



*Energizing Life in Our Communities*

April 29, 2019

Kimberly D. Bose, Secretary  
Nathaniel J. Davis, Sr., Deputy Secretary  
Federal Energy Regulatory Commission  
888 First Street NE  
Washington, DC 20426

**Re: Jackson Hydroelectric Project, FERC No. 2157  
License Article 402 – Marsh Creek Slide Modification Effectiveness Report**

Dear Secretary Bose:

With this letter, Public Utility District No. 1 of Snohomish County (the District) is filing its Marsh Creek Slide (MCS) Modification Effectiveness Report for the Jackson Hydroelectric Project (Project), per License Article 402. This report documents the results of the effectiveness of the initial rockslide modifications to improve fish passage within six months of the sixth-year anniversary date of the filing of the MCS Modification Report; the MCS Modification Report was filed with the Commission on November 1, 2012. The attached report was provided to the Aquatic Resources Committee for a 30-day review and comment period; consultation documentation is included in the appendices.

If you have any questions regarding the report, please do not hesitate to contact Keith Binkley, Natural Resources Manager, at (425) 783-1769.

Sincerely,

*/s/ Tom DeBoer*

Tom DeBoer  
Assistant General Manager of Generation, Power, Rates and Transmission Management  
[TDeBoer@snopud.com](mailto:TDeBoer@snopud.com)  
(425) 783-1825

Enclosed: MSC Modification Effectiveness Report

cc: Aquatic Resource Committee

Jackson Hydroelectric Project  
FERC No. 2157

Marsh Creek Slide  
Modification Effectiveness Report  
(License Article 402)



*Everett, WA*

*April 2019*

**Final** – This document has been prepared for the District. It has been peer-reviewed by the District for accuracy and formatting based on information known at the time of its preparation and with that understanding is considered complete by the District. The document may be cited as:

*District. 2019. Marsh Creek Slide Modification Effectiveness Report for the Henry M. Jackson Hydroelectric Project, FERC No. 2157. April 2019.*

This document should not be cited or distributed without this disclaimer.

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## List of Acronyms and Abbreviations

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ARC	Aquatic Resource Committee
C	Celsius
CFS	cubic feet per second
District	Public Utility District No. 1 of Snohomish County
FERC	Federal Energy Regulatory Commission
MCS	Marsh Creek Slide
MW	Megawatt
Project	Henry M. Jackson Hydroelectric Project, FERC No 2157
RM	River Mile
USGS	United State Geological Survey

## 1. INTRODUCTION

Public Utility District No. 1 of Snohomish County (the District) owns and operates the 111.8 megawatt (MW) Henry M. Jackson Hydroelectric Project (Project) located on the Sultan River in Snohomish County, Washington. The District received a new 45-year license for the Project from the Federal Energy Regulatory Commission (FERC) on September 2, 2011 (FERC 2011), and a Section 401 Water Quality Certification Order from the Washington Department of Ecology (Ecology) on October 18, 2010. As a component of these orders and the Settlement Agreement, the District developed a Marsh Creek Slide (MCS) Monitoring and Modification Plan (MCS Plan).

On December 11, 2004, a natural landslide occurred in the Sultan River near Marsh Creek at River Mile (RM) 7.6. The Marsh Creek Slide blocked or impeded the passage of adult anadromous salmonids upstream of RM 7.6. During the relicensing process, the District conducted the Revised Study Plan No. 20 Phase 1: Fish Passage Assessment, Evaluation of Salmon and Steelhead Migration after a Landslide on the Sultan River (Ruggerone 2008) and the Revised Study Plan No. 24: Feasibility of Marsh Creek Slide Modification to Improve Fish Passage (CH2M Hill 2009). These plans analyzed whether the MCS was a hindrance to fish passage in the Sultan River and if so, whether modifications to the slide could improve passage.

During meetings with the Aquatic Resource Committee (ARC), modification of the slide was deemed necessary to provide safe, timely, and effective access to 2.1 miles of salmon and steelhead habitat up to the Diversion Dam, and an additional approximate 6 miles of historically available habitat upstream of the Diversion Dam after passage was implemented. The ARC anticipated that this measure would allow salmon and steelhead to fully utilize available spawning habitat upstream of the MCS.

As such, the District and ARC developed the MCS Plan and FERC approved it in License Article 402 with minor modifications. Modifications to the MSC were conducted by the District's contractor in July 2012, as specified in the contract drawings. A MCS Modification Report was developed and filed with FERC in November 2012 detailing the methods used to modify the MCS.

Per License Article 402, the District is to provide an additional report that documents the results of the effectiveness of the initial rockslide modifications to improve fish passage within six months of the sixth-year anniversary date of the filing of the MCS Modification Report. This report serves as the additional report documenting effectiveness. The ARC was provided a 30-day review and comment period regarding the draft report.

## 2. MONITORING

Pursuant to MCS Plan's Section 4.1, the District monitored fish passage at the MCS by annually monitoring escapement in the reach upstream of the slide. The ARC agreed in the Settlement Agreement that if additional modifications are necessary, these modifications will be made no earlier than six years after the initial modification. This timeframe will allow time to evaluate the effectiveness of the initial modification after process flows and several fishery life cycles occur.

Subsequent to flow events exceeding 4,000 cfs instantaneous peak as measured at the Diversion Dam or a scheduled process flow pursuant to the Process Flow Plan, the District will conduct a visual inspection of the MCS to assess any movement and redistribution of substrate and to characterize changes in slide morphology related to these high flows.

### 2.1. Annual Escapement Monitoring

Monitoring escapement upstream and downstream the MCS represents an indicator of slide modification effectiveness. Each spring and fall, steelhead and Chinook salmon escapement surveys are conducted using established protocols with a target survey frequency of 10 to 14 days during their respective spawning seasons. Under the previous License, four established index areas existed on the Sultan River between the confluence with the Skykomish River at RM 0.0 and the Diversion Dam at RM 9.7. As part of the new License, and since the Diversion Dam volitional passage project was completed in late 2016, the District has created an additional index upstream of the Diversion Dam from RM 9.8 to RM 10.4. Following modifications to the MCS in 2012, Chinook redds have been documented upstream each spawning season from 2013 through 2018 (Table 1). Steelhead redds were found upstream of the MCS in each year following modification except in 2018 when escapement was extremely low (Table 1).

**Table 1. Number and percentage of Chinook and Steelhead redds upstream and downstream the MCS in years following modification.**

Chinook					
Year	Downstream Marsh Creek Slide		Upstream Marsh Creek Slide		Total Number Redds For Season
	Number	Percentage	Number	Percentage	
2013	138	98%	3	2%	141
2014	102	95%	5	5%	107
2015	126	89%	15	11%	141
2016	237	96%	11	4%	248
2017*	98	70%	42	30%	140
2018	216	92%	18	8%	234
Steelhead					
Year	Downstream Marsh Creek Slide		Upstream Marsh Creek Slide		Total Number Redds For Season
	Number	Percentage	Number	Percentage	
2013	37	79%	10	21%	47
2014	33	67%	16	33%	49
2015	61	82%	13	18%	74
2016	57	89%	7	11%	64
2017*	38	76%	12	24%	50
2018	17	100%	0	0%	17

\* First season with access upstream of the City of Everett Diversion Dam at River Mile 9.8.

### 2.2. Post High Flow Surveys

A channel forming flow occurred on March 16-17, 2014, and maintenance flows occurred on November 4-5, 2014; November 17-18, 2015; and February 4-5, 2018. Following each of these high flow events, biologists evaluated the MCS and no noticeable changes were identified. Photos following the most recent high flow event (February 4-5, 2018) are included in Appendix

A. Further, redds were documented upstream of the MCS in the following spawning season after each of these high flow events.

### 2.3. Seasonal Hydrology

Upstream of the MCS minimum flow is delivered at RM 9.7. During spring and fall, License Articles 412 (Whitewater Recreation Plan) and 416 (Process Flow Plan) require the occasional delivery of significantly greater volumes than what is required by the Settlement Agreement Aquatic License Article 9 (Minimum Flow). This introduces a range of flows over each spawning season and contributes to the large variation in mean daily discharge as measured at USGS gage number 12138000 (Table 2). Hydrographs during each spring (April 1 through June 30) and fall (September 10 through October 31) spawning season from years 2013 – 2018 can be found in Appendix B.

**Table 2. Mean ( $\pm$  S.D.) daily discharge during Steelhead and Chinook salmon spawning seasons in years post MCS modification.**

Steelhead			Chinook		
Year	Mean Daily Flow (cfs)	Standard Deviation	Year	Mean Daily Flow (cfs)	Standard Deviation
2013	165	71	2013	244	86
2014	153	61	2014	249	88
2015	140	47	2015	217	84
2016	166	48	2016	262	106
2017	158	59	2017	206	62
2018	203	122	2018	208	46

## 3. DISCUSSION

From December 2004 until its modification in July 2012, the MCS blocked or impeded passage of adult anadromous salmonids upstream of RM 7.6. Chinook and steelhead spawner surveys indicate that the initial modifications to the MCS have enhanced fish passage upstream of RM 7.6. Chinook salmon redds have been documented upstream of the slide in each consecutive year following modification. When Chinook redds are partitioned into pink and non-pink salmon years (odd and even years), each consecutive odd and even year cycle since 2012 has resulted in an increased percentage of redds found upstream of the MCS (Appendix C).

Steelhead redds have also been encountered upstream of the MCS in all years following modification except in 2018. Abundance of Snohomish/Skykomish winter run steelhead has been in decline since 2000 and returns were particularly poor in 2018. The Snohomish/Skykomish and the Sultan River had escapement estimates of 372 and 28 fish, respectively. The previous low for the Snohomish/Skykomish and Sultan was 732 fish (2010) and 56 fish (2011), respectively (WDFW 2019).

As such, the lack of redds upstream was due to low returns, and not a function of the MCS being a hindrance to fish passage. Further evidence to support this claim is that four months after the steelhead spawning season, Chinook salmon redds were documented upstream of the MCS.

There are no plans to modify the MCS area as the modifications are functioning as expected per the requirements of the MCS Plan.

#### **4. REFERENCES**

CH2M Hill. 2009. Fish Passage Feasibility at the Sultan River Diversion Dam. Phase 2 Assessment.

Powers, P. D., and J. F. Orsborn. 1985. Analysis of Barriers to Upstream Fish Migration. An Investigation of the Physical and Biological Conditions Affecting Fish Passage Success at Culverts and Waterfalls. Final Project Report. Part 4 of 4. Submitted to the Bonneville Power Administration, Portland, Oregon. Project No. 82-14. August 1985.

Ruggerone, G. 2008. Phase 1 Fish Passage Assessment. Evaluation of Salmon and Steelhead Migration after a Landslide on the Sultan River. Natural Resource Consultants, Inc.

WDFW. 2019. Escapement data Snohomish/Skykomish Winter Steelhead [Internet]. Last accessed February 13, 2019. Available from [https://fortress.wa.gov/dfw/score/score/species/population\\_details.jsp?stockId=6117](https://fortress.wa.gov/dfw/score/score/species/population_details.jsp?stockId=6117)



## **Appendix A**

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*Photos of Marsh Creek Slide Following High Flow Event on February 4-5, 2018*



**Photo A-1. Marsh Creek Slide following high flow event on February 4-5, 2018.**



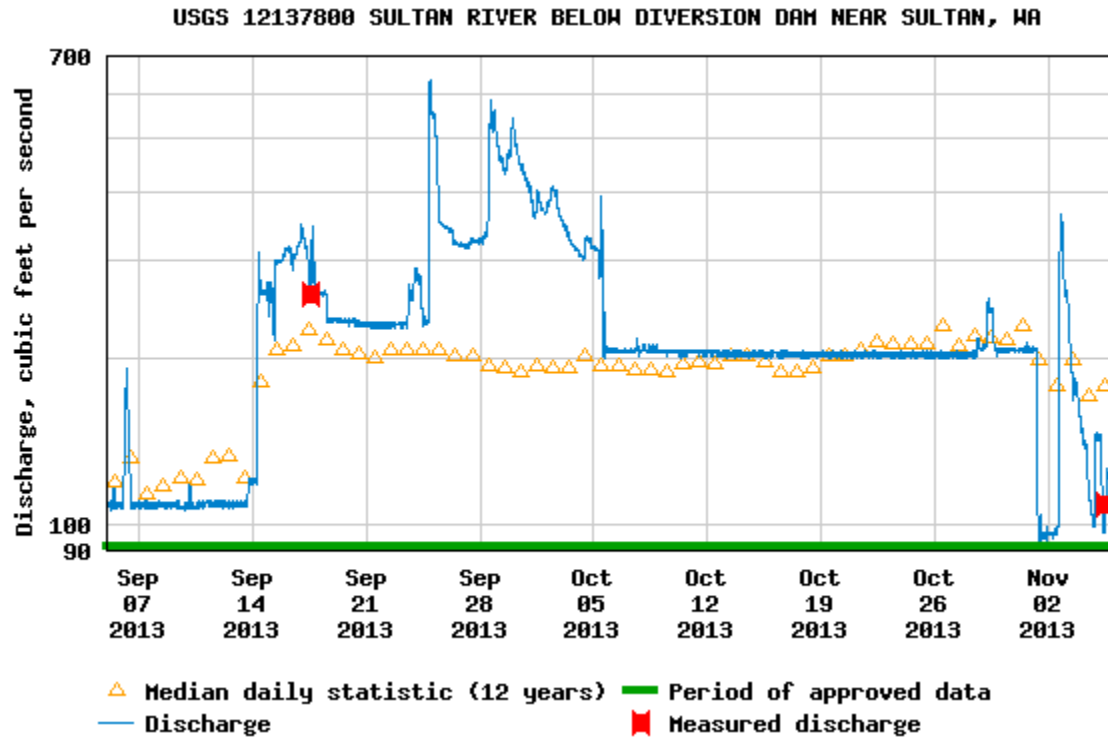
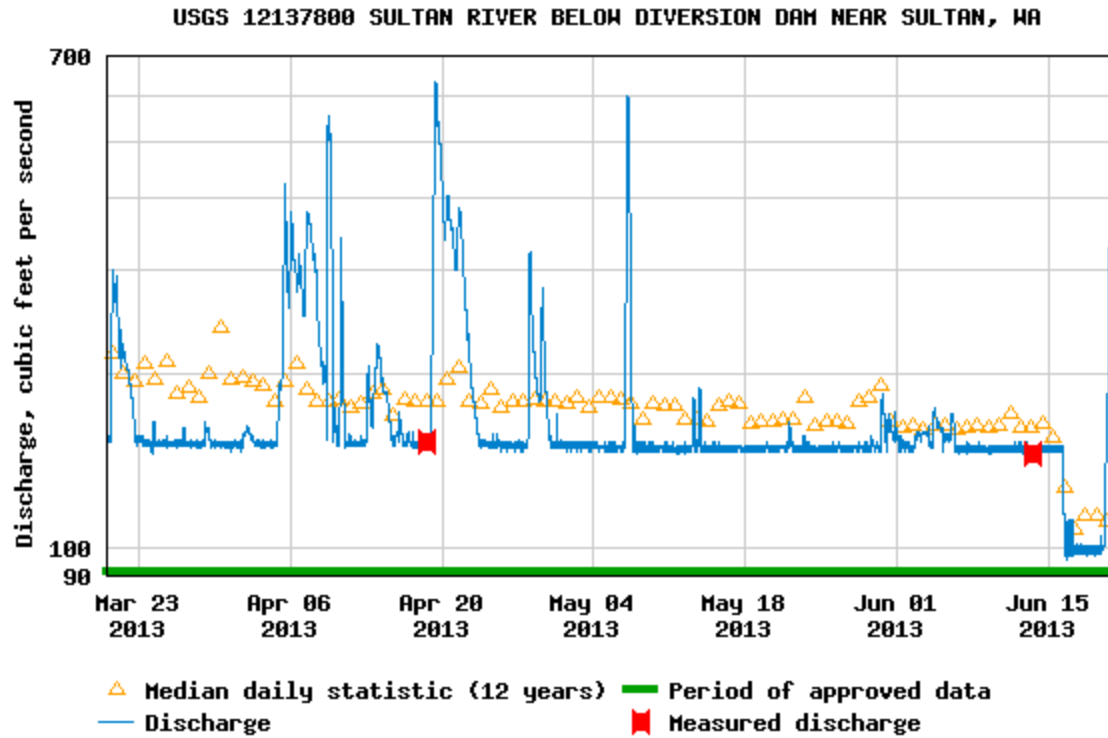


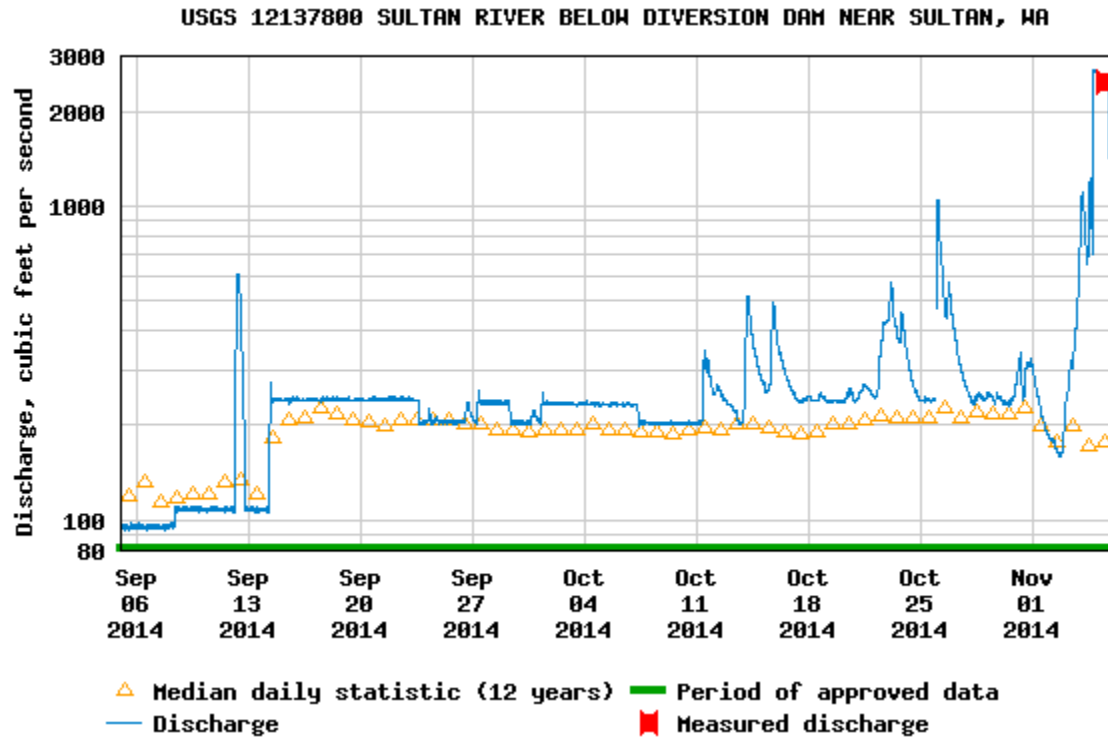
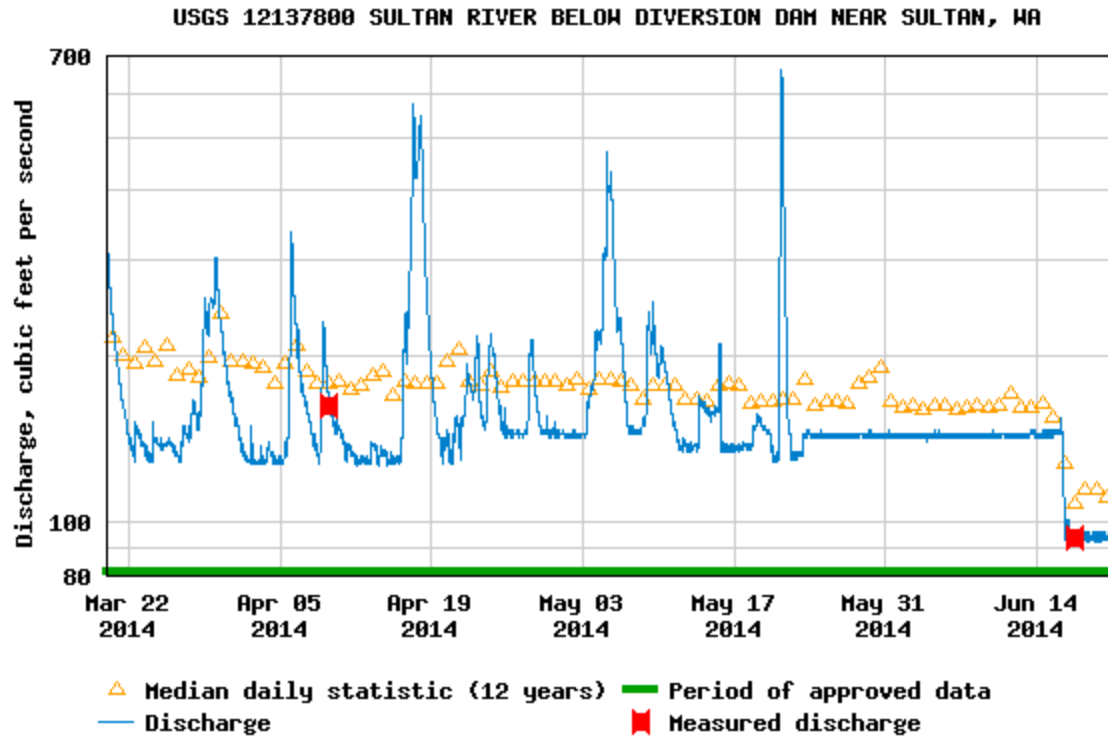
**Photo A- 2. Marsh Creek Slide following high flow event on February 4-5, 2018.**

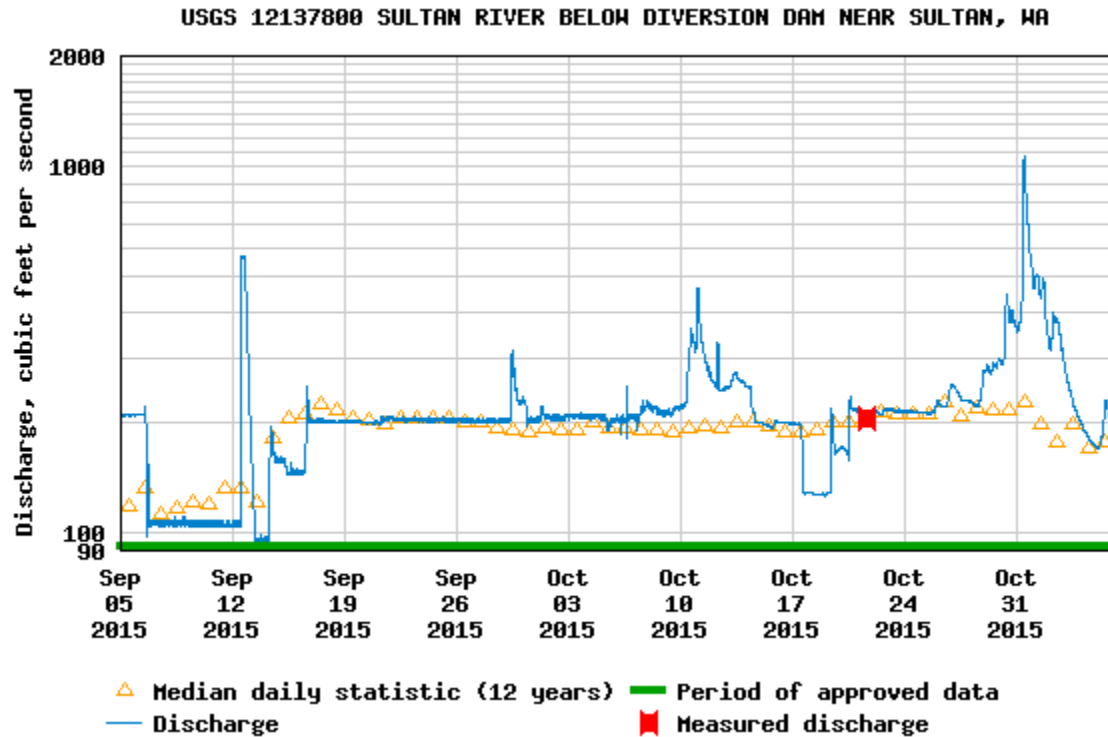
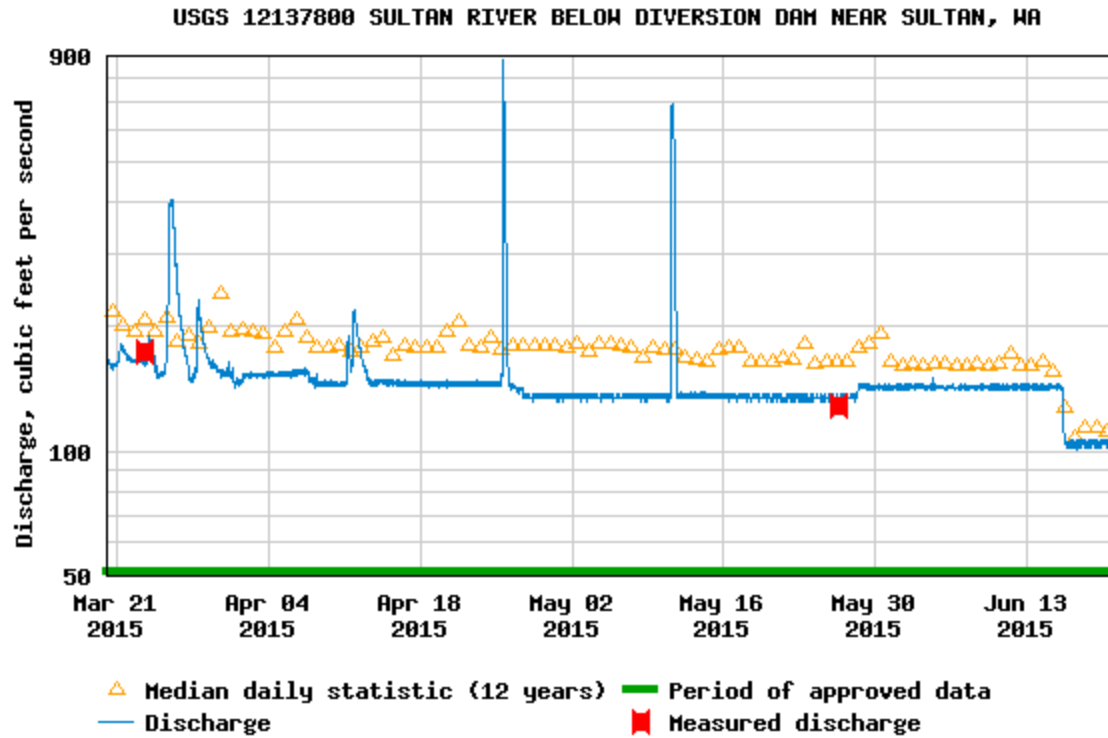
## **APPENDIX B**

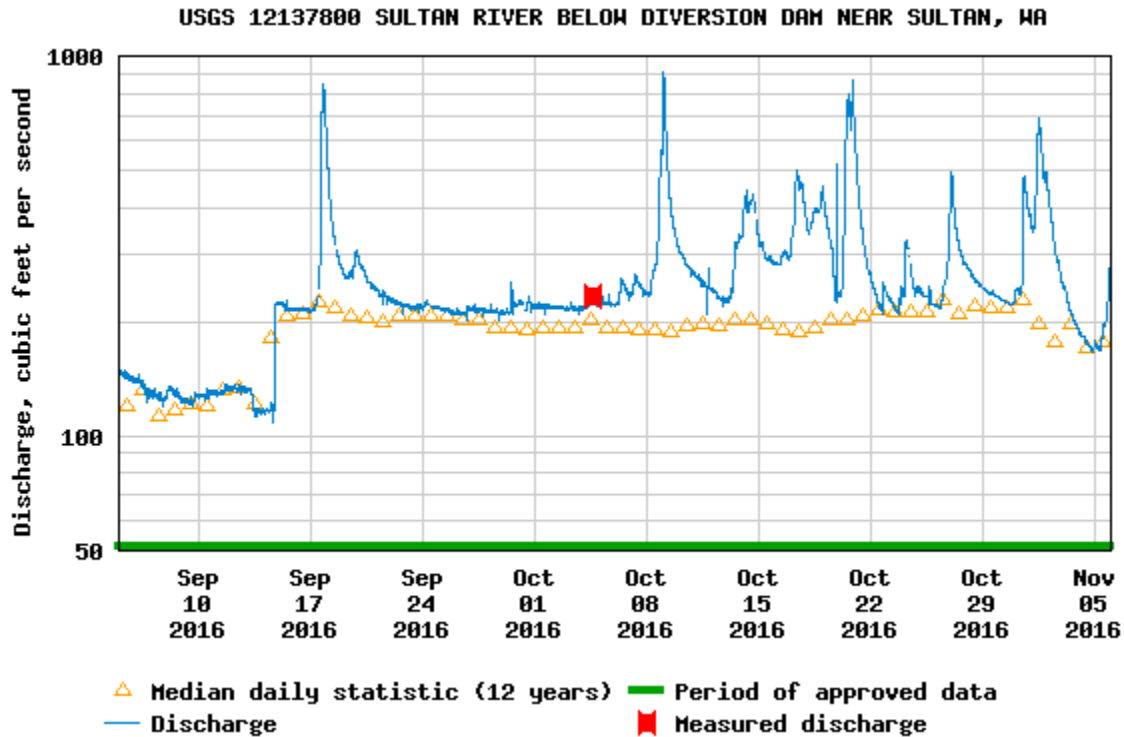
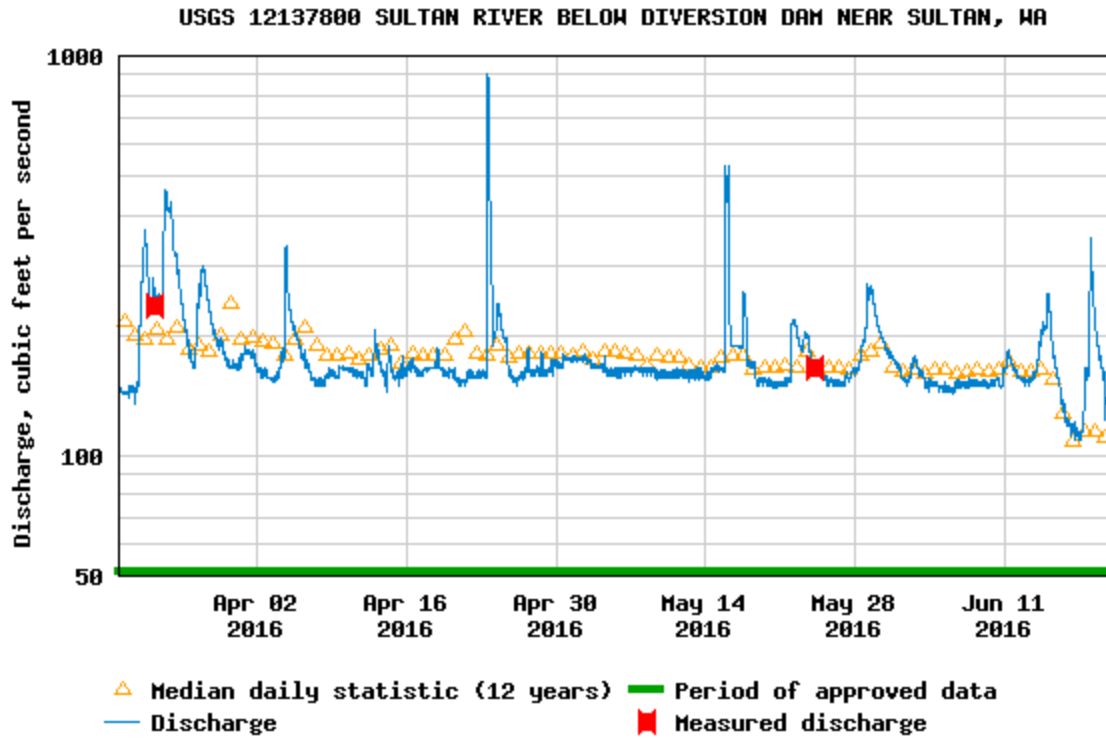
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### *Hydrographs During Steelhead and Chinook Spawning Seasons 2013-2018*

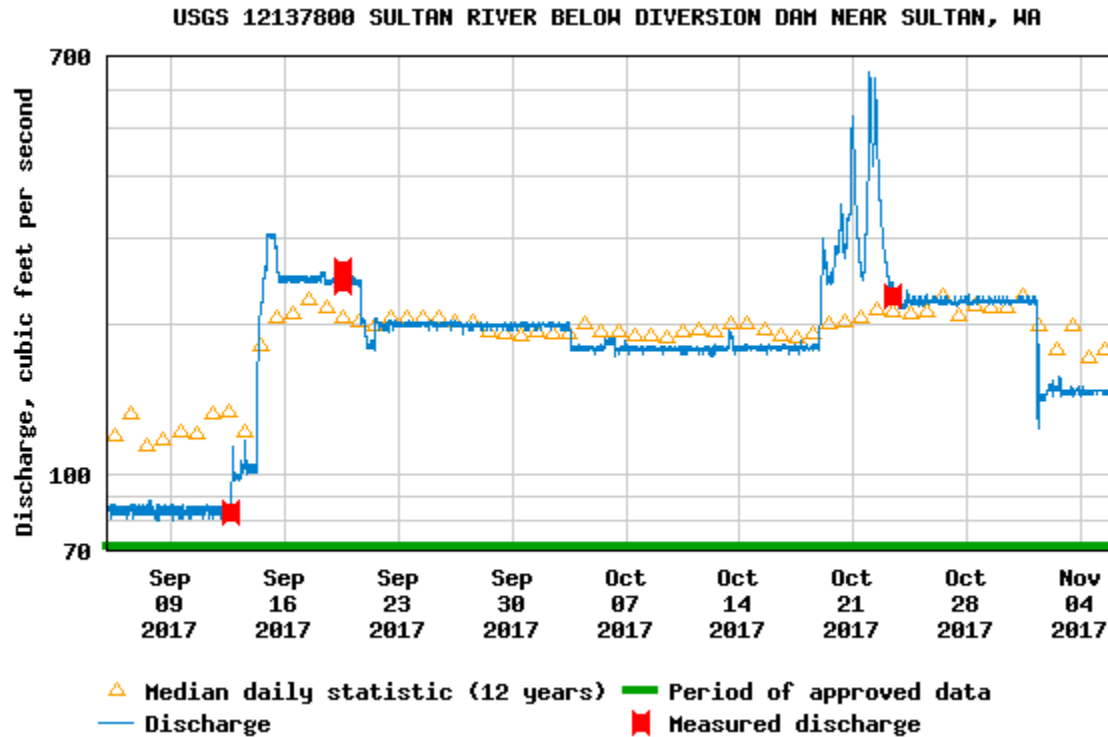
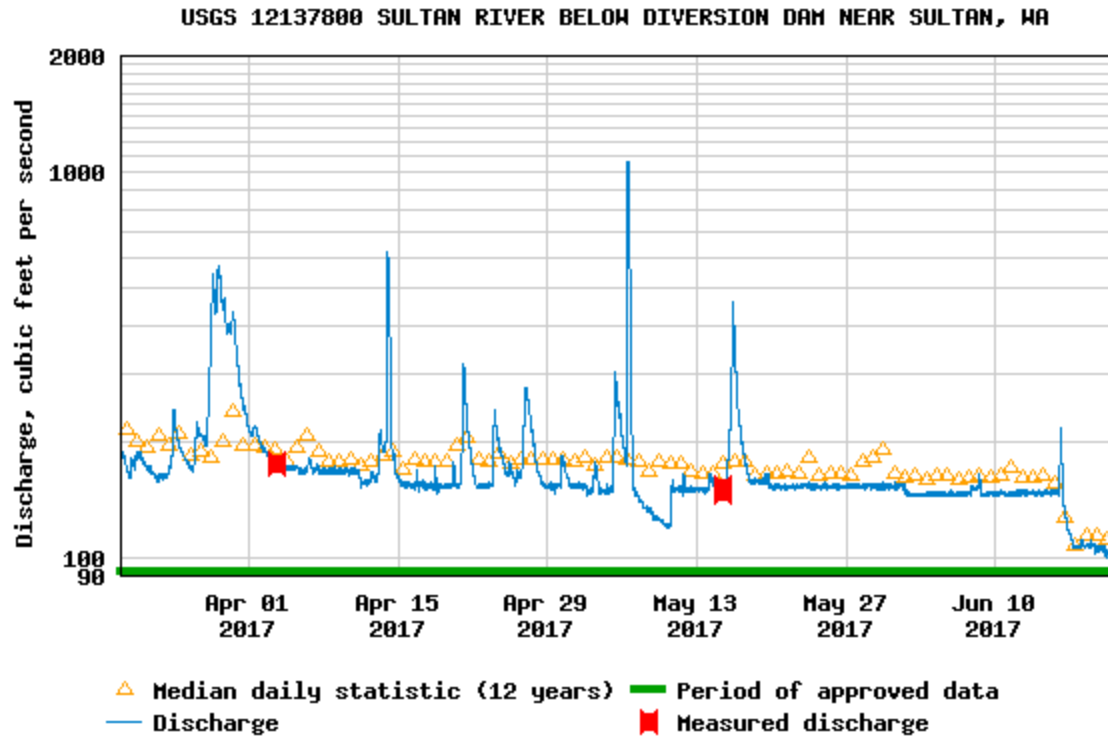


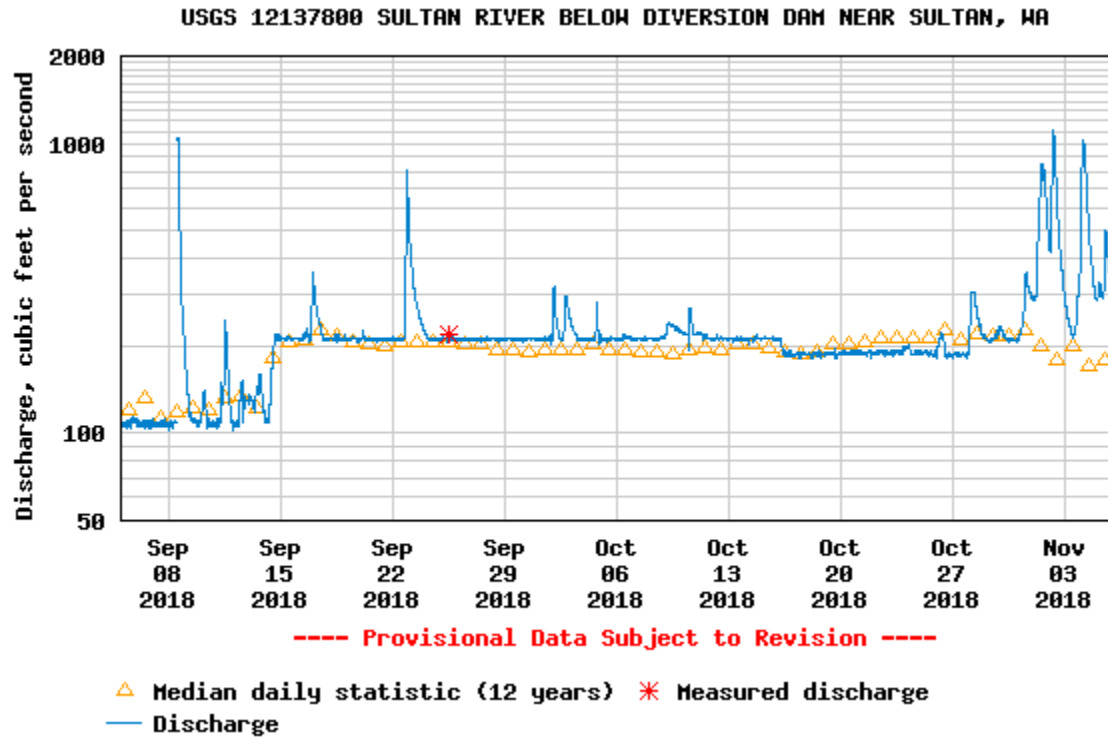
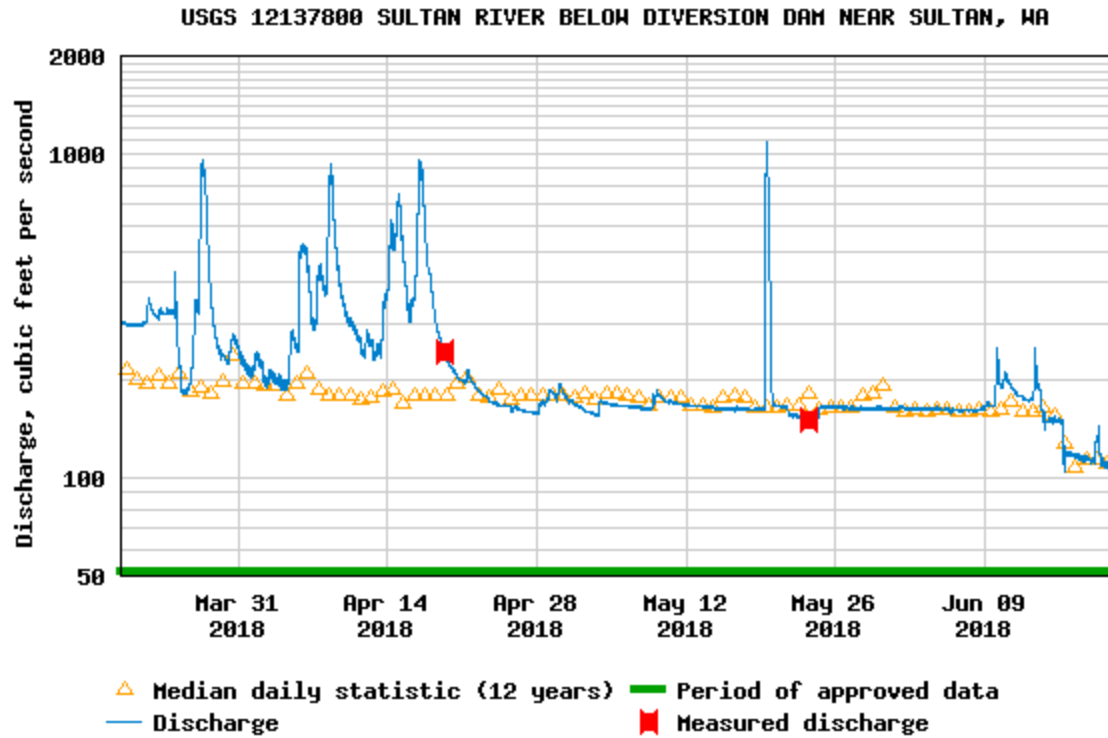












## **APPENDIX C**

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### *PowerPoint Presentation at Aquatic Resource Committee Meeting*

# Marsh Creek Slide Effectiveness

## Presentation Outline

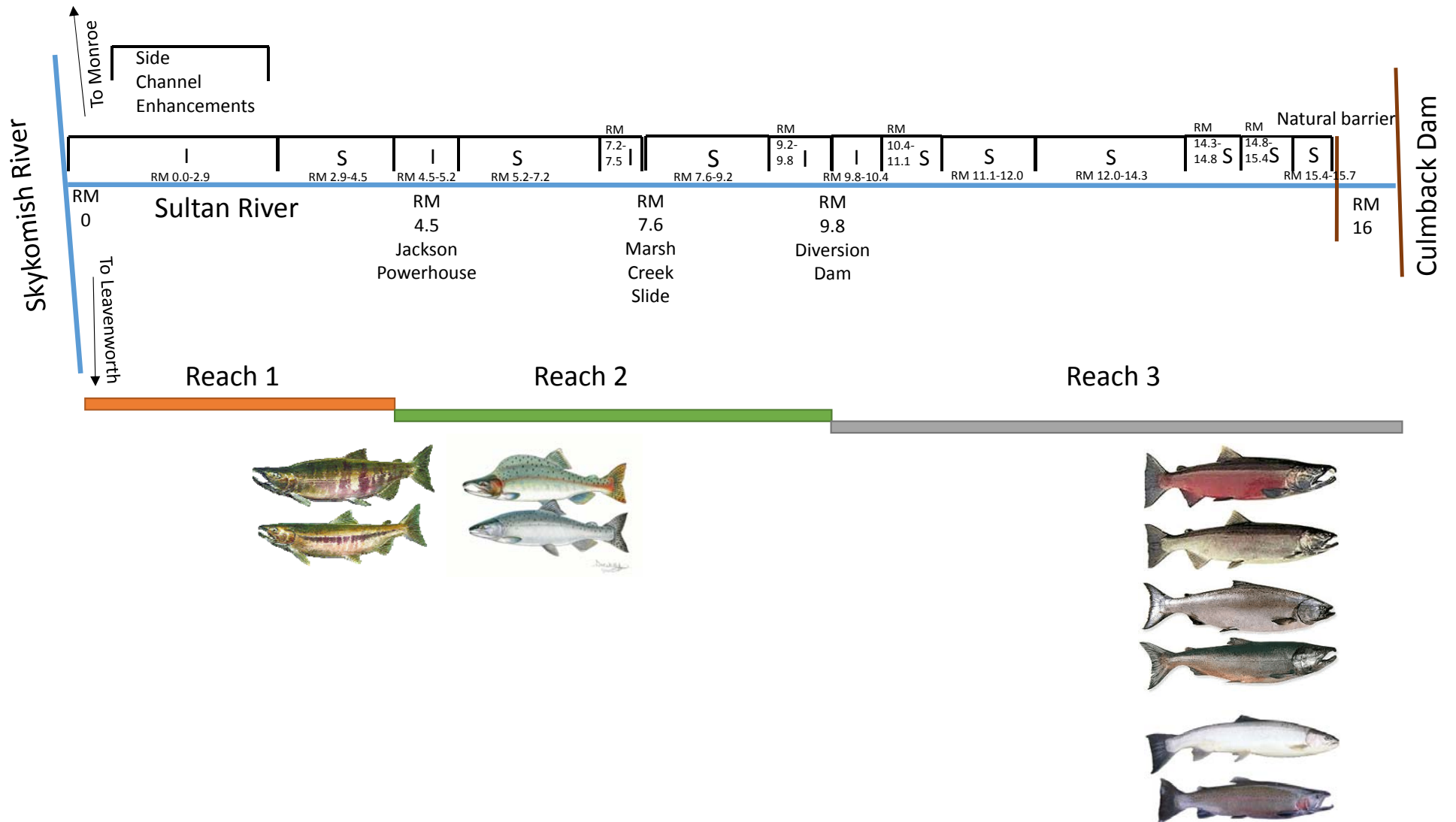
- History of the MCS
- Overview of fish distribution
  - Fall spawning chronology
  - Spawning grounds competition
- Indicators of effective passage since modification



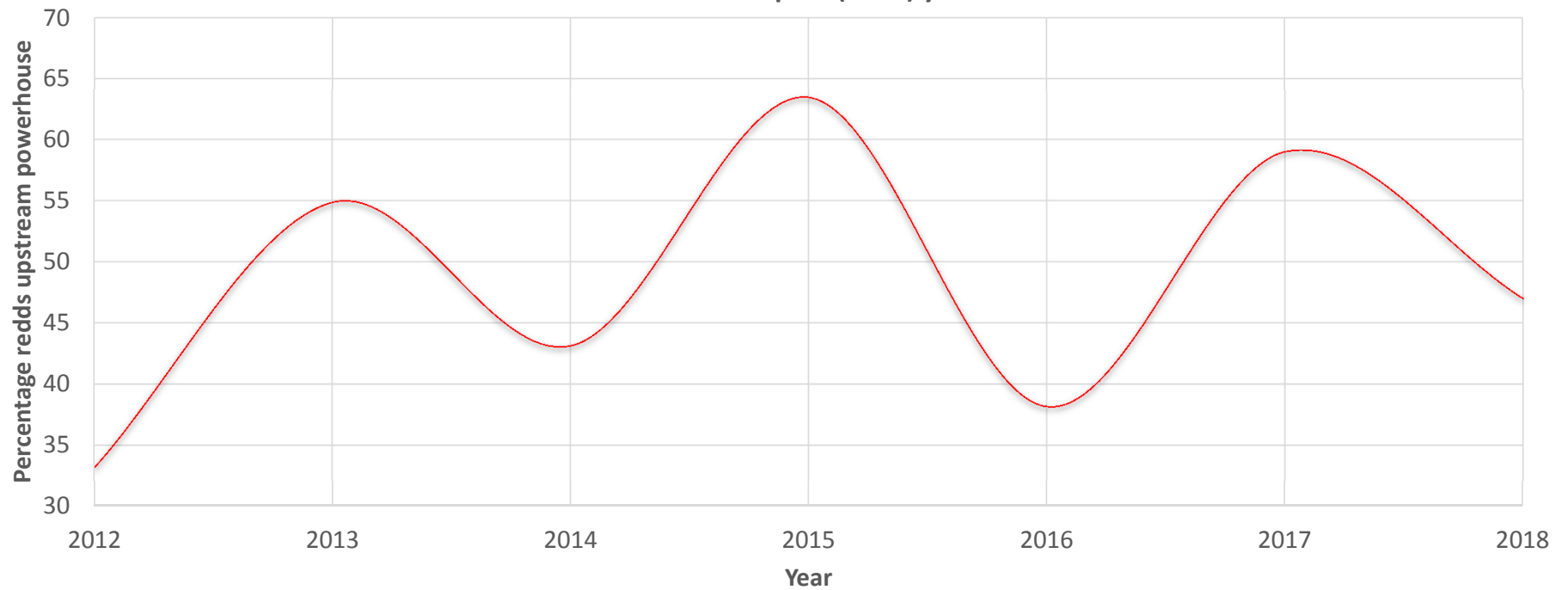
# History of the MCS

- Natural landslide occurred on December 11, 2004
- Downstream of Marsh Creek at RM 7.6
- Blocked upstream passage of adult anadromous salmonids
- Jackson relicensing efforts led to modification in 2012
- Provision: no modifications for 6 years after the initial modification

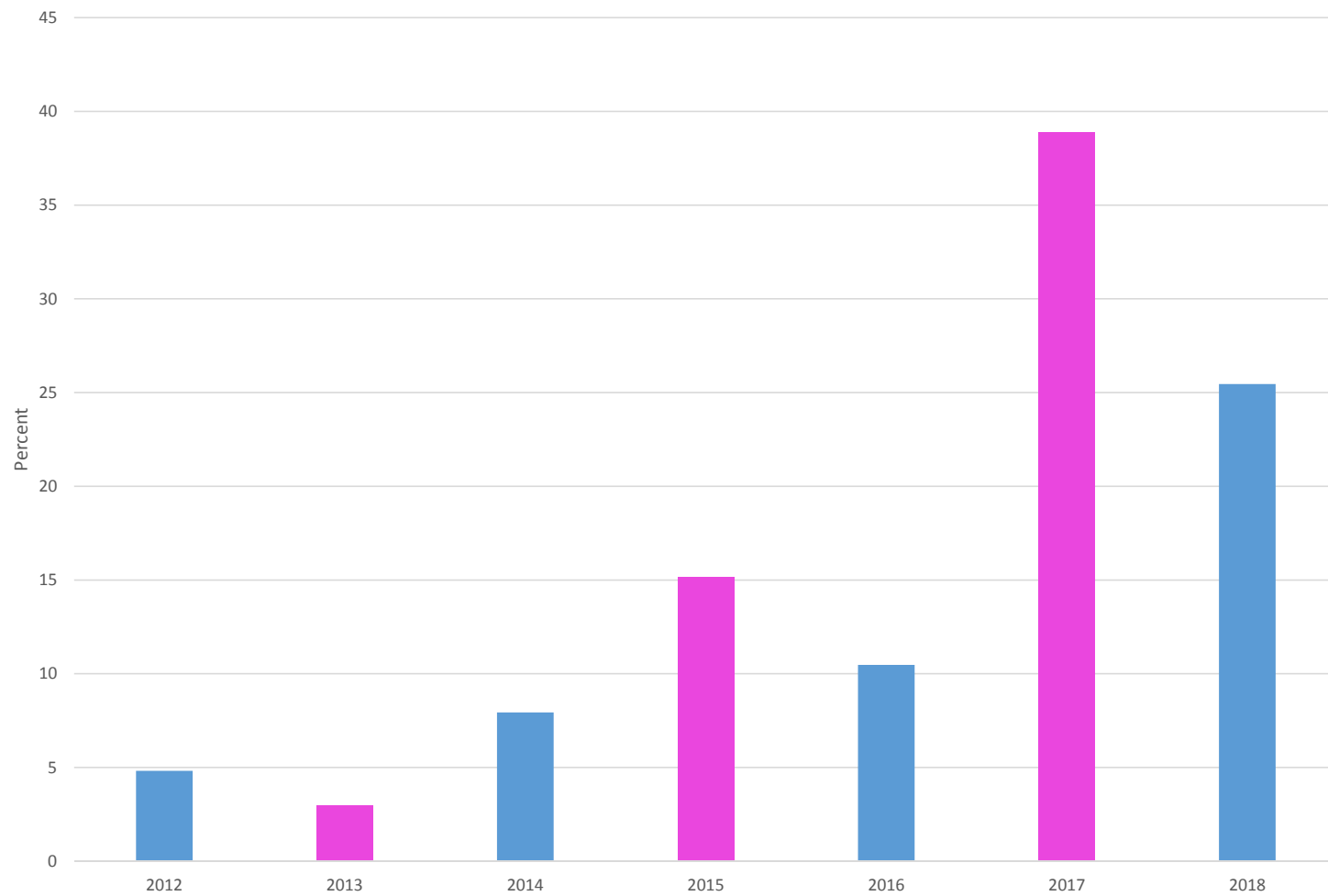




**Percentage of Chinook Redds Upstream of Powerhouse (RM 4.5) in pink (odd)  
and non-pink (even) years**



Percentage of redds above the powerhouse documented upstream of the MCS during pink and non-pink years 2012-2018

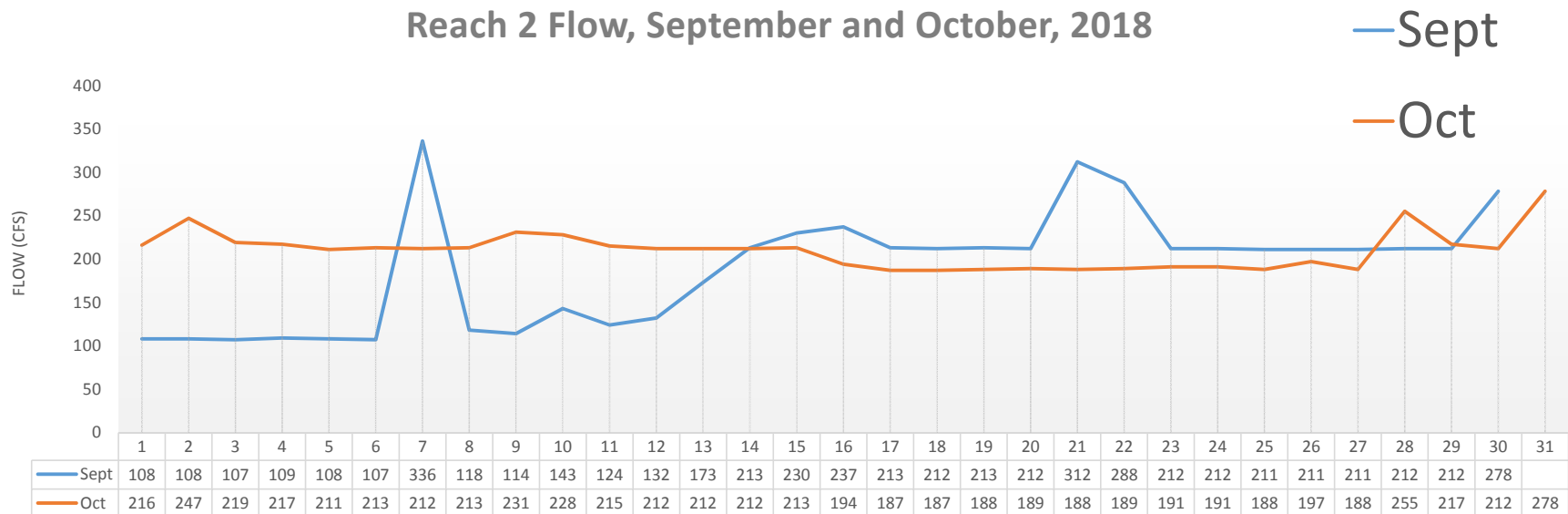




Supplemental Chinook spawner survey in reach upstream of MCS (RM 7.5-9.2) on Oct 23, 2018 (10 redds and 3 live fish).

Redds observed in Sept (8%)	18
Redds observed in Oct (92%)	216
Total	234

Redds upstream MCS for season (12%)	28
Total redds observed for season	234

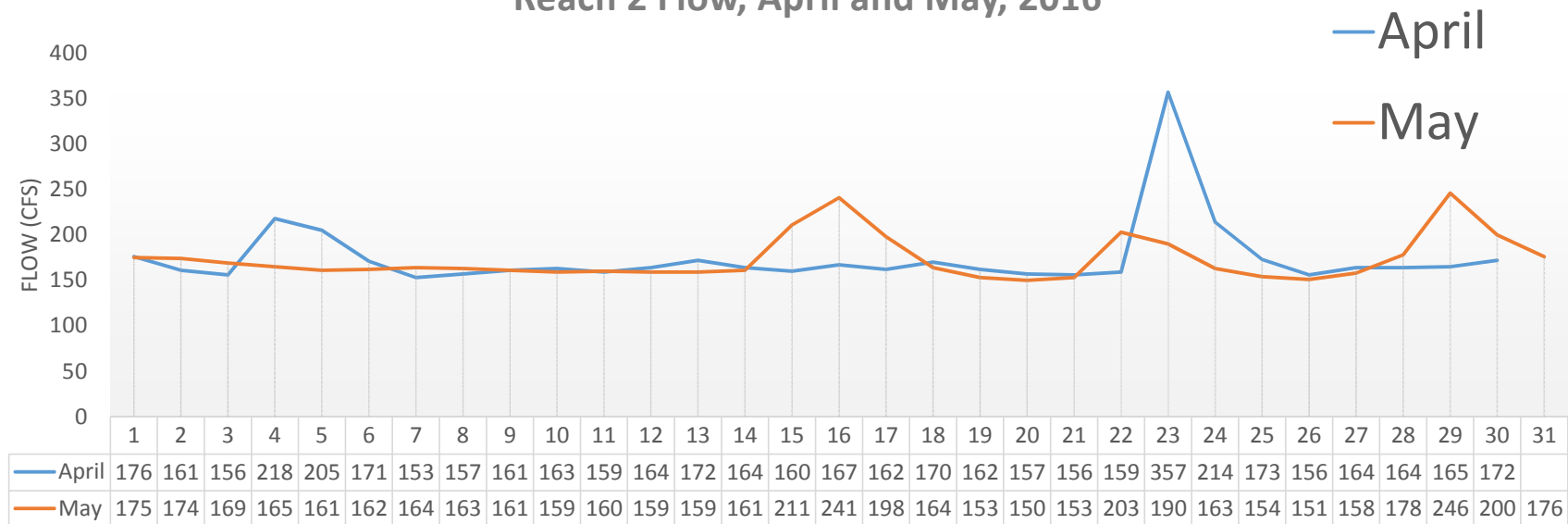


Supplemental steelhead spawner survey in reach upstream of MCS (RM 7.5-9.2) on May 12, 2016 (4 redds and no live fish).

Redds observed in April (34%)	22
Redds observed in May (61%)	39
Redds observed in June (5%)	3

Redds upstream MCS for season (10%)	7
Total redds observed for season	71

Reach 2 Flow, April and May, 2016



In the spawner survey index immediately downstream (RM 7.2-7.5) of MCS, the following table shows the number of Chinook redds that have been observed by year. A spawning riffle is located at the upper end of this index (approximately 50 meters downstream of MCS). If fish were unable to migrate passed MCS we would expect to see a high incidence of spawning at this riffle which is not the case. Occasionally we see a redd at this location but 95% of the spawning in this index occurs downstream of this riffle, mostly from RM 7.2 to 7.4.

Also, we have recovered 16 carcasses in this index from 2012-18 and have observed no incidence of pre-spawning mortality.

River Mile 7.2-7.5			
Year	# Chinook Redds	# Carcasses	# Pre-Spawn Mortality Carcasses
2018	12	1	0
2017	11	1	0
2016	15	2	0
2015	25	1	0
2014	3	1	0
2013	30	8	0
2012	29	2	0

Questions?

## **APPENDIX D**

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### *Consultation Documentation Regarding Draft Report*

## Presler, Dawn

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**From:** Binkley, Keith  
**Sent:** Thursday, February 21, 2019 10:02 AM  
**To:** 'Anne Savery'; Presler, Dawn; 'Vacirca, Richard -FS'; 'Janet Curran - NOAA Federal'; 'Asman, Lindsay'; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'James (ECY) Pacheco' (JPAC461@ECY.WA.GOV); 'Rustay, Michael'; 'okeefe@americanwhitewater.org'; 'Jim Miller (JMiller@everettwa.gov)'; 'nate.morgan@ci.sultan.wa.us'  
**Cc:** Lowe, Larry; McDonnell, Andrew  
**Subject:** RE: JHP (FERC No. 2157) - Marsh Creek Slide Effectiveness Report for your 30-day review

Anne - Thanks for the input. I'll carve out some time to discuss this in person at the upcoming ARC meeting. I'll make sure and have our field staff present for the discussion.

Keith

-----Original Message-----

From: Anne Savery [mailto:asavery@tulaliptribes-nsn.gov]  
Sent: Wednesday, February 20, 2019 10:39 AM  
To: Presler, Dawn <DJPresler@SNOPUD.com>; 'Vacirca, Richard -FS' <rvacirca@fs.fed.us>; 'Janet Curran - NOAA Federal' <janet.curran@noaa.gov>; 'Asman, Lindsay' <lindsay\_asman@fws.gov>; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov) <brock.applegate@dfw.wa.gov>; 'James (ECY) Pacheco' (JPAC461@ECY.WA.GOV) <JPAC461@ECY.WA.GOV>; 'Rustay, Michael' <mike.rustay@co.snohomish.wa.us>; 'okeefe@americanwhitewater.org' <okeefe@americanwhitewater.org>; 'Jim Miller (JMiller@everettwa.gov)' <JMiller@everettwa.gov>; 'nate.morgan@ci.sultan.wa.us' <nate.morgan@ci.sultan.wa.us>  
Cc: Binkley, Keith <KMBinkley@SNOPUD.com>  
Subject: Re: JHP (FERC No. 2157) - Marsh Creek Slide Effectiveness Report for your 30-day review

CAUTION: THIS EMAIL IS FROM AN EXTERNAL SENDER.

Do not click on links or open attachments if the sender is unknown or the email is suspect.

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Thanks for the opportunity to review the Marsh Creek Slide report

I think more specific graphs are necessary to review the ability of fish to migrate past the slide.

I'd like to see graphics showing daily flows through migration season and dates of redd surveys and redd counts for each species surveyed. The idea is that there may be a threshold flow at which chinook or steelhead can't migrate upstream. By plotting daily flows you may see that there is a flow that stands out and doesn't permit migration, or fish wait to migrate when a better flow range occurs. The peak flows should stand out pretty well in the regulated system

The percentage of Chinook that migrate upstream of the Marsh Creek Slide is relatively low each year, the highest being 30% in 2017. I think flows related to migration need a much closer look.

Happy to discuss over the phone

Anne

Anne Savery  
Hydrologist  
503-984-0667

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From: Presler, Dawn <DJPresler@SNOPUD.com>  
Sent: Wednesday, February 13, 2019 12:18:28 PM  
To: 'Vacirca, Richard -FS'; 'Janet Curran - NOAA Federal'; 'Asman, Lindsay'; Anne Savery; 'brock.applegate@dfw.wa.gov' (brock.applegate@dfw.wa.gov); 'James (ECY) Pacheco' (JPAC461@ECY.WA.GOV); 'Rustay, Michael'; 'okeefe@americanwhitewater.org'; 'Jim Miller (JMiller@everettwa.gov)'; 'nate.morgan@ci.sultan.wa.us'  
Cc: Binkley, Keith  
Subject: JHP (FERC No. 2157) - Marsh Creek Slide Effectiveness Report for your 30-day review

Dear ARC,  
Attached is the Marsh Creek Slide Effectiveness Report for your 30-day review and comment as briefly discussed at the October 2018 ARC meeting. Please return comments to me with cc: to Keith by March 15. If you have any specific questions about the report, please contact Keith.

Sincerely,  
Dawn Presler  
Sr. Environmental Coordinator  
Generation – Natural Resources  
(425) 783-1709

PUD No. 1 of Snohomish County  
PO Box 1107  
Everett, WA 98206-1107

## **APPENDIX E**

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### *Response to Comments Regarding Draft Report*



No.	Comment	Response
<b>Anne Savery, Tulalip Tribes, via email dated 02/20/2019</b>		
1	I think more specific graphs are necessary to review the ability of fish to migrate past the slide.	Whereas it would be interesting to understand flow preference and tally fish as they migrate upstream of the MCS, we follow WDFW escapement survey protocols and, as such, data are collected every 10 days. As a result, it is impossible to precisely pinpoint at which flow steelhead and Chinook migrate upstream past the MCS. What we do know, however, is flows at the MCS are adequate to allow passage upstream during fall and spring spawning seasons based on spatial distribution of redds.
2	I'd like to see graphics showing daily flows through migration season and dates of redd surveys and redd counts for each species surveyed. The idea is that there may be a threshold flow at which chinook or steelhead can't migrate upstream. By plotting daily flows you may see that there is a flow that stands out and doesn't permit migration, or fish wait to migrate when a better flow range occurs. The peak flows should stand out pretty well in the regulated system	We observe no evidence of fish stacking up below the MCS, nor do we observe pre-spawned mortality immediately above or below the MCS. Fish migration upstream of the MCS is mostly a function of run-timing. Appendix C points out examples of daily flow in Reach 2 of the Sultan River and associated percentages of redds observed during fall and spring spawning seasons.
3	The percentage of Chinook that migrate upstream of the Marsh Creek Slide is relatively low each year, the highest being 30% in 2017. I think flows related to migration need a much closer look.	It is not appropriate to compare Chinook redds on a year-to-year basis because their distribution depends on whether pink salmon are present. Appendix C illustrates that since 2012 the percentage of Chinook redds found upstream of the MCS has increased every year when the data is partitioned into pink or non-pink years.