream of Outlet, looking downstream.

Side Channel 2: 800 feet upstream of Outlet.

Side Channel 2: 880 feet upstream of Outlet, looking downstream.

Side Channel 2: 960 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,040 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,120 feet upstream of Outlet, looking downstream.

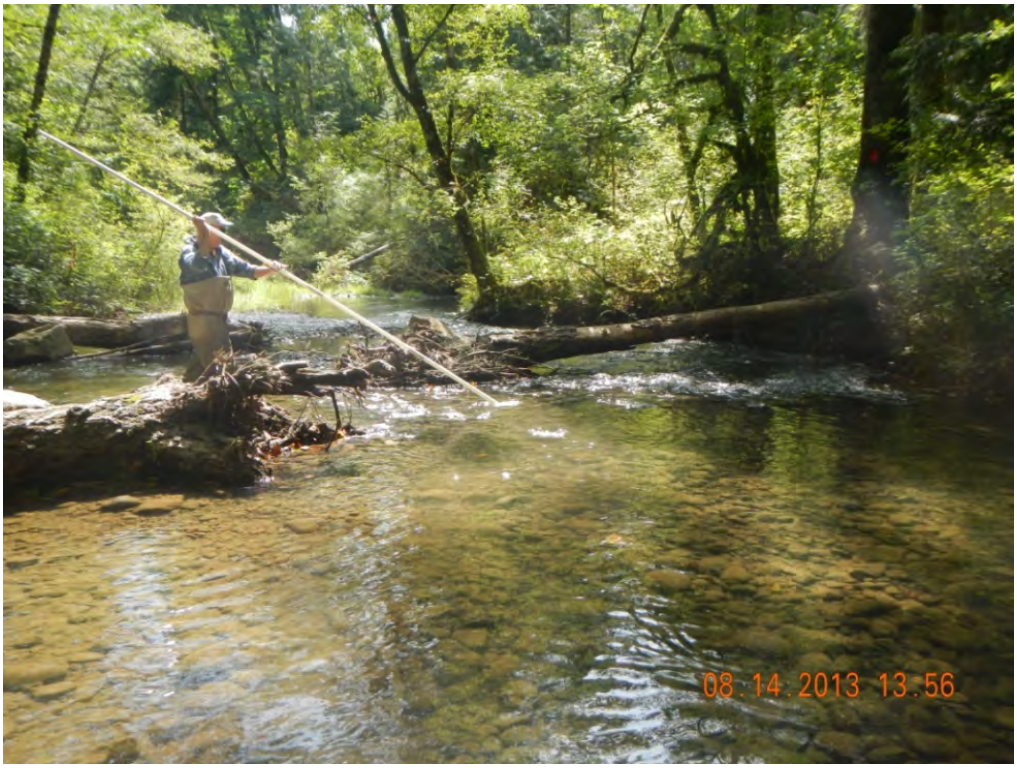
Side Channel 2: 1,200 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,280 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,360 feet upstream of Outlet, looking downstream.

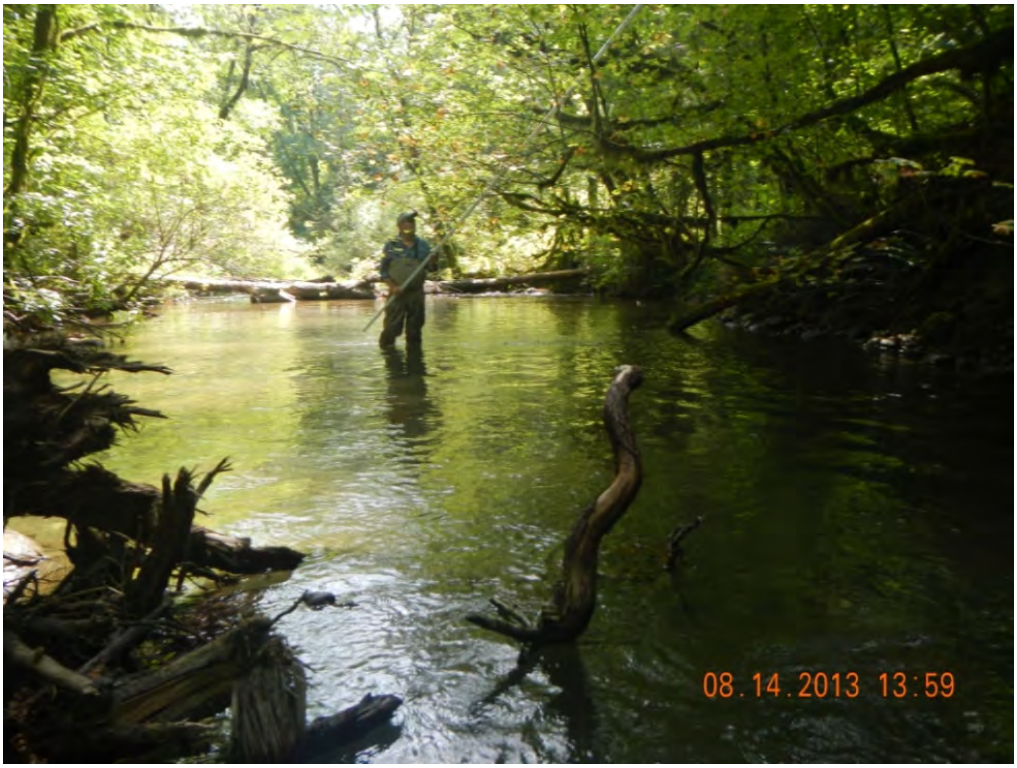
Side Channel 2: 1,440 feet upstream of Outlet, side inflow.

Side Channel 2: 1,520 feet upstream of Outlet, looking downstream.



Side Channel 2: 1,600 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,680 feet upstream of Outlet, looking downstream.



Side Channel 2: 1,760 feet upstream of Outlet, looking downstream.

Side Channel 2: 1,840 feet upstream of Outlet, looking downstream.

Side Channel 2: 50 feet downstream of inlet, looking downstream.

Side Channel 2: Inlet, looking downstream into channel from river.

Side Channel 3 at mainstem discharge of 380 cfs

Side Channel 3: Outlet.

Side Channel 3: 120 feet upstream of Outlet, looking downstream.

Side Channel 3: 366 feet upstream of Outlet, looking downstream.

Side Channel 3: 600 feet upstream of Outlet, looking downstream.

Side Channel 3: 833 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,000 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,100 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,300 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,366 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,500 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,633 feet upstream of Outlet, looking downstream.

Side Channel 3: 1,800 feet upstream of Outlet, looking downstream.

Side Channel 3: 2,000 feet upstream of Outlet, looking downstream.

Side Channel 3: 2,200 feet upstream of Outlet, looking downstream.

Side Channel 3: Inlet, looking downstream.

Side Channel 4 at mainstem discharge of 376 cfs

Side Channel 4: Outlet, looking downstream.

Side Channel 4: 100 feet upstream from Outlet, looking downstream.

Side Channel 4: 166 feet upstream from Outlet, looking downstream.

Side Channel 4: 300 feet upstream from Outlet, looking downstream.

Side Channel 4: 366 feet upstream from Outlet, looking downstream.

Side Channel 4: 400 feet upstream from Outlet, looking downstream.

Side Channel 4: 466 feet upstream from Outlet, looking downstream.

Side Channel 4: 600 feet upstream from Outlet, looking downstream.

Side Channel 4: 800 feet upstream from Outlet, looking downstream.

Side Channel 4: 900 feet upstream from Outlet, looking downstream.

Side Channel 4: 933 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,000 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,100 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,200 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,300 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,366 feet upstream from Outlet, looking downstream.

Side Channel 4: 1,400 feet upstream from Outlet, looking downstream at ELJ 1.

Side Channel 4: 1,400 feet upstream from Outlet, looking downstream across face of ELJ 1, to Left Fork.

Side Channel 4: 1,500 feet upstream from Outlet, at downstream end of starter channel, looking downstream.

Side Channel 4: 1,600 feet upstream from Outlet, within starter channel, looking downstream.

Side Channel 4: 1,700 feet upstream from Outlet, within starter channel, looking downstream.

Side Channel 4: 1,750 feet upstream from Outlet, within starter channel, looking downstream.

Side Channel 4: 1,800 feet upstream from Outlet, within starter channel, looking downstream.

Side Channel 4: Inlet.

Side Channel 4: Inlet looking downstream from river.

Side Channel 4: Left Fork Outlet, looking downstream.

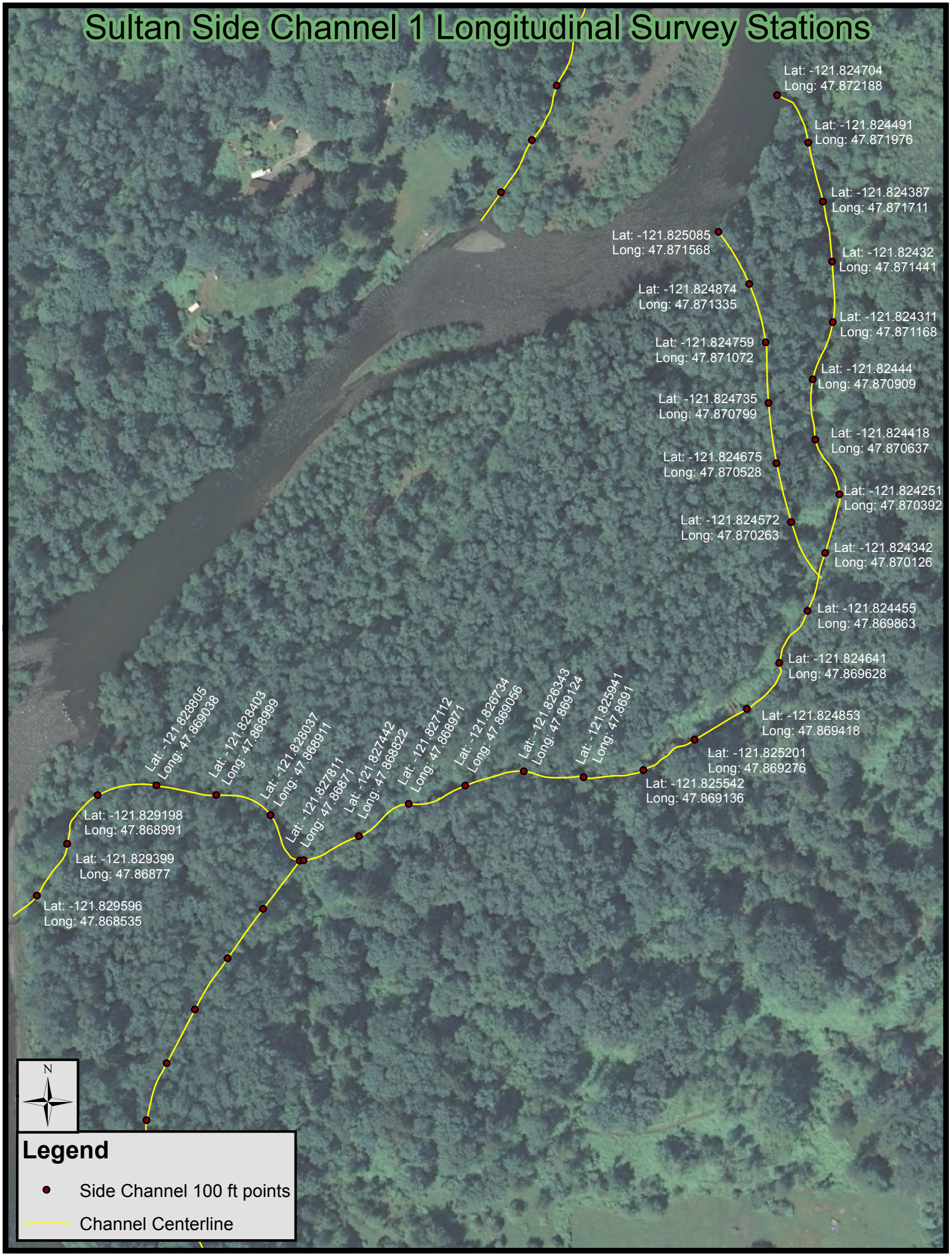
Side Channel 4: 50 feet upstream from Left Fork Outlet, looking upstream.

Side Channel 4: View of Engineered Log Jam 1 from Left Fork.

Side Channel 4: Engineered Log Jam 1.

APPENDIX 2

Field Data Collected during Systematic Inventory of Habitat Conditions (Low Flow Survey)


Sultan Side Channel 1 Longitudinal Survey Stations
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Long: 47.872188
Lat: -121.824491
Long: 47.871976
Lat: -121.824387
Long: 47.871711
Lat: -121.825085
Long: 47.871568
Lat: -121.82432
Long: 47.871441
Lat: -121.824874
Long: 47.871335
Lat: -121.824311
Long: 47.871168
Lat: -121.824759
Long: 47.871072
Lat: -121.82444
Long: 47.870909
Lat: -121.824735
Long: 47.870799
Lat: -121.824418
Long: 47.870637
Lat: -121.824675
Long: 47.870528
Lat: -121.824251
Long: 47.870392
Lat: -121.824572
Long: 47.870263
Lat: -121.824342
Long: 47.870126
Lat: -121.824455
Long: 47.869863
Lat: -121.824641
Long: 47.869628
Lat: -121.824853
Long: 47.869418
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Long: 47.868971
Lat: -121.827442
Long: 47.868822
Lat: -121.827811
Long: 47.86871
Lat: -121.828037
Long: 47.868911
Lat: -121.828403
Long: 47.868999
Lat: -121.828805
Long: 47.869038
Lat: -121.829198
Long: 47.868991
Lat: -121.829399
Long: 47.86877
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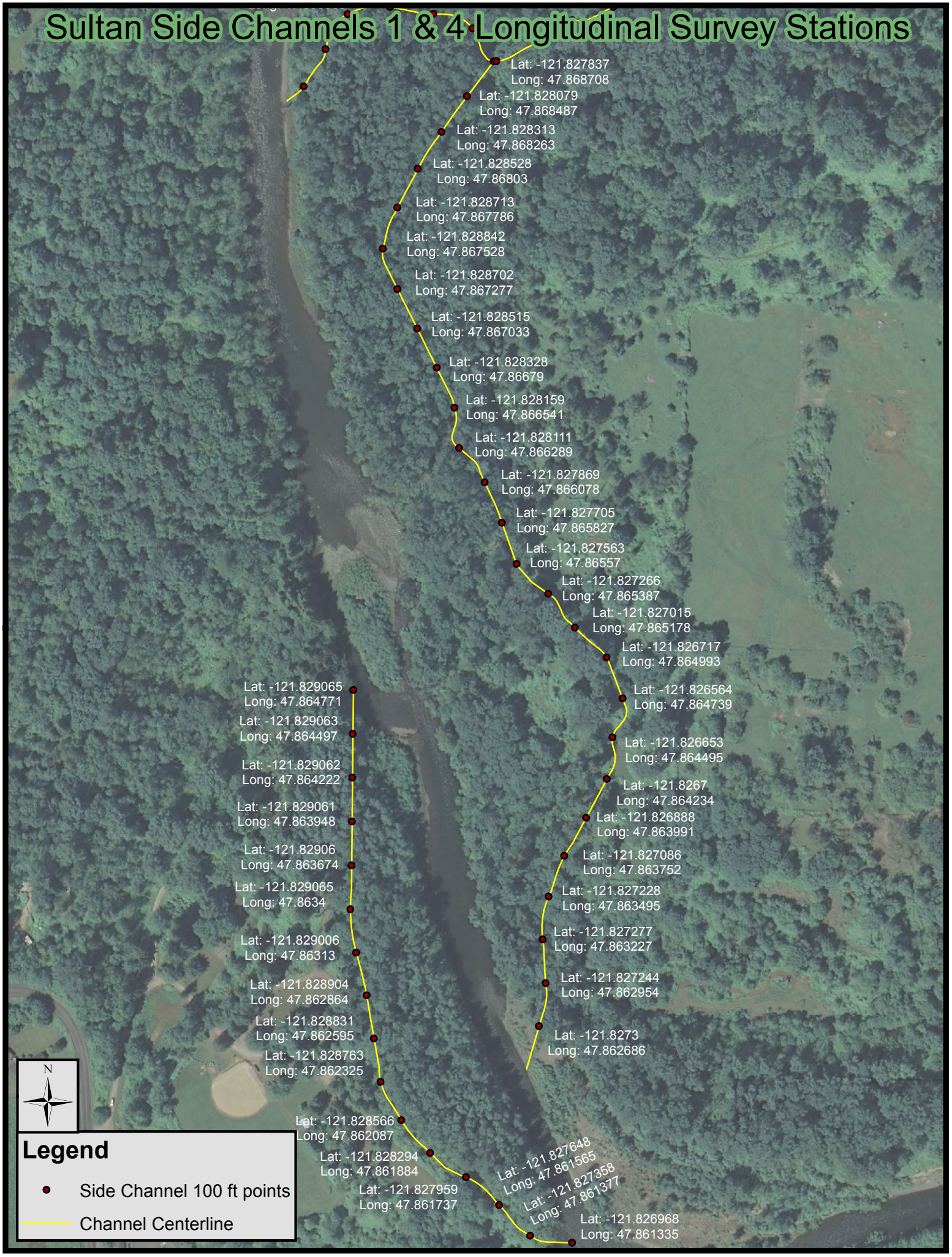
Long: 47.868535
N
Legend
Side Channel 100 ft points
Channel Centerline


Sultan Side Channels 1 & 4 Longitudinal Survey Stations
Lat: -121.827837
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Long: 47.868263
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Long: 47.867528
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Long: 47.866541
Lat: -121.828111
Long: 47.866289
Lat: -121.827869
Long: 47.866078
Lat: -121.827705
Long: 47.865827
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Long: 47.864739
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Long: 47.864495
Lat: -121.8267
Long: 47.864234
Lat: -121.826888
Long: 47.863991
Lat: -121.827086
Long: 47.863752
Lat: -121.827228
Long: 47.863495
Lat: -121.827277
Long: 47.863227
Lat: -121.827244
Long: 47.862954
Lat: -121.8273
Long: 47.862686
Lat: -121.829065
Long: 47.864771
Lat: -121.829063
Long: 47.864497
Lat: -121.829062
Long: 47.864222
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Long: 47.863948
Lat: -121.82906
Long: 47.863674
Lat: -121.829065
Long: 47.8634
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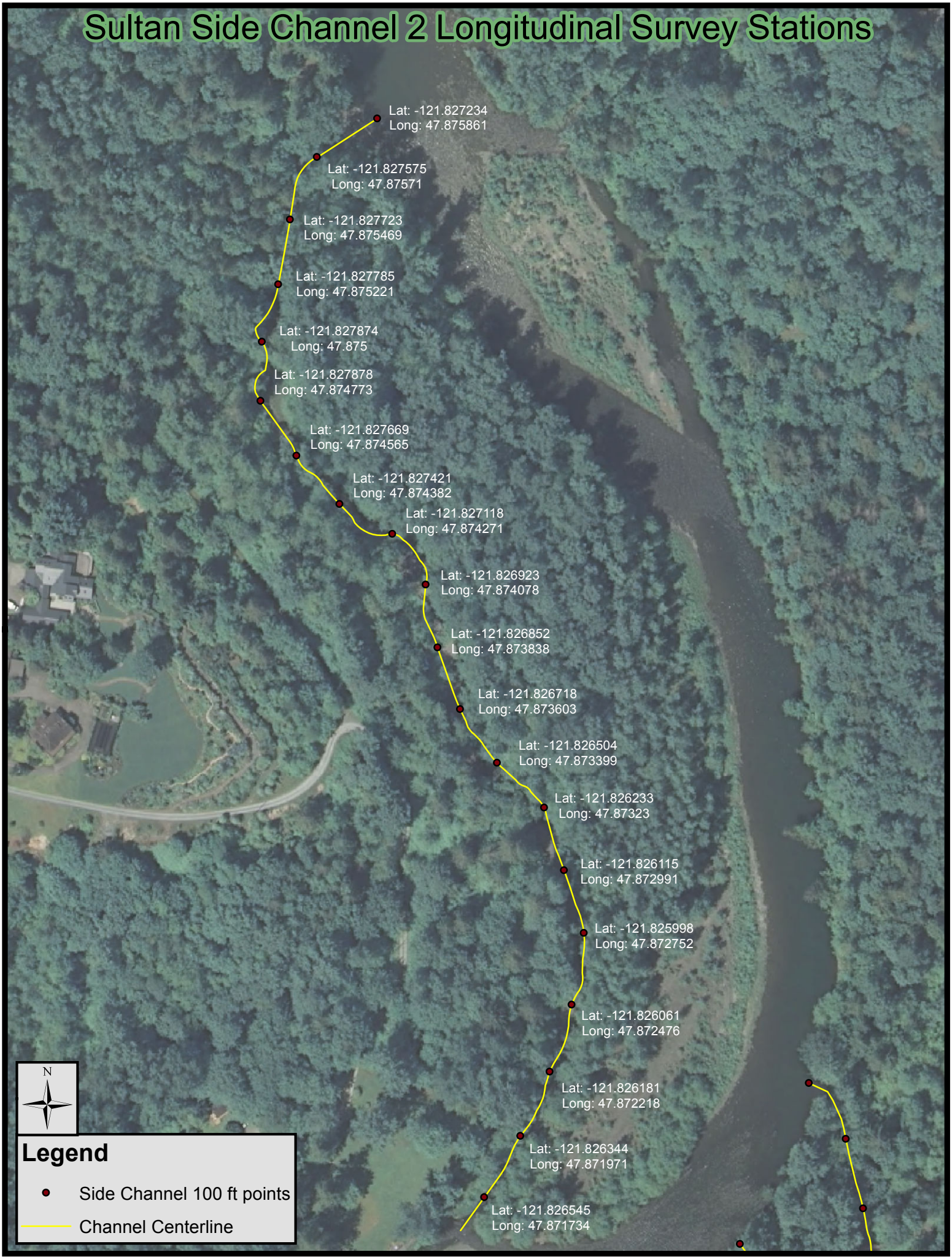
Long: 47.86313
Lat: -121.828904
Long: 47.862864
Lat: -121.828831
Long: 47.862595
Lat: -121.828763
Long: 47.862325
Lat: -121.828566
Long: 47.862087
Lat: -121.828294
Long: 47.861884
Lat: -121.827959
Long: 47.861737
Lat: -121.827648
Long: 47.861565
Lat: -121.827358
Long: 47.861377
Lat: -121.826968
Long: 47.861335
N
Legend
Side Channel 100 ft points
Channel Centerline


Sultan Side Channel 2 Longitudinal Survey Stations
Lat: -121.827234
Long: 47.875861
Lat: -121.827575
Long: 47.87571
Lat: -121.827723
Long: 47.875469
Lat: -121.827785
Long: 47.875221
Lat: -121.827874
Long: 47.875
Lat: -121.827878
Long: 47.874773
Lat: -121.827669
Long: 47.874565
Lat: -121.827421
Long: 47.874382
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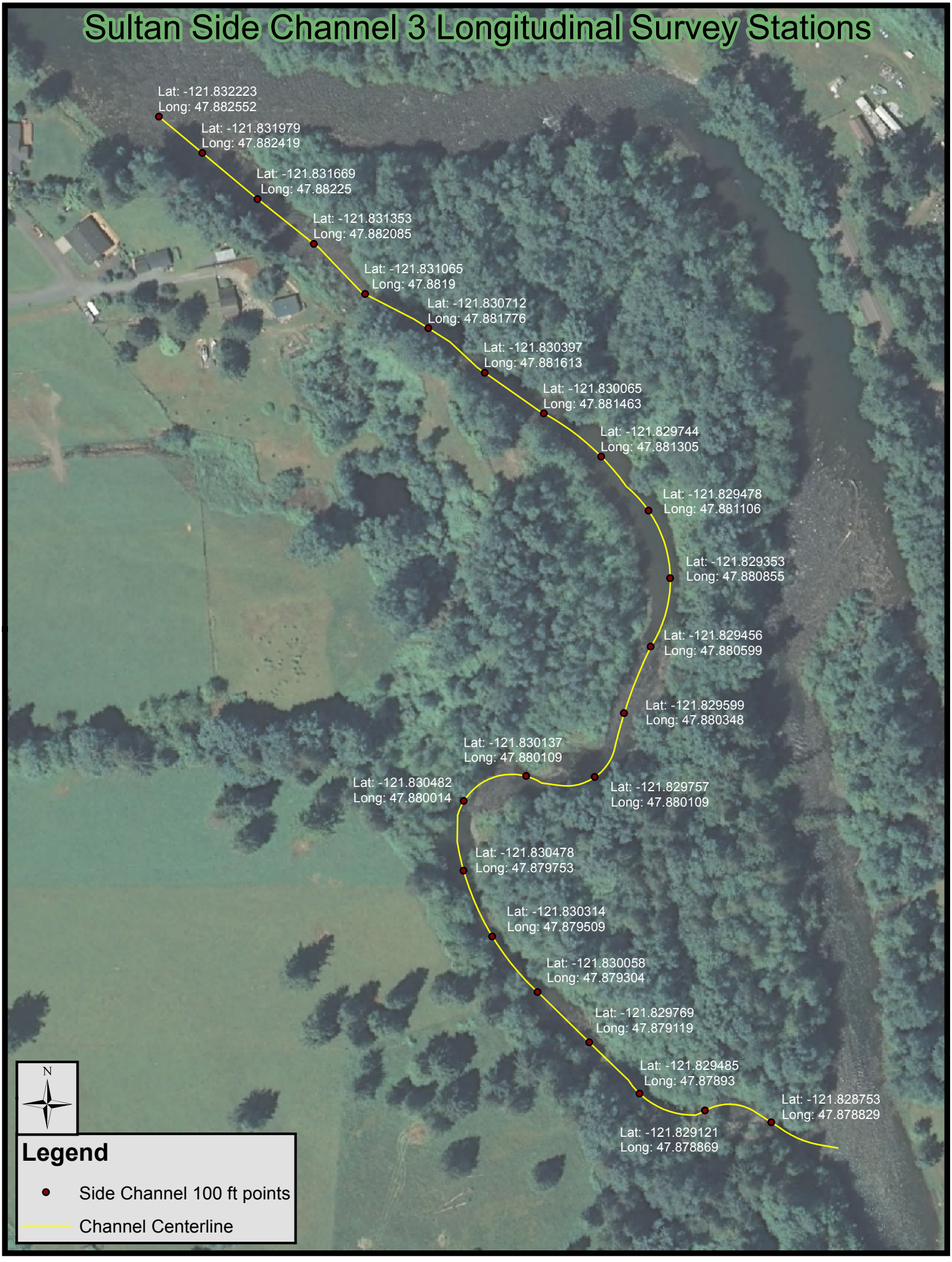
Lat: -121.826923
Long: 47.874078
Lat: -121.826852
Long: 47.873838
Lat: -121.826718
Long: 47.873603
Lat: -121.826504
Long: 47.873399
Lat: -121.826233
Long: 47.87323
Lat: -121.826115
Long: 47.872991
Lat: -121.825998
Long: 47.872752
Lat: -121.826061
Long: 47.872476
Lat: -121.826181
Long: 47.872218
Lat: -121.826344
Long: 47.871971
Lat: -121.826545
Long: 47.871734
N
Legend
Side Channel 100 ft points
Channel Centerline


Sultan Side Channel 3 Longitudinal Survey Stations
Lat: -121.832223
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Lat: -121.831979
Long: 47.882419
Lat: -121.831669
Long: 47.88225
Lat: -121.831353
Long: 47.882085
Lat: -121.831065
Long: 47.8819
Lat: -121.830712
Long: 47.881776
Lat: -121.830397
Long: 47.881613
Lat: -121.830065
Long: 47.881463
Lat: -121.829744
Long: 47.881305
Lat: -121.829478
Long: 47.881106
Lat: -121.829353
Long: 47.880855
Lat: -121.829456
Long: 47.880599
Lat: -121.829599
Long: 47.880348
Lat: -121.830137
Long: 47.880109
Lat: -121.830482
Long: 47.880014
Lat: -121.829757
Long: 47.880109
Lat: -121.830478
Long: 47.879753
Lat: -121.830314
Long: 47.879509
Lat: -121.830058
Long: 47.879304
Lat: -121.829769
Long: 47.879119
Lat: -121.829485
Long: 47.87893
Lat: -121.828753
Long: 47.878829
Lat: -121.829121
Long: 47.878869
N
Legend
Side Channel 100 ft points
Channel Centerline

Side Channel 1 Extension

Date: 7/11/2013 PH Discharge: 357 cfs Weather: sunny, excellent visibility

Personnel: KB, LL

Measurements are at 25' intervals, 100' stations are in sequence with engineering layout

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
Outlet	12	0.4	0.5	sand, fine gravel		absent, post constuction	5
	11	0.4	0.5	sand, fine gravel		absent, post constuction	5
	7 *	0.4	0.5	silt, sand		absent, post constuction	10
25+00	9 *	0.4	0.5	silt, sand		absent, post constuction	
	10	0.4	0.4	silt, sand		absent, post constuction	
	10	0.4	0.5	silt, sand		absent, post constuction	
	11	0.3	0.5	silt, sand		absent, post constuction	
24+00	11	0.2	0.4	silt, sand		absent, post constuction	5
	12	0.7	0.8	sand, fine gravel		absent, post constuction	10
	14	0.5	0.6	sand, silt		absent, post constuction	10
	14	0.6	0.7	sand, silt		absent, post constuction	
23+00	18	1.1	1.8	sand, silt		absent, post constuction	
	18	0.2	0.8	silt, sand		absent, post constuction	
	11	0.2	0.6	silt, sand		absent, post constuction	
	14	0.4	1.0	sand, fine gravel		absent, post constuction	10
22+00	13	0.5	0.9	sand, fine gravel		absent, post constuction	
	14	0.5	1.0	sand, silt		absent, post constuction	
	16	0.5	0.6	sand, silt		absent, post constuction	
	14	1.0	1.4	sand, silt		absent, post constuction	
21+00	11	0.7	0.9	sand, silt		absent, post constuction	15
	11	0.5	0.7	sand, fine gravel		absent, post constuction	
	12	0.6	0.8	silt, sand		absent, post constuction	
	15	0.7	0.8	silt, sand		absent, post constuction	10
20+00	19	0.4	0.4	silt, sand		absent, post constuction	5
	21	0.8	1.4	silt, sand		absent, post constuction	25
	19	0.4	0.5	silt, sand		absent, post constuction	5
	18	0.2	0.6	sand, fine gravel		absent, post constuction	20

Date: 7/11/2013 PH Discharge: 357 cfs Weather: sunny, excellent visibility

Personnel: KB, LL

Measurements are at 25' intervals, 100' stations are in sequence with engineering layout

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
19+00	15	0.4	0.8	sand, silt		absent, post constuction	
	15	0.5	0.7	sand, silt		absent, post constuction	
	14	0.6	0.6	sand, silt		absent, post constuction	
	14	0.9	0.9	sand, silt		absent, post constuction	30
18+00	11	1.4	1.9	sand, silt		absent, post constuction	10
	12	1.4	1.6	sand, silt		absent, post constuction	15
	11	0.8	1.2	sand, silt		absent, post constuction	20
	15	0.1	0.7	fine gravel, sand		absent, post constuction	20
17+00	16	0.4	0.8	sand, fine gravel		absent, post constuction	10
	15	0.3	0.9	sand, fine gravel		absent, post constuction	5
Bridge						absent, post constuction	
	13	0.4	0.5	fine gravel, sand		absent, post constuction	
	12	0.5	0.5	fine gravel, sand		absent, post constuction	5
16+00	15	0.3	0.5	fine gravel, sand		absent, post constuction	
	10	0.4	0.5	fine gravel, sand		absent, post constuction	5
	14	0.3	0.4	fine gravel, sand		absent, post constuction	5
	12	0.8	0.9	fine gravel, sand		absent, post constuction	10
15+00	11	0.3	0.4	fine gravel, sand		absent, post constuction	
	15	0.6	1.1	fine gravel, sand		absent, post constuction	
	12	0.4	0.5	sand, coarse gravel		absent, post constuction	5
	10	0.7	1.1	coarse gravel, sand		absent, post constuction	10
14+00	10	0.7	0.8	coarse gravel, sand		absent, post constuction	10
	13	0.8	1.0	fine gravel, sand		absent, post constuction	
	12	0.3	0.4	fine gravel, sand		absent, post constuction	
	12	0.4	0.8	fine gravel, sand		absent, post constuction	
13+00	13	0.3	0.3	fine gravel, sand		absent, post constuction	
	12	0.4	0.6	fine gravel, sand		absent, post constuction	10

Date: 7/11/2013 PH Discharge: 357 cfs Weather: sunny, excellent visibility

Personnel: KB, LL

Measurements are at 25' intervals, 100' stations are in sequence with engineering layout

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
	12	0.6	0.8	fine gravel, sand		absent, post constuction	
	10	0.4	0.7	fine gravel, sand		absent, post constuction	
12+00	11	1.7	1.8	sand, coarse gravel		absent, post constuction	
	14	0.3	0.7	fine gravel, sand		absent, post constuction	15
	8	0.8	1.0	sand, coarse gravel		absent, post constuction	
	10	0.5	0.7	sand, coarse gravel		absent, post constuction	10
11+00	6	0.4	0.6	fine gravel, coarse gravel		absent, post constuction	10
	7	0.3	0.3	fine gravel, coarse gravel		absent, post constuction	
	13	0.4	0.8	sand, fine gravel		absent, post constuction	
	12	0.5	0.8	coarse gravel, fine gravel		absent, post constuction	
10+00	7 *	0.4	0.5	coarse gravel, fine gravel		absent, post constuction	
	6 *	0.3	0.5	coarse gravel, fine gravel		absent, post constuction	5
	16	0.5	0.7	silt, fine gravel		absent, post constuction	
Wetland						absent, post constuction	
	4 *	0.8	0.9	coarse gravel, fine gravel		absent, post constuction	
9+00	10 *	0.1	0.4	fine gravel, sand		absent, post constuction	
	16	0.4	0.5	silt, fine gravel		absent, post constuction	
	15	0.5	0.6	silt, fine gravel		absent, post constuction	10
	14	0.3	0.7	silt, fine gravel		absent, post constuction	
8+00	12	0.4	0.7	silt, fine gravel		absent, post constuction	
	11	0.8	0.9	coarse gravel, sandi		absent, post constuction	
	12	0.7	1.1	silt, fine gravel		absent, post constuction	
	13	0.3	0.3	fine gravel, coarse gravel		absent, post constuction	
7+00	12	0.3	0.4	coarse gravel, fine gravel		absent, post constuction	5
	8 *	0.2	0.3	coarse gravel, fine gravel		absent, post constuction	5
	11	0.4	0.6	silt, fine gravel		absent, post constuction	
	14	0.4	0.6	silt, fine gravel		absent, post constuction	

Side Channel 1 Extension

Date: 7/11/2013 PH Discharge: 357 cfs Weather: sunny, excellent visibility

Personnel: KB, LL

Measurements are at 25' increments beginning at outlet and working upstream

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
Pedestrain Bridge							
6+00	17	0.3	0.7	silt, sand		absent, post constuction	20
	21	0.5	1.2	silt, sand		absent, post constuction	5
	22	1.2	1.5	sand, silt		absent, post constuction	
	11	0.5	0.7	sand, fine gravel		absent, post constuction	10
5+00	10	0.7	1.0	fine gravel, sand		absent, post constuction	
	13	1.3	1.7	silt, sand		absent, post constuction	5
	10	1.1	1.4	silt, coarse gravel		absent, post constuction	5
	13	0.9	1.0	fine gravel, coarse gravel		absent, post constuction	
4+00	9	0.4	0.4	coarse gravel, fine gravel		absent, post constuction	
	12	0.7	0.7	fine gravel, coarse gravel		absent, post constuction	15
	13	0.7	0.7	fine gravel, coarse gravel		absent, post constuction	5
	14	0.7	0.9	sand, fine gravel		absent, post constuction	10
3+00	10	0.4	0.4	coarse gravel, fine gravel		absent, post constuction	5
	13	0.4	0.5	sand, fine gravel		absent, post constuction	15
	14	0.3	0.4	sand, silt		absent, post constuction	
	13	0.3	0.7	fine gravel, coarse gravel		absent, post constuction	
2+00	14	0.5	0.8	fine gravel, coarse gravel		absent, post constuction	
	14	0.7	0.8	coarse gravel, fine gravel		absent, post constuction	5
	14	0.4	0.4	sand, fine gravel		absent, post constuction	15
	15	1.4	2.1	silt, sand		absent, post constuction	10
1+00	12	0.7	0.8	coarse gravel, fine gravel		absent, post constuction	10
	13	0.6	0.7	fine gravel, coarse gravel		absent, post constuction	15
	13	0.8	1.1	silt, coarse gravel		absent, post constuction	5
	14	1.1	1.8	coarse gravel, cobble		absent, post constuction	10
0+00	15	1.9	2.8	silt, coarse gravel		absent, post constuction	15
END	* denotes stations were measured width is less than toe-width						

Side Channel 1 - Historic Channel						Page 1 of 4
Date: 7/11/2013			PH Discharge: 357 cfs		Weather: sunny, excellent visibility	
Personnel: KB, LL						
Measurements are at 25' intervals, 100' stations are in sequence with engineering layout						

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
	8	0.5	0.7	fine gravel, coarse gravel		intact, mature, both	
	8	0.6	1.0	fine gravel, coarse gravel		intact, mature, both	
25+00	17	0.4	0.6	fine gravel, coarse gravel		intact, mature, both	
	18	0.4	0.6	fine gravel, coarse gravel		intact, mature, both	
	13	1.0	1.4	coarse gravel, fine gravel		intact, mature, both	
	20	0.7	1.2	silt, fine gravel		intact, mature, both	
24+00	16	0.6	1.0	fine gravel, coarse gravel	1	intact, mature, both	
	16	0.4	0.8	rubble, cobble		intact, mature, both	
	15	1.0	1.1	cobble, rubble	1	intact, mature, both	
	17	0.6	0.7	rubble, cobble		intact, mature, both	
City of Sultan Pedestrian Bridge							
23+00	15	0.9	1.1	rubble, cobble		intact, mature, both	
	12	1.1	1.3	silt, sand		intact, mature, both	
	26	0.6	1.4	fine gravel, sand		intact, mature, both	
	21	1.0	1.5	fine gravel, sand	1	intact, mature, both	
22+00	19	0.9	1.1	sand, silt		intact, mature, both	
	15	1.3	1.6	sand, silt	1	intact, mature, both	
	16	1.2	1.6	sand, silt		intact, mature, both	
	18	1.3	1.9	silt, coarse gravel	3	intact, mature, both	
21+00	19	1.7	2.1	silt, sand	3	intact, mature, both	
	19	1.8	2.1	sand, silt	2	intact, mature, both	
	20	1.4	1.9	sand, silt	1	intact, mature, both	
	12	2.2	2.4	sand, silt	2	intact, mature, both	
20+00	12	1.6	2.8	sand, silt	1	intact, mature, both	
	19	0.8	1.8	sand, silt	2	intact, mature, both	
	15	1.0	1.4	silt, sand	2	intact, mature, both	
	18	1.1	1.2	silt, sand	3	intact, mature, both	

Side Channel 1 - Historic Channel							Page 2 of 4
Date: 8/8/13			PH Discharge: 373 cfs		Weather: sunny, excellent visibility		
Personnel: KB, LL							
Measurements are at 25' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
Confluence with SC 1 Extension							
19+00	17	2.3	2.4	coarse gravel, fine gravel			
	19	1.5	1.7	silt, coarse gravel			
	18	0.4	0.7	coarse gravel, fine gravel			
	21	0.4	0.5	cobble, coarse gravel			
18+00	16	0.8	1.0	cobble, coarse gravel	2		
	16	0.5	0.7	cobble, coarse gravel	1		
	15	0.5	0.9	cobble, rubble	1		
	16	0.7	0.9	cobble, coarse gravel			
17+00	14	0.5	0.7	coarse gravel, cobble			
	16	0.6	0.8	rubble, cobble			
	17	0.9	1.0	rubble, cobble	1		
	16	0.9	1.4	silt, sand			
16+00	15	0.7	0.9	rubble, cobble	1		
	18	0.7	0.8	rubble, sand			
	23	0.8	1.0	coarse gravel, sand	1		
	27	0.6	1.0	sand, silt	3		
15+00	31	0.7	1.1	sand, coarse gravel			
	38	0.6	1.3	sand, coarse gravel	1		
	37	0.7	1.3	sand, silt			
	31	0.1	0.5	sand, silt	2		
14+00	23	0.5	1.1	silt, sand	1		
	20	1.3	1.9	silt, sand	2		
	27	0.4	1.3	sand, coarse gravel			
	17	0.9	1.0	coarse gravel, fine gravel			
	23	0.4	0.7		1		
13+00	21	1.2	1.4	coarse gravel, fine gravel	1		

Side Channel 1 - Historic Channel							Page 3 of 4
Date: 8/8/13			PH Discharge: 373 cfs				
Personnel: KB, LL							
Measurements are at 25' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
Overflow Channel to River Park							
	24	1.4	1.9	fine gravel, coarse gravel	1		
	17	1.2	1.4	silt, fine gravel	2		
12+00	18	1.6	1.9	sand, cobble			
	20	2.6	2.6	sand, cobble			
Middle Bridge							
	21	1.3	1.7	sand, rubble			
	20	0.8	1.3	coarse gravel, fine gravel			
11+00	18	0.3	0.5	coarse gravel, fine gravel			
	16	1.1	1.6	coarse gravel, fine gravel			
	16	0.8	1.4	coarse gravel, cobble			
	16	1.7	1.9	sand, cobble			
10+00	15	1.5	1.7	sand, cobble			
	18	2.1	2.3	sand, cobble			
	20	1.7	2.0	cobble, coarse gravel			
	19	1.3	1.4	cobble, coarse gravel	1		
9+00	16	2.1	2.4	sand, cobble			
	20	1.1	1.4	sand, coarse gravel			
	21	0.7	1.3	coarse gravel, cobble			
	32	1.3	2.0	sand, silt			
Confluence with SC1 redundant inlet							
8+00	17	1.2	1.7	sand, silt			
	18	1.9	2.1	sand, silt			
	17	2.9	3.5	silt, sand	1		
	20	2.2	3.0	sand, silt			
7+00	19	0.8	1.4	silt, sand	1		
	18	0.9	1.3	silt, sand			

Side Channel 1 - Historic Channel							Page 4 of 4
Date: 8/8/13			PH Discharge: 373 cfs				
Measurements are at 25' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
	21	0.4	1.4	coarse gravel, fine gravel	2		
	18	1.2	1.3	coarse gravel, cobble			
6+00	13	0.5	0.6	coarse gravel, fine gravel			
	14	0.8	1.0	coarse gravel, sand	1		
	13	0.7	0.9	coarse gravel, fine gravel	1		
	15	0.8	1.0	coarse gravel, sand			
5+00	18	1.6	1.7	coarse gravel, sand			
	12	1.9	2.4	coarse gravel, sand			
	15	1.1	1.4	coarse gravel, sand	2		
	13	1.0	1.2	cobble, rubble			
4+00	17	0.9	1.0	cobble, rubble	1		
	21	0.7	1.0	cobble, sand			
	23	0.8	1.1	cobble, sand			
	25	1.4	1.9	cobble, sand	3		
3+00	18	1.1	1.5	sand, cobble	1		
	19	0.8	1.2	silt, sand	1		
	23	0.7	1.5	sand, silt			
	24	0.6	1.3	sand, silt			
2+00	26	0.8	2.0	silt, sand			
	13	2.1	2.2	sand, silt			
	17	1.2	1.4	silt, fine gravel	2		
Vehicle Bridge							
	18	0.5	0.7	fine gravel, coarse gravel			
1+00	23	0.7	0.8	silt, sand	1		
	16	0.9	1.0	sand, rubble	1		
	26	0.6	1.0	sand, rubble	3		
	17	1.1	2.2	silt, cobble			
0+00	20	1.9	2.2	silt, sand			

* denotes stations were measured width is less than toe-width			

Side Channel 1 - Redundant Inlet							
Date: 8/8/2013	PH Discharge: 373 cfs		Weather: sunny, excellent visibility				
Personnel: KB, LL							
Measurements are at 25' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
6+00	11	1.1	1.3	sand, coarse gravel		absent, post constuction	
	12	1.2	1.7	sand, silt		absent, post constuction	12
	11	1.1	1.7	sand, silt	1	absent, post constuction	4
	9	1.7	1.8	cobble, coarse grave	2	absent, post constuction	8
5+00	12	0.7	1.0	sand, fine gravel		absent, post constuction	
	10	0.8	1.0	coarse gravel, sand	1	absent, post constuction	
	14	0.7	0.8	sand, coarse gravel	2	absent, post constuction	3
	12	0.7	1.0	sand, coarse gravel	1	absent, post constuction	7
4+00	10	0.7	1.2	sand, cobble		absent, post constuction	**5**
	13	0.7	0.9	sand, fine gravel	1	absent, post constuction	
	12	0.9	1.0	coarse gravel, fine gravel		absent, post constuction	5
	11	0.6	0.7	fine gravel, coarse g	2	absent, post constuction	4
3+00	11	0.5	0.9	sand, fine gravel		absent, post constuction	**9**
	13	0.5	0.6	sand, fine gravel		absent, post constuction	
	12	0.7	0.8	sand, fine gravel		absent, post constuction	12
	12	0.7	0.9	sand, fine gravel		absent, post constuction	
2+00	12	0.7	0.9	sand, fine gravel	1	absent, post constuction	**20**
	11	0.6	0.7	sand, fine gravel	1	absent, post constuction	13
	10	0.6	0.7	fine gravel, sand	1	absent, post constuction	
	11	0.7	0.7	fine gravel, coarse g	1	absent, post constuction	12
1+00	12	0.7	1.5	sand, coarse gravel		absent, post constuction	**6**
	13	0.7	0.7	sand, fine gravel		absent, post constuction	4
City of Sultan Pedestrian Bridge							
	15	0.6	0.7	cobble, rubble		absent, post constuction	3
END	* denotes stations were measured width is less than toe-width						

Side Channel 2							Page 1 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
	26	1.3	1.6	cobble, rubble		intact, mature, both banks	
	24	0.8	1.0	cobble, coarse gravel		intact, mature, both banks	
19+00	25	0.8	0.9	cobble, coarse gravel		intact, mature, both banks	
	26	0.9	1.0	cobble, rubble		intact, mature, both banks	
	27	0.5	0.6	cobble, coarse gravel		intact, mature, both banks	
18+00	30	0.4	1.0	cobble, coarse gravel		intact, mature, both banks	
	32	0.4	0.7	cobble, coarse gravel		intact, mature, both banks	
	34	0.9	1.1	cobble, coarse gravel		intact, mature, both banks	
17+00	35	0.5	0.9	coarse gravel, cobble		intact, mature, both banks	
	44	0.4	0.6	coarse gravel, cobble	1	intact, mature, both banks	
	28	0.6	1.0	coarse gravel, cobble	1	intact, mature, both banks	
16+00	26	0.7	1.6	coarse gravel, cobble		intact, mature, both banks	
	19	0.7	1.7	coarse gravel, cobble		intact, mature, both banks	
	20	0.6	2.1	coarse gravel, cobble		intact, mature, both banks	
15+00	25	0.5	0.8	coarse gravel, cobble		intact, mature, both banks	
Vehicle Fjord							
	26	0.6	0.7	coarse gravel, cobble		intact, mature, both banks	
	27	0.9	1.0	coarse gravel, cobble	2	intact, mature, both banks	
14+00	25	0.8	1.0	coarse gravel, cobble	1	intact, mature, both banks	
	29	0.6	0.9	coarse gravel, cobble		intact, mature, both banks	
	33	0.4	0.8	coarse gravel, cobble	2	intact, mature, both banks	
13+00	35	0.6	0.8	cobble, coarse gravel	1	intact, mature, both banks	
	25	0.4	1.5	cobble, coarse gravel		intact, mature, both banks	
	31	0.8	1.5	cobble, coarse gravel	2	intact, mature, both banks	
12+00	26	0.6	1.8	cobble, coarse gravel		intact, mature, both banks	
	33	0.5	0.7	cobble, coarse gravel		intact, mature, both banks	
	38	0.5	0.6	cobble, coarse gravel		intact, mature, both banks	

Side Channel 2							Page 2 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
11+00	21	0.9	1.0	cobble, coarse gravel	1	intact, mature, both banks	
	16	1.2	1.9	cobble, coarse gravel		intact, mature, both banks	
	19	0.8	1.1	cobble, coarse gravel	1	intact, mature, both banks	
10+00	18	0.6	1.0	cobble, coarse gravel		intact, mature, both banks	
	23	0.5	1.3	cobble, coarse gravel		intact, mature, both banks	
	32	0.8	0.9	coarse gravel, cobble		intact, mature, both banks	
9+00	41	0.7	1.0	cobble, coarse gravel		intact, mature, both banks	
	48	0.6	1.4	coarse gravel, cobble	3	intact, mature, both banks	
	33	2.0	2.6	rubble, cobble		intact, mature, both banks	
8+00	23	0.5	0.7	cobble, coarse gravel	1	intact, mature, both banks	
	22	0.5	0.8	cobble, rubble		intact, mature, both banks	
	30	0.6	0.7	cobble, coarse gravel		intact, mature, both banks	
7+00	31	1.1	1.9	cobble, rubble		intact, mature, both banks	
	32	0.7	1.3	cobble, coarse gravel		intact, mature, both banks	
	21	1.3	1.4	cobble, rubble		intact, mature, both banks	
6+00	27	1.8	2.1	cobble, rubble	1	intact, mature, both banks	
	22	1.8	2.8	cobble, rubble	2	intact, mature, both banks	
	16	0.7	0.9	cobble, coarse gravel	2	intact, mature, both banks	
5+00	14	0.9	1.5	cobble, rubble	1	intact, mature, both banks	
Tributary Inflow along RB							
	32	1.1	1.3	cobble, rubble		intact, mature, both banks	
	19	2.2	2.7	cobble, rubble	1	intact, mature, both banks	
4+00	42	0.3	0.7	cobble, rubble	2	intact, mature, both banks	
	45	0.5	0.6	rubble, cobble	1	intact, mature, both banks	
	43	0.9	1.3	cobble, rubble		intact, mature, both banks	
3+00	33	1.4	2.0	silt, fine gravel	1	intact, mature, both banks	
	30	2.1	2.6	silt, fine gravel	2	intact, mature, both banks	

Side Channel 2							Page 3 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
	28	1.0	2.2	fine gravel, rubble		intact, mature, both banks	
2+00	24	1.4	1.7	rubble, fine gravel		intact, mature, both banks	
	22	0.9	1.2	coarse gravel, rubble		intact, mature, both banks	
	11	0.9	1.1	rubble, cobble		intact, mature, both banks	
1+00	20	0.7	0.9	cobble, rubble	3	intact, mature, both banks	
	32	0.6	0.8	coarse gravel, cobble		intact, mature, both banks	
0+33	36	1.0	1.7	cobble, rubble	1	intact, mature, both banks	
END							
* denotes stations were measured width is less than toe-width							

Side Channel 3							Page 1 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
22+66	64 *	0.4	1.1	rubble, cobble		intact, mature, both banks	
	52 *	0.4	1.0	rubble, cobble		intact, mature, both banks	
22+00	62 *	0.5	1.5	rubble, cobble	1	intact, mature, both banks	
	88 *	0.8	2.7	rubble, cobble		intact, mature, both banks	
	92 *	0.8	1.8	rubble, cobble		intact, mature, both banks	
21+00	62	1.2	1.7	rubble, cobble		intact, mature, both banks	
	39	0.9	1.8	rubble, cobble	1	intact, mature, both banks	
	42	0.8	1.1	rubble, boulder		intact, mature, both banks	
20+00	36	0.7	1.0	rubble, boulder		intact, mature, both banks	
	38	1.3	1.5	rubble, boulder		intact, mature, both banks	
	31	1.6	2.3	boulder, rubble		intact, mature, both banks	
19+00	46	0.7	1.4	boulder, rubble		intact, mature, both banks	
	66	0.7	1.4	rubble, cobble		intact, mature, both banks	
	69	0.7	1.6	rubble, boulder	1	intact, mature, both banks	
18+00	68	0.7	1.3	rubble, cobble	1	intact, mature, both banks	
	53	1.6	1.8	rubble, cobble		intact, mature, both banks	
	45	1.7	1.9	rubble, cobble		intact, mature, both banks	
17+00	45	1.2	3.2	rubble, cobble		intact, mature, both banks	
	29	1.5	3.0	rubble, cobble		intact, mature, both banks	
	38	1.6	3.1	rubble, cobble		intact, mature, both banks	
16+00	38	3.6	5.2	boulder, rubble		intact, mature, both banks	
	43	3.8	5.7	silt, boulder		intact, mature, both banks	
	52	3.1	4.9	silt, boulder		intact, mature, both banks	
15+00	52	3.6	5.8	silt, boulder	1	intact, mature, both banks	
	42	3.0	4.8	cobble, rubble	2	intact, mature, both banks	
	82	0.6	1.2	cobble, rubble		intact, mature, both banks	
14+00	68	0.6	0.8	rubble, cobble		intact, mature, both banks	

Side Channel 3							Page 2 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
	39	1.0	1.4	rubble, cobble	1	intact, mature, both banks	
	28	1.4	1.7	cobble, rubble		intact, mature, both banks	
13+00	31	1.1	1.5	cobble, rubble	1	intact, mature, both banks	
	39	2.2	3.5	rubble, cobble		intact, mature, both banks	
	39	3.4	4.2	cobble, rubble	1	intact, mature, both banks	
12+00	28	1.6	1.9	rubble, cobble		intact, mature, both banks	
	62	0.4	0.8	rubble, cobble	1	intact, mature, both banks	
	67	0.7	2.5	rubble, boulder	1	intact, mature, both banks	
11+00	35	0.8	1.3	rubble, boulder		intact, mature, both banks	
	40	0.6	0.7	rubble, boulder		intact, mature, both banks	
	44	2.0	3.3	rubble, boulder	1	intact, mature, both banks	
10+00	47	1.5	2.5	rubble, boulder		intact, mature, both banks	
	51	1.5	1.7	rubble, cobble	2	intact, mature, both banks	
	52	1.7	1.9	rubble, cobble	1	intact, mature, both banks	
9+00	50	2.3	2.7	rubble, cobble		intact, mature, both banks	
	52	1.9	2.8	rubble, cobble	1	intact, mature, both banks	
	54	1.6	1.8	rubble, cobble	1	intact, mature, both banks	
8+00	55	1.7	2.0	rubble, cobble	1	intact, mature, both banks	
	49	1.6	1.9	rubble, boulder		intact, mature, both banks	
EQUIPMENT ACCESS							
	52	1.6	1.8	rubble, cobble		intact, mature, both banks	
7+00	50	1.4	2.1	rubble, cobble	1	intact, mature, both banks	
	52	0.8	1.0	rubble, cobble	2	intact, mature, both banks	
	58	0.9	1.0	cobble, rubble	1	intact, mature, both banks	
6+00	56	1.4	1.8	rubble, boulder		intact, mature, both banks	
	58	0.8	1.9	rubble, boulder		intact, mature, both banks	
	61	0.7	0.8	rubble, cobble		intact, mature, both banks	

Side Channel 3							Page 3 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
5+00	66	0.6	1.0	rubble, boulder		intact, mature, both banks	
	50	1.2	1.5	rubble, cobble		intact, mature, both banks	
	44	1.2	1.5	rubble, cobble		intact, mature, both banks	
4+00	38	1.1	1.5	rubble, cobble		intact, mature, both banks	
	39	0.8	1.0	rubble, cobble		intact, mature, both banks	
	45	0.7	1.4	rubble, cobble		intact, mature, both banks	
3+00	58	0.8	1.0	rubble, boulder		intact, mature, both banks	
	69	0.6	1.8	rubble, cobble	2	intact, mature, both banks	
	82	0.5	0.9	rubble, boulder		intact, mature, both banks	
2+00	74	0.6	0.8	rubble, boulder	1	intact, mature, both banks	
	77	0.8	1.0	rubble, boulder		intact, mature, both banks	
	77	0.8	1.0	rubble, cobble		intact, mature, both banks	
1+00	84	0.8	1.0	rubble, cobble		intact, mature, both banks	
	84	0.8	1.0	rubble, cobble		intact, mature, both banks	
	82	1.0	1.1	rubble, boulder		intact, mature, both banks	
0+00	67	1.1	1.2	rubble, cobble		intact, mature, both banks	
END							
* denotes stations were measured width is less than toe-width							

Side Channel 4							Page 1 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							

ENG Station	Width* (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
15+00	17	2.5	2.7	cobble, fine gravel		Intact, mature within 25'	
	17	2.3	2.5	rubble, fine gravel		Intact, mature within 25'	
	23	1.5	2.1	fine gravel, rubble		Intact, mature within 25'	
14+00	24	1.4	2.1	fine gravel, rubble	1	Intact, mature within 25'	
	22	1.8	2.2	fine gravel, rubble	1	Intact, mature within 25'	
	21	2.2	2.7	fine gravel, sand	2	Intact, mature within 25'	
13+00	21	1.9	2.4	sand, fine gravel	3	Intact, mature within 25'	
	25	1.3	1.5	fine gravel, sand		Intact, mature within 25'	
	22	1.6	1.8	fine gravel, coarse gravel		Intact, mature within 25'	
12+00	20	1.7	1.9	fine gravel, rubble		Intact, mature within 25'	
	21	1.3	1.9	rubble, fine gravel		Intact, mature within 25'	
	26	1.2	1.7	fine gravel, cobble		Intact, mature within 25'	
11+00	24	1.6	2.0	coarse gravel, fine gravel	2	Intact, mature within 25'	
	25	1.6	1.9	rubble, cobble		Intact, mature within 25'	
	26	1.2	1.4	coarse gravel, fine gravel	2	Intact, mature within 25'	
10+00	25	2.0	2.2	coarse gravel, fine gravel	1	Intact, mature within 25'	
	23	1.9	2.2	coarse gravel, rubble	3	Intact, mature within 25'	
	24	1.6	2.5	coarse gravel, fine gravel	3	Intact, mature within 25'	
9+00	28	0.7	0.9	coarse gravel, fine gravel		Intact, mature within 25'	
	25	0.9	1.1	coarse gravel, fine gravel		Intact, mature within 25'	
	24	1.4	1.6	coarse gravel, fine gravel	1	Intact, mature within 25'	
8+00	22	1.5	1.7	coarse gravel, cobble		Intact, mature within 25'	
	22	1.6	1.8	coarse gravel, cobble	3	Intact, mature within 25'	
	21	1.9	2.4	fine gravel, coarse gravel		Intact, mature within 25'	
7+00	19	1.7	1.9	coarse gravel, fine gravel		Intact, mature within 25'	
	21	1.9	2.2	coarse gravel, fine gravel		Intact, mature within 25'	
	20	1.7	1.9	coarse gravel, fine gravel		Intact, mature within 25'	

Side Channel 4							Page 2 of 3
Date: 8/14/2013		PH Discharge: 376 cfs				Weather: sunny, excellent visibility	
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
6+00	22	1.0	1.1	coarse gravel, cobble		Intact, mature within 25'	
	22	1.5	1.8	fine gravel, rubble		Intact, mature within 25'	
City of Sultan Pedestrian Bridge (New)							
	18	1.7	1.9	cobble, rubble	2	Intact, mature within 25'	
5+00	25	1.8	2.2	fine gravel, cobble		Intact, mature within 25'	
	23	1.8	2.0	coarse gravel, fine gravel		Intact, mature within 25'	
	22	1.8	2.0	coarse gravel, fine gravel	1	Intact, mature within 25'	
4+00	22	1.9	2.1	coarse gravel, fine gravel		Intact, mature within 25'	
	19	1.5	1.7	coarse gravel, fine gravel		Intact, mature within 25'	
	20	1.8	1.9	coarse gravel, cobble		Intact, mature within 25'	
3+00	19	1.9	2.0	coarse gravel, cobble	2	Intact, mature within 25'	
	20	1.8	2.0	coarse gravel, cobble	2	Intact, mature within 25'	
	23	2.0	2.1	coarse gravel, fine gravel		Intact, mature within 25'	
2+00	26	2.2	2.5	fine gravel, coarse gravel	2	Intact, mature within 25'	
	22	1.7	2.0	fine gravel, coarse gravel		Intact, mature within 25'	
	22	1.6	1.7	coarse gravel, fine gravel		Intact, mature within 25'	
1+00	21	0.8	1.0	cobble, coarse gravel		Intact, mature within 25'	
	17	2.1	2.5	cobble, rubble		Intact, mature within 25'	
ELJ 1							
	52	0.9	1.3	cobble, coarse gravel		Intact, mature within 25'	
0+00	28	1.4	1.6	cobble, coarse gravel		Intact, mature within 25'	
Upstream end of SC4, downstream end of starter channel							
	24	1.7	1.9	cobble, rubble		Intact, mature within 25'	
	21	1.8	2.1	rubble, cobble		Intact, mature within 25'	
-100	20	2.4	3.1	rubble, cobble		Intact, mature within 25'	
	23	1.9	3.0	cobble, rubble		Intact, mature within 25'	
	23	2.3	2.6	rubble, cobble		Intact, mature within 25'	

Side Channel 4							Page 3 of 3
Date: 8/14/2013		PH Discharge: 376 cfs			Weather: sunny, excellent visibility		
Personnel: KB, LL							
Measurements are at 33' intervals, 100' stations are in sequence with engineering layout							
ENG Station	**Width* (feet)**	**Average Depth (feet)**	**Maximum Depth (feet)**	**Substrate (dominant, sub-dominant)**	**LWD Tally (permanent, > 12" diameter)**	**Riparian Condition (see photos)**	**# Fish observed**
-200	23	2.3	2.7	cobble, coarse gravel		Intact, mature within 25'	
	26	2.0	2.3	coarse gravel, rubble		Intact, mature within 25'	
	24	2.4	2.7	coarse gravel, cobble		Intact, mature within 25'	
-300	25	1.8	2.2	coarse gravel, cobble		Intact, mature within 25'	
	24	2.5	2.8	rubble, cobble		Intact, mature within 25'	
	64	0.8	1.5	rubble, cobble		Intact, mature within 25'	
Upstream end of starter channel							
Secondary Channel on left at ELJ 1							
	13.0	1.4	1.7	rubble, cobble	0	none present, gravel bar	
1+00	11.0	1.1	1.3	rubble, cobble	0	none present, gravel bar	
	11.0	1.0	1.2	rubble, cobble	0	none present, gravel bar	
	14.0	0.9	1.1	rubble, cobble	1	none present, gravel bar	
0	24.0	2.6	4.2	cobble, fine gravel	ELJ	none present, gravel bar	
END at ELJ 1							
* denotes stations were measured width is less than toe-width							

APPENDIX 3

Consultation Documentation Regarding RRE Plan and Draft Report

Presler, Dawn

From: Maynard, Chris (ECY) <cmay461@ecy.wa.gov>
Sent: Tuesday, October 23, 2012 3:17 PM
To: Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim; Binkley, Keith
Subject: RE: ARC - draft mtg summary for your review

I just read the notes of the ARC meeting that Tim and I missed. I'm not sure if SnoPUD plans to share the results of the year 1 benthic survey along this year, but I would like to see a summary (with raw data available to any ARC member who wants it) distributed to the ARC the beginning of December along with the reach 3 water temperature data.

I don't recall who brought up the downramping rate evaluation for effect on side channels but I agree with the language in the meeting summary that a plan is not needed as channels remain connected at minimum flows. Kieth and Steve and I exchanged emails on this and are in agreement.

From: Presler, Dawn [mailto:DJPresler@SNOPUD.com]
Sent: Monday, October 22, 2012 11:04 AM
To: 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; Maynard, Chris (ECY); 'mick.matheson@ci.sultan.wa.us'; Moore, Kim; Binkley, Keith
Subject: ARC - draft mtg summary for your review

Dear ARC Members,

Attached are the:

1. draft of the meeting summary
2. quarterly standard conditions update and
3. Keith's meeting PPT
4. Snohomish County's FHE proposal PPT

from our ARC meeting on October 17. If you have any changes/edits to the meeting summary, please email them to me by October 29 COB; otherwise, a lack of response will be deemed approval of the summary as written.

I will route a separate email for consensus on the FHE Plan proposals selection.

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

Presler, Dawn

From: Binkley, Keith
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Thank you

Keith

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

Email correspondence on this topic follows:

From: Maynard, Chris (ECY) [mailto:cmay461@ecy.wa.gov]
Sent: Tuesday, October 23, 2012 3:17 PM
To: Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank;

'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim; Binkley, Keith
Subject: RE: ARC - draft mtg summary for your review

I don't recall who brought up the downramping rate evaluation for effect on side channels but I agree with the language in the meeting summary that a plan is not needed as channels remain connected at minimum flows. Kieth and Steve and I exchanged emails on this and are in agreement.

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Thursday, October 18, 2012 11:50 AM
To: Maynard, Chris (ECY)
Cc: 'Steven Fransen'
Subject: Downramping Rate Evaluation Plan

Hi Chris – I got your voice message. I think the three of us are all on the same page and the issue is really connectivity not downramping. Along those lines, we can infer that if connectivity is in place at the project minimum of 300 cfs that it will be in place for all flows above that. So, if you agree, I will present to the ARC a program to document low flow connectivity and flow at both the inlets and outlets of each side channel.

Let me know if you concur.

Thanks

Keith

From: Maynard, Chris (ECY) [mailto:cmay461@ecy.wa.gov]
Sent: Thursday, October 18, 2012 10:39 AM
To: Binkley, Keith
Subject: RE: Downramping Rate Evaluation Plan

I don't recall who brought it up. Do you think it came from concern for totally cutting off channel flow from the river before we had the information about having flows at the inlets and outlets at all ranges of operation?

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Wednesday, October 17, 2012 12:51 PM
To: Maynard, Chris (ECY)
Cc: 'Steven Fransen'
Subject: Downramping Rate Evaluation Plan

Chris – I would like to have a conversation with you about the need (or not) for a downramping rate evaluation plan tied to the side channel project. This requirement is under Article 405. This came up today during the ARC meeting and we were all scratching our head about the logic behind it. In terms of connectivity, the side channels all flow at the inlet and outlet under the full range of operational flows so there is no risk of stranding. Furthermore, the banks within the side channels do not contain bars or topographic features that would result in stranding. I was trying to recall how this became a license requirement.

Give me a call when you get a chance. Steve has volunteered to provide perspective as well as we sort through this.

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

Presler, Dawn

From: Thomas O'Keefe <okeefe@americanwhitewater.org>
Sent: Thursday, October 25, 2012 1:41 PM
To: Binkley, Keith
Cc: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: Re: ARC - Request to remove license requirement for Downramping Evaluation Plan

I defer to my agency and tribal colleagues but based on my own empirical assessment in the field the proposed course of action makes sense and I have no concerns. The more interesting relevant question is how they preform long term.

-- Tom

On Oct 25, 2012, at 10:15 AM, Binkley, Keith wrote:

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Thank you

Keith

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

Email correspondence on this topic follows:

From: Maynard, Chris (ECY) [mailto:cmay461@ecy.wa.gov]
Sent: Tuesday, October 23, 2012 3:17 PM
To: Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim; Binkley, Keith
Subject: RE: ARC - draft mtg summary for your review

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From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Thursday, October 18, 2012 11:50 AM
To: Maynard, Chris (ECY)
Cc: 'Steven Fransen'
Subject: Downramping Rate Evaluation Plan

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Let me know if you concur.

Thanks

Keith

From: Maynard, Chris (ECY) [mailto:cmay461@ecy.wa.gov]
Sent: Thursday, October 18, 2012 10:39 AM
To: Binkley, Keith
Subject: RE: Downramping Rate Evaluation Plan

I don't recall who brought it up. Do you think it came from concern for totally cutting off channel flow from the river before we had the information about having flows at the inlets and outlets at all ranges of operation?

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Wednesday, October 17, 2012 12:51 PM
To: Maynard, Chris (ECY)

Cc: 'Steven Fransen'
Subject: Downramping Rate Evaluation Plan

Chris – I would like to have a conversation with you about the need (or not) for a downramping rate evaluation plan tied to the side channel project. This requirement is under Article 405. This came up today during the ARC meeting and we were all scratching our head about the logic behind it. In terms of connectivity, the side channels all flow at the inlet and outlet under the full range of operational flows so there is no risk of stranding. Furthermore, the banks within the side channels do not contain bars or topographic features that would result in stranding. I was trying to recall how this became a license requirement.

Give me a call when you get a chance. Steve has volunteered to provide perspective as well as we sort through this.

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

Presler, Dawn

From: Binkley, Keith
Sent: Thursday, October 25, 2012 12:21 PM
To: Presler, Dawn
Subject: FW: ARC - Request to remove license requirement for Downramping Evaluation Plan

Importance: High

1

From: Jim Miller [mailto:JMiller@ci.everett.wa.us]
Sent: Thursday, October 25, 2012 10:37 AM
To: Binkley, Keith
Cc: Julie Sklare
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan
Importance: High

Keith:

The City of Everett is in receipt of and in agreement with your Downramping request/proposal as articulated below.

Jim Miller

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; Jim Miller; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Presler, Dawn

From: Binkley, Keith
Sent: Thursday, October 25, 2012 3:08 PM
To: Presler, Dawn
Subject: FW: ARC - Request to remove license requirement for Downramping Evaluation Plan

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From: Steven Fransen [mailto:steven.m.fransen@noaa.gov]
Sent: Thursday, October 25, 2012 2:56 PM
To: Binkley, Keith
Subject: Re: ARC - Request to remove license requirement for Downramping Evaluation Plan

Keith,

Your description and rationale are fine with me. I don't see any direct benefit from an additional ramping rate evealuation plan.

SF

On Thu, Oct 25, 2012 at 10:15 AM, Binkley, Keith <KMBinkley@snopud.com> wrote:

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Presler, Dawn

From: Binkley, Keith
Sent: Thursday, October 25, 2012 3:08 PM
To: Presler, Dawn
Subject: FW: ARC - Request to remove license requirement for Downramping Evaluation Plan

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From: Everest, Loren -FS [mailto:leverest@fs.fed.us]
Sent: Thursday, October 25, 2012 3:03 PM
To: Binkley, Keith
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

I agree that as long as side channels remain connected and fully wetted at minimum flows, then stranding in the side channels is not an issue and a ramping rate evaluation plan is not necessary.

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Loren Everest
Fisheries Program Manager
Mt. Baker Snoqualmie NF
Office (425) 783-6040
Cell (425) 238-2721
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From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; DJPRESLER@SNOPUD.COM; 'Steven Fransen'; 'Anne Savery'; Everest, Loren -FS; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; okeefe@americanwhitewater.org
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Presler, Dawn

From: Binkley, Keith
Sent: Monday, October 29, 2012 10:16 AM
To: Binkley, Keith; 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Applegate, Brock A (DFW)'; 'Leonetti, Frank'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

So far, I have heard back from Jim, Loren, Steve, and Chris in support and from Tom to defer to the group. I'm waiting to hear from Brock, Anne, Tim, and Mick before moving this forward. Thanks for giving this your attention.

Keith

From: Binkley, Keith
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Thank you

Keith

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD

Presler, Dawn

From: Binkley, Keith
Sent: Monday, October 29, 2012 1:47 PM
To: 'Leonetti, Frank'; 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Applegate, Brock A (DFW)'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks for your input Frank and it was an oversight on my part to not request your input in my prior email. Yes, our obligation is to ensure that flow through is maintained over the license term. The last thing we want to do is create an "attractive nuisance" where fish move in but are trapped and can't move back out. Your thoughts on establishing stage / discharge rating curves at the inlets and also the outlets of the side channels are consistent with my thoughts on the subject.

Thanks again,

Keith

From: Leonetti, Frank [mailto:frank.leonetti@snoco.org]
Sent: Monday, October 29, 2012 1:07 PM
To: Binkley, Keith; 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Applegate, Brock A (DFW)'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Hi Keith, thinking about this a little more, it seems unlikely that a downramping study in the next 6 months-1yr would be very useful given the design criteria for the side channels. In the longer term I have some questions. We see many side channels that experience either deformation of the banks and channel alignment (and gravel recruitment/storage) or actual bedload movement from the mainstem into the side channel that significantly changes bed topography over time, often with fill at the inlet. Some of this can be subtle. It's conceivable that higher flows could entrain juveniles into the side channel which would be disconnected at or above 300 cfs due to these kinds of topographic changes that isolate pool or glide areas between high elevation riffle crests. And, would most likely happen at the highest process flows. If Im reading correctly below, it looks like the PUD would be obligated to maintain channel flow-through at 300cfs. Would this be true if such bed topographic changes occurred? Does this mean you would excavate riffle crests to assure this? Perhaps it makes sense to evaluate flow connectivity at a variety of flows after flow events that are predicted to mobilize bedload. I'm just thinking those channels are likely to look very different 10-20 years out (they'll be great habitat!), but might require some down ramping evaluation around that 300cfs threshold.

Im OK with removing the existing language but it seems like a downramping study might make sense if such channel changes occur in the future. Evaluation of flow at different discharges would be useful, easy to do, and inform the need for more rigorous evaluation of downramping. You'd winde up with a habitat rating curve showing flow vs. wetted area and flow vs. connectivity (or flow-through). -Frank

Frank Leonetti / Senior Habitat Specialist
Snohomish County Public Works / Surface Water Management
3000 Rockefeller Ave., MS 607 / Everett WA 98201-4046
Voice 425 388-3464 x4249 / FAX 425 388-6455
frank.leonetti@co.snohomish.wa.us

Presler, Dawn

From: Binkley, Keith
Sent: Monday, October 29, 2012 1:38 PM
To: Presler, Dawn
Subject: FW: ARC - Request to remove license requirement for Downramping Evaluation Plan

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From: Mick Matheson [mailto:mick.matheson@ci.sultan.wa.us]
Sent: Monday, October 29, 2012 1:47 PM
To: Binkley, Keith
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Keith,

I don't have an issue with the District's request to remove the license requirement for a Downramping Evaluation Plan.

Mick Matheson, P.E.
City of Sultan
Director of Public Works/City Engineer
Tel: (360) 793-2231
Fax: (360) 793-3344
Direct: (360) 793-2262
Cell: (425) 583-6528
mick.matheson@ci.sultan.wa.us

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
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Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these

Presler, Dawn

From: Binkley, Keith
Sent: Monday, October 29, 2012 3:43 PM
To: 'Applegate, Brock A (DFW)'; 'Leonetti, Frank'; Maynard, Chris (ECY); Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks for your input as well Brock. It would have been good to discuss this more in person or in the field but I think we are getting there via email. I appreciate everyone's patience. In answer to your question, if in the future, connectivity becomes an issue, we will make the necessary physical changes to ensure connectivity at the 300 cfs minimum flow schedule in the license. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. Downramping refers to something different than connectivity, it is the rate of change in stage. The license requirement being discussed for removal relates to an evaluation of whether more restrictive rates are necessary at the project to address flow behavior within the side channels. So since we know it will be wetted over the range of flows, the question boils down to the relevance of rate in this topographic setting.

From: Applegate, Brock A (DFW) [mailto:Brock.Applegate@dfw.wa.gov]
Sent: Monday, October 29, 2012 2:23 PM
To: Binkley, Keith; 'Leonetti, Frank'; Maynard, Chris (ECY); Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Hi Keith, I agree with Frank's e-mail. However, what if connectivity of the side channel requires more flow because of future physical changes to the side channels? Future ramping rate studies could have value. WDFW can agree with your license requirement removal if the ARC maintains the ability to adjust flow rates, if necessary. In addition, I am unclear on how the flow/rate response of the main channel will affect the ever-changing side channels and maintaining flexibility in addressing our concerns would be important.

Thanks for coordinating on the license requirement.

Sincerely, Brock

Brock Applegate
Major Projects Mitigation Biologist
Washington Department of Fish and Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012-1541

(425) 775-1311 x310
(360) 789-0578 (cell)
(425) 338-1066 (fax)

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Monday, October 29, 2012 1:47 PM
To: 'Leonetti, Frank'; Maynard, Chris (ECY); Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks for your input Frank and it was an oversight on my part to not request your input in my prior email. Yes, our obligation is to ensure that flow through is maintained over the license term. The last thing we want to do is create an "attractive nuisance" where fish move in but are trapped and can't move back out. Your thoughts on establishing stage / discharge rating curves at the inlets and also the outlets of the side channels are consistent with my thoughts on the subject.

Thanks again,

Keith

From: Leonetti, Frank [mailto:frank.leonetti@snoco.org]
Sent: Monday, October 29, 2012 1:07 PM
To: Binkley, Keith; 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Applegate, Brock A (DFW)'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Hi Keith, thinking about this a little more, it seems unlikely that a downramping study in the next 6 months-1yr would be very useful given the design criteria for the side channels. In the longer term I have some questions. We see many side channels that experience either deformation of the banks and channel alignment (and gravel recruitment/storage) or actual bedload movement from the mainstem into the side channel that significantly changes bed topography over time, often with fill at the inlet. Some of this can be subtle. It's conceivable that higher flows could entrain juveniles into the side channel which would be disconnected at or above 300 cfs due to these kinds of topographic changes that isolate pool or glide areas between high elevation riffle crests. And, would most likely happen at the highest process flows. If Im reading correctly below, it looks like the PUD would be obligated to maintain channel flow-through at 300cfs. Would this be true if such bed topographic changes occurred? Does this mean you would excavate riffle crests to assure this? Perhaps it makes sense to evaluate flow connectivity at a variety of flows after flow events that are predicted to mobilize bedload. I'm just thinking those channels are likely to look very different 10-20 years out (they'll be great habitat!), but might require some down ramping evaluation around that 300cfs threshold.

Im OK with removing the existing language but it seems like a downramping study might make sense if such channel changes occur in the future. Evaluation of flow at different discharges would be useful, easy to do, and inform the need for more rigorous evaluation of downramping. You'd winde up with a habitat rating curve showing flow vs. wetted area and flow vs. connectivity (or flow-through). -Frank

Frank Leonetti / Senior Habitat Specialist
Snohomish County Public Works / Surface Water Management
3000 Rockefeller Ave., MS 607 / Everett WA 98201-4046
Voice 425 388-3464 x4249 / FAX 425 388-6455
frank.leonetti@co.snohomish.wa.us

From: Binkley, Keith [mailto:KMBinkley@SNOPUD.com]
Sent: Monday, October 29, 2012 10:16 AM
To: Binkley, Keith; 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Applegate, Brock A (DFW)'; Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

So far, I have heard back from Jim, Loren, Steve, and Chris in support and from Tom to defer to the group. I'm waiting to hear from Brock, Anne, Tim, and Mick before moving this forward. Thanks for giving this your attention.

Keith

From: Binkley, Keith
Sent: Thursday, October 25, 2012 10:16 AM
To: 'Maynard, Chris (ECY)'; Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; Applegate, Brock A (DFW); Leonetti, Frank; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: ARC - Request to remove license requirement for Downramping Evaluation Plan

This email is a follow-up to a discussion during the ARC meeting on October 17. During that meeting, we discussed Article 405 and the requirement for a Ramping Rate Evaluation Plan and subsequent report. The article states that *"within 6 months of completing the side-channel enhancement projects required by Appendix A, condition 5.2 (A-LA 7), the licensee shall file, for Commission approval, a Ramping Rate Evaluation Plan. The plan shall include: 1) the methods and schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels required by Appendix A, condition 5.2 (A-LA 7); and 2) a provision to file a ramping rate report within one of completing the side channel enhancements, with any specific proposals for more restrictive ramping rate based on the outcome of the ramping rate evaluation."*

The District is requesting to remove this license requirement for a plan and report and hereby seeking verification from the ARC that it is not necessary. The request is based on protections in place under the broader requirement under A-LA 7 to provide connectivity between the mainstem and side channels at mainstem flows above the 300 cfs minimum flow. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. This connectivity was established at completion of the construction of the side channel project this fall and will be documented as a maintenance requirement for these projects. In addition to connectivity and adequate flow through the side channels, the topographic configuration of both the existing and newly created channels does not create the type of stranding situation observed in mainstem habitats. The District contends that the downramping rate schedule, as presented in A-LA 5, provides adequate resource protection for fish present in the mainstem and side channels to the Sultan River and that additional ramping rate restrictions are not necessary.

Please reply to this email indicating your acknowledgement and acceptance of this request.

Thank you

Keith

Keith Binkley
Manager - Natural Resources Department
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

Email correspondence on this topic follows:

Presler, Dawn

From: Tim_Romanski@fws.gov
Sent: Tuesday, October 30, 2012 12:12 PM
To: Binkley, Keith
Cc: 'Anne Savery'; 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Sorry, it has taken a while to weigh in. I have been out of the office. I concur with both Steve and Keith. A ramping rate study is not necessary, especially to ensure proper connectivity of the side channel. I am not sure how such a study got to be part of the license in the first place. And any connectivity issues would be addressed with a physical alteration at the mouth of the side channel as proposed by Keith. Monitoring at the side channel will tell us if and when such alteration is needed.

Tim Romanski
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Division of Conservation and Hydropower Planning
510 Desmond Drive SE, Lacey, WA 98503
360.753.5823 (phone) 360.753.9518 (fax)

"Binkley, Keith" <KMBinkley@SNOPUD.com>

10/29/2012 03:42 PM

To "'Applegate, Brock A (DFW)'" <Brock.Applegate@dfw.wa.gov>, "'Leonetti, Frank'" <frank.leonetti@snoco.org>, "Maynard, Chris (ECY)" <cmay461@ECY.WA.GOV>, "Presler, Dawn" <DJPresler@SNOPUD.com>, "'Steven Fransen'" <steven.m.fransen@noaa.gov>, "'Anne Savery'" <asavery@tulaliptribes-nsn.gov>, "'Loren Everest - USFS'" <leverest@fs.fed.us>, "'Jim Miller'" <JMiller@ci.everett.wa.us>, "'Thomas O'Keefe'" <okeefe@americanwhitewater.org>

cc "'Tim_Romanski@fws.gov'" <Tim_Romanski@fws.gov>, "'mick.matheson@ci.sultan.wa.us'" <mick.matheson@ci.sultan.wa.us>, "Moore, Kim" <KDMoore@SNOPUD.com>

Subject RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks for your input as well Brock. It would have been good to discuss this more in person or in the field but I think we are getting there via email. I appreciate everyone's patience. In answer to your question, if in the future, connectivity becomes an issue, we will make the necessary physical changes to ensure connectivity at the 300 cfs minimum flow schedule in the license. Through inference, the requirement to keep 10,000 linear feet of side channel wetted at minimum flows ensures that these habitats will be wetted at flows greater than 300 cfs. Downramping refers to something different than connectivity, it is the rate of change in stage. The license requirement being discussed for removal relates to an evaluation of whether more restrictive rates are necessary at the project to address flow behavior within the side channels. So since we know it will be wetted over the range of flows, the question boils down to the relevance of rate in this topographic setting.

From: Applegate, Brock A (DFW) [mailto:Brock.Applegate@dfw.wa.gov]
Sent: Monday, October 29, 2012 2:23 PM
To: Binkley, Keith; 'Leonetti, Frank'; Maynard, Chris (ECY); Presler, Dawn; 'Steven Fransen'; 'Anne Savery'; 'Loren Everest - USFS'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: 'Tim_Romanski@fws.gov'; 'mick.matheson@ci.sultan.wa.us'; Moore, Kim
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Presler, Dawn

From: Binkley, Keith
Sent: Wednesday, November 14, 2012 8:50 AM
To: 'Anne Savery'; 'Tim_Romanski@fws.gov'; 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks for your input Anne.

From: Anne Savery <asavery@tulaliptribes-nsn.gov>
Date: November 13, 2012, 11:10:04 AM PST
To: "Binkley, Keith" <KMBinkley@SNOPUD.com>, "'Tim_Romanski@fws.gov'" <Tim_Romanski@fws.gov>
Cc: "'Applegate, Brock A (DFW)'" <Brock.Applegate@dfw.wa.gov>, "Maynard, Chris (ECY)" <cmay461@ECY.WA.GOV>, "Presler, Dawn" <DJPresler@SNOPUD.com>, "'Leonetti, Frank'" <frank.leonetti@snoco.org>, 'Jim Miller' <JMiller@ci.everett.wa.us>, "Moore, Kim" <KDMoore@SNOPUD.com>, 'Loren Everest - USFS' <leverest@fs.fed.us>, "'mick.matheson@ci.sultan.wa.us'" <mick.matheson@ci.sultan.wa.us>, 'Thomas O'Keefe' <okeefe@americanwhitewater.org>, 'Steven Fransen' <steven.m.fransen@noaa.gov>
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Sorry for the delay in my response - I was shut out of my Tulalip email account for a week (+).

My thoughts on the sidechannels align with Frank's. They are experimental, need to have time to develop a dynamic equilibrium with the lower Sultan River and will require monitoring to understand the stage/discharge relationship.

On to down ramping - I hesitate to agree to removing the downramping requirement for two reasons. 1. we don't know what will happen in the side channels if downramping in the mainstem exceeds or even meets the current prescription - regardless of whether the minimum instream flow is being met in the lower Sultan River
2. the side channels will be evolving over time - we won't know what the connectivity of the downstream ends of the side channels at any flow regime or what sort of refugia are created for juveniles, until it is allowed to develop.

I suggest we monitor the stage discharge relationship of both the upstream and downstream ends of the side channels (especially respect to down ramping events) and to monitor the development of habitats within the side channels. Monitoring should tell us if we need a downramping rate specific to sidechannels.

Anne

From: Anne Savery
Sent: Thursday, November 08, 2012 12:06 PM
To: Binkley, Keith; 'Tim_Romanski@fws.gov'
Cc: 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'

Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

---

From: Binkley, Keith [KMBinkley@SNOPUD.com]
Sent: Monday, November 05, 2012 5:08 PM
To: 'Tim_Romanski@fws.gov'
Cc: Anne Savery; 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

That is correct Tim and thanks for pointing out the District's obligation to physical ensure the connectivity is maintained.

From: Tim_Romanski@fws.gov [mailto:Tim_Romanski@fws.gov]
Sent: Monday, November 05, 2012 3:51 PM
To: Binkley, Keith
Cc: 'Anne Savery'; 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'
Subject: RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

I think the language looks good. I am assuming if the connectivity is lost for whatever reason that the County would have a adequate response (i.e. restore connectivity through physical alteration of side-channel). Thanks Keith for coordinating this.

Tim Romanski
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Division of Conservation and Hydropower Planning
510 Desmond Drive SE, Lacey, WA 98503
360.753.5823 (phone) 360.753.9518 (fax)

"Binkley, Keith" <KMBinkley@SNOPUD.com<mailto:KMBinkley@SNOPUD.com>>

11/05/2012 01:58 PM

To

'"Tim_Romanski@fws.gov"' <Tim_Romanski@fws.gov<mailto:Tim_Romanski@fws.gov>>

cc

'"Anne Savery"' <asavery@tulaliptribes-nsn.gov<mailto:asavery@tulaliptribes-nsn.gov>>, '"Applegate, Brock A (DFW)"' <Brock.Applegate@dfw.wa.gov<mailto:Brock.Applegate@dfw.wa.gov>>, "Maynard, Chris

(ECY)" <cmay461@ECY.WA.GOV<mailto:cmay461@ECY.WA.GOV>>, "Presler, Dawn" <DJPresler@SNOPUD.com<mailto:DJPresler@SNOPUD.com>>, "'Leonetti, Frank'" <frank.leonetti@snoco.org<mailto:frank.leonetti@snoco.org>>, "'Jim Miller'" <JMiller@ci.everett.wa.us<mailto:JMiller@ci.everett.wa.us>>, "Moore, Kim" <KDMoore@SNOPUD.com<mailto:KDMoore@SNOPUD.com>>, "'Loren Everest - USFS'" <leverest@fs.fed.us<mailto:leverest@fs.fed.us>>, "'mick.matheson@ci.sultan.wa.us'" <mick.matheson@ci.sultan.wa.us<mailto:mick.matheson@ci.sultan.wa.us>>, "'Thomas O'Keefe'" <okeefe@americanwhitewater.org<mailto:okeefe@americanwhitewater.org>>, "'Steven Fransen'" <steven.m.fransen@noaa.gov<mailto:steven.m.fransen@noaa.gov>>

Subject

RE: ARC - Request to remove license requirement for Downramping Evaluation Plan

Thanks Tim.

I would ask the membership to review the entire email string and then see if the following language from the maintenance and monitoring section of the SCE/LWD plan addresses the issue:

Side channel habitats will be monitored seasonally to qualitatively assess functionality over the full range of flow conditions with focused surveys conducted when mainstem flows drop below 400 cfs. Benchmarks for horizontal and vertical control will be established near the inlet to each side channel. Bed elevation, water depth / stage, and velocity will be collected along an established transect during each site visit. This information will define flow connectivity and the relationship between mainstem and side channel flow.

Thanks all,

Keith

From: Tim_Romanski@fws.gov<mailto:Tim_Romanski@fws.gov> [mailto:Tim_Romanski@fws.gov]
Sent: Tuesday, October 30, 2012 12:12 PM
To: Binkley, Keith
Cc: 'Anne Savery'; 'Applegate, Brock A (DFW)'; Maynard, Chris (ECY); Presler, Dawn; 'Leonetti, Frank'; 'Jim Miller'; Moore, Kim; 'Loren Everest - USFS'; 'mick.matheson@ci.sultan.wa.us'; 'Thomas O'Keefe'; 'Steven Fransen'
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Presler, Dawn

From: Presler, Dawn
Sent: Tuesday, November 27, 2012 1:41 PM
To: 'Anne Savery'; 'brock.applegate@dfw.wa.gov'; 'Maynard, Chris (ECY)'; 'Loren Everest - USFS'; 'Tim_Romanski@fws.gov'; 'Leonetti, Frank'; 'Steven Fransen'; 'mick.matheson@ci.sultan.wa.us'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: Binkley, Keith; Moore, Kim
Subject: ARC - Article 405 - SCE Ramp Rate Eval Plan for your review and comment
Attachments: Article 405 Ramping Rate Evaluation Plan.docx

Dear ARC,
Since not all ARC members agreed to delete the requirement for a side channel enhancement ramp rate evaluation (based on emails to/from Keith), attached is the Plan per License Article 405. Please take the next 30 days to review and provide your comments back to me (cc: Keith) by December 28. (It's very concise so it should not take much time for your review.) If you have no comments on the Plan, an email stating so would still be appreciated. Thanks!

Happy Holidays!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

Presler, Dawn

From: Jim Miller <JMiller@ci.everett.wa.us>
Sent: Tuesday, November 27, 2012 1:44 PM
To: Presler, Dawn
Subject: RE: ARC - Article 405 - SCE Ramp Rate Eval Plan for your review and comment

OK by me.
Jim Miller

From: Presler, Dawn [mailto:DJPresler@SNOPUD.com]
Sent: Tuesday, November 27, 2012 1:41 PM
To: 'Anne Savery'; 'brock.applegate@dfw.wa.gov'; 'Maynard, Chris (ECY)'; 'Loren Everest - USFS'; 'Tim_Romanski@fws.gov'; 'Leonetti, Frank'; 'Steven Fransen'; 'mick.matheson@ci.sultan.wa.us'; Jim Miller; 'Thomas O'Keefe'
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Happy Holidays!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

Presler, Dawn

From: Steven Fransen - NOAA Federal <steven.m.fransen@noaa.gov>
Sent: Tuesday, November 27, 2012 1:55 PM
To: Presler, Dawn
Subject: Re: ARC - Article 405 - SCE Ramp Rate Eval Plan for your review and comment

Dawn,

I reviewed the article 405 ramping rate evaluation plan for side channels. NMFS approves the plan.

SF

On Tue, Nov 27, 2012 at 1:41 PM, Presler, Dawn <DJPresler@snopud.com> wrote:

Dear ARC,

Since not all ARC members agreed to delete the requirement for a side channel enhancement ramp rate evaluation (based on emails to/from Keith), attached is the Plan per License Article 405. Please take the next 30 days to review and provide your comments back to me (cc: Keith) by December 28. (It's very concise so it should not take much time for your review.) If you have no comments on the Plan, an email stating so would still be appreciated. Thanks!

Happy Holidays!

Dawn Presler

Sr. Environmental Coordinator

Generation Resources

(425) 783-1709

****

PUD No. 1 of Snohomish County

PO Box 1107

Everett, WA 98206-1107

Presler, Dawn

From: Mick Matheson <mick.matheson@ci.sultan.wa.us>
Sent: Thursday, November 29, 2012 10:51 AM
To: Presler, Dawn
Subject: RE: ARC - Article 405 - SCE Ramp Rate Eval Plan for your review and comment

Dawn,

I have reviewed the plan and have no comments.

Thanks,

Mick Matheson, P.E.
City of Sultan
Director of Public Works/City Engineer
Tel: (360) 793-2231
Fax: (360) 793-3344
Direct: (360) 793-2262
Cell: (425) 583-6528
mick.matheson@ci.sultan.wa.us

From: Presler, Dawn [mailto:DJPresler@SNOPUD.com]
Sent: Tuesday, November 27, 2012 1:41 PM
To: 'Anne Savery'; 'brock.applegate@dfw.wa.gov'; 'Maynard, Chris (ECY)'; 'Loren Everest - USFS'; 'Tim_Romanski@fws.gov'; 'Leonetti, Frank'; 'Steven Fransen'; 'mick.matheson@ci.sultan.wa.us'; 'Jim Miller'; 'Thomas O'Keefe'
Cc: Binkley, Keith; Moore, Kim
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Happy Holidays!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

Presler, Dawn

From: Anne Savery <asavery@tulaliptribes-nsn.gov>
Sent: Thursday, December 20, 2012 12:03 PM
To: Presler, Dawn; 'Thomas O'Keefe' (okeefe@americanwhitewater.org); 'Jim Miller' (JMiller@ci.everett.wa.us); 'mick.matheson@ci.sultan.wa.us' (mick.matheson@ci.sultan.wa.us); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Leonetti, Frank' (frank.leonetti@snoco.org); 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov)
Cc: Binkley, Keith; Moore, Kim
Subject: SCE
Attachments: Article 405 Ramping Rate Evaluation Plan_TTT_Comments.doc

Attached are my comments on the Ramping Rate Evalution summary

Summary of comments

1. We should evaluate the full range of minimum instream flows released at the Powerhouse. Minimum instream flow schedule drops to 200 cfs at the Powerhouse when Spada Lake reaches elevation 1420. Should downramping be established within that flow schedule?

2. Side channels should be evaluated in more places than the upstream and downstream ends for stage/discharge relationship. There may be places within the sidechannels that dewater earlier - we should know where those areas are.

Anne

2. METHODS AND SCHEDULE

The District proposes to evaluate patterns of flow behavior in four distinct side channels in the lower Sultan River. These side channels: SC1, SC2, SC3, and SC4 each underwent restoration in summer 2012 are highlighted in Figure 1. With the exception of SC1, all side channels have one inlet and one outlet. SC1 has two inlets and two outlets.

Consistent with other monitoring efforts, side channel habitats will be monitored seasonally to qualitatively assess functionality over the full range of flow conditions with focused quantitative surveys conducted when mainstem flows drop below 600 cfs, as measured at United States Geological Survey (USGS) Streamflow Gage No. 12138160. The flow range below 600 cfs was selected for this evaluation to be consistent with prior survey efforts (CH2MHill 1990). Table 1 depicts the applicable downramping schedule in Reach 1 when the flow range is between 600 and 300 cfs (minimum instream flow), as measured at USGS Streamflow Gage No. 12138160.

Comment [AS1]: Although the minimum flow is estimated to be 300 cfs, we don't know what happens in the side channels in case flows go below 300. I would like to know what happens in the side channels when the minimum instream flows are lower, when Spada Lake is below 1420.

Table 1. Downramping Rate Schedule, 600 to 300 cfs flow range, Reach 1, Lower Sultan River.

Season	Day Rate	Night Rate
January 1 to May 31	2 inches per hour	4 inches per hour
June 1 to September 15	2 inches per hour	1 inch per hour
September 16 to October 31	2 inches per hour	2 inches per hour
November 1 to December 31	4 inches per hour	4 inches per hour

Qualitative surveys will rely on field observations and photo documentation. Quantitative surveys will document flow volume at the inlets and outlets of each of the four side channels. Benchmarks for horizontal and vertical control will be established near the inlet and outlet to each side channel. Bed elevation, water depth / stage, and velocity will be collected along an established transect during each site visit in the target flow range between 600 and 300 cfs. No less than three site visits will be made to bracket this flow range. This information will define flow connectivity and the relationship between mainstem and side channel flow.

Comment [AS2]: We need to know the water levels throughout the side channels, to understand if there are areas where fish can get trapped within the sidechannels. Connectivity at the upstream and downstream end is important, however if fish are trapped in the sidechannel and can't leave, we should know where those areas are.

Site visits will be scheduled to occur during summer 2013, as flow conditions allow, with a draft report provided to the ARC by August 31, 2013, for a 30-day review and comment period. A final report will be filed with the FERC by October 31, 2013.

142 FERC ¶ 62,223
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Utility District No. 1 of Snohomish County, Washington — Project No. 2157-213

ORDER APPROVING RAMPING RATE EVALUATION PLAN PURSUANT TO ARTICLE 405

(Issued March 19, 2013)

1. On January 24, 2013, the Public Utility District No.1 of Snohomish County, Washington (licensee) filed its Ramping Rate Evaluation Plan (Plan) with the Federal Energy Regulatory Commission (Commission) pursuant to Article 405 of the Henry M. Jackson Hydroelectric Project license.[1] The project is located on the Sultan River in Snohomish County, Washington, and occupies U.S. lands within the Mount Baker-Snoqualmie National Forest.

BACKGROUND AND LICENSE REQUIREMENTS

2. Article 405 requires the licensee to develop its Plan, for Commission approval, within six months of completing the side channel enhancement projects required by Condition 5.2 of the project's Water Quality Certification. The Plan must include methods and a schedule for conducting an evaluation to determine whether additional ramping rate restrictions are necessary to prevent juvenile fish stranding in the reconnected side channels. Additionally, it must include provisions for filing a ramping rate report with the Commission within one year of completing the side channel enhancements that contains specific proposals for more restrictive ramping rates based on the ramping rate evaluation.

LICENSEE'S PLAN

3. The licensee proposes to employ quantitative and qualitative monitoring methods to evaluate patterns of flow behavior in four distinct side channels in the lower Sultan

[1] Order Issuing New License. 136 FERC ¶ 62,188 (September 2, 2011).

River. The subject side channels underwent restoration in the summer of 2012. The licensee would monitor side channel habitats seasonally to qualitatively assess functionality over the full range of flow conditions, while quantitative surveys would take place when mainstem flows drop below 600 cubic feet per second (cfs), as measured by the U.S. Geological Survey gaging station located below the powerhouse and downstream of Culmback Dam on the Sultan River. The licensee's proposed qualitative and quantitative monitoring methods are described below.

4. According to the licensee, qualitative surveys would rely on a combination of field observations and photographic documentation. Quantitative surveys would document flow volume at the inlets and outlets of each of the four side channels. The licensee would establish benchmarks for each side channel where it would repeat bed elevation, water depth and stage, and velocity measurements along a transect. The licensee would conduct a minimum of three site visits in the summer of 2013 to collect the abovementioned data when flows range from 300 to 600 cfs. The surveys should define flow connectivity and the relationship between mainstem river and side channel flow. The licensee would supplement this information with physical habitat measurements that are collected along the length of each side channel, photographic documentation, and systematic measurements of specific habitat characteristics.

5. Upon the completion of monitoring, the licensee would develop a ramping rate report. The report would include a summary of evaluation methods, visual documentation of flow conditions during each site visit, flow discharge measurements, a stage/discharge rating curve based upon the discharge measurements, and specific proposals for more restrictive ramping rates, if needed. Prior to filing the report with the Commission, the licensee would provide the draft report to the Aquatic Resource Committee (ARC)[2] for a 30-day review and comment period. The licensee would incorporate the consultation record into the final report, along with specific descriptions of the how the ARC's comments are accommodated by the report, before filing it with the Commission by October 31, 2013.

AGENCY CONSULTATION

6. Article 405 requires the licensee to develop the Plan in consultation with the ARC

[2] The ARC is comprised of the National Marine Fisheries Service, U.S. Forest Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Department of Fish and Wildlife, Tulalip Tribes, Snohomish County, City of Everett, City of Sultan, and American Whitewater.

and provide documentation of its consultation with the ARC in its filing to the Commission. The licensee coordinated with the ARC to develop the Plan, and on November 27, 2012, provided the Plan to the ARC for review and comment. Following the 30-day comment period, the licensee addressed the comments provided by the ARC and received ARC approval of the Plan on January 16, 2013.

DISCUSSION AND CONCLUSIONS

7. The licensee's Plan meets the requirements specified in Article 405 and if implemented as approved, should adequately evaluate whether additional ramping rate restrictions are necessary to protect juvenile fish from stranding in the reconnected side channels on the Sultan River. The licensee has satisfied the consultation requirements, and the plan represents a collaborative effort between the licensee and the ARC. Based on our review, the plan should be approved.

The Director orders:

(A) The Public Utility District No.1 of Snohomish County, Washington's Ramping Rate Evaluation Plan, filed with the Federal Energy Regulatory Commission (Commission) on January 24, 2013, pursuant to license Article 405 for the Henry M. Jackson Hydroelectric Project, is approved.

(B) This order constitutes final agency action. Any party may file a request for rehearing of this order within 30 days from the date of its issuance, as provided in section 313(a) of the Federal Power Act, 16 U.S.C. § 8251 (2006), and the Commission's regulations at 18 C.F.R. § 385.713 (2012). The filing of a request for rehearing does not operate as a stay of the effective date of this order, or of any other date specified in this order. The licensee's failure to file a request for rehearing shall constitute acceptance of this order.

Thomas J. LoVullo
Chief, Aquatic Resources Branch
Division of Hydropower Administration
and Compliance

Presler, Dawn

From: Presler, Dawn
Sent: Friday, September 20, 2013 2:31 PM
To: 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); 'Leonetti, Frank' (frank.leonetti@snoco.org); Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith
Subject: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment
Attachments: RREP Report.pdf

Dear ARC,
Attached is the draft Side Channel Enhancement Ramp Rate Evaluation Report for your 30-day review and comments. Comments, if any, are due to me (with cc: to Keith) by October 20. If you have no comments regarding the draft report, an email stating so would be appreciated. Due to the size of the Appendix 1 photos (which is enormous), I have put that portion on CD and am mailing it to you. If you have any questions on the report, feel free to contact Keith at 425-783-1769.

Have a great weekend!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

Presler, Dawn

From: Leonetti, Frank <frank.leonetti@snoco.org>
Sent: Thursday, October 17, 2013 11:14 AM
To: Presler, Dawn; 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith
Subject: RE: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment
Attachments: RREP Report_FLcomments.pdf

Hi Dawn, thanks for the opportunity to review the Side Chan Ramp Rate Report (and the reminder yesterday) - here are a few comments on report. The comments are included as sticky notes in the attachment so youll have to scroll through. I'd recommend providing more detail in report for method documentation and repeatability for future comparison, and there is some uncertainty (to me) as to whether the selected cross sections are the right hydraulic controls to consider in the side channels in order to answer the specific study question. In particular, the cross section of the redundant inlet of SC1 appears to have been selected at the scour created by the ELJ. In Figure 4.1, however, it appears there is a relatively uniform and shallow riffle immediately downstream that is the hydraulic control point – which is also the location most likely to adjust with any sediment transport/aggradation or bank deformation (assuming the ELJ will continue to scour right in from of it). I think the long profile info included in the appendix table is great and should be plotted (max depth by station). The longtitudinal profile area can be calculated as well as wetted area (for whatever the discharge was at the time). Other minor comments in the doc. Thanks. –Frank

Frank Leonetti | **Senior Habitat Specialist**
Surface Water Management

Snohomish County | Department of Public Works
3000 Rockefeller Ave, M/S 607, Everett, WA 98201
Phone: (425) 388-3464 x4249 | FAX: (425) 388-6455
EMAIL: Frank.Leonetti@snoco.org | WEB: www.Snoco.org

From: Presler, Dawn [mailto:DJPresler@SNOPUD.com]
Sent: Friday, September 20, 2013 2:31 PM
To: 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); Leonetti, Frank; Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
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Have a great weekend!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
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PO Box 1107
Everett, WA 98206-1107

3. STUDY METHODOLOGY

During summer 2013, District biologists evaluated patterns of flow behavior in four distinct side channels in the lower Sultan River (Figure 2-2). These side channels – SC1, SC2, SC3, and SC4 – had each undergone varying degrees of construction during summer 2012 to restore and/or enhance salmonid habitat; some channels were newly created while others just received LWD and boulder treatments. Each side channel is unique in terms of length, gradient, flow volume and flow distribution. For instance, SC1 has two inlets ("historic" and "redundant") and two outlets ("historic" and "extension"), SC2 and SC3 each have one inlet and one outlet, and SC4 has one inlet and two outlets ("primary" and "secondary").

Since construction, side channel habitats have been routinely monitored to qualitatively assess functionality over the full range of flow conditions. Qualitative surveys rely on field observations and photo documentation. For this evaluation, qualitative surveys were complemented by focused quantitative surveys. These surveys were conducted as mainstem flows dropped below 600 cfs, as measured at United States Geological Survey (USGS) Streamflow Gage No. 12138160. This flow range, below 600 cfs and extending down to the Project minimum of 300 cfs, was selected for this evaluation to be consistent with prior survey efforts related to Project downramping (CH2MHill 1990).

Quantitative surveys documented flow volume at the inlets and outlets of each of the four side channels within the 600 to 300 cfs flow range. This information was collected to define flow connectivity and the relationship between mainstem and side channel flow and habitat. During 2013, three to four site visits were made to survey conditions and bracket this flow range. For each side channel, discharge readings were collected along an established transect near the inlet(s) and outlet(s) using a FlowTracker velocity meter. Benchmarks for horizontal and vertical control were also established near the inlet(s) and outlet(s) to each side channel. During each survey, bed elevation and water surface elevation were recorded at the inlet hydraulic control. Water surface elevation (stage) was recorded at each outlet.

During low flow conditions, physical habitat measurements were collected along the length of each channel including the systematic measurement of select habitat characteristics (depth, width, substrate, presence of woody debris, and riparian condition). During this longitudinal survey, representative photos were taken at regular intervals to document habitat conditions during low flow.

4. RESULTS

Surveys were conducted during the months of June, July, and August 2013. Over the summer, side channels were surveyed when flows were within the target flow range. Surveys included a topographic survey of each inlet, discharge measurements, and a low flow survey of habitat conditions within each side channel. The results are organized by side channel in the following sections with photo documentation and systematic inventories of low flow conditions presented in the Appendix 1 and 2, respectively.

Summary of Comments on Microsoft Word - RREP Report.docx

Page: 13

Number: 1 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:28:53 AM
The inlet cross section profiles dont appear to be consistent with selection of hydraulic controls such as riffle crests, which would be float

Number: 2 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:56:21 AM
Were locations for channel measurements at random locations, regular intervals? "Systematic" can imply different things. Were locations of width measurement monumented for repeat survey in future years?
Also I recommend your LWD tally be consistent with other local/regional protocols for minimum size criteria and sample methodology - State TFW protocols are good place to start. At County we base all wood counts on minimum size of 10cm diameter and 2 meters length.
I'd expand you methods section to be more specific about criteria and measurement method for each of selected hab characteristics.

4.1 Side Channel 1

As previously stated, SC1 is unique among the Sultan River side channels in that it has two inlets and two outlets. The constructed, redundant inlet (Figure 4-1) works with the historic inlet (Figure 4-2) to ensure the adequate delivery of sufficient flow volumes throughout the side channel network. Downstream, streamflow is split and routed down one of two pathways: 1) down the historic channel to its outlet (Figure 4-3), or 2) down the constructed extension to SC1 to its outlet (Figure 4-4).

Figure 4-1. Redundant inlet to SC 1, looking downstream with Engineered Log Jam (ELJ) 4 on the right.

Number: 1 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:19:19 AM
Seems to me your cross sections should be at existing riffle crest or other flow control feature, not at deepest location next to ELJ?

Table 4-1. Water surface elevation (WSE) and discharge at inlets and outlets to SC1 under varying mainstem discharge.

Date	Mainstem Discharge (cfs)	Relative WSE at Side Channel Inlet (ft)	Discharge at Inlet (cfs)	Discharge at Redundant Inlet (cfs)	Discharge (G.H.) at Historic Outlet (cfs)	Discharge (G.H.) at Secondary Outlet (cfs)
6/25/13	338	95.80	6.2	5.6	8.5 (2.375")	3.7 (3")
7/25/13	369	95.86	6.0	4.2	8.0 (2.25")	1.9 (2.5")
8/22/13	581	96.27	9.4	9.6	13.1 (4.0")	5.8 (7.5")
8/27/13	400	96.01	4.3	4.9	7.3 (2.125")	1.9 (2.5")

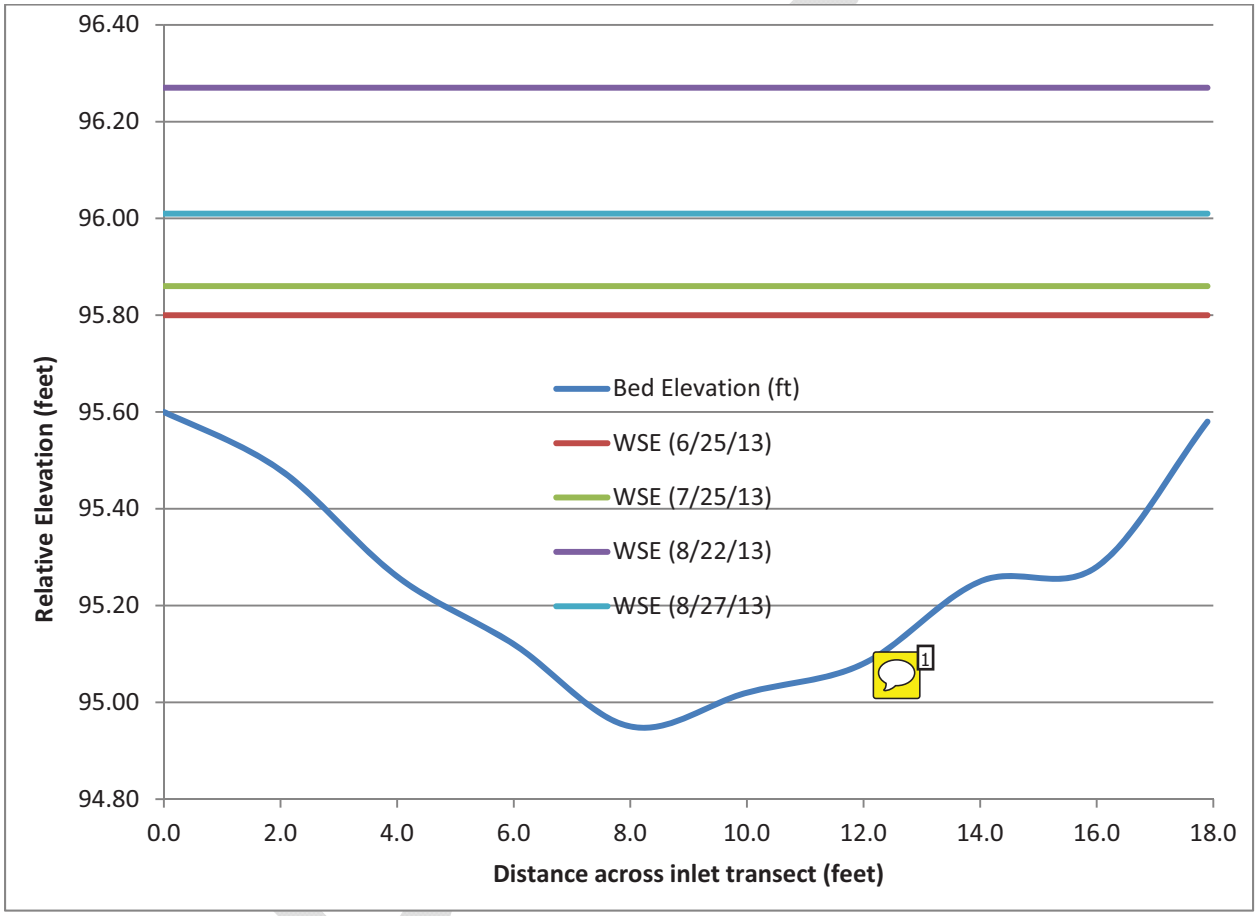

Figure 4-5. Bed and water surface elevations, historic inlet (left side) to SC1, summer 2013.

Number: 1 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:30:51 AM
This isnt the profile of a hydraulic control point.

Table 4-3. Width and depth measurements from systematic survey of SC 1 complex under low flow conditions.

Side Channel	Width (feet)			Average Depth (feet)		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
SC1 – Historic	18.6	7.5	38.0	1.0	0.1	2.9
SC1 – Extension	12.7	4.3	21.7	0.6	0.1	1.9
SC1 – Redundant inlet	11.5	9.0	15.0	0.8	0.5	1.9

4.2 Side Channel 2

Construction within SC2 focused on enhancing functionality through improved flow connectivity at the inlet coupled with strategic placements of large woody debris downstream. During summer 2013, SC 2 was surveyed on three occasions. During these surveys, mainstem discharge, as measured at USGS Gaging Station No. 12138160, ranged between 369 and 581 cfs (Table 4-4). Total inflow to SC1 ranged between 8.0 and 21 cfs during the surveys accounting for between 2.1 and 3.6% of the mainstem flow. Measurements of outflow were within 2% of inflow and ranged between 7.9 and 20.6 cfs (Table 4-4).

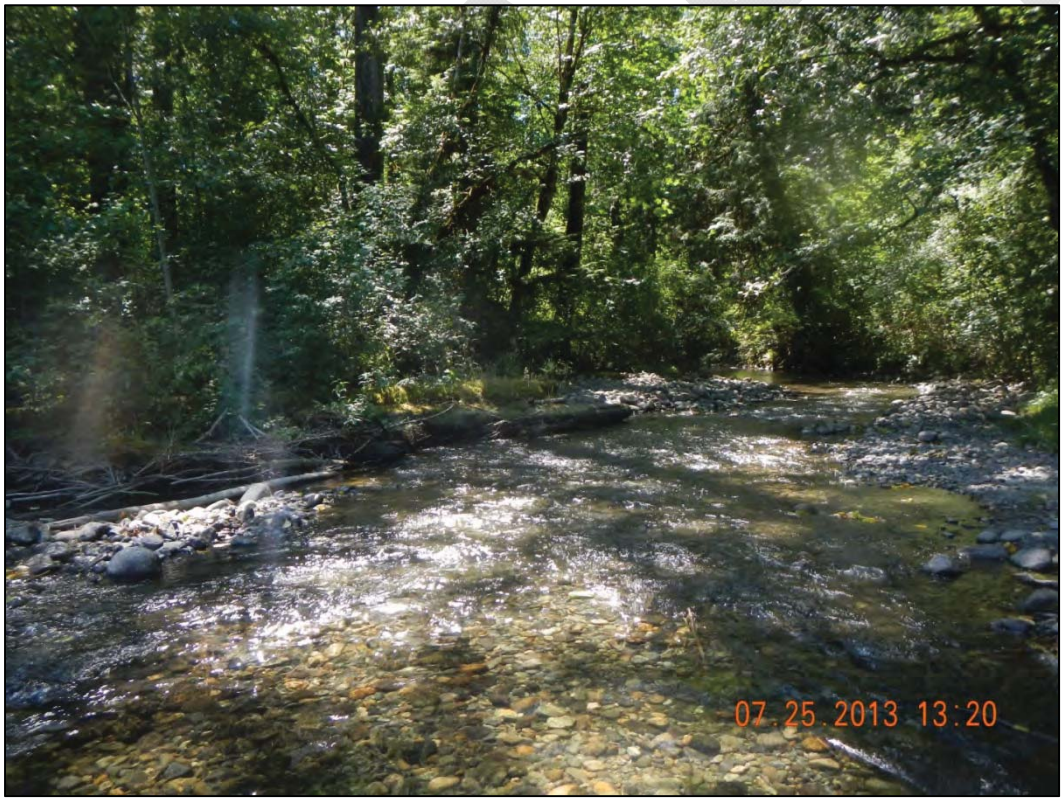

Figure 4-8. Inlet to SC 2, looking downstream from main channel.

Number: 1 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:50:55 AM
I'd include more specific reporting of LWD based on the appendix tables? Is wood count only for placed structures?

Side Channel 1 Extension

Date: 7/11/2013 Weather: sunny, excellent visibility

Personnel: KB, LL

Measurements are at 25' increments beginning at outlet and working upstream

Station #	Width (feet)	Average Depth (feet)	Maximum Depth (feet)	Substrate (dominant, sub-dominant)	LWD Tally (permanent, > 12" diameter)	Riparian Condition (see photos)	# Fish observed
0	12.0	0.4	0.5	sand, fine gravel	see project as-builts	absent, post constuction	5
1	10.5	0.4	0.5	sand, fine gravel	see project as-builts	absent, post constuction	5
2	7.4	0.4	0.5	silt, sand	see project as-builts	absent, post constuction	10
3	9.6	0.4	0.4	silt, sand	see project as-builts	absent, post constuction	
4	10.0	0.4	0.5	silt, sand	see project as-builts	absent, post constuction	
5	11.3	0.2	0.4	silt, sand	see project as-builts	absent, post constuction	5
6	11.5	0.7	0.8	sand, fine gravel	see project as-builts	absent, post constuction	10
7	13.8	0.5	0.6	sand, silt	see project as-builts	absent, post constuction	10
8	14.0	0.6	0.7	sand, silt	see project as-builts	absent, post constuction	
9	18.0	1.1	1.8	sand, silt	see project as-builts	absent, post constuction	
10	18.0	0.2	0.8	silt, sand	see project as-builts	absent, post constuction	
11	10.6	0.2	0.6	silt, sand	see project as-builts	absent, post constuction	
12	14.4	0.4	1.0	sand, fine gravel	see project as-builts	absent, post constuction	10
13	14.4	0.5	1.0	sand, silt	see project as-builts	absent, post constuction	
14	16.0	0.5	0.6	sand, silt	see project as-builts	absent, post constuction	
15	13.6	1.0	1.4	sand, silt	see project as-builts	absent, post constuction	
16	11.2	0.7	0.9	sand, silt	see project as-builts	absent, post constuction	15
17	11.1	0.5	0.7	sand, fine gravel	see project as-builts	absent, post constuction	
18	15.0	0.7	0.8	silt, sand	see project as-builts	absent, post constuction	10
19	18.5	0.4	0.4	silt, sand	see project as-builts	absent, post constuction	5
20	20.6	0.8	1.4	silt, sand	see project as-builts	absent, post constuction	25
21	18.8	0.4	0.5	silt, sand	see project as-builts	absent, post constuction	5
22	18.1	0.2	0.6	sand, fine gravel	see project as-builts	absent, post constuction	20
23	14.9	0.4	0.8	sand, silt	see project as-builts	absent, post constuction	
24	14.2	0.6	0.6	sand, silt	see project as-builts	absent, post constuction	
25	13.6	0.9	0.9	sand, silt	see project as-builts	absent, post constuction	30
26	11.1	1.4	1.9	sand, silt	see project as-builts	absent, post constuction	10

Page: 32

Number: 1 Author: spwfel Subject: Sticky Note Date: 10/17/2013 10:47:43 AM
What measurements did you use to calculate mean? I'd plot the maximum depth as a function of length and highlight the minimum maximum locations (0.3 and 0.4) as potential locations to watch for stranding. You should also be able to plot the residual depth profile for future comparsion.

Presler, Dawn

From: Anne Savery <asavery@tulaliptribes-nsn.gov>
Sent: Thursday, October 17, 2013 8:41 PM
To: Leonetti, Frank; Presler, Dawn; 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith
Subject: RE: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment
Attachments: image003.jpg; RREP_TTTcomments_ Report.pdf

Thanks for the report. I went back to the original plan that was submitted to FERC and fault myself for not having reviewed it more thoroughly. That said, I don't find the report as carried out to be a satisfactory analysis of stranding risks within the side channel. The bulk of the analysis lies in the inlets and the outlets of the side channels, rather than in areas within the side channels where stranding would most likely occur - hydraulic controls such as shallow riffles. The lack of documentation of habitat units and identification of hydraulic controls is problematic, as we have no way to compare changes to habitat in the side channel or level of risk of stranding based habitat types and depths. We have no idea what will happen within shallow habitats in the side channel when the river drops 1 to 4 inches per hour in the 600-300 cfs flow range.

I agree with Frank that PUD should graph the long profile at 25 foot intervals with the maximum depth for each side channel with an eye to resurveying in the next few years.

I have included a few comments in the report.
Anne

From: Leonetti, Frank [frank.leonetti@snoco.org]
Sent: Thursday, October 17, 2013 11:14 AM
To: 'Presler, Dawn'; 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
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Frank Leonetti | Senior Habitat Specialist Surface Water Management
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Have a great weekend!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County
PO Box 1107
Everett, WA 98206-1107

3. STUDY METHODOLOGY

During summer 2013, District biologists evaluated patterns of flow behavior in four distinct side channels in the lower Sultan River (Figure 2-2). These side channels – SC1, SC2, SC3, and SC4 – had each undergone varying degrees of construction during summer 2012 to restore and/or enhance salmonid habitat; some channels were newly created while others just received LWD and boulder treatments. Each side channel is unique in terms of length, gradient, flow volume and flow distribution. For instance, SC1 has two inlets ("historic" and "redundant") and two outlets ("historic" and "extension"), SC2 and SC3 each have one inlet and one outlet, and SC4 has one inlet and two outlets ("primary" and "secondary").

Since construction, side channel habitats have been routinely monitored to qualitatively assess functionality over the full range of flow conditions. Qualitative surveys rely on field observations and photo documentation. For this evaluation, qualitative surveys were complemented by focused quantitative surveys. These surveys were conducted as mainstem flows dropped below 600 cfs, as measured at United States Geological Survey (USGS) Streamflow Gage No. 12138160. This flow range, below 600 cfs and extending down to the Project minimum of 300 cfs, was selected for this evaluation to be consistent with prior survey efforts related to Project downramping (CH2MHill 1990).

Quantitative surveys documented flow volume at the inlets and outlets of each of the four side channels within the 600 to 300 cfs flow range. This information was collected to define flow connectivity and the relationship between mainstem and side channel flow and habitat. During 2013, three to four site visits were made to survey conditions and bracket this flow range. For each side channel, discharge readings were collected along an established transect near the inlet(s) and outlet(s) using a FlowTracker velocity meter. Benchmarks for horizontal and vertical control were also established near the inlet(s) and outlet(s) to each side channel. During each survey, bed elevation and water surface elevation were recorded at the inlet hydraulic control. Water surface elevation (stage) was recorded at each outlet.

During low flow conditions, physical habitat measurements were collected along the length of each channel including the systematic measurement of select habitat characteristics (depth, width, substrate, presence of woody debris, and riparian condition). During this longitudinal survey, representative photos were taken at regular intervals to document habitat conditions during low flow.

4. RESULTS

Surveys were conducted during the months of June, July, and August 2013. Over the summer, side channels were surveyed when flows were within the target flow range. Surveys included a topographic survey of each inlet, discharge measurements, and a low flow survey of habitat conditions within each side channel. The results are organized by side channel in the following sections with photo documentation and systematic inventories of low flow conditions presented in the Appendix 1 and 2, respectively.

Summary of Comments on Microsoft Word - RREP Report.docx

Page: 13

Number: 1 Author: Owner Subject: Sticky Note Date: 10/17/2013 8:06:13 PM

Hydraulic controls need to be identified within the side channels, at riffles and pool tails, not in the deepest part of the channel. Having flow in the inlet and outlet does not necessarily mean that change in flow is the same within habitat units and margins within the side channel.

Is this survey repeatable?

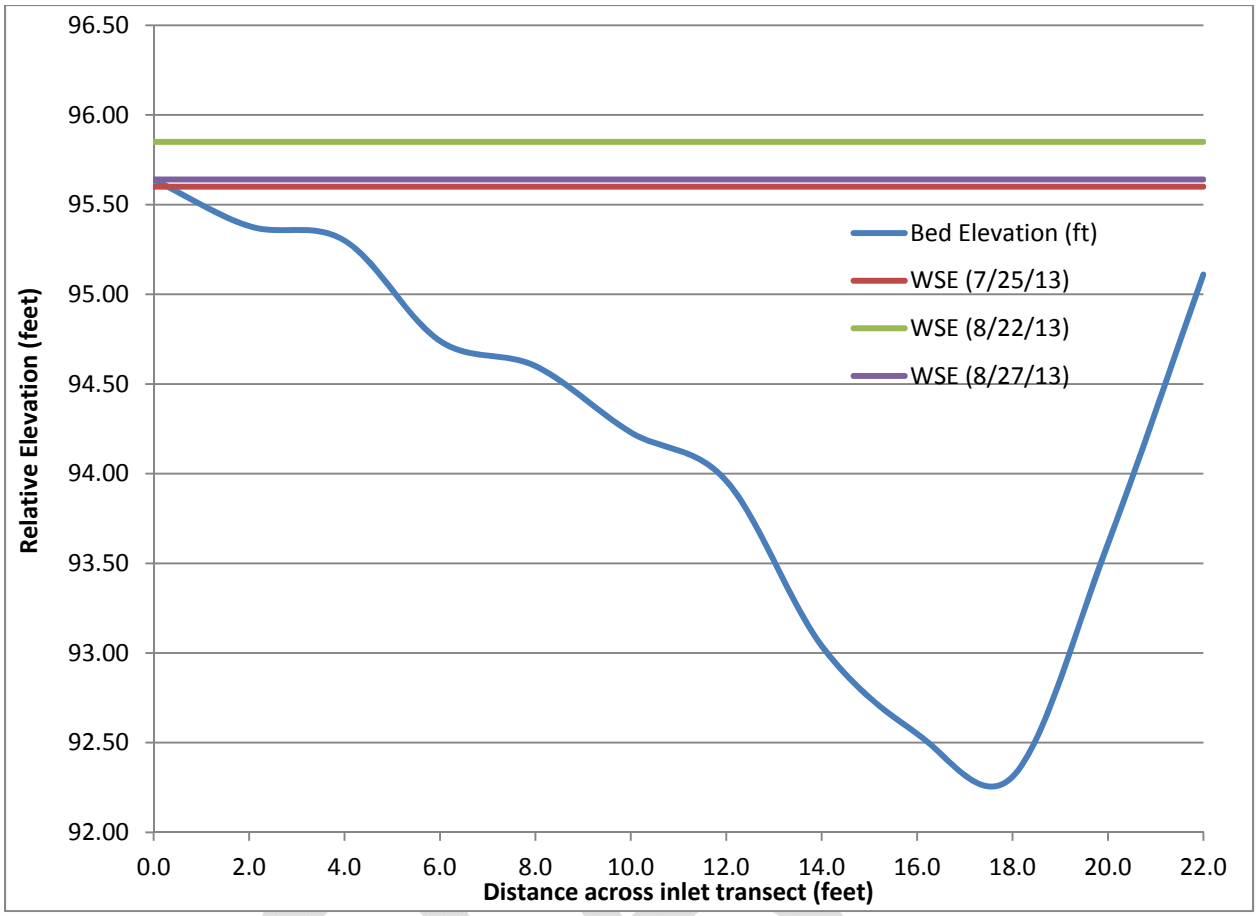


Figure 4-7. Bed and water surface elevations, redundant inlet to SC1, summer 2013.

The longitudinal survey of the SC1 included photo documentation and systematic collection of physical habitat measurements (Appendix 1 and 2). Channel width in the historic channel that existed prior to the 2012 restoration project ranged between 7.5 and 38.0 feet with a mean measured width of 18.6 feet (Table 4-3). Under low flow conditions, the average depth of measured cross sections in the historic channel ranged between 0.1 and 2.9 feet, with a mean of 1.0 feet (Table 4-3). Similarly, channel width in the created extension to SC1 ranged between 4.3 and 21.7 feet with a mean measured width of 12.7 feet. Under low flow conditions, the average depth of measured cross sections in the extension ranged between 0.1 and 1.9 feet, with a mean of 0.6 feet. Channel width in the created redundant inlet to SC1 ranged between 9.0 and 15.0 feet with a mean measured width of 11.5 feet. Under low flow conditions, the average depth of measured cross sections in the extension ranged between 0.5 and 1.9 feet, with a mean of 0.8 feet. Substrates were predominantly fine grained in the newly created extension and redundant inlet (Appendix 2). Relatively larger substrate material was present in the historic channel dominated by rubble, cobble, and gravels (coarse and fine). LWD was well distributed throughout the SC1 complex including the newly created and historic channels. The riparian community within the historic channel was well established but heavily impacted by the presence of knotweed (Appendix 1). Evidence of the first year of knotweed treatment efforts, financed through the Fish Habitat Enhancement Plan's Habitat Enhancement Account, was notable. Riparian vegetation planted along the banks of the extension and redundant inlet was well established with excellent survival noted after year 1.

Page: 19

Number: 1 Author: Owner Subject: Sticky Note Date: 10/17/2013 8:03:41 PM

was physical habitat identified? Pools, riffles, etc?? It is difficult to tell what the purpose of these measurements were.

Presler, Dawn

From: Applegate, Brock A (DFW) <Brock.Applegate@dfw.wa.gov>
Sent: Friday, October 18, 2013 4:28 PM
To: Presler, Dawn; 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); 'Leonetti, Frank' (frank.leonetti@snoco.org); Anne Savery; Maynard, Chris (ECY); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith; Beecher, Hal (DFW); Bails, Jamie L (DFW); Whitney, Jennifer L (DFW); Allegro, Justin K (DFW)
Subject: RE: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment
Attachments: A-LA 5 Side Channel Enhancement Ramp Rate Evaluation comment letter.pdf

Hi Dawn, Please see attached comment letter for more detail. WDFW thinks you have address channel connectivity, but may not have addressed classic bar stranding from ramping rates in the side channels. Please consult with the ARC so that we can address all issues from ramping rates.

Thank you for your consultation.

Sincerely, Brock

Brock Applegate
Major Projects Mitigation Biologist
Washington Department of Fish and Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012-1541

(425) 775-1311 x310
(360) 789-0578 (cell)
(425) 338-1066 (fax)

From: Presler, Dawn [mailto:DJPresler@SNOPUD.com]
Sent: Friday, September 20, 2013 2:31 PM
To: 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); 'Leonetti, Frank' (frank.leonetti@snoco.org); Anne Savery; Applegate, Brock A (DFW); Maynard, Chris (ECY); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith
Subject: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment

Dear ARC,
Attached is the draft Side Channel Enhancement Ramp Rate Evaluation Report for your 30-day review and comments. Comments, if any, are due to me (with cc: to Keith) by October 20. If you have no comments regarding the draft report, an email stating so would be appreciated. Due to the size of the Appendix 1 photos (which is enormous), I have put that portion on CD and am mailing it to you. If you have any questions on the report, feel free to contact Keith at 425-783-1769.

Have a great weekend!

Dawn Presler
Sr. Environmental Coordinator
Generation Resources
(425) 783-1709
****
PUD No. 1 of Snohomish County

PO Box 1107
Everett, WA 98206-1107

State of Washington
Department of Fish and Wildlife
Major Projects Section
16018 Mill Creek Boulevard, Mill Creek, Washington 98012-1541

October 18, 2013

Public Utility District No. 1 of Snohomish County
C/o Dawn Presler
PO Box 1107
Everett, WA 98206-1107

Subject: **Comments on Draft Side Channel Enhancement Ramp Rate Evaluation Report (License Article 405) Sultan River, Washington, Henry M. Jackson Hydroelectric Project (FERC No. 2157)**

Dear Ms. Presler:

The Washington Department of Fish and Wildlife (WDFW) has reviewed the Draft Side Channel Enhancement Ramp Rate Evaluation Report (Report) for the Henry M. Jackson Hydroelectric Project (FERC No. 2157) (Project). WDFW has collaborated with Snohomish County Public Utility District No. 1 (SnoPUD) on various energy projects. WDFW appreciates your consultation over the Report before SnoPUD files it with the Federal Energy Regulatory Commission (FERC).

Overall, WDFW finds the Report only partially fulfilling the assessment of fish sensitivity to the established ramping rates. SnoPUD should consider two factors when considering ramping rates:

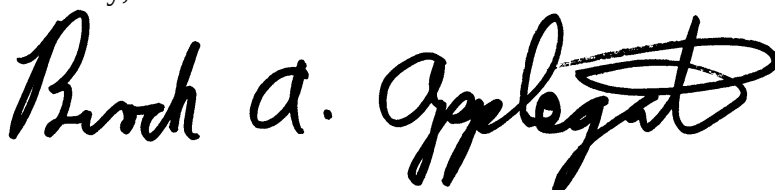
(1) The risk of trapping or stranding fish by declining flow and water surface elevation that cuts off a side channel from the main channel.

(2) The risk of conventional bar stranding as addressed by Hunter (1992) report and criteria.

The risk of bar stranding depends on (a) bank slope and (b) ramping rate. The study in the report focuses only on measuring inlet and outlet flow. The side channels and their associated downramping rates will have a higher risk for conventional bar stranding. The license has established higher ramping rates than the interim ramping rates recommended by WDFW (1995). WDFW finds your conclusion about suitability of the ramping rate premature. Please refer to the specific comments on page three below.

Thank you for sending us the Report for our review. WDFW looks forward to working with you on the Project as we proceed forward to implement the license. If you have any questions or need more information or clarification from the WDFW, please feel free to call me at (425) 775-1311 x310.

Sincerely,



Brock Applegate
Fish and Wildlife Biologist

Cc: Justin Allegro, WDFW Olympia
Jamie Bails, WDFW Mill Creek
Hal Beecher, WDFW Olympia
Jenni Whitney, WDFW Mill Creek

SPECIFIC COMMENTS REGARDING THE DRAFT SIDE CHANNEL ENHANCEMENT RAMP RATE EVALUATION REPORT (LICENSE ARTICLE 405) SULTAN RIVER, WASHINGTON, HENRY M. JACKSON HYDROELECTRIC PROJECT (FERC NO. 2157):

4.1 Side Channel 1, third paragraph. The text alludes to mean water depth, but does not state where the mean water depth occurs. Figures, 4-5 through 4-7 provide the mean water depth, but the paragraph does not really address concerns of ramping.

Table 4-2, page 11. Please include the lowest mainstem discharge surveyed in the caption. A reader could determine that 338 cubic feet per second (cfs) represented the lowest mainstem discharge by looking back at Table 4-1. Rather than recording minimum depth, which depends on where you measure along a cross-section, SnoPUD could have informed the reader better through the listing of the wetted width during changes over a range of flows. This type of information would have allowed us to consider the risk of conventional bar stranding.

4.1 Side Channel 1, third paragraph sentence and Table 4-3, page 13. The text and table report useful data, but the widest transects represent the most likely place for conventional bar stranding. Please include a detailed cross-section so that the reader may evaluate the risk of conventional bar stranding.

4.2 Side Channel 2. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 2.

Figure 4-10, page 14. This figure illustrates shallow gravel with little slope. WDFW recommends this area receive additional monitoring and analysis because it would have a higher probability of conventional bar stranding.

4.3 Side Channel 3. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 3.

4.4 Side Channel 4. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 4.

5. Discussion and Conclusions. The report only addresses the connectivity role of ramping rates. WDFW concurs with the conclusion that the report demonstrates that the side channel maintains connectivity. The report ignores the risk of conventional bar stranding, which the photographs show to have the greatest risk in Side Channel 2 outlet. Without a complete survey of the most sensitive areas in the side channels, the report cannot thoroughly address conventional bar stranding. We propose that SnoPUD may have prematurely assumed their ramping rate as suitable for the side channels. The license has established higher ramping rates than the interim ramping rates recommended by WDFW (1995), which may prove more risky for conventional bar stranding in the side channel.

Appendix 2, Side Channel 1 Extension. Overall, the shallow maximum depths and small difference between maximum and average depths, combined with the moderate widths suggest low risk of conventional bar stranding. However, some stations 20, 30, 39, 41, 49, 51, 62, 65, 67, 73, 90, 94, and 95 have an average depth considerably shallower than the maximum depth, so SnoPUD could find a higher risk of conventional bar stranding.

Appendix 2, Side Channel 1-Historic Channel. WDFW has the same concerns as for the Channel 1 Extension. Please concentrate on more data collection or analysis for Stations 1, 5-7, 12, 23, 42-46, 48, 51, 57, 66, 72, 85, 91, and 92.

Appendix 2, Side Channel 1 - Redundant Inlet, Side Channels 2-4. Please use the comments from the last two paragraphs and conduct similar analysis as suggested for Channel 1.

Literature Cited

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes and options for mitigation~ Unpublished Technical Report. Washington Department of Fish and Wildlife, Olympia, Washington.

Washington Department of Fish and Wildlife, 1995. Draft Hydroelectric Project Assessment Guidelines 99pp.

Presler, Dawn

From: Binkley, Keith
Sent: Wednesday, October 30, 2013 5:28 PM
To: 'Anne Savery'
Cc: Daryl Williams; 'frank leonetti'; 'brock.applegate@dfw.wa.gov'
Subject: RE: Ramping Rate Evaluation Plan

The final report will be more comprehensive. I realize the draft was rushed.

Keith

-----Original Message-----
From: Anne Savery [mailto:asavery@tulaliptribes-nsn.gov]
Sent: Wednesday, October 30, 2013 1:05 PM
To: Binkley, Keith
Cc: Daryl Williams; 'frank leonetti'; 'brock.applegate@dfw.wa.gov'
Subject: RE: Ramping Rate Evaluation Plan

Keith
You are welcome. What are your next steps based upon the comments you have received from us on the adequacy of the evaluation and report?
Anne

_____
From: Binkley, Keith [KMBinkley@SNOPUD.com]
Sent: Tuesday, October 29, 2013 4:16 PM
To: Anne Savery
Cc: Daryl Williams; 'frank leonetti'; 'brock.applegate@dfw.wa.gov'
Subject: RE: Ramping Rate Evaluation Plan

Thank you for your continued constructive input, Anne.

Keith

-----Original Message-----
From: Anne Savery [mailto:asavery@tulaliptribes-nsn.gov]
Sent: Tuesday, October 29, 2013 2:58 PM
To: Binkley, Keith
Cc: Daryl Williams; frank leonetti; brock.applegate@dfw.wa.gov
Subject: RE: Ramping Rate Evaluation Plan
Importance: High

Keith
My apologies for the timing of these comments, I don't want to disrupt your progress; but we are dissatisfied with the downramping assessment effort.

The focus of the effort on the connectivity of the upstream and downstream ends of the sidechannels misses the issue of assessing juvenile stranding during downramping events. Juvenile rearing habitats in the side channels where stranding may occur during downramping events were not identified - these are margin areas and hydraulic controls such as riffles. If the river drops 1- 4" an hour, we don't know what happens at the hydraulic controls within the sidechannels, regardless of the fact that the sidechannel is connected at the upstream end. As habitat evolves in the sidechannels there will be areas that aggrade and become very shallow and there is potential that flow will not be continuous within the sidechannels at all times. The areas of aggradationo (hydraulic controls) are the areas that should have been assessed during the ramping evaluation - not the connections with the mainstem. The

ARC has assurances that the PUD will maintain side channel connectivity with the mainstem - so that is not a data gap for the technical representatives on the ARC, even before the results of the side channel ramping rate evaluation plan. It is within the body of the sidechannels and the risks of dewatering at the hydraulic controls that concern us with respect to juvenile fish. This remains a data gap after the study.

Frank Leonetti said pretty much the same thing in his email, which is also below. What is needed is 1) a longitudinal survey of the hydraulic controls (channel bottom and water level at X cfs) within each side channel - location and elevation, 2) visual observation and physical measurement of water elevations at the hydraulic controls at 2 to 3 flows - or just the minimum in the Lower Sultan - this obtains a depth of water within the hydraulic control, 3) a measured assessment (depth and width) of how the water level changes at the hydraulic controls when flows drop - we could chose 1, 2, 3 or 4 inches per hour.

I'd like to bring Frank Leonetti and Brock Applegate back into this discussion - as they too submitted comments on the study. I noticed that the summary of the October 16 ARC meeting stated that no comments were received (#8).

For the record, I am attaching my comments that I sent in on October 18, 2013, plus the email comments I submitted below.

Forward anne's comments from Oct 18,2013 Thanks for the report. I went back to the original plan that was submitted to FERC and fault myself for not having reviewed it more thoroughly. That said, I don't find the report as carried out to be a satisfactory analysis of stranding risks within the side channel. The bulk of the analysis lies in the inlets and the outlets of the side channels, rather than in areas within the side channels where stranding would most likely occur - hydraulic controls such as shallow riffles. The lack of documentation of habitat units and identification of hydraulic controls is problematic, as we have no way to compare changes to habitat in the side channel or level of risk of stranding based habitat types and depths. We have no idea what will happen within shallow habitats in the side channel when the river drops 1 to 4 inches per hour in the 600-300 cfs flow range.

I agree with Frank that PUD should graph the long profile at 25 foot intervals with the maximum depth for each side channel with an eye to resurveying in the next few years.

I have included a few comments in the report.
Anne

From: Leonetti, Frank [frank.leonetti@snoco.org]
Sent: Thursday, October 17, 2013 11:14 AM
To: 'Presler, Dawn'; 'Tim_Romanski@fws.gov' (Tim_Romanski@fws.gov); 'Steven Fransen' (steven.m.fransen@noaa.gov); 'Loren Everest - USFS' (leverest@fs.fed.us); Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'Maynard, Chris (ECY)' (cmay461@ecy.wa.gov); Mick Matheson; 'Jim Miller' (JMiller@ci.everett.wa.us); Tom O'Keefe
Cc: Binkley, Keith
Subject: RE: JHP - draft Side Channel Ramp Rate Evaluation report - for your 30-day review and comment

Hi Dawn, thanks for the opportunity to review the Side Chan Ramp Rate Report (and the reminder yesterday) - here are a few comments on report. The comments are included as sticky notes in the attachment so youll have to scroll through. I'd recommend providing more detail in report for method documentation and repeatability for future comparison, and there is some uncertainty (to me) as to whether the selected cross sections are the right hydraulic controls to consider in the side channels in order to answer the specific study question. In particular, the cross section of the redundant inlet of SC1 appears to have been selected at the scour created by the ELJ. In Figure 4.1, however, it appears there is a relatively uniform and shallow riffle immediately downstream that is the hydraulic control point - which is also the location most likely to adjust with any sediment transport/aggradation or bank deformation (assuming the ELJ will continue to scour right in from of it). I think the long profile info

included in the appendix table is great and should be plotted (max depth by station). The longtitudinal profile area can be calculated as well as wetted area (for whatever the discharge was at the time). Other minor comments in the doc. Thanks. -Frank

Frank Leonetti | Senior Habitat Specialist Surface Water Management
[cid:image003.jpg@01CE051C.FDAF4B70]Snohomish County | Department of Public Works
3000 Rockefeller Ave, M/S 607, Everett, WA 98201
Phone: (425) 388-3464 x4249 | FAX: (425) 388-6455
EMAIL: Frank.Leonetti@snoco.org<mailto:Frank.Leonetti@snoco.org> | WEB: www.Snoco.org<http://www.snoco.org/>
From: Binkley, Keith [KMBinkley@SNOPUD.com]
Sent: Tuesday, October 29, 2013 1:55 PM
To: Anne Savery
Subject: Ramping Rate Evaluation Plan

Anne - Dawn alerted me that you may have some additional comments to the Ramping Rate Evaluation Plan. I am concerned as we are in well into the process of finalizing the report based on comments received to date and discussion at the most recent ARC meeting. Please let me know what's up?

Keith

Keith Binkley
Manager - Natural Resources Department
Generation Division
Snohomish County PUD
425 783 1769 (office)
425 293 6201 (mobile)

APPENDIX 4

Responses to Comments Regarding Draft Report

Comment No.	Comment	District Response to Comment
Snohomish County		
1.	I'd recommend providing more detail in report for method documentation and repeatability for future comparison, and there is some uncertainty (to me) as to whether the selected cross sections are the right hydraulic controls to consider in the side channels in order to answer the specific study question. In particular, the cross section of the redundant inlet of SC1 appears to have been selected at the scour created by the ELJ. In Figure 4.1, however, it appears there is a relatively uniform and shallow riffle immediately downstream that is the hydraulic control point – which is also the location most likely to adjust with any sediment transport/aggradation or bank deformation (assuming the ELJ will continue to scour right in from of it). I think the long profile info included in the appendix table is great and should be plotted (max depth by station). The longtitudinal profile area can be calculated as well as wetted area (for whatever the discharge was at the time).	Maps with coordinates have been added for the stations where measurements were taken. Survey is repeatable. Additional figures have been presented to depict inlet topography at the river interface and at the downstream hydraulic control. Additional figures for longitudinal profiles have been added. Wetted area could be easily calculated. With the exception of a few locations, all measurements of width were equivalent to toe-width under the lowest measured flow.
2.	Section 3, 3rd paragraph: The inlet cross section profiles dont appear to be consistent with selection of hydraulic controls such as riffle crests, which would be float	Additional figures have been added to capture topography at interface with river and at hydraulic control.
3.	Section 3, 4th paragraph: Were locations for channel measurements at random locations, regular intervals? "Systematic" can imply different things. Were locations of width measurement monumented for repeat survey in future years? Also I recommend your LWD tally be consistent with other local/regional protocols for minimum size criteria and sample methodology - State TFW protocols are good place to start. At County we base all wood counts on minimum size of 10cm diameter and 2 meters length. I'd expand you methods section to be more specific about criteria and measurement method for each of selected hab characteristics.	Locations for channel measurements were at regular intervals (25 feet for the SC1 complex and 33 feet for SC2, SC3, and SC4). Locations for width measurements were monumented by latitude and longitude at 100-foot intervals for repeat surveys in future years. Map has been added to Appendix 2. While LWD was tallied during this survey it was more as a notation and does not reflect the protocols that will be employed during the riverine habitat surveys, consistent with Revised Study Plan (RSP) 18 conducted as part of the Project's relicensing effort. Per License Article 410, the Fisheries and Habitat Monitoring Plan, the riverine habitat surveys will be conducted after high flow or other major event during the Year 1 to 10 timeframe and then after 5-year intervals starting in Year 15. The RSP 18 provides the baseline for these future surveys.
4.	Figure 4-1: Seems to me your cross sections should be at	See District's Response to Comment 2.

	existing riffle crest or other flow control feature, not at deepest location next to ELJ?	The District has data at both locations. The challenge at the inlets for SC1 (both historic and redundant) is that they are still in a post construction state and have not been subjected to a high flow. Erosion tied to deformation is evident at the small island upstream of the historic inlet to SC1. Both inlets were graded during construction and will be revisited after being subjected to channel maintenance or channel forming flows.
5.	Figure 4-5: This isn't the profile of a hydraulic control point.	Noted and corrected as described in previous comments.
6.	Section 4.2, 1st paragraph: I'd include more specific reporting of LWD based on the appendix tables? Is wood count only for placed structures?	Refer to District's Response to Comment 3 above. Wood count is for all wood (placed and already existing).
7.	Appendix 2: What measurements did you use to calculate mean? I'd plot the maximum depth as a function of length and highlight the minimum maximum locations (0.3 and 0.4) as potential locations to watch for stranding. You should also be able to plot the residual depth profile for future comparsion.	Depth was measured at 5 locations to establish the mean. Maximum depth will be plotted as a function of length.
Tulalip Tribes		
8.	Section 3, 3rd paragraph: Hydraulic controls need to be identified within the side channels, at riffles and pool tails, not in the deepest part of the channel. Having flow in the inlet and outlet does not necessarily mean that change in flow is the same within habitat units and margins within the side channel. Is this survey repeatable?	The challenge at the inlets for SC1 (both historic and redundant) is that they are still in a post construction state and have not been subjected to a high flow. They were both graded during construction and will be revisited after being subjected to channel maintenance or channel forming flows.
9.	Section 4.1 paragraph under Figure 4.7: was physical habitat identified? Pools, riffles, etc?? It is difficult to tell what the purpose of these measurements were.	These physical measurements were collected during low flow. One set of physical measurements was systematically collected under this low flow to characterize conditions. This information is complemented by photo documentation and engineering survey.
10.	My apologies for the timing of these comments, I don't want to disrupt your progress; but we are dissatisfied with the downramping assessment effort. The focus of the effort on the connectivity of the upstream and downstream ends of the sidechannels misses the issue of assessing juvenile stranding during downramping events. Juvenile rearing habitats in the side channels where stranding may occur during downramping	The ARC was provided an opportunity to comment on and provide input into the RRE Plan prior to submittal to the FERC (consultation documentation is included in Appendix 3). The District followed the FERC-approved RRE Plan for conducting the study. Further information was added to the final report as noted in the other comments. The District believes this study adequately addresses the concern for adoption of a more conservative

	events were not identified - these are margin areas and hydraulic controls such as riffles. If the river drops 1- 4" an hour, we don't know what happens at the hydraulic controls within the sidechannels, regardless of the fact that the sidechannel is connected at the upstream end. As habitat evolves in the sidechannels there will be areas that aggrade and become very shallow and there is potential that flow will not be continuous within the sidechannels at all times. The areas of aggradationo (hydraulic controls) are the areas that should have been assessed during the ramping evaluation - not the connections with the mainstem. The ARC has assurances that the PUD will maintain side channel connectivity with the mainstem - so that is not a data gap for the technical representatives on the ARC, even before the results of the side channel ramping rate evaluation plan. It is within the body of the sidechannels and the risks of dewatering at the hydraulic controls that concern us with respect to juvenile fish. This remains a data gap after the study. Frank Leonetti said pretty much the same thing in his email, which is also below. What is needed is 1) a longitudinal survey of the hydraulic controls (channel bottom and water level at X cfs) within each side channel - location and elevation, 2) visual observation and physical measurement of water elevations at the hydraulic controls at 2 to 3 flows - or just the minimum in the Lower Sultan - this obtains a depth of water within the hydraulic control, 3) a measured assessment (depth and width) of how the water level changes at the hydraulic controls when flows drop - we could chose 1, 2, 3 or 4 inches per hour. I'd like to bring Frank Leonetti and Brock Applegate back into this discussion - as they too submitted comments on the study. I noticed that the summary of the October 16 ARC meeting stated that no comments were received (#8). Forward anne's comments from Oct 18,2013 Thanks for the report. I went back to the original plan that was submitted to FERC and fault myself for not having reviewed it more thoroughly. That said, I don't find the report as carried out to be a satisfactory analysis of stranding risks within the side channel. The bulk of the analysis lies in the	downramping rates relative to side channel morphology within the normal range of project operations. The District did identify areas within the SC1 extension that warrant additional (post high flow) monitoring. Surveys have not been conducted for flows below the normal minimum instream flow of 300 cfs. As such, the District will implement the most conservative rate for downramping possible for flows below 300 cfs, recognizing equipment limitations, until surveys indicate that a less conservative rate is acceptable.

	inlets and the outlets of the side channels, rather than in areas within the side channels where stranding would most likely occur - hydraulic controls such as shallow riffles. The lack of documentation of habitat units and identification of hydraulic controls is problematic, as we have no way to compare changes to habitat in the side channel or level of risk of stranding based habitat types and depths. We have no idea what will happen within shallow habitats in the side channel when the river drops 1 to 4 inches per hour in the 600-300 cfs flow range. I agree with Frank that PUD should graph the long profile at 25 foot intervals with the maximum depth for each side channel with an eye to resurveying in the next few years.	
WA Department of Fish and Wildlife		
11.	Overall, WDFW finds the Report only partially fulfilling the assessment of fish sensitivity to the established ramping rates. SnoPUD should consider two factors when considering ramping rates: (1) The risk of trapping or stranding fish by declining flow and water surface elevation that cuts off a side channel from the main channel. (2) The risk of conventional bar stranding as addressed by Hunter (1992) report and criteria. The risk of bar stranding depends on (a) bank slope and (b) ramping rate. The study in the report focuses only on measuring inlet and outlet flow. The side channels and their associated downramping rates will have a higher risk for conventional bar stranding. The license has established higher ramping rates than the interim ramping rates recommended by WDFW (1995). WDFW finds your conclusion about suitability of the ramping rate premature. Please refer to the specific comments on page three below.	See District's Response to Comment 10.
12.	4.1 Side Channel 1, third paragraph. The text alludes to mean water depth, but does not state where the mean water depth occurs. Figures, 4-5 through 4-7 provide the mean water depth, but the paragraph does not really address concerns of ramping.	Text has been modified to clarify. Noted, those figures relate to flow connectivity.
13.	Table 4-2, page 11. Please include the lowest mainstem discharge surveyed in the caption. A reader could determine that 338 cubic feet per second (cfs) represented the lowest mainstem discharge by looking back at Table 4-1. Rather than recording minimum depth, which depends	Mainstem discharge added to caption for Table 4-2. Comment noted.

	on where you measure along a cross-section, SnoPUD could have informed the reader better through the listing of the wetted width during changes over a range of flows. This type of information would have allowed us to consider the risk of conventional bar stranding.	
14.	4.1 Side Channel 1, third paragraph sentence and Table 4-3, page 13. The text and table report useful data, but the widest transects represent the most likely place for conventional bar stranding. Please include a detailed cross-section so that the reader may evaluate the risk of conventional bar stranding.	Comment noted and addressed in report discussion.
15.	4.2 Side Channel 2. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 2.	Comment noted.
16.	Figure 4-10, page 14. This figure illustrates shallow gravel with little slope. WDFW recommends this area receive additional monitoring and analysis because it would have a higher probability of conventional bar stranding.	Comment noted.
17.	4.3 Side Channel 3. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 3.	Comment noted.
18.	4.4 Side Channel 4. Please apply the same comments from Side Channel 1section to the correlated headings, tables, and figures for Side Channel 4.	Comment noted.
19.	5. Discussion and Conclusions. The report only addresses the connectivity role of ramping rates. WDFW concurs with the conclusion that the report demonstrates that the side channel maintains connectivity. The report ignores the risk of conventional bar stranding, which the photographs show to have the greatest risk in Side Channel 2 outlet. Without a complete survey of the most sensitive areas in the side channels, the report cannot thoroughly address conventional bar stranding. We propose that SnoPUD may have prematurely assumed their ramping rate as suitable for the side channels. The license has established higher ramping rates than the interim ramping rates recommended by WDFW (1995), which may prove more risky for conventional bar stranding in the side channel.	Revised the Discussion and Conclusions section in the final report to be more comprehensive.
20.	Appendix 2, Side Channel 1 Extension. Overall, the shallow maximum depths and small difference between maximum and average	The Side Channel 1 Extension has not been subject to a high flow since construction. This fact, coupled with ongoing refinements to the flow

	depths, combined with the moderate widths suggest low risk of conventional bar stranding. However, some stations 20, 30, 39, 41, 49, 51, 62, 65, 67, 73, 90, 94, and 95 have an average depth considerably shallower than the maximum depth, so SnoPUD could find a higher risk of conventional bar stranding.	split at the confluence of the historic and redundant channels warrants revisiting in 2014. Stations have been noted for recommended future evaluation.
21.	Appendix 2, Side Channel 1-Historic Channel. WDFW has the same concerns as for the Channel 1 Extension. Please concentrate on more data collection or analysis for Stations 1, 5-7, 12, 23, 42-46, 48, 51, 57, 66, 72, 85, 91, and 92.	Stations have been noted for recommended future evaluation.
22.	Appendix 2, Side Channel 1 - Redundant Inlet, Side Channels 2-4. Please use the comments from the last two paragraphs and conduct similar analysis as suggested for Channel 1.	Comment noted.