2017 Water Management Plan
Seasonal Update
October 23, 2017

1. Introduction

The annual Water Management Plan (WMP) is developed prior to the implementation of Federal Columbia River Power System (FCRPS) operational measures identified in the NOAA Fisheries 2008 FCRPS Biolgical Opinion (BiOp), as supplemented in 2010 and 2014 (collectively referred to as the 2014 NOAA Fisheries Supplemental BiOp), and the U.S. Fish and Wildlife Service (USFWS) 2000 FCRPS BiOp and 2006 Libby BiOp. The WMP is also developed prior to the receipt of any seasonal information that may determine how many of the operation measures are implemented. The Seasonal Update is intended to supplement the WMP with more detailed information on operations as the water year progresses. Each section of the Seasonal Update will be updated when information is available and finalized when no further information is available.

The first update for the primary elements of Fall and Winter will be posted on November 1 of each year. The first update for the primary elements of Spring and Summer will be posted by March 1 of each year. The elements and operations included in the Seasonal Update are generally the same as have been previously presented in the Fall/Winter and Spring/Summer Updates to the WMP. The change to update in this manner is intended to present better continuity for tracking operations as they change throughout and across each season. The elements and operations described in the Seasonal Update and the approximate schedule for updates and finalization are as displayed in Table 1.

Table 1. Schedule for update and finalization of Seasonal Update elements and operations.

Section	Element	Begins	Finalized	Last Updated
2.1	Current Conditions (e.g., WSF, Streamflows)	October	July	August 8, 2017
2.2	Seasonal Flow Objectives	April	August	August 8, 2017
2.3	Flood Control	January	June	March 1, 2017
2.4	Storage Project Operations	September	September	August 8, 2017
2.5	Water Quality (Spill Priority Lists)	January	December	August 8, 2017
	Specific Operations	**Start Date**	**End Date**	**Last Updated**
2.6	Burbot spawning temperature management (Libby Dam)	November	December 30	November 10, 2010
2.7	Lake Pend Oreille Kokanee (Albeni Falls Dam)	September 1	December 30	-
2.8	Upper Snake Flow Augmentation	April 1	August 31	-
2.9	Chum Flows (Bonneville Dam)	November 1	April 10	March 1, 2017
2.10	Hanford Reach Fall Chinook Protection	November	June	March 1, 2017
2.11	Snake River Zero Generation	December	February	December 14, 2016
2.12	Minimum Operating Pool	April 3	September 30	August 8, 2017
2.13	Spill Operations	April 3	September 30	-

2.14	Transport Operations	May 1	-	July 27, 2017
2.15	Fish Passage Research	March	October	-

2. Seasonal Update Elements and Specific Operations

2.1. Current Conditions

Water Supply Forecasts – NWRFC

The final water supply forecast (WSF) is defined as the forecast posted on NOAA's Northwest River Forecast Center (NWRFC) website at 5:00 pm Pacific Standard Time on the third business day of the month. NWRFC water supply forecasts are available on the following website: http://www.nwrfc.noaa.gov/ws/

Table 2. The Dalles Dam Final Water Supply Forecasts.

Forecast Issue Date	January-July 2017		April-August 2017	
	Volume (MAF)	% of 30-year Average (101.4 MAF)	Volume (MAF)	% of 30-year Average (87.5 MAF)
January 5, 2017	96.6	95%	84.9	97%
February 3, 2017	93.4	95%	82.8	95%
March 3, 2017	108.8	107%	92.3	105%
April 5, 2017	130.8	129%	105.0	120%
May 3, 2017	136.9	135%	111.1	127%
June 5, 2017	141.9	140%	115.6	132%
July 5, 2017	138.0	136%	111.4	127%

Table 3. Grand Coulee Dam Final Water Supply Forecasts.

Forecast Issue Date	January-July 2017		April-August 2017	
	Volume (MAF)	% of 30-year Average (59.6 MAF)	Volume (MAF)	% of 30-year Average (56.8 MAF)
January 5, 2017	57.5	97%	54.9	97%
February 3, 2017	55.4	93%	53.7	95%
March 3, 2017	60.9	102%	57.3	101%
April 5, 2017	72.6	122%	65.0	114%
May 3, 2017	75.6	127%	68.2	120%
June 5, 2017	78.1	131%	70.4	124%
July 5, 2017	75.6	127%	67.1	118%

Table 4. Lower Granite Dam Final Water Supply Forecasts.

Forecast Issue Date	January-July 2017		April-August 2017	
	Volume (MAF)	% of 30-year Average (27.4 MAF)	Volume (MAF)	% of 30-year Average (21.1 MAF)
January 5, 2017	25.6	93%	21.1	100%
February 3, 2017	26.8	98%	22.5	107%
March 3, 2017	34.6	126%	26.5	126%
April 5, 2017	41.6	152%	29.9	142%
May 3, 2017	42.6	154%	30.7	145%
June 5, 2017	42.5	155%	30.8	146%
July 5, 2017	42.0	153%	30.2	143%

Water Supply Forecasts - Corps

Water supply forecasts for Libby and Dworshak dams are produced by the Corps' Seattle and Walla Walla Districts, respectively. Corps' forecasts are available on the following website:

http://www.nwd.usace.army.mil/Missions/Water/Columbia/Flood-Control/

Table 5. Libby Dam Water Final Supply Forecasts.

Forecast Issue Date	April-August 2017	
	Volume (KAF)	% of 78-year (1929-2008) Average (6,282 KAF)
December	7093	113%
January	6861	109%
February	5583	89%
March	6783	108%
April	7654	122%
May	8190	130%
June	7594	129%

Table 6. Dworshak Dam Final Water Supply Forecasts.

Forecast Issue Date	April-July 2017	
	Volume (KAF)	% of 81-year (1929-2010) Average (2,663 KAF)
December	3493	130%
January	3055	113%
February	2541	94%
March	2867	106%
April	2984	111%
May	2941	109%
June	2838	116%

Water Supply Forecasts – Bureau of Reclamation

Water supply forecasts for Hungry Horse Dam are produced by the Bureau of Reclamation.

Table 7. Hungry Horse Dam Final Water Supply Forecasts.

Forecast Issue Date	April-August 2017		January-July 2017		May-September 2017	
	Volume (KAF)	% of 30-year Average (2,070 KAF)	Volume (KAF)	% of 30-year Average (2,224 KAF)	Volume (KAF)	% of 30-year Average (1,835 KAF)
January	2091	108%	2266	108%	1828	108%
February	1704	88%	1839	88%	1493	88%
March	1936	100%	2114	101%	1693	100%
April	2023	105%	2407	115%	1778	105%
May	2325	129%	2698	129%	2015	119%
June	2326	120%	2698	129%	2020	119%

Weekly Weather and Precipitation Retrospectives

Week	Weekly Weather / Precipitation Retrospective
October 3, 2016	**Temperatures:** Gradually rose to above average. **Precipitation:** Well above average north 2/3rd. Below average south. Some precipitation fell as snow above 7000 feet. **Streamflows:** Minor rises in the Willamettes, ID, Mid-Cs and western MT, otherwise flat. For the first time since May, base flows are now above average.
October 10, 2016	**Temperatures:** Near average, with cool days and mild nights. **Precipitation: Record rainfall west and north, which was accompanied by damaging wind Thu and Sat.** Most of the precipitation fell as rain in US basins. Above 6500 feet in BC, a few snow pillows picked up over 2 feet of snow since Friday. **Streamflows:** Modest, basinwide rises underway. Most soils are now fully recharged for the upcoming winter.
October 17, 2016	**Temperatures:** Mostly above average but dropping to average mid-week. **Precipitation:** Above average, but not as wet as previous week. Most precipitation in BC above 6000 feet fell as snow. **Wettest October since at least 2012, and in some basins the wettest since at least the mid-1970s.** **Streamflows:** Modest basinwide crests Tuesday-Thursday, followed by slow recessions due to cooler temperatures and somewhat less precipitation. Unregulated flows at The Dalles peaked near 160 kcfs.
October 24, 2016	**Temperatures:** Above average. Higher than normal snow levels US basins. **Precipitation:** Well above average (200-400 % of normal), which pushed many reporting sites to their wettest October on record. **Streamflows:** Unusually high baseflows. Moderate rises in the Willamettes, with minor flow bumps in other US basins. Flat flows in BC where temperatures were colder and most mountain precipitation fell as snow.

Week	Weekly Weather / Precipitation Retrospective
October 31, 2016	**Temperatures:** Well above average, especially west of the Cascades. Colder nights east of Cascades with widespread freezes. **Precipitation:** Above average BC and western WA. Well below average elsewhere. **Streamflows:** Slow basinwide recessions.
November 7, 2016	**Temperatures: Well above average. Near record highs Monday - Friday.** **Precipitation:** Well below average, except closer to average in BC and western WA. **Streamflows:** Slow basinwide recessions.
November 14, 2016	**Temperatures:** Well above average Monday - Tuesday, near average Wednesday - Friday, then above average again this weekend. **Precipitation:** Near average NW half. Below average SE half. **Streamflows:** Minor rises in headwater areas, which then receded by the weekend. Mostly flat elsewhere.
November 21, 2016	**Temperatures:** Above average, but with snow levels falling to pass levels. **Precipitation:** Above average, especially along and west of the Cascades. First snowfall of the season in Spokane this morning, with the first heavy mountain snows of the season in much of the basin this past weekend. **Streamflows:** Significant rises an in the Willamettes with minor tributary and small flooding on Thursday - Friday. Minor rises in the lower Columbia. Slowly receding elsewhere due to colder temperatures.
November 28, 2016	**Temperatures:** Above average, but not as warm as previous week. **It was the warmest November on record in parts of the basin, including Portland.** **Precipitation:** Below average. **Streamflows:** Slowly receding.
December 5, 2016	**Temperatures:** Remember those warm temperatures in November? Now a distant memory as first full week of December was much below average with ice storm in Portland Thursday and Friday. Warming to just average for the weekend. **Precipitation:** Slightly below average. **Streamflows:** Flat and/or slowly receding.
December 12, 2016	**Temperatures: Sustained cold snap Wednesday - Sunday.** Temperatures bottomed out near 18F below normal on Sat. **Precipitation:** Below average, particularly in the northern portion of the basin. **Streamflows:** Flat and/or slowly receding overall. Ice jams noted on several headwater streams.
December 19, 2016	**Temperatures:** Warmed to near average. However, we are now into the two coldest weeks of the year. **Precipitation:** Above average north. Slightly below average south. **Streamflows:** Moderate rises on the Willamettes peaked on Wed, then receded. Flat flows elsewhere with ice jams noted on several headwater streams
December 26, 2016	**Temperatures:** Near average through Sat, then dropped well below average this weekend. **Precipitation:** Above average north. Below average south. **Streamflows:** Flat or receding
January 2, 2017	**Temperatures: Major cold snap, with temperatures 15-20° F below average. Coldest period since February, 2014.** **Precipitation:** Above average south half with a major winter storm this past weekend. Well below average north. **Streamflows:** Flat, with occasional headwater ice jams.
January 9, 2017	**Temperatures: Second cold snap of the year, with temperatures 15-18°F below average.** **Precipitation:** Above average south, with a major snowstorm in Portland metro area, Columbia Gorge, southeast OR and southern ID. Well below average north. **Streamflows:** Flat, with occasional headwater ice jams

Week	Weekly Weather / Precipitation Retrospective
January 16, 2017	**Temperatures:** Below average, but not nearly as cold as the first half of January. **Precipitation:** Above average. **Streamflows:** Minor rises on the Willamettes and lower Columbia. Rises were lower than expected due to less precipitation and colder temperatures
January 23, 2017	**Temperatures:** Below average valleys. Above average mountains. **Precipitation:** Mostly dry. **Streamflows:** Flat.
January 30, 2017	**Temperatures:** Below average **Precipitation:** Well below average initially, then increased to above average with low elevation snows. **Streamflows:** Flat
February 6, 2017	**Temperatures:** Well below average initially, then warmed to above average. **Precipitation: Well above average (150-300% of normal). Significant mountain snowpack gains,** with snowpack losses on valley floors **Streamflows:** Significant rises on the Snake, lower Columbia, Clearwater and Spokane. Unregulated flows at Lower Granite rose to 80kcfs this weekend, but have begun to recede. Mostly flat flows elsewhere.
February 13, 2017	**Temperatures:** Slightly above average. **Precipitation:** Above average. **Streamflows:** Basinwise recessions Mon-Wed, followed by re-rises on the Willamettes, lower Columbia, lower Snake, and Cleawater. Mostly flat flows elsewhere
February 20, 2017	**Temperatures:** Fell to below average, with snow levels fallingto near valley floors. **Precipitation:** Slightly below average. **Streamflows:** Basinwise recessions due to colder temperatures.
February 27, 2017	**Temperatures:** Below average, with unusually low snow levels this weekend. **Precipitation:** Increased to well above average (200-300% of normal). **Significant snowpack gains, especially above Grand Coulee.** **Streamflows:** Basinwise recessions due to colder temperatures through Sat, followed by minor rises in the lower Columbia, lower Snake, Clearwater and Spokane basins where temperatures were warmer yesterday.
March 6, 2017	**Temperatures:** Gradually rose to above average US basins; below average in BC and MT. **Precipitation: Well above average (150-250% of normal),** with significant snowpack gains. **Streamflows: Record high early March flows Snake and Clearwater with some tributary flooding.** Significant rises/crests in the Willamettes and lower Columbia this weekend, with modest/temporary recessions this morning. Moderate rises in the mid C's and Spokane. Flat flows in western MT and BC.
March 13, 2017	**Temperatures:** Above average, except slightly below average in BC **Precipitation:** Well above average (150-300% of normal). **Streamflows: Record mid-March flows lower-mid Columbia, Snake, Clearwater and Spokane** with major tributary and minor mainstem flooding. Moderate crests elsewhere in US basins and the Kootenay. Unregulated flows crested near 230kcfs at Lower Granite and 470kcfs at The Dalles.
March 20, 2017	**Temperatures:** Near average with above average in southern Idaho.. **Precipitation:** Well above average (150-300% of normal). **Streamflows:** Continued high water with flows dropping slowly.
March 27, 2017	**Temperatures:** Near average. **Precipitation:** Above average US basins. Below average in BC **Streamflows:** Slow basinwide recessions. **Unregulated flows remained at record levels for late March at Lower Granite (150-175kcfs) and The Dalles (350-420kcfs).**

Week	Weekly Weather / Precipitation Retrospective
April 3, 2017	**Temperatures:** Rose to above average Wed-Thu, then fell to below average Sat-Sun. Damaging wind storm on Fri with numerous gusts of 50-70mph across the region. **Precipitation:** Increased to well above average northwest half and in the upper Snake. Near average elsewhere. **Streamflows:** Slow recessions initially, followed by modest basinwide rises/crests over the weekend. Unregulated flows remained between 300-400kcfs at The Dalles.
April 10, 2017	**Temperatures:** Below average, with unusually low snow levels. **Precipitation:** Well above average northwest half; below average southeast half. **Streamflows:** Unusually high flows in the Spokane, Clearwater, Snake and Grand Coulee side streams. However, flows decreased slightly due to colder temperatures and snowpack building. Unregulated flows hovered between 300-350kcfs at The Dalles.
April 17, 2017	**Temperatures:** Slightly above average. **Precipitation:** Above average, but not as wet as previous weeks. **Streamflows:** Modest, gradual snowmelt rises resumed over much of the basin, but were tempered by cold nighttime mountain temperatures. Unregulated flows rose hovering near 350kcfs at The Dalles.
April 24, 2017	**Temperatures:** Slightly below average. **Precipitation:** Above average, with unusual late-season snowpack gains. **Streamflows:** Significant snowmelt rise on the Willamettes, with more modest rises in lower Coilumbia, Yakima, Clearwater and Spokane. Unregulated flows rose to 400kcfs at The Dalles with the Columbia at Vancouver and Longview approaching flood stage.
May 1, 2017	**Temperatures:** Rose to well above average Wed-Thur, then cooled over the weekend west of the Cascades. **Precipitation:** Increased to above average. **Streamflows:** Significant snowmelt rises in many basins on the east side where the spring freshet is beginning. Unregulated flows climbed over 500kcfs at The Dalles. **Snowpack**: Last week for snowpack numbers being meaningful as percentages this late in the season can get skewed. Snowpack percentages decreased from last week in US basins and stayed the same in Canada.
May 8, 2017	**Temperatures:** Below average Mon, above average Tue-Thu, then well below average Fri-Sun. **Precipitation:** Increased to above average Northwest; below average southeast. **Streamflows:** Very high freshet flows in US basins, although they decreased slightly this weekend due to cold weekend temps. Modest flow increases in BC. Unregulated flows climbed over 600kcfs at The Dalles.
May 15, 2017	**Temperatures:** Below average through Fri, then warmed above average this weekend. **Precipitation:** Above average through Thu with unusually heavy late season mountain snow. Dried out over the weekend. **Streamflows:** Temporarily diminished due to colder temperatures, with unregulated flows dropping below 500kcfs at The Dalles. However, headwater snowmelt rises were resuming this morning.
May 22, 2017	**Temperatures:** Sharp swings from well above average Mon-Tue, well below average Wed-Thu, then above average this weekend. **Precipitation:** Below average, except closer to average in BC and western MT. **Streamflows:** Significant basinwide snowmelt rises above The Dalles, and especially above Grand Coulee. Decreasing lower Columbia and Willamette flows where much of the snowpack has melted.
May 29, 2017	**Temperatures:** Slightly above average. **Precipitation:** Below average, but with scattered thunderstorms over BC, ID and western MT. **Streamflows:** Highest flows in several years above Grand Coulee and in the Salmon Basin, with several headwaters at minor flood stages. Slowly decreasing flows lower Columbia, Willamette, Spokane and Yakima basins as snowpacks deplete. Unregulated flow at The Dalles peaked near 850 kcfs over the weekend.

Week	Weekly Weather / Precipitation Retrospective
June 5, 2017	**Temperatures**: Well above average through Wed, then fell sharply below average. **Precipitation:** Increased to near average, with localized thunderstorms and heavy rain in BC, OR and central ID. **Streamflows:** Although flows have peaked for the season, and decreased more significantly this weekend due to colder temperatures, they remain very high as considerable snowmelt continues.
June 12, 2017	**Temperatures:** Below average through Fri, then warmed to slightly above average. Heat wave developed in SW US this weekend. **Precipitation:** Well above average through Fri, then dried out. **Streamflows:** Localized flow spikes and re-rises in ID/MT. Otherwise, snowmelt flows diminished with unregulated flows at The Dalles falling from 700 to 500 kcfs.
June 19, 2017	**Temperatures:** Warmed to well above average south and west (just short of heat wave criteria), but only slightly above average north and east. Load center temperatures briefly spiked near 16°F above normal Sunday. Major SW US heat wave began to ease this weekend. **Precipitation:** Mostly dry, except for isolated thunderstorms in BC and western OR. Streamflows: Slow basinwide recessions as snowpacks gradually deplete. Unregulated flows at The Dalles slipped from 520kcfs to around 470kcfs, which is still above normal for mid-June.
June 26, 2017	**Temperatures:** Slightly above average. **Precipitation:** Below average, but with scattered strong thunderstorms east half on Tuesday **Streamflows:** Slow basinwide recessions, except in BC where very high snowmelt flows continue. Unregulated flows at The Dalles slipped from 420kcfs to around 350kcfs.
July 3, 2017	**Temperatures:** Above average. **Precipitation:** Mostly dry, except for isolated mountain thunderstorms BC and SE ID. **Streamflows:** Basinwide recessions, except in BC where high snowmelt flows continue. Unregulated flows at The Dalles slipped to 300kcfs this weekend.
July 10, 2017	**Temperatures:** Near average west of Cascades; well above average elsewhere, with near record heat in ID/western MT. **Precipitation:** Mostly dry, except for isolated mountain thunderstorms BC, ID and MT. **Streamflows:** Typical summer recessions.
July 17, 2017	**Temperatures:** Near average.. **Precipitation:** Mostly dry, except for isolated mountain thunderstorms BC, ID and MT. **Streamflows:** Typical summer recessions.
July 24, 2017	**Temperatures:** Near average west; above average east. **Precipitation:** Mostly dry, except for isolated mountain thunderstorms. **Streamflows:** Typical summer recessions. Unregulated flows at The Dalles fell slightly below average for the first time since early February.
July 31, 2017	**Temperatures:** Heat wave Wed-Fri, with hottest weather since July, 2009. Numerous records broken, mostly west of the Cascades. Modest cooling over the weekend. **Precipitation:** Mostly dry. **Streamflows:** Slow recessions, except in BC where snow a glacier melt kept flows steady.
August 7, 2016	**Temperatures:** Well above average (just below heat wave criteria through Thu), then cooled sharply to near average this weekend. **Precipitation:** Well below average, but with scattered showers and thunderstorms US basins. **Streamflows:** Slow recessions, except faster recessions above Revelstoke, BC due to cooler temperatures and reduced snow/glacier melt.
August 14, 2017	**Temperatures:** Near average. **Precipitation:** Well below average, but with isolated showers and thunderstorms. **Streamflows:** Flat or receding. Flows fell more noticeably in BC due to colder temperatures reducing snow and glacier melt.

Week	Weekly Weather / Precipitation Retrospective
August 21, 2017	**Temperatures:** Near average through Fri, then rose to well above average. **Precipitation:** Mostly dry. **Streamflows:** Flat or receding, except for a minor snow/glacier melt increase in BC Wed-Fri.
August 28, 2017	**Temperatures:** Rose to well above average (up to 12F above average Sat-Mon). Prospects for the latest Pacific NW heat wave on record were mitigated by dense smoke Sun-Mon, which held down high temps. **Precipitation:** Mostly dry. Driest August on record in the Columbia Basin (averaged above The Dalles), with the driest weather concentrated above Grand Coulee. **Streamflows:** Flat or receding.
September 4, 2017	**Temperatures:** Well above average. Heat wave conditions barely averted by dense smoke Sun-Thu. Cooled closer to average this weekend. **Precipitation:** Above average north of Arrow, BC. Below average elsewhere but with scattered showers. **Streamflows:** Flat or receding, except in BC where snow and glacier melt elevated flows, followed by a brief flow spike from weekend thunderstorms. Flows were rapidly declining this morning.
September 11, 2017	**Temperatures:** Near record warmth through Tue, then cooled to slightly below average. **Precipitation:** Well above average southeast. Below average elsewhere, but the first in a series of fall storms is passing through the region this morning. First high mountain snows of the season in BC and central ID. **Streamflows:** Isolated minor rises in a few tributaries due to spotty heavy rain. Flows receded in BC due to colder temperatures
September 18, 2017	**Temperatures:** Below average but warming as we entered the weekend. **Precipitation:** Well above average southeast and west side with wide-spread rain across the basin. First high mountain snows of the season in BC and central ID. **Streamflows:** Minor rises in Snake and Spokane basins localized heavy rain. Flows receded in BC due to colder temperatures
September 25, 2017	**Temperatures:** Above average with departures 5-10° F. above normal much of the week. **Precipitation:** Below average with little precipitation across the basin **Streamflows:** Flat with some areas holding up due to limited snowmelt from previous week.

2.2. Seasonal Flow Objectives

Project	Planning Dates	BiOp Season Average Flow Objective – (kcfs)	Season Average Flow to date (kcfs)
Priest Rapids	Spring 4/10–6/30	135	244
McNary	Spring 4/10–6/30	220-260[i]	387
	Summer 7/1–8/31	200	
Lower Granite	Spring 4/3–6/20	85-100[i]	140
	Summer 6/21–8/31	50-55 [ii]	

i. Varies according to NWRFC April forecast.
ii. Varies according to NWRFC June forecast.

2.3. Flood Control

Flood Control Elevations and April 10 objective elevations per each forecast period are listed in the table below. Forecasted flood control elevations will be calculated beginning in December after the Libby and Dworshak water supply forecasts are available. Subsequent forecasted flood controls will be updated after the final water supply forecasts are available January-April.

Grand Coulee and all Canadian projects will be operated for standard flood control. Hungry Horse and Libby will be operated for Variable Q (VARQ) Flood Control. Beginning in January, the Corps calculates Upper Rule Curve elevations based on the monthly official final forecasts. Projects are operated using these elevations as an upper limit, with the objective of reaching their spring refill elevations. Detailed flood control operations are available at the following website: http://www.nwd-wc.usace.army.mil/report/colsum.

The April 10 elevations shown in the table below are calculated by linear interpolation between the March 31 and April 15 forecasted flood control elevations.

Project	Elevation Date Objective	Dec	Jan	Feb	Mar	Apr
Libby	**Jan 31**		2396.2			
	Feb 28		2383.3	2433.7		
	March 31		2377.9	2437.8	2382.1	
	April 10		2377.9	2437.8	2382.1	
	April 15		2377.9	2437.8	2382.1	
	April 30		2377.9	2437.8	2382.1	2325.4
Hungry Horse	**Jan 31**	3544.1	3543.8	3543.8		
	Feb 28	3539.4	3538.7	3549.0		
	March 31	3534.1	3532.9	3548.9	3539.8	
	April 10	3532.3	3531.0	3548.8	3538.7	
	April 15	3531.4	3530.1	3548.8	3538.2	3533.6
	April 30	3528.8	3527.2	3548.8	3536.6	3531.3
Grand Coulee	**Jan 31**	1290.0	1290.0	1290.0		
	Feb 28	1290.0	1290.0	1285.6		
	March 31	1283.3	1283.0	1278.5	1267.1	
	April 10	1276.6	1276.2	1253 (Drum Gate)	1253	
	April 15	1273.2	1272.8	1263.6	1249.6	1234.0
	April 30	1256.8	1256.4	1252.0	1235.8	1222.7
Brownlee	**Jan 31**		2077.0			
	Feb 28		2050.1	2048.3		
	March 31		2046.5	2046.4	2036.0	
	April 15		2047.4	2046.5	2030.8	2024.0
	April 30		2047.5	2048.6	2026.9	2012.6
Dworshak	**Jan 31**		1528.3			
	Feb 28		1506.0	1531.1		
	March 31		1501.8	1537.2	1493.1	
	April 10		1506.1	1543.5	1578.4	
	April 15		1508.3	1546.7	1471.1	1448.2
	April 30		-	-	1471.1	1448.2

2.4. Storage Project Operations

Libby Dam

Bull Trout Flows: Bull trout minimum flows are specified in the 2006 Libby Sturgeon Biological Opinion (2006 BiOp) and may be found in Table 10 on page 27 of the 2017 Water Management Plan on the following website:

http://pweb.crohms.org/tmt/documents/wmp/2017/

February 2017 Spillway Re-Commissioning: In February 2017, Libby Dam will be performing required maintenance by replacing the spillway gate control system which is nearly 40 years old. After the control system is replaced the spillway gates will have to be re-commissioned, which requires the testing to be done with the gates out of the water such that the forebay of Libby Dam will be lowered to elevation 2404 feet (1 foot below spillway crest) by the end of January. Depending on the water supply forecast, drafting to 2404 feet at the end of January and holding this elevation for the 5 weeks required for testing may impact the ability of Libby Dam to meet the April 10 target elevation, lower VarQ flows in May, and slight impacts to peak reservoir elevations and summer releases from Libby Dam. A January 1 forecast of 6.5 MAF (109% of average) would require a 2404 feet FRM requirement at the end of the month. By March 1, spillway gate maintenance and recommissioning was complete and Libby Dam resumed normal spillway gate operation.

April 10 and Refill Objectives: According to the Corps' Libby March Runoff Forecast the most probable runoff volume for April-August was 6,783 KAF (115% of average from 1981-2010). This forecast runoff volume resulted in an April 10 elevation objective of 2382.1 feet.

Sturgeon Pulse: On May 3, 2017, the Action Agencies (AAs) received System Operational Request (SOR) FWS #1 regarding the 2017 Libby Dam releases for sturgeon and bull trout augmentation flows. Based on the Service's 2006 BiOp on operations of Libby Dam, and the May final April-August volume runoff forecast of 8.19 million acre-feet (MAF), we are within a Tier 5 operations year for Kootenai River white sturgeon. The minimum recommended release volume for sturgeon conservation in a Tier 5 year is 1.2 MAF.

The following guidelines were included in the SOR.

- The 2017 sturgeon operations at Libby Dam will consist of one period of pre-peak flow (20,000 cubic feet per second (cfs)), one period of peak flow (powerhouse capacity), one period of interim flow maintenance (~18-21 kcfs at Bonners Ferry), a second period of peak flow (powerhouse capacity), and one period of post-peak flow (ramp-down). The ramp-down from peak operation will occur within 2006 BO ramping rates, and will exhaust remaining sturgeon volume following the second period of peak flow augmentation.

- Based on the Service's 2006 BiOp on operations of Libby Dam, and the May final April-August volume runoff forecast of 8.19 MAF, we are within a Tier 5 operations year for Kootenai River white sturgeon. The minimum recommended release volume for sturgeon conservation in a Tier 5 year is 1.2 MAF, and we recommend the following procedures for discharge of at least this minimum volume.

- Begin sturgeon augmentation flow for the first peak when the Regional Team of Biologists determines that local tributary run-off downstream of Libby Dam is peaking.

- Increase discharge according to ramping rates in 2006 BO) from Libby Dam up to full powerhouse capacity (~25,000 cfs), depending on local conditions (e.g. river stage at Bonners Ferry).

- Maintain peak discharge for a period of 5-7 days.

- Selective withdrawal gates at Libby Dam above elevation 2,326 mean sea level will remain uninstalled during this peak, allowing for conservation of warmer surface water that will be targeted for release during the descending limb of the second peak, described below.

- After 5-7 days of peak discharge, decrease discharge at Libby Dam (according to ramping rates in 2006 BiOp) to a discharge that is sufficient to maintain a flow of at least 18,000 cfs at Bonners Ferry until commencement of the second peak.

- Increase discharge (according to ramping rates in 2006 BO) from Libby Dam up to full powerhouse capacity when the Regional Team of Biologists determines that the high-elevation run-off in the Kootenai Basin has begun. Actual peak discharge during this second peak will depend on local conditions (i.e. river stage at Bonners Ferry).

- Selective withdrawal gates at Libby Dam above elevation 2326 mean sea level will be placed to within 30' of the surface of the reservoir prior to the end of the second peak, described above, allowing for release of warmer surface water as the receding limb of the hydrograph commences. Release of warmer water from Libby Dam, in combination with lower volume of release, will allow the Kootenai River temperature to increase to appropriate spawning temperatures at Bonners Ferry (8-10°C) during the receding limb of the hydrograph.

- Maintain peak discharge for a period of 7-14 days.

- After 7-14 days of peak discharge, and until the sturgeon volume is exhausted, decrease discharge at Libby Dam towards stable summer flows, to no less than bull trout minimum flows (9000 cfs in Tier 5).

- Total number of days at peak discharge will depend on real time conditions and the shape of the inflow hydrographs.

May 10, Technical Management Team (TMT) Meeting. The USFWS, presented on SOR FWS #1 which calls for a double pulse operation at Libby Dam. The USFWS explained that is the same operation as was implemented in 2013 and 2014. There will be two pulses of increased outflow from Libby Dam: the first will take place to coincide with the low elevation snow melt and will be close to or at full turbine capacity for 5-7 days. The second will be timed to coincide with the high elevation snow melt, and will last for 7-14 days. The initial pulse is intended to move upstream to spawning areas; the second pulse is intended to encourage them to spawn. After the two pulses, the project will ramp back down to stable summer flows.

TMT Members in attendance were polled and provided the following response to the SOR.

Kootenai Tribe of Idaho (KTOI) - Support
Montana (MT) - Support
NOAA Fisheries - Support
Nez Perce Tribe (NPT) - Support
Umatilla Tribe (Umatilla) - Support
Oregon (OR) - No objection
U.S. Fish and Wildlife Service (USFWS) - Support
Washington (WA) - Support
Bonneville Power Administration (BPA) - Support
Bureau of Reclaimation (BOR) - Support
U.S. Army Corps of Engineers (Corps) - Support

ACTION:
The Corps will implement SOR FWS #1.

A summary of Libby outflows during the sturgeon pulse are included below.

May 7 through 14: Prior to the 1st peak outflow was 16 kcfs.

May 15: 20.0 kcfs (initiation of the first pulse).

May 16 to May 21: 24 kcfs.

May 22 through June 1: 18 kcfs (1st pulse ended on May 22 when outflows were reduced to 18 kcfs).

June 2: 22 kcfs (initiation of the 2nd pulse).

June 3 through 11: 25 kcfs.

June 12: 22 kcfs.

June 13 through 15: 20 kcfs.

June 16 through 18: 17 kcfs.

June 20: 14 kcfs (end of the second pulse).

Summer Draft Limit: From August through October in 2015-2017, the AAs will be operating Libby Dam in coordination with the Kootenai Tribe of Idaho in order to provide conditions for construction of a suite of Kootenai River Habitat Restoration Projects (KRHRP). In order to accommodate this operation, the AAs will coordinate with TMT on the actual operation to reach the 2014 NOAA Fisheries Supplemental BiOp September 30 elevation of either 2439 or 2449 feet.

May 10, TMT Meeting. The Kootenai Tribe of Idaho (KTOI) presented SOR-2017-1 which calls for 6 kcfs or less outflow from Libby from September through the first week of November to allow for in-water habitat work. This is part of an ongoing effort since 2011 aimed at improving habitat for Kootenai River white sturgeon, including building spawning and rearing habitat. The construction this year will be finishing up the "pool-ladder" concept for the reach just upstream of Bonners Ferry. The KTOI noted that this work is implementing the USFWS BiOp.

TMT Members in attendance were polled and provided the following response to the SOR.

Umatilla - No objection
Kootenai - Support
MT - Support
OR - No objection
NOAA Fisheries - Support
NPT - Support
USFWS - Support
WA - Support
BPA - Support
BOR - Support
Corps - Support

ACTION: The Corps will implement SOR 2017-1.

Libby Dam maintained daily total outflow of 9 kcfs from August 1 though August 31. August 1 midnight reservoir elevation was 2448.6 feet and the midnight reservoir elevation on August 31 was 2445.1 feet.

Libby Dam maintained daily total outflow of 9 kcfs on September 1 and 2, 8 kcfs on September 3, and 6 kcfs September 4 through September 30. September 1 midnight reservoir elevation was 2444.9 feet and September 30 midnight reservoir elevation of 2442.5 feet.

Hungry Horse Dam

Water Supply Forecast and Minimum Flows: The minimum flow requirements are measured at two locations the South Fork Flathead River below Hungry Horse Dam and the Flathead River at Columbia Falls. The minimum flows will be determined monthly, beginning in January, with the Bureau of Reclamation's WSF forecast for Hungry Horse Reservoir for the period of April 1 to August 31. The final flow levels, for the remainder of the calendar year, are based on the March Final forecast. Reclamation's March 2017 Final WSF for April-August was 1936 (100% of average) KAF which set the minimum flow requirements below Hungry Horse and at Columbia Falls at 900 cfs and 3500 cfs, respectively. The mimimum flows are set for the rest of the calendar year and will be updated following the January 2018 Final Forecast.

April 10 and June 30 Refill Objectives: The Bureau of Reclamation computes Hungry Horse's final April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final WSF. Based on the March final forecast and forecasted flood control elevations, the April 10 elevation objective was 3538.7 feet for Hungry Horse, the actual elevation was 3533.3 feet. The actual elevation was lower than the April 10 target because of very high flows both into the reservoir and at Columbia Falls. The high inflows and uncertainty in the runoff shape was the rational for discharging higher flows from Hungry Horse in March and early April and caused the draft below the April 10 target. The April 30 target for flood risk management bounced from 3527.2 feet from the January forecast, to 3531.3 feet for the April forecast. The actual April 30 elevation was 3529 feet which was lower than the April 30 flood risk management elevation a result of the unusual early runoff and the continued short term weather forecast for additional runoff. Discharges from Hungry Horse were held in the 8000 to 10,000 cfs range in early May to manage the refill of the reservoir. Flows were dropped significantly in June when forecasted storms did not make it to the S.Fk. Flathead basin. As a result the reservoir was not able to fill as much as expected in June. Hungry Horse's maximum elevation was 3555.7 feet which was 4.3 feet below the full elevation.

Summer Draft Limit: The summer reservoir draft limit at Hungry Horse is 3550 feet (10 feet from full) by September 30, except in the lowest 20 percentile of water years (The Dalles April-August < 72.2 MAF) when the draft limit is elevation 3540 feet (20 feet from full) by September 30. The RFC's May Final April-August forecast is used to set the official draft limit. The May Final April - August forecast at The Dalles was 111.1 MAF which set the September 30 draft target to 3550 feet.

Grand Coulee Dam

April 10 and June 30 refill Objective: The Bureau of Reclamation computes Grand Coulee's final April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March Final WSF for The Dalles.

For 2017 the official April 10 elevation objective was 1253.4 feet. The actual elevation on April 10 was 1237.5 feet. From March to April the volume forecasts were increasing and the actual

April 10 elevation was significantly lower than the objective to make sure that the draft rates for Lake Roosevelt would not have to be exceeded to reach the April 30 objective for flood risk management of no higher than 1222.7 feet. In mid-April the Colville tribe requested to hold the elevation of Lake Roosevelt higher than 1232 feet to keep the Inchellium Ferry in service. There had been significant damage to roads during the spring snowmelt and taking the ferry out of service would present a risk to health and human safety. The draft of Lake Roosevelt was temporarily haulted at no lower than 1233 feet over the Easter weekend to allow road repairs to take place on the Colville reservation.

On Thursday, April 20, 2017, the Colville tribe formally requested from the Corps to keep the elevation of Lake Roosevelt above 1232 feet through the entire spring drawdown period. This request was granted by the Corps due to the extreme damage to transportation on the reservation and the risk to human health and safety. As a result Grand Coulee remained above 1232 feet and was at 1232.9 feet on April 30. Grand Coulee began refill during the first week of May and continued to refill to 1285.2 feet on June 30 to set up for the July 4 operation. Through the July 4 weekend Grand Coulee filled no more than 0.5 feet per day and remained below 1287 feet. After the July 4 holiday, Grand Coulee refilled to 1289.8 feet on July 10 which allowed for the 0.2 feet for the Lake Roosevelt Incremental Storage Release Program.

The Lake Roosevelt Incremental Storage Release Program: The total amount of water to be released from Grand Coulee in 2017 under the Lake Roosevelt Incremental Storage Release Program was 36,468 acre-feet and was be distributed as shown in Table 8.

Table 8. Lake Roosevelt releases requested for 2017.

"Bucket"	2017 Releases (acre-feet)	Total Lake Roosevelt Incremental Storage Releases Program (acre-feet)
Odessa	3656	15,000
M&I	8500	12,500
Instream Flow	24,312	55,000

Summer Draft Limit: The Grand Coulee summer draft limit is set by the magnitude of the RFC's July Final April-August WSF at The Dalles Dam. Based on the July Final WSF at The Dalles, the summer draft limit for Grand Coulee is 1280 feet. The draft limit will be modified an additional 0.4 feet, to elevation 1279.6 feet to implement the Lake Roosevelt Incremental Storage Release Program.

This section will be updated as information becomes available.

Drum Gate Maintenance: A full 8-week period for drum gate maintenance was implemented in 2017. The maintenance required Lake Roosevelt to be below elevation 1255 feet for the whole period. The maintenance period began on March 12 and was completed by mid-May, 2017. Drum gate maintenance at Grand Coulee is essential to keep the drum gates in a safe working condition.

Banks Lake: Banks Lake will draft to elevation 1565 feet by August 31 to provide more water for summer flow augmentation. Pumping to Banks Lake will be reduced and irrigation for the

Columbia Basin Project will be met be drafting the reservoir up to 5 feet from full. This section will be updated as information becomes available.

Dworshak Dam

January 18, 2017, TMT Meeting. The Corps indicated that the Unit 3 outage will likely extend in to July and early August. The Corps asked Salmon Managers to provide feedback on the balance between the benefits and impacts of temperature augmentation and TDG during the outage. Without Unit 3, outflows will be constrained and there will be a point in time where decisions will need to be made between TDG levels and temperature augmentation. The Corps asked for Salmon Managers to consider different operations and provide feedback to the Corps. For example, is it prudent not to refill by a certain volume or refill the project and have high flows in August and September. NOAA Fisheries added that this discussion is dependent on the season. Discharging more in June in order to keep temperatures cool is one possibility; flows mid to late June would benefit temperature. NOAA Fisheries noted that this is a challenging conversation and one that should continued to be discussed as early as possible.

February, 1, 2017, TMT Meeting. The Corps provided an updated chart of Dworshak Unit 3 milestones. The Corps explained that the Revised Schedule column is the contractor's estimate of milestone completion dates. The Actual (A)/Predicted* column is either the actual completion date or the Corps' "best guess as to what will occur." This column estimates that Unit 3 will be returned to service on July 8, 1017. The schedule will be updated in March. Work on the project is proceeding as quickly as possible. However, the precision of the work required limits the hours crews can be expected to work and still provide adequate product.

February 8, 2017, TMT Meeting. The Corps, provided an update on Dworshak Dam operations. The Corps noted that the forebay is currently at 1518.35 feet; the project is releasing 8 kcfs and inflow is 4 kcfs; TDG ranges between 108-109%. The Corps has been operating to stay below 110% TDG, as coordinated at TMT.

The Corps reported that the official February water supply forecast for Dworshak is 2.5 MAF. The Corps presented operational scenarios to the TMT, which considered both a 2.5 and 2.6 MAF water year. The 2.6 MAF scenarios were presented due to a forecasted weather system moving through the region this weekend. The scenarios can be found on the following TMT website.

http://pweb.crohms.org/tmt/agendas/2017/0208_Agenda.html

It was noted that there was a step down in volume in the STP; however, the STP is tracking the NWRFC forecasts pretty well. Additionally, the USFWS, asked if it is possible for the Corps to deviate from the April 15 flood control elevation to help alleviate the TDG issues. The Corps cannot deviate from the April 15 target. However, in the past, the Corps has deviated from the end of April target, if the project is close to the refill curve. The Corps

explained how the Corps calculates the refill curve, which, is based upon a 95% likelihood of refilling.

As requested at the February 1 TMT meeting, the Corps presented longer term scenarios, looking out into the refill period (through June). These scenarios, which can be accessed on the TMT website, considered high, medium, and low flow conditions. With both the high and medium flow scenarios, the project would still have to bump up to over 110% TDG for May and June. With the low flow scenario, the refill is shifted earlier and is above minimum discharge during refill. The Corps suggested that the low flow scenario is not likely; even if the next two months are very dry, operations will still be above the minimum discharge for refill because there is already more snowpack than in 2015.

WA, noted that these scenarios suggest TDG levels of 120% in mid-to late-April given the current volume outlook. The Corps affirmed, suggesting that the project continue to operate below 110% TDG barring any significant changes, and continue watching conditions and adjusting as necessary. The TMT discussed the scenarios, concerns, and suggested considerations moving forward. They provided the following.

- ID, suggested trying to hold the reservoir close to the current elevation, while keeping flows as smooth as possible and TDG levels below 110%. The Colville Tribes, ID, WA, and the Confederated Tribes of Warm Springs were supportive of this suggestion.

- Another option discussed, was to stop spill and run water through units 1 and 2 only. This would decrease the outflow. USFWS was supportive of this suggestion, however, expressed that they are also okay with holding around the current pool elevation.

- OR was generally supportive of dropping to the two units and stopping spill. OR, expressed concern with dropping the reservoir too quickly, noting that the pool is nearing the end of April elevation at this point. OR noted that the spring freshet is important to move fish out of the system and dropping the pool elevation too soon flattens the freshet.

- BOR, BPA, MT, and NOAA were supportive of maintaining TDG below 110%.

- The Nez Perce were not available to provide input; however, multiple TMT members shared interest in knowing the Nez Perce's preferences.

After hearing the regions' concerns and interests, the Corps confirmed that they will operate Dworshak to meet the April 15 flood control elevation. They will continue the current operation to maintain TDG levels below 110% through next week in order to reduce the probability of higher TDG in April. They will also manage operations to reduce potential impacts to spring flow augmentation flows. The Corps agreed to provide a mid-month water supply forecast and updated long-term scenarios at the February 15 meeting.

ACTION: The Corps will continue to operate Dworshak to stay below 110% TDG, until further discussion by the TMT on February 15. They will provide updated forecasts and scenarios for the TMT's consideration as well.

February 15, 2017, TMT Meeting. The Corps provided an update on Dworshak operations. The forebay is currently at 1520.4 feet, compared to 1519 feet last week. The project is releasing 8.1-8.2 kcfs, with inflow at 7 kcfs, which is slowly receding. TDG has stayed close to 107%. The Corps has been operating to stay below 110% TDG, as coordinated at TMT.

NOAA Fisheries, presented three scenarios, prepared by the Fish Passage Center for FPAC conversations. The three scenarios show potential operations based off a range of inflow and water supply through the end of July 2017. These scenarios are available on the TMT website. Those present at the February 14 FPAC meeting reached consensus on holding at or below 110% TDG until late March to early April, then dropping outflow to lower TDG for two weeks when Fall Chinook emerge in the Clearwater River. This operation also was intended to meet the April 15 flood control targets.

ID agreed with the FPAC recommendation. ID stated his understanding that the intent of the state water quality standards is to stay below 110% TDG, however, did not think that it would be considered a violation if TDG went above 110% for a few hours because of unusual conditions.

The Nez Perce, commented on the desire to lower TDG levels in late-March and early April for fall Chinook emergence. It was noted that typically the hatchery requests an increase in flows at Dworshak to help push the fish out, however, in the past this was not associated with higher TDG. Both the Nez Perce and IDFG agreed to connect with the hatchery to see if 8 kcfs flows and 108-110% TDG or 5 kcfs flows and 100% TDG would be preferred.

ACTION: The Nez Perce and IDFG will work with the hatchery to determine desired flow and TDG during the Fall Chinook releases in early April. They will also check to make sure that the release dates are up to date and see if there is any flexibility in those dates.

The Corps, provided a scenario, similar to the FPAC runs that the Corps noted was one potential operational option. The Corps scenario is available on the TMT website. The Corps also apologized for errors in the long-term scenarios provided last week, noting that he was trying to get the scenarios out to the TMT quickly and was short staffed. The Corps provided an early-bird water supply forecast, which assumed no additional precipitation. The forecast was still 2.4 MAF on March 1, which would equate to a flood control elevation of 1515-1520 feet on April 15. The Corps noted that this estimate is conservative.

ACTION: The Corps will continue to operate Dworshak Dam with approximately 8 kcfs outflow to meet the April 15 flood control value and stay below 110% TDG. It will then set up for refill.

February 22, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. The Corps noted that the forebay is currently at 1524.4 feet compared to 1520.4 feet last week. The project is releasing around 8 kcfs, with inflows at 13 kcfs. The project is slowly filling.

TDG has stayed between 108-109%. The Corps has been operating to stay below 110% TDG, as coordinated at TMT.

The Corps reported that the current 10-day forecast is fairly wet. Therefore, the Corps expects that the March 1 forecast will be approximately 2.6 MAF, making the April 15 flood control elevation 1510 feet. The April 15 and April 30 flood control targets are firm and the Corps cannot deviate from them regardless of the effect on TDG. The region will continue to coordinate in real-time, so if there is an early runoff and then things dry up, as suggested by the Umatilla, the region can manage the flows to smooth out the transition. The Corps reported that he has not yet received data from the most recent snow flight, however, will provide it when he does.

The Corps presented two graphs, available on the TMT website. Both assume a 2.6 MAF water supply. The first shows the projected effect of a balanced operation, holding outflows steady around 8 kcfs until early March, then increasing to 11 kcfs to reach the 1510 feet April 15 value. The second shows the projected effect of typical flood risk management, which would hold close to 8 kcfs until the end of March, then increase to 15 kcfs for the first two weeks of April to get down to the April 15 target.

NOAA, reported that FPAC had discussed holding 8 kcfs out, however, did not discuss increasing to 11 kcfs. NOAA suggested increasing to 11 kcfs sooner than later to "buy space" and avoid having even higher TDG later. If the season proved drier, flow could be backed off later. NOAA Fisheries suggested this operation could begin this week.

IDFG, updated TMT on hatchery operations, noting that the Clearwater Hatchery had planned a smolt release on March 15, but is now planning to coordinate the release with the Dworshak federal hatchery on March 27-31. This scenario depends on the ability to provide lower (100-110%) TDG levels favorable for fish.

Additionally, IDFG noted that the Clearwater hatchery must perform intake cleaning in the forebay, which will require no spill for a half day for diver safety. At this point it looks like the best date for this operation is right after the April 15 target has been met.

The USFWS, noted that the hatchery degassers can work at up to 115% TDG. The USFWS was not sure if that meant that the hatchery would be comfortable with targeting 115% or would prefer to stay below 115%. USFWS agreed to follow-up with the hatchery. Amongst the TMT members in attendance, it was suggested that the project target 114% TDG as soon as possible.

ACTION: The Corps will target 114% TDG as soon as possible, with the objective of operating with TDG levels below 115% until the hatchery weighs in on if 115% is an appropriate target. TMT will receive an update at its next meeting.

March 1, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. The Corps noted that the forebay is currently at 1523.4 feet, compared to 1524.4 feet last week. The project is releasing around 10 kcfs, with 4.7 kcfs generation and 5.2 kcfs spill through the RO's. There is now more water in the system, with inflow currently 13 kcfs. TDG below the project

has been at 114%, however, is now at 113% because the project accidently did not bump it up overnight. The current plan is to increase flows carefully to reach 114% and avoid spikes. The Corps recommends that because of the structure of the spill mechanism, in the future the Corps be permitted to set a specific flow target, which could let TDG levels vary a bit (as opposed to setting a TDG target). The Corps presented two graphs, available on the TMT web site, from the NRCS verification flights of February 13 & 14, 2017. They show data from the two Snotel pillows that are side-by-side at each site in the basin. There is some variability between the two pillows due to natural conditions and the ability to accurately measure the snow. The snowpack in the Dworshak Basin is overall at 98% of normal. Lower elevations are above, mid-elevations are at, and upper elevations are below normal, mainly because of a warm November.

The Corps presented seven graphs, available on the TMT web site, that show the results of modeling scenarios for potential operations at Dworshak. Water supply in the basin has been climbing and according to NWRFC, has gained 600 KAF since the beginning of February. The Corps explained that the scenarios he presented were based on a forecast of 2.8 MAF, though the actual water supply forecast will probably be higher. The Corps is now looking at 2.87 MAF. After February inflows that were 200% of normal, the 10-day forecast is very wet, with significant increases in low-level snowpack.

The Corps recommends the first scenario in the series as "the prudent plan." This plan calls for flow at 16 kcfs for March, except for a two-day drop on March 27-28 to 8 kcfs to accommodate the Clearwater hatcheries' release. On April 1, flow would then increase to 17 kcfs until April 15 to meet the flood control rule curve. After April 15, flows should be held at 8 kcfs until the end of April for Spring augmentation, then drop to 5-6 kcfs through mid-June during refill. The Corps predicted that at 15 kcfs, TDG levels would be 125%. The Nez Perce, noted that 125% TDG is not manageable by the degassers at the Nez Perce hatchery. After degassing, this would probably produce 109% at the hatchery, and thus gas bubble trauma for the fish on station.

In answer to a question from the Nez Perce, The Corps said that at 2.8 MAF, the rule curve would require an elevation of 1501 feet on April 15. If the wetter forecast proves accurate, and 2.87 MAF results, the end of March target would be 1493 feet, and the April 15 rule curve elevation would be 1471 feet.

FPC presented three scenarios showing forecasts of operations based on flood control data from 2008 and 1984 as comparable years, assuming a 2.8 MAF water supply forecast. The April 15 flood control elevation was 1481.9 feet for the first two scenarios (2008), and 1507 feet for the third (1984). The Corps raised a concern with using 1984 as a comparable year, as runoff was late that year so it was easier to reach the April 15 flood control target. The Corps did not think it was comparable to the current runoff forecast.

FPC noted that there would be lower TDG levels if operations were to target April 30 rather than April 15. This is represented in Trace 3. The Corps, responded that it is too far out to assess the risk of deviation from the April 15 FC target, especially with 150-60% normal snowpack in the Snake River basin.

Hatchery managers reported that they have identified some changes in operation that they can make to alleviate some of the TDG concerns, however, not all. They will continue to explore options and report back to TMT.

There was a general conversation about potential alternatives, including:

- Taking a system view to include flood control contributions from Grand Coulee, Libby, or other Columbia River reservoirs, to help relieve the pressure on DWR. Modifications to hatchery operations to include moving fish, changing rearing densities, testing existing degassers at higher levels, pulling water from the reservoir for the DWR hatchery, and using temporary degassers.

- Lowering the volume of spill through March and then increasing it to meet the April 15 target.

- Modify the flood control targets/scenarios during this critical time for fish. In view of the uncertainty about alternatives, TMT agreed to meet again on Friday, March 3, 2017, for further discussion.

ACTION: The Corps will increase DWR discharge to 12.5 kcfs immediately. March water supply forecast information will be posted immediately when available, which will hopefully be later this afternoon, and at least by end of Thursday. All parties commit to out-of-the-box exploration of alternatives to best manage flood control risk and minimize impact on fish. They will bring ideas back to TMT on Friday.

March 3, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. The forebay is currently at 1521.5 feet, compared to 1524.4 feet at the last TMT meeting on March 1, 2017. The project is releasing around 12.3-12.5 kcfs, inflow currently is around 7 kcfs, and TDG is between 118-19.2%.

The Official Water Supply Forecast for March is 2.867 MAF. This will require the April 1 elevation to be 1493.1 feet, and the April 15 elevation to be 1471.1 feet. This forecast does not reflect current low elevation snowpack. The National Weather Service 10-day forecast is for 5" of precipitation in the Dworshak basin, mostly as snow. If these predictions are accurate, it may result in a mid-March water supply forecast of closer to 3 MAF, equating to an April 15 reservoir elevation of 1445 feet. At this level, the reservoir would be "empty."

Both the Corps and FPC presented potential operational scenarios. The Corps presented nine graphs, developed by the Corps and available on the TMT web site. The scenarios are based upon an assumption of 2.9 MAF water supply and all are targeting both the end of March and the April 15 flood control targets. The Corps noted that if the forecast moves to 3 MAF, Dworshak operations would be required to discharge 25 kcfs from March 20 to April 15 to reach the 1445 feet target. The Corps added that the objective of these potential operations is to position the reservoir to respond to both snowmelt and future "atmospheric river" conditions. Dworshak reservoir is a small "thimble" in the role it plays as it relates to system flood control. Flood control storage projects only have the ability to store about 25% of the runoff volume in the

Columbia River because there is about six times as much inflow as storage. There is perhaps 30 MAF total flood storage capacity in the Columbia Basin, mostly in the upper basin.

The Nez Perce, commented that the current Northwest River Forecast Center prediction is for 2.7 MAF, which is a slight decrease from forecasts earlier this week. The Nez Perce noted that TMT should take into consideration the variability of these forecasts.

FPC, presented additional scenarios, which are available on the TMT web site. These scenarios present a longer-term look at the potential operations and use WY 1984 and 1985 as reference years. The FPC explained that FPAC's preferred approach is illustrated in the fourth scenario and is based upon higher water inflow (year 1985), with an earlier runoff and aims to meet April 30 flood control targets instead of April 15.

NOAA, shared that Salmon Managers' biggest concern at this point is the effect of high TDG on hatchery fish. The USFWS, reported that the hatchery managers came together to discuss options. They recognize the Corps' need to increase flow and request:

1. Stepping up flows incrementally, with 500 cfs per day on business days, to allow the hatchery time to monitor the changes and impacts.
2. Due to concerns of gas bubble trauma, back off from increasing flows if TDG elevates to 105% in the hatchery.

The USFWS shared that the hatchery managers discussed potential hatchery management options: keep the fish on station; release them into the river early; or temporarily move them to another location. There are 1.6 million spring Chinook smolts in the hatchery, with few options for moving, especially for brood year 2015 fish. The USFWS continued that additional hardware to pump oxygen into the ponds and raceways is not yet available, though it is being contracted for future years. Early release results in poor survival for small fish, so is a last resort. Thus, the preferred option is to keep the fish on station and closely monitor TDG levels. Currently, TDG levels at the hatchery are between 102-03%.

After a caucus, the Corps presented two alternatives, both linked to meeting the March 31 and April 15 flood control targets, and both lowering flow to 8 kcfs for the late March hatchery fish release:

→ Increase flow immediately to 17 kcfs until the end of March, when flow would increase, probably to 21-25 kcfs, to meet the April 15 flood risk management (FRM) elevation.
→ Increase flow in daily increments of 1,000 cfs, beginning midnight March 2, 1017. Incremental increases would continue until approximately March 13, when flow would be a predicted 22 kcfs. Then the Corps would reassess, reserving the right to go up more rapidly as the situation required. The Corps noted that if the water supply forecast goes to 3 MAF in the future, operations would have to increase to 25 kcfs.

The Corps noted that there is a fairly low probability that high outflows would be necessary in May (estimated 5-10% at 17 kcfs) unless this is an outlier year for wetness.

The Nez Perce, requested that the Corps target the FRM elevation of April 30, and consider recruiting assistance to deal with the problems at Dworshak from other parts of the system, such as Grand Coulee. The Corps noted that due to uncertainty of actual weather conditions so far in the future, they could not forecast to an April 30 rule elevation and need to manage the system for flood control.

After another caucus and conversation with Hatchery Managers, Salmon Managers stated that both of the options proposed by the Corps are detrimental to fish and will cause mortalities. In order to gather data to learn from this situation, they would rather the gradual increase over the instant increase in flow. It was acknowledged that there are no options available at this time that meet the needs of the fish and FRM.

ACTION: The Corps will increase flow in daily increments of 1,000 cfs, beginning at 8:00 pm on March 3, 1017. Incremental increases will continue until the project outflow is 22 kcfs. Then the Corps will reassess, reserving the right to go up more rapidly as the situation required to achieve FRM requirements.

March 8, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. The Corps noted that the forebay is currently at 1514.7 feet, compared to 1521.5 feet at the last TMT meeting on March 3, 2017. The project is releasing 17.4 kcfs, with 4.8 kcfs through the turbines and 12.5 kcfs spill. Total Dissolved Gas (TDG) levels are around 122%. At the Peck Gauge, (located at the confluence of the North Fork and the main stem of the Clearwater River), TDG levels were between 113-114 %. The Dworshak National Fish Hatchery is around 104%. Other downstream measuring station readings: Cherry Lane between 109-110%, and 101.6-7% past the degassing unit; Big Canyon 100-101%. The Corps reported that TDG probes are collecting data every 10-15 minutes for a continuous record; teams will gather spot readings through Friday and then continue downloading the data 1-2 times per week throughout this remainder of these conditions at DWR.

In river TDG numbers have leveled out at about 122% over the past few days. This may be because of the increased depth of the downstream plunge pool as discharge has increased above 15 kcfs. Another factor that may be leveling out the TDG is barometric pressure changes. The hatchery reports degassing operations are performing as expected, leveling off at 104 % at current discharge. It is unknown how the degassers will perform when TDG reaches 127-8%.

The USFWS, reported that the fish sampled at the hatchery are showing small numbers of gas bubbles, however, none yet on the fins. The USFWS noted that they are not looking at the gills, as fins and eyes are more reliable indicators of gas bubble disease. It was noted that GBD is not an instantaneous reaction and the longer the fish are exposed the worse it is likely to become.

The Corps ran another early bird water supply forecast for the basin, which predicts an April 1 forecast of 3.17 MAF and the next ten days look exceptionally wet. The NW River Forecast Center weekly estimate is 1-1½ inches of precipitation in the Clearwater basin over the next two

days, and another 1½ - 3 inches thereafter. Temperatures will be in the 32-40° F. range, suggesting low elevation snowmelt.

The Corps presented six graphs, available on the TMT web site, modeling various scenarios that could meet the April 15 flood control rule curve. They show predictions at both a 2.9 and a 3.0 MAF water year, and provide comparative traces from 1997, a 2.9 MAF year. They also show the effect of lowered discharge at the end of March to accommodate hatchery release.

The Corps reported that Dworshak operations will continue to be stepped up at 1 kcfs daily to reach 22 kcfs, which will likely occur on Monday, March 13. After reaching 22 kcfs, the Corps expects to need to increase to 25 kcfs for a period of time, depending on weather and inflow. The Corps also noted that if the forecast continues to look like a 3.2 MAF year, they will have to prepare the reservoir before the office water supply forecast is out in April. Local flood control elevations for a 2.86 MAF year are 1515.2 feet at the end of March, and 1497.6 feet on April 15. In the event of a 3.2 MAF year, these figures move to 1490.3 feet and 1497.6 feet.

Several members asked whether there could be relief for the local Dworshak situation from other parts of the larger Columbia River Basin system. The Corps, provided information about the broader system, noting that Idaho Power is struggling to meet its flood control rule, and Brownlee is also moving water. Conversations about Arrow in British Columbia involve an international treaty, and will not be feasible this year. The Upper Snake River above Heise has the highest water supply levels on record according to the NWS-RFC. The Boise River is predicted to remain above flood stage for a couple of months. Grand Coulee cannot help with flood control conditions on the Snake River side.

The Nez Perce, responded to a question about the proposed dip in discharge for scheduled hatchery fish release at the end of March. None of the TDG levels being discussed are good for fish, especially when they are in the river. It is even harder on fish if TDG levels fluctuate, so a dip in discharge to 8 kcfs may not make as much sense as earlier. Idaho Department of Fish & Game, said that because the water for their hatchery comes from the reservoir, not the river, they will want the dip.

ACTION: The hatchery representatives agreed to coordinate, and will bring a recommendation to TMT on Monday.

The Corps reported that a new scenario, posted on the TMT web site this morning, models Dworshak operations from April 4 through the end of June. It is based on 1996 after April 1, a 3 MAF year, and uses STP data. It shows the transition between the draft and the refill curves in mid-April. The Corps noted that the refill curve was picked for volume rather than shape, and will vary depending on actual weather conditions. Under this forecast, assuming predicted inflows, discharge will drop to 12 kcfs on April 15 to meet the refill curve. Historically, the Corps has been requested to keep flows high through the end of April. Fish Passage Center, expressed concern over the high outflows through April 15 and then subsequent decrease in flow down to 2 kcfs in the beginning of May. There was a request for additional long-term scenarios, which the Corps could provide. Fish Passage Center, provided a late runoff graph as an

appendix to the FPC letter presented and discussed at the March 3, 2017, TMT, and available on the TMT web site.

ACTION: The Corps will continue to step up discharge at DWR by 1 kcfs per day until they reach 22 kcfs, at which point they will determine if/how they will increase to 25 kcfs. They will continue to operate DWR to meet 1493 feet by the end of March, assuming that there will be a two day drop to 8 kcfs for the hatchery fish release.

March 13, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. The forebay is currently at 1508.0 feet. The project is releasing 22.5 kcfs, with 5.0 kcfs through the turbines and 17.5 kcfs spill through the regulating outlets (ROs). TDG levels at the Dworshak National Fish Hatchery are 104.7% today. The NW River Forecast Center's forecasted inflow shows a slight decrease, however, the Corps' newly revised inflow trace shows an increase from 10 kcfs to 14 kcfs. The Corps noted that the revised early bird water supply forecast is fluctuating, and indicates an April-July runoff volume of around 2.9 or 3.0 MAF. The next snow flight is scheduled for the end of March.

Short Term Scenarios

The Corps presented five short-term potential scenarios for Dworshak operations, designed to reach a projected April 15 target flood control elevation. The scenarios are available on the TMT web site. All but the last scenario assume a 2.9 MAF water supply and a 1471 feet target flood control elevation. The last scenario assumes a 3.0 MAF or greater water supply, and a 1440 feet flood control elevation. The scenarios illustrate potential outflows, both with and without the 8 kcfs drop for the hatchery release.

The USFWS, thought that the second scenario (22.5 kcfs until the two-day drop in flow to 8 kcfs, then 24 kcfs for two days and 21.8 kcfs to April 15) could work for hatchery operations, but hoped the move to 24 kcfs could be avoided. The Corps, noted concerns with the inflow forecasts. The Corps explained that it will be challenging to reach the end of March and April targets, and the forecasts are very dynamic and unpredictable. Outflows can be held at 22.5 kcfs until Wednesday, but with the need to operate to flood control rules, it is likely that an increase to 25 kcfs will be necessary.

Longer Term Scenarios

The Corps presented three longer-term scenarios for Dworshak operations through the end of June. Each is based upon a 2.9 MAF water supply. Scenario 1 uses STP traces with "normal" inflow and shape. Scenario 2 uses the 1989 water year, when volume was similar to that projected for this year, but an earlier runoff and more "front loaded" in shape. Scenario 3 uses the 1985 water year, a late runoff year with several peaks. All three scenarios show a need to bump up to 25 kcfs and drop down to between 2.9-4.3 kcfs for refill.

The date on which discharges to draft will intercept the refill curve will be based upon real time weather conditions. The Corps expects the intercept this year in early April assuming 2.8 MAF and a 1471 feet FRM target, but notes there have been years when the FRM and refill curves intersect in the end-of-April.

Idaho, noted that the long range scenarios showed it is hard to manage operations to meet the April 15 flood control elevation, but easier after that point. Idaho noted that he is getting a lot of questions from his constituents regarding any flexibility in the April 15 target and asked for clear rationale from the Corps as to why they cannot deviate. The Corps said that the flood risk management protocol is rigid and designed to prepare for spring runoff. The reduction in reservoir elevation is to protect the lower river as it experiences runoff. The Corps added that uncertain weather conditions could add up to a 3.5 to 4 MAF year by the end of April. And at this point the Corps is operating to try and avoid having to go higher than 25 kcfs. It was noted that other areas have had real problems this year with atmospheric rivers, both at the local and the system level.

Hatchery Report

USFWS, reported that the hatchery fish are doing well at this point. With TDG levels holding at about 104%, and relatively stable conditions. There is now more evidence of gas bubble disease on more parts of examined fish. Spring Chinook were examined on March 10: 7 of 10 fish showed gas bubbles in the gills, 6 of 10 had bubbles on the lateral line. Only 2 of 10 steelhead had gas in their gills. The USFWS will compile a spreadsheet of daily fish observations and send the results to TMT.

Salmon and hatchery managers are in the process of determining the best approach for their releases. At this point, they are still anticipating a need for a reduced flow operation, but may want to move the date up depending on the smoltification status. This might occur as early as next week. The first fish to be released are Spring Chinook smolt. It might also be better to keep the fish in a low gas situation in the hatchery for a day, and then release them into a low gas river. Managers will try to have a decision by TMT on Wednesday, March 15.

Action Agencies would need a day to prepare for this reduced flow operation. Depending on the hatcheries' needs, the lowering operation would probably start in the evening or at midnight, with fish release the next morning. There are probably few anglers in the river to be affected by these operations, but the region will be notified.

There is now a semi-permanent TDG monitoring station installed inside the hatchery. The Lewiston TDG station is on line today, and the Peck station will be soon. The Corps will build a page to display all this TDG data in real time.

March 15, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. Currently the reservoir elevation is 1507.4 feet and filling. Outflow is 22.5 kcfs, with 5 kcfs through the powerhouse and the balance through the RO gates. Inflow is 19 kcfs, and has been rising rapidly. On March 14, the 6-hour inflow was 14 kcfs, end of day was 21.4 kcfs, the morning of March 15 was 26.5 kcfs, and at 0700 hours on March 15 was 32.2 kcfs. The NWRFC forecast calls for peak inflow on March 16 at 70 kcfs, though the Corps is anticipating closer to 45 kcfs. The 10-day forecast is for substantial precipitation for 4 days, then backing off for 2 days, then wet again. Snow density, measured in real time, is 33% at Cool Creek and 45% at Shanghai with a little decline in SWE.

In river TDG levels have been between 124.9 and 126%, varying largely because of fluctuations in barometric pressure. Water temperature changes and a rapid change in gauge depth also contributed. In answer to a question, The Corps, will report back to the next TMT on what TDG levels would be expected if all turbines were available and running at capacity of 10 kcfs. OR, asked about the variables for TDG percentages, noting that it should incorporate barometric pressure. FPC, noted that TDG calculations are a direct calculation of TDG/barometric pressure, and measures super saturation relative to solubility in the water column.

Yesterday's early bird water supply forecast (calculated assuming current conditions and no further precipitation until the end of March) suggests an April water supply of 2.965 MAF. Extrapolating current weather conditions from the end of February suggests a 3.57 MAF. Another run that the Corps conducted using a different forecast method suggest 3.2 MAF if assuming no additional precipitation, or 4 MAF if extrapolating from the end of February. Variability factors include the chance of significant snowmelt, especially at lower elevations; basin temperature; and additional precipitation. The NWRFC downgraded its prediction to 2.64 MAF for the 10 day forecast and 2.58 MAF for the 0 day forecast.

The Corps explained current system operations noting that the Corps has declared a system-wide flood emergency due to the flood stage forecast at Vancouver. This requires that the Corps call on the Districts to help manage flows in the upper basin to alleviate flows in the lower basin. The Corps has therefore asked the Walla Walla District to hold outflow at Dworshak at 22.5 kcfs for 3-4 days, depending on real-time conditions. These operations may cause the end-of-month reservoir elevation to be higher than the flood control target; the Corps will do what they can to not exceed 25 kcfs (channel capacity below the dam). It was noted that project regulating outlets could release up to 45 kcfs, if needed, to protect the structure from overtopping (not the current situation), and there may be some flexibility to go higher as flows in the mainstem decrease. Releases of this magnitude (45 kcfs) would impact people and fish downstream and are not currently planned. The Corps noted that the situation is dynamic and the Corps will track and respond to any changes as necessary. Additionally, the Corps may also be using Dworshak Dam for local flood control based on the forecasted increase in stage at the Orofino, and Spalding gages.

ACTION: The Corps will manage DWR based on local and system flood control needs. At this point in time, they expect to hold 22.5 kcfs outflow until Saturday, potentially longer. Operations are subject to changed based on real-time conditions and FRM needs.

The Nez Perce, noted concern that a reaction operation to the current operation may cause more harm to fish if it required increasing outflows to 25 kcfs.

<u>Dworshak National Fish Hatchery Operations</u>
The DWR Hatchery, reported on fish health. They are currently starting to smolt, however, are not up to size for release. From a sample of 10 fish in the raceway, 9 had bubbles in the gills, 6 in the midline, and 1 in the caudal fin. Of 10 steelhead sampled, 4 had bubbles in the gills and 2 in the dorsal and caudal fins. In summary, gas problems are increasing in the number of fish, the location, and the level of bubbles.

The hatcheries are considering releasing as early as next week. BPA and the Corps suggested that it would be easier to drop down to 8 kcfs this week, when they know that they have to hold back for local flood control. Hatchery managers did not think that they would be able to release this week, however, agreed to coordinate internally and reconvene with TMT on Friday at 1:30 pm.

ACTION: Hatchery manager will discuss release timing options and come to TMT on Friday, March 17 to coordinate further.

The semi-permanent TDG measuring station is now operational at the hatchery. It can be accessed by searching for *dhci* at the "data query" tab on the TMT web site.

There was a request for a Unit 3 update. The Corps noted that they have concerns over the quality of the rods and have sent them out to Canada for testing. The Corps swould provide an update after they've decided on the rods.

March 17, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. Currently the reservoir elevation is 1515.6 feet and filling. Outflow is 12.5 kcfs, with 4.8 kcfs through the powerhouse and the balance through the RO gates. Discharge was reduced from 22.5 kcfs to 12.5 kcfs on March 16 to reduce flood impacts at Ahsahka and Spaulding (downstream on the Clearwater River). Inflow is 40 kcfs, and has been rising rapidly. On March 16, inflow was 40 kcfs. The forecast still calls for peak inflow at 70 kcfs late Saturday or early Sunday.

The weather forecast calls for ½ - 1" of rain today and 1-2" tomorrow, a clear day on Monday, and more rain early next week through the next ten days. Below freezing overnight temperatures in the basin should dampen snowmelt over the next ten days.

In river TDG levels currently between 119.8 and 126%, and were 119.1% this morning. TDG levels at the hatchery are currently 102.6%, down from a high of over 105%.

The Corps announced that discharge at Dworshak is now being reduced. A Flood Watch was posted for Nez Perce and Clearwater counties because of potential flooding at Ahsahka and Spalding. This requires that DWR outflow is further reduced to balance out high flows in the mainstem Clearwater to help limit damaging river levels. DWR discharge will be reduced to 8 kcfs from Saturday evening through Monday to shave the peak off expected Sunday inflows. The hatchery fish releases will be coordinated to take place during this reduction as well. On Monday, the project will ramp up by 2 kcfs per hour to 25 kcfs, starting at noon, and will hold this rate for the foreseeable future because the reservoir is currently well above the flood control elevation target.

ACTION: The Corps will drop down to 8 kcfs over the weekend and the hatcheries will release their spring Chinook. On Monday at noon, discharge will increase by 2 kcfs/hour up to 25 kcfs.

Long Term Scenarios

The Corps also presented six scenarios of possible operations through mid-June; all are based on STP inflow traces. Scenario 1 models operations based upon the 4 MAF 1997 water supply year. The current forecast is for 2.9 MAF, with the early bird prediction more than 3.0 MAF.

Scenarios 2, 4 and 6 have been superseded by the current flood control operations.

Scenario 3 models operations based upon the 3.3 MAF 2013 water year, which had early inflows. This shows a similar pattern until April 15, when discharge will drop to 8 kcfs for a brief period before settling at 4.1 kcfs through the end of the period.

Scenario 5 models operations based upon the 3.0 MAF 1996 water year, which has both early and late inflow peaks. It shows a similar pattern through April 15, with a step down to 8 kcfs for a short time before settling at 4.9 kcfs through the end of the period.

Discussion

ID, and The Nez Perce, asked whether it was possible to do a slower ramp up rate if forecasted conditions change? ID understood the need for flood control and noted that the hatchery could adjust the planned Chinook smolt release for Sunday. However, they would prefer if the ramp up rate were reduced. The hatchery had requested a two-day reduction to 8 kcfs. It would be better for the releases to have two days to get the fish into a more optimal river environment.

TDG levels are currently 119% at the bottom of the dam, 104% at the Peck gauge, and 102-103% at Lewiston. Because the volume of the Clearwater mainstem is now 10 times that of Dworshak discharge, released fish would not be exposed to high TDG levels for too long. The Nez Perce noted that anything greater that 21.5 kcfs creates issues for fish health, and increasing to 25 kcfs will create significant health issues.

The USFWS, encouraged the group to consider every possibility, noting that there are 2.4 million steelhead still on station that are very important and critical to ESA agreements. They are not yet ready to be released from the hatchery. With the operations proposed, these fish will be exposed to severe conditions. The USFWS asked the Corps to consider a ramp up rate of 4.5 kcfs per day, which would conclude the ramp up operation on Thursday.

OR, asked about flood control operations. It was noted that Spalding flood stage is at 17 feet. The houses at risk for flooding are immediately downstream of the Highway 95 Bridge. Yesterday the reduction in discharge from Dworshak held peak to 17 feet and the forecasted peak before the flood control operation was 18 feet. Now the forecast is for a peak of 17.5 feet, which is why there is a 5 kcfs reduction planned: 5 kcfs equates to ½ foot in reduction in stage at Spalding on the Clearwater River.

The Corps, stated that they did not have flexibility to slow the rate of increase. With forecasted inflows of 70 kcfs the reservoir would be 40 feet above end of March FRM requirements, so they absolutely need to manage for flood risks. The reservoir filled 100 KAF in the last two days, and expect 150 KAF more this weekend. There is a possibility that they would need to decrease discharge more to avoid flooding homes, if the forecast comes in heavier. They have provided

several unexpected days at 12.5 kcfs, and will provide another one and a half days at 8 kcfs for local and system FRM: this is the best that they can do for fish at this point, given the flood risk management needs.

The Corps also provided a system-wide perspective. The Corps is operating for flood stage at Vancouver and there is not a lot of space to put water in the system. There are limitations at John Day and Grand Coulee due to maintenance work. Some upstream projects are also increasing outflows to prepare for spring runoff. Dworshak is above the end of month target. The AAs explored whether they could delay the Grand Coulee drumgate maintenance and determined it would not provide much benefit as a short-term fix. Impacting drumgate maintenance would require a 10-day notice to remove equipment, result in higher elevations at Coulee and they will have a deeper draft requirement in April, with increasing water supply forecasts. Being higher will make drafting in April more challenging. The Corps stated that with the uncertainty from the flood control perspective, they needed to be aggressive on moving water and had no flexibility to slow down moving water by either lower volume or lower ramp rate.

Given the situation, the Corps agreed to an emergency TMT call on Monday, March 20, 2017, to check in on the conditions. The Nez Perce said the hatchery is now exploring de-gassing scenarios and fish transport by truck. The hatcheries will update TMT on Monday. The Corps committed to notifying the hatcheries over the weekend if conditions change.

ACTION: An unscheduled TMT phone meeting is set for 10:00 AM on Monday, March 20, 2017, to check in on conditions.

March 20, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. Currently the reservoir elevation is 1528.6 feet and filling. Outflow was held at 12.5 kcfs through midnight Saturday, March 18, when it was dropped to 7.5 kcfs through mid-day Sunday, then raised to 8 kcfs until currently. Inflow was 52.6 kcfs over the past 6 hours, and 42 kcfs currently.

In river TDG levels currently are 107-108%. Levels reached 120% on March 17-18, then dropped to 106% during the period of low discharge. TDG levels at the hatchery were 103% before the decreased discharge, and are currently 98-99%. The Peck station recorded 105, 101.5, and currently 102.5% during these operations, and Lewiston 103% and currently 101% TDG.

The Corps confirmed that conditions had not changed from the planned operation to ramp up Dworshak discharges by 2 kcfs per hour to 25 kcfs beginning at noon on 3/20. The project plans to hold 25 kcfs discharge for the foreseeable future because the reservoir is currently well above the flood control elevation target. The Dworshak increase in flow is part of the necessary effort to move water out of the system to prepare space for spring runoff.

The upper Snake River facilities are also releasing water. Brownlee is drafting inflow for system flood control. Water is also being released from the Boise, Payette, Palisades, Owyhee, and Malheur to avoid local flooding.

Hatchery Update

The Nez Perce, reported that the spring Chinook release from the Dworshak Hatchery began this morning (3/20) into the Mainstem Clearwater, and should be completed by mid-afternoon. Because they cannot maintain satisfactory TDG levels when outflows increase to 25 kcfs, they are discussing options for an early release of steelhead as well. Only a portion of the steelhead on station are smolting at this point. Generally, it would be better to leave these fish on station at this stage, however, due to uncontrollable TDG it may be better to release them early. The hatchery is also working with the Idaho hatchery to assess options of trucking fish for an off station release, however there are a lot of resource and logistical challenges that need to be addressed. Sampling today showed some reduced gas bubbles in the gills, however, this is a 1-day observation and too early to tell if there has been an improvement.

The Idaho hatchery should have completed its release of Spring Chinook into the North Fork Clearwater yesterday. The Idaho hatchery will then be able to transfer some low-TDG reservoir water to the Dworshak hatchery. The USFWS, noted for the group that the Dworshak ramp-up will impact 1.4 million steelhead at the hatchery because they have inadequate protection from the rising TDG levels.

There was generally expressed appreciation for the work done over the weekend by both action agencies and salmon and hatchery managers.

ACTION: The Corps will ramp up discharge from Dworshak Dam by 2 kcfs/hour, beginning at noon today, until discharge reaches 25 kcfs. It will hold 25 kcfs discharge for the foreseeable future to meet local and system flood control needs.

March 29, 2017, TMT Meeting. The Corps, provided an update on Dworshak operations. Currently the reservoir is at 1528.89 feet elevation. Discharge is 25 kcfs, with 4.7 kcfs generation and 20.3 kcfs spill. TDG levels are 125% measured at the dam and 105.5% at the hatchery.

The forecast calls for 1-1.5 inches of rain over the next couple of days, then tapering off Thursday through the weekend. Temperatures will warm slightly, but remain cool. The April/July NWRFC forecast is for 2.6 MAF. The official Corps forecast will be available next week, but is expected to be approximately 2.9 MAF.

The Nez Perce, reported on a March 18, 2017, memo from the hatcheries to FPAC updating fall Chinook fry emergence timing (available on the web site). It discusses redd creation, distribution and water temperatures downstream of Dworshak. The Nez Perce pointed the TMT to Figure 2, which shows 258 redds in the Lower Clearwater River (representing approximately 4% of the redds in the NF around the Ahsahka Islands reach and 2% of the total population). These figures suggest 57% Chinook emergence by mid-April, and 75% emergence by May 1 in the North Fork Ahsahka Islands reach. In the lower Clearwater, most fry are still in the gravel, with 15% expected out by May 1. This is a delayed date from the September 2016 report, which is good news, as they will have less TDG exposure. The Nez Perce noted that they will continue to update these dates as the season progresses.

The Nez Perce and USFWS, provided an update on fish on station. In the hatchery, some brood year 2016 spring Chinook will be taken off incubation water and onto North Fork Clearwater water on May 1. The Nez Perce noted that it would be good to have the TDG closer to 100% when that happens. The fish appear to be feeding pretty well.

The USFWS reported on recent hatchery releases. The hatchery released Chinook on March 20. It released some steelhead early (those that they could not switch over to reservoir water), starting on March 21 and completed March 23. Fish were released on and offsite. Released fish moved downstream very rapidly. Fish onsite continue to be sampled for GBT: sampled fish showed bubbles in gills and lateral line, but no deaths were seen.

May 17, 2017, TMT Meeting. The Corps, reported that the Corps has found significant deficiencies in stator bars that contractor has produced for Unit 3 overhaul and has officially rejected those bars. The Corps noted that the insufficiency is due to issues with insulation, voids, and incorrect dimensions. The bars need to be very specific and accurate and the Corps is currently in negotiations with contractor as to what happens next. Previously at TMT, The Corps reported a July 15 return to service date; however, this is no longer the case. The schedule is changing day to day, and Unit 3 will likely not be available for summer flow augmentation. There is not yet an official schedule update to provide, however, the Corps assured the TMT that as soon as he has an update he will report back to the TMT.

The group discussed the need to determine contingency plans and priorities for Dworshak operations during the summer flow augmentation season. It was noted that Idaho and the Nez Perce are in discussions now to determine their joint recommendation in preparation for requesting a TDG waiver. The Corps noted that ideally the entire TMT will inform and get behind those recommendations. The challenge will be to balance TDG levels and cold water releases from Dworshak as flow capacity will be limited and in order to release the flow needed to cool the Snake, there will be high TDG levels.

The Corps noted that they are working with the downstream hatchery to improve the oxygen system to increase oxygen levels in the raceways. Additionally, the joint water supply in the pipeline will help reduce TDG in the raceways. The Corps requested TMT members to bring forward any other ideas to explore.

June 7, 2017, TMT Meeting. The Corps, provided an update on Dworshak summer operations coordination. The Corps is coordinating with the Nez Perce and Idaho on a short-term exemption to TDG standards. Unit 3 will remain out of service through summer temperature augmentation operations, thus TDG is likely to exceed standards at times between July 1 through October 1. They are expecting to request a 120% target.

June 28, 2017, TMT Meeting. The Corps, reported on Dworshak indicating the current elevation is 1599.5 feet; they are passing inflow, with around 6 kcfs of generation and 1.5 kcfs of spill. TDG levels are ranging from 104-106%. The Corps noted that the project touched full last week in preparation for what was forecast to be a dropping inflow. At the time the forecast

called for a 7 kcfs drop, thus the project decided to fill the reservoir. In reality, the drop did not occur and inflows stayed around 10 kcfs, causing the project to increase discharge to 11 kcfs temporarily. The current plan is to hold 6 kcfs out to keep the reservoir within the top foot through the July 4 holiday.

Current water temperatures in the tailwater at Lower Granite are 63° F.; 64° F. at Anatone; and 66° F. at Orofino.

NOAA, shared that FPAC was interested in operating Dworshak to keep the Lower Granite tailwater around 65° F., so that later in the season it is easier to keep temperatures below 68° F. clarified that the project can target 65° F. at Lower Granite as long as possible, without exceeding 115% TDG. Once it is no longer possible to target 65° F. within 115% TDG, the project will shift to target 67° F., trying not to exceed 68° F. NOAA noted that his may require utilizing the 120% TDG waiver that was granted to the Corps by the State of Idaho and Nez Perce Tribe; the waiver allows the project to go beyond the 110% State TDG limit, up to 121% if needed to manage for temperature and flow augmentation. However, due to biological implications of high TDG on fish, interest was expressed to back off of the 120% whenever possible.

The Corps noted that modelling suggests that they should be able to hold 65° F. through the first week of July with 6 kcfs. After July 4, the project will likely increase to 7 kcfs (110% TDG), or as needed 8.5-9 kcfs (115%) in order to maintain 65° F.

The Corps, explained that as a result of the turbine outages, there is a strong possibility that the project will not be able to meet all of the BiOp specifications this summer. It is unlikely that the project will be at 1535 feet at the end of August, as it would require discharges of around 11 kcfs and thus 120% TDG. Instead the water will have to be moved out in September or October. The project will move the water, it will just be later. Additionally, due to the current limitation of 121% TDG Dworshak may not have the ability to operate at or below 68° F. as described in the BiOp. The Corps asked that all TMT members acknowledge these limitations, noting that they will continue to model weekly and the TMT will work to coordinate in real-time throughout the season. All TMT members present (BOR, BPA, Colville Tribes, Corps, ID, Nez Perce, NOAA, Umatilla, USFWS, and WA) acknowledged these limitations and agreed for the current operation (targeting 65° F. at Lower Granite) to move forward. The Nez Perce, noted that the TMT will have to work to balance the realities of temperature, TDG, adult fish passage, and gas bubble trauma, and meet the needs of the fish as best possible. The Nez Perce also asked the TMT to look for other temperature augmenting options.

ACTION: The Corps will operate DWR to target 65° F. tailwater at Lower Granite, while not exceeding 115% TDG. Once it is no longer possible to target 65° F. within 115% TDG, the project will shift to target 67° F., trying not to exceed 68° F. The Corps will conduct weekly modelling and the TMT will revisit the operation and conditions at their next meeting.

July 5, 2017, TMT Meeting. The Corps, presented on Dworshak operations. Because of increasing temperature in the Lower Granite tailrace, at midnight on June 30, the project increased discharge from 7 kcfs to 9 kcfs and held it at 9 kcfs through the weekend. During the

weekend, TDG in the Dworshak tailrace ranged between 115% and 118% and temperature readings at the Lower Granite tailrace ranged between 64-68° F., with the highest readings at 4:00 PM. Currently, the Dworshak reservoir forebay elevation is 1597.69 feet, with outflow at 8.8 kcfs. Lower Granite tailrace temperature is at 66.5° F.

To inform operations moving forward, the Corps today provided 3 modeling scenarios for TMT to consider:

1) Hold flow at 9 kcfs to maintain temperatures close to the 68° F. margin, and check in with the TMT during our next meeting on July 12;

2) Increase flow to 10 kcfs at midnight July 5 to provide some temperature relief, but with TDG likely increasing to 120%; and

3) Increase flow to 11 kcfs at midnight, temperature impact would be similar as with scenario 2, however, TDG is modelled to go above 120%.

Under these three scenarios, the model is assuming that Anatone flows will drop off, however, it is unclear what Idaho Power plans to do in the near future, and Hells Canyon could come up adding more warm water into the system. The Nez Perce, agreed to reach out to Idaho Power to get a better idea of their plans.

Additionally, a fourth option was briefly discussed, which entailed holding discharge at 9 kcfs for a few days and then bumping up to 10 kcfs. OR, thought this would be a prudent option, however, there was little traction due to the water travel time from Dworshak to Lower Granite and the unknown of Anatone flows.

CRITFC, stated that the near term forecast for Idaho is hot for the next few days, returning to normal cooler temperatures by the end of the week.

TMT discussed how to best manage Dworshak this year given the BiOp requirements and project limitations due to the Unit 3 outage. The Corps, explained that the BiOp requires the Corps to regulate Dworshak outflow to attempt to maintain water temperatures at the Lower Granite Dam tailwater at or below the water quality standard of 68° F. and be within the state of Idaho TDG water quality standards of 110%. The Corps continued that unfortunately, due to project constraints this year, it may not be possible to achieve both of these BiOp objectives at some point, even with the current TDG exemption. For example, with the current coordinated operation, the benefit to the hatcheries downstream of Dworshak Dam resulting from reduced Dworshak Dam outflow and TDG comes at a cost to adult salmon downstream of Lower Granite Dam that will experience relatively higher temperatures.

The Corps emphasized that due to the complexity of managing Dworshak Dam outflows and Lower Granite Dam tailrace temperatures, the TMT needs to clearly prioritize TDG downstream of Dworshak or temperatures below Lower Granite in order to ensure that operations have successful outcomes and asked TMT for input. The Nez Perce noted that temperature at the Lower Granite tailrace, TDG, gas bubble trauma in hatchery and in-river fish, and adult passage

all need to be taken into consideration. From the Nez Perce perspective, the Corps should operate to maintain 68° F. water temperatures at Lower Granite, going up to 120% TDG in the Dworshak tailrace when necessary to do so, however, not to exceed the 120% waiver. The Corps continued that the waiver states that 121% allows the Corps to operate to 120% TDG with a 1% safety buffer to account for daily variation. The USFWS, explained that the hatcheries are not comfortable with 120% TDG and asked that the Corps drop discharge when at all possible.

TDG data from the Dworshak hatchery is linked to the TMT agenda. It shows that at 9 kcfs, TDG readings were 102% at the hatchery collection channel. In the past, the hatchery managed up to 115% TDG in-river. The group discussed the short and long term impacts of high TDG and gas bubble trauma. It was noted that during this past spring the Dworshak Hatchery fish went "off feed" at 104-105% TDG, and both short-and long-term consequences of this situation can be anticipated throughout the life cycle, however, are not easy to track. In the past, when TDG levels have decreased, fish went back on feed but did not expel existing gas bubbles. Literature shows that GBT kills tissue in fish, however, it is not clear how this impacts survival in the long run.

- **CONSENSUS:** Based on their conversation, TMT agree to increase flow at Dworshak to 10 kcfs at midnight on July 5, operating to keep TDG levels at or below 120%. The Corps will reduce flows if conditions allow for it.

ACTION: The Corps will implement the above stated operation. The Nez Perce and USFWS will connect with hatchery managers and stay apprised of conditions in the hatchery, reporting back to TMT. TMT will reconvene to review operations and projections at 11 AM Monday, July 10.

July 10, 2017, TMT Meeting. The Corps, presented on Dworshak operations. As coordinated at the July 5 TMT meeting, the Corps has been operating within the 121% TDG waiver, maintaining outflows around 10 kcfs. TDG levels in the tailrace are fluctuating between 117% early in the day to around 119% between 2 to 4 PM during the warmest part of the day. Water temperatures at Lower Granite have been variable, in part due to wind events mixing the warm surface water down deeper into the reservoir.

The weather forecast in the Clearwater basin is for a few days of cooler ambient temperatures before a warming trend. The Corps therefore proposed to bump discharge from 10 kcfs to approximately 10.5 kcfs daily average, taking care to keep total TDG levels at or below 120% (with a 1% buffer to allow the project to operate within the 121% TDG waiver). Depending on the conditions, the Corps may be able to move a bit more water during cooler temperatures (e.g., at night) and stay within the TDG waiver, or at times they may not be able to move as much. They will adjust operations accordingly with the intent of managing to the TDG waiver and keeping water temperatures below 68° F. as possible.

- **CONSENSUS**: All TMT members present agreed that the Corps should increase outflows at Dworshak as needed to manage TDG within the 121% wavier with the intention of keeping Lower Granite tailrace water temperatures at or below 68° F. At the time of the meeting, it was expected that a 500 cfs increase would be possible.

ACTION: The Corps will increase outflows at Dworshak Dam by about 500 cfs (to 10.5 kcfs) to manage total TDG levels to target 120%, providing a 1% buffer so as not to exceed 121%. The operation will manage to TDG rather than flow to the extent possible, with the intent of maintaining water temperatures in the Lower Granite tailrace at or below 68° F. They will back off on outflows if conditions allow for a decrease while maintaining TDG limits.

TDG levels at the hatchery have been around 103%. The USFWS, noted that fish presently in the hatchery are smaller in size than during the spring 2017 operations, so are more susceptible to TDG. Some gas bubble disease has been observed in hatchery fish already. Spring Chinook are on an air oxygenation system, however, coho and steelhead are not and thus are more vulnerable to higher TDG levels. The USFWS also noted that the hatchery is working on a "tweak" to the system that could reduce hatchery TDG levels by 1-2%. The Nez Perce, requested that the TDG monitoring equipment is provided to the Nez Perce hatchery if available.

ACTION: The will coordinate with the Nez Perce hatchery to resupply TDG monitors and will connect with the USFWS hatchery to see if the vacuum degasser can be tweaked to improve TDG.

BPA, suggested that the region consider pulling the spillway weir at Lower Granite to help reduce water temperatures downstream. BPA suggested that this could aid in adult sockeye passage and the amount of spill would not change. The TMT agreed to discuss this option at their meeting on Wednesday, July 12.

ACTION: TMT will consider removing the Lower Granite spillway weir at their next meeting on July 12.

July 12, 2017, TMT Meeting. The Corps, presented on Dworshak operations. Current reservoir elevation is 1592.5 feet, with a 10.7 kcfs discharge at the time of the meeting. TDG at the tailrace has been between 118.6 and 119.4%; TDG at the hatchery fixed monitoring station has been between 103 and 103.7%.Water temperature in the Lower Granite tailrace is 68.6° F. and has been coming down slightly due to cooler weather and lower inflow temperatures from Orofino and Anatone. The Corps, provided a graphic depicting system water temperature in the Snake and Clearwater Basin. The graphic shows water temperatures for various parts of each project. TMT members thanked the Corps, noting that it was very helpful. It was suggested that it would also be helpful if he could develop a graphic that showed the water temperature stratification in the Lower Granite forebay. Recently, Lower Granite temperatures were significantly affected by winds that reduced temperature stratification in the pool. This stratification is now starting to rebuild, and cold water will reamass in a few days.

According to weather forecasts for Lewiston, temperatures are expected to stay high around 97-98° F. through Saturday. Temperatures are expected to cool down to the low 90's starting Sunday. The Corps shared that the new weather station at Lower Granite is now on line.

The Corps is running models daily and will post results every few days to the TMT agendas. The Corps shared that they are doing what they can within the current limitations, however, are

above 68° F. and don't expect to drop below 68° F. until the weekend. He is working with operators to be less risk adverse and push as much water as they can while staying below 121% TDG. They are close to 11 kcfs out.

July 19, 2017, TMT Meeting. The Corps, summarized operations at Dworshak Dam. The facility has been passing 10.5-11.1 kcfs over the last week, with TDG levels between 117.5% and 120.1%. TDG levels at the hatchery averaged 103.5%. Water temperature at the Lower Granite tailwater has been around 68.5° F. The 7-day forecast for Lewiston calls for air temperature to be cooler for a few days be fore rising again at the weekend, which could cause water temperatures in the Lower Granite Dam tailwater to go above 68° F. The Dworshak Dam is passing the coldest water possible (43° F.) from the bottom of the outlet; the Corps anticipates that the Dworshak Dam outflows will warm to about 45° F. by the end of the summer. NOAA complimented the Corps' efforts to manage temperatures and TDG given the situation.

The USFWS, reported that TDG levels at the hatchery have increased slightly above 103.5%, which is not ideal for fish, especially due to their smaller size and being exposed to moderately high levels of TDG for an extended period of time. No mortality has been observed to date, but there have been reports of GBT and they are unsure of the impacts of longer term exposure to high gas levels. When examined, 4/10 young coho had no food in their stomachs, which is unusual and not a good sign. Because of this uncertainty over long-term consequences, conditions will be monitored weekly.

July 26, 2017, TMT Meeting. The Corps, summarized the week's operations at Dworshak Dam. The facility has been releasing between 11 and 11.4 kcfs in attempt to balance TDG and water temperatures downstream. TDG levels in the Dworshak tailrace ranged between 119.5% and 120%. TDG levels at the hatchery averaged 103%. Water temperature in the Lower Granite tailwater has been between 68.0 and 68.9° F. The Corps noted that models seem to be performing well, with today's model run anticipating water temperatures between 68 and 69° F. The 7-day forecast for Lewiston, ID calls for air temperatures in the high 90s for a few days. The Corps noted that it was hard to fine tune Dworshak discharge at the levels that the project is currently trying (within 100-200 cfs) due to the "slop" in the hydraulic linkage. The Corps noted that there may be slight variations in discharge as a result. The Corps will continue to operate as they have been, balancing TDG in the Dworshak tailrace with temperature in the Lower Granite tailrace.

The USFWS, shared that the hatchery is hoping for a respite from high temperatures, allowing a reduction in spill and TDG to give the fish a break from high TDG levels. If/when temperatures decrease, there will likely be a request for the Corps to model the effect that reducing spill by 2-3 kcfs might have on water temperatures at Lower Granite. Any reduction, for example even to 101-2% TDG for a week, would be helpful for fish in the hatchery.

August 2, TMT Meeting. The Corps, updated TMT on Dworshak conditions and operations. Currently the reservoir elevation is 1570.4 feet. Inflows are 1.5 kcfs, and outflows are at are between 11.1 to 11.2 kcfs, with most as spill through the RO gates. At 9 am today total dissolved gas (TDG) in the Dworshak Dam tailrace (DWQI) was 119.1%. The project has been backing off project outflows slightly when temperatures cool at night.

Temperatures in the Lower Granite Dam tailwater were slightly above 69° F., at 69.4° F. yesterday. The Corps highlighted two water temperature model scenarios. Given the forecast for very high ambient air temperatures at Lewiston, perhaps approaching 108-9° F., and maintaining the current discharge of 11 kcfs, each model showed water temperature levels hugging the 69-70° F. line for the foreseeable future.

The Corps noted that the project will continue to operate to the 120% target identified in the TDG waiver, with the intention of keeping downstream water temperatures below 68° F. The Corps noted that this operation will likely be necessary for the next 10 days and that there is nothing else that the project can do at this point.

The USFWS, reported on hatchery conditions. TDG levels in the collection channel yesterday measured 103.3-4% during the day, and 102.8% nighttime. Some gas bubble disease has been observed in gills and lateral lines, but no mortality is reported. There is concern that sampling results show no food in the stomachs of about 40% of the steelhead and 50% of the coho sampled fish. However, the USFWS noted that the feeding protocol recently changed from manual to mechanical and the sampling was conducted in the morning instead of the typical evening sampling; both factors could contribute to the empty stomachs. The USFWS noted that the conditions are not ideal; however, the hatchery is not yet panicking.

August 9, 2017 TMT Meeting. Corps, summarized operations at Dworshak. Reservoir elevation is currently at 1562 feet, with inflows ranging between 1.7-1.8 kcfs, and around 11 kcfs outflow. TDG is ranging from 119.5 to 120% at the dam and from 102.9 to 103.4% in the hatchery collection channel. Snake River water temperatures are also varying slightly, with highs as high as 70° F. in the Lower Granite Dam tailwater, however, cooling in the evenings. The air temperature forecast at Lewiston continues in the upper 90's until Sunday, when temperatures will drop.

The Corps developed three model scenarios simulating the impact of Dworshak Dam outflows on water temperatures in the Lower Granite tailrace. In the three model runs, on August 12 or 13, the current Dworshak Dam outflow would 1) continue at 11 kcfs, 2) be lowered to 10 kcfs, or 3) lowered to 9 kcfs. The models predicted there would be little difference between water temperatures at these outflow rates. It was noted that if the project is operated at 11 kcfs through August, the reservoir will be drafted deeper than the end of August elevation of 1535 feet described in the NOAA Fisheries Biological Opinion.

The Corps' recommendation was to drop Dworshak outflow to a flat 10 kcfs until water temperatures in the Lower Granite tailwater are comfortably below 68° F., then reassess at next TMT and reduce to 9 kcfs if possible. This would provide a water temperature buffer in case the ambient temperatures remain high. NOAA reported that some at FPAC preferred to go to 10 kcfs sooner, both to provide some relief at the hatchery and so as not to run out of water later. The USFWS, reported that fish are doing reasonably well at the hatchery, considering the prolonged exposure to high TDG levels. The fish are showing some gas bubble in the gills of both steelhead and coho, and in the lateral lines of the coho, however, they are not seeing elevated mortality. The USFWS noted that the hatchery would appreciate relief and are

comfortable dropping to 10 kcfs now, with the hope of dropping down to 9 kcfs the following week. ID noted that most adult sockeye have passed Lower Granite Dam and are appearing in the Salmon River basin. After the discussion, TMT agreed by consensus to the following:

ACTION: The TMT agreed to reduce discharge at Dworshak to a flat 10 kcfs at midnight on Friday, August 11, and to continue at that rate until the next scheduled TMT, on Wednesday August 16. TMT will then reassess and consider another reduction to 9 kcfs.

August 16, 2017, TMT Meeting. The Corps, summarized operations at Dworshak. Reservoir elevation is currently at 1554 feet, with inflows less than 2 kcfs, and 9.1 to 9.2 kcfs discharge. TDG is ranging from 115 to 117% at the dam, and from 102.6 to 103% in the hatchery collection channel. Snake River temperatures in the Lower Granite tailwater have been at 66° F. since August 13. The air temperature forecast at Lewiston is for reasonably cool, with temperatures in the low 90s through the end of the forecast period, with some warming predicted for next Tuesday and Wednesday (mid-90s).

The Corps reported that per TMT coordination last week, they dropped project outflows to 10 kcfs on August 9, and then further reduced to 9 kcfs outflow due to a decrease in water temperatures that allowed for lower discharge needed to maintain temperatures below 67° F. The Corps developed two modeled scenarios showing the impact of Dworshak outflows on water temperatures in the Lower Granite tailwater: one looked at holding 9 kcfs through the forecast period, the other considered dropping down to 8 kcfs. Given the forecast, if held at 9 kcfs temperatures would be below 67° F. If outflow were reduced to 8 kcfs today, temperatures are expected to remain below 68° F. through the forecast period and would not exceed the temperature threshold. The Corps also noted both of these scenarios would result in reservoir elevations that are higher than the 2014 NOAA Fisheries Supplemental BiOp end of August elevation target of 1535 feet.

The USFWS and Nez Perce, reported that fish are doing reasonably well at the hatchery, given their long term exposure to high TDG levels. There are Rank 1 gas bubbles in the gills of both spring Chinook and steelhead, and Rank 3 in coho. Some had empty stomachs, but unusual levels of mortality were not observed. A new parasite was observed, but was not necessarily related to TDG exposure. All these conditions may be the residual effects of chronic exposure to high TDG levels. ID, noted that most sockeye have passed Lower Granite Dam and are appearing in the basin.

The Nez Perce explained that the ID and Nez Perce TDG waiver sought to minimize the impact of TDG and did not assume that the project would hit 1535 feet by the end of August. The Nez Perce pointed out that water temperatures could be maintained below 68° F. if flows were dropped down to 8 kcfs and that a drop in discharge would help relieve fish downstream. The Nez Perce recommended a reduction in flow to 8 kcfs.

NOAA, stated that a straight reduction in flow should not affect transit time or passage, as there is a lull in fish numbers currently and there will be more fish in the system when water is released in September. NOAA also noted that in the past there had been a couple of high water years in which the end of August elevation exceeded 1535 feet. The Nez Perce, commented that

the 2014 NOAA Fisheries Supplemental BiOp also provided a target elevation of 1520 feet by the end of September, which the Corps said the Corps would have no problem meeting. It was noted that lower flows will impact the 18 kcfs target for Lower Granite, however, there will still be near 50% spill. Oregon, stated that a reduction in flow at Dworshak will affect fish passage, as more will need to pass through the powerhouse, as there will be less flow over the spillway. Oregon shared that Oregon would not object because the TDG needs in the hatchery are also important. Washington, asked whether Idaho Power might send 1 kcfs more flow downriver to help compensate for reduced flow at Dworshak. After the discussion, TMT approved by consensus.

ACTION: The TMT agreed to coordinate a reduction of discharge at Dworshak to 8 kcfs, effective immediately, and to continue at that rate until further notice. If water temperatures at Lower Granite go higher than 67° F., discharge will be increased to maintain the temperature threshold of below 68° F.

TMT also noted that this action will likely result in an end of August reservoir elevation above 1535 feet, but that this excess water would be discharged from the reservoir in September.

August 23, 2017, TMT Meeting. The Corps, summarized operations at Dworshak. Reservoir elevation is currently at 1548 feet, with inflows of 1.5 kcfs, and 9 kcfs discharge. TDG is ranging from 115-116% downstream and from 101.5 to 102.5% at the hatchery collection channel. Water temperature in the Lower Granite tailwater averaged 67.6° F. over the past 12 hours, though it exceeded 68° F. for a short period on August 22. The weather at Lewiston has been in the mid-90s, and is forecasted to cool somewhat for the next couple of days before returning to the high 90s over the weekend.

The Corps developed a modelled scenario showing the impact of Dworshak discharge on water temperatures in the Lower Granite tailrace. In the model, the Dworshak outflow would continue at 9 kcfs. The prediction is for water temperature to remain close to, but below 68° F. with a 9 kcfs flow from Dworshak. Cooler weather conditions and predicted showers could help lower water temperatures more. In answer to a question from the USFWS, the Corps said that another model (not yet posted to today's agenda) used 8 kcfs discharge and suggested temperature readings too close to 68° F. for comfort. The Corps' recommendation was to maintain Dworshak discharge of 9 kcfs until the water temperatures are a steady 67° F. or lower.

The USFWS, reported that there are no major changes at the hatchery. Gas bubbles are showing in the gills of both spring Chinook and Coho, with some Rank 2 cases because of gas bubbles in the lateral lines; however, they are not seeing elevated mortality. Some steelhead are also showing Rank 1 bubbles. The Nez Perce Tribe, confirmed that fish are growing normally in the hatchery, and remain on target size-wise. Still, TDG levels will need to fall below 100% to remove the risk of bubbles. There are still concerns over the longer-term impact of the sustained exposure to high TDG levels. FPAC did not meet this week, but a hatchery call confirmed that remaining at 9 kcfs is a reasonable action due to temperature concerns.

ACTION: The Corps will continue to operate Dworshak with a 9 kcfs discharge until water temperatures in the Lower Granite tailrace are a steady 67° F. or lower. When feasible, the project will further decrease discharge to allow for TDG reprieve downstream and in the hatchery.

The Nez Perce reported that the Dworshak Board met and finalized the 200 KAF plan for September releases. The plan is similar to previous years with a 6 kcfs release starting September 4 through mid-month, then a step down over a few days, with flow augmentation concluding around September 21 when the Dworshak reservoir elevation reaches 1520 feet.

August 30, 2017, TMT Meeting. The Corps, summarized operations at Dworshak. Reservoir elevation is currently at 1539.3 feet, with inflows of 1.3 kcfs, and 9 kcfs discharge. TDG is 116% +/- 1% downstream, with higher levels in the afternoon because of high air temperature. TDG levels ranged from 102 to 103% in the hatchery collection channel. Water temperature at Lower Granite averaged 67° F., though there were three excursions above 68° F. on August 26 and 29. The Lewiston weather forecast is for hot temperatures through the weekend, with some cooling after Labor Day.

The Corps developed two modelled scenarios showing the impact of Dworshak discharge on water temperatures in the Lower Granite tailrace. In the first model, the discharge was dropped to 7 kcfs on September 1; this model predicts water temperature rising above 68° F. by the end of the modelled period. The second model shows 8 kcfs out beginning September 1; according to this model, water temperature remains below 68° F.

The Corps' recommendation is to maintain discharge at 9 kcfs until September 1, then reduce to 8 kcfs until September 4. The Corps estimates that the project will cross the elevation of 1535 feet target at that point. Discussions are ongoing whether to drop discharge down to 7 kcfs on September 5, however, this is weather dependent. The Corps coordinated with the Nez Perce on this operation and the Nez Perce accept this plan.

The USFWS, reported on conditions at the hatchery. The Hatchery Health Report came out on August 28. Current TDG is 102.4% at the collection channel. Spring Chinook, steelhead, and coho are showing gas bubbles in the gills, and some with gas bubbles in the lateral lines. Most of the bubbles are rank 1; however, some are rank 2. There was no observed GBD in fins or eyes. The USFWS confirmed that fish are growing at the expected rate in the hatchery, and are eating normally. In-river samples are not available. USFWS will continue to monitor the situation until there is no evidence of GBD.

BPA, questioned whether the region would like to retain the deep spill at Lower Granite instead of switching to the RSW on September 1 as coordinated through FPOM due to the juvenile bypass system being taken out of service for upgrades. BPA pointed to surface water temperatures of 71-72° F. and 66-68° F. deeper in the pool. TMT members discussed whether to spill warmer surface water through the RSW or to spill from deeper in the pool. FPAC did not discuss the issue this week, and although FPOM coordinated spill patterns extensively, they did not consider water temperature. NOAA will check with other FPAC members and circle back to

the Corps before Friday, September 1. The Corps encouraged feedback on this operation to be routed through FPOM because a significant amount of coordination has been involved in this operation and most of those involved in the coordination are not at the TMT meeting today.

September 6, 2017, TMT Meeting. The Corps, summarized operations at Dworshak Dam. Pool elevation is currently at 1532 feet, with 7 kcfs discharge, 4.6 kcfs through the powerhouse and 2.4 kcfs spill. TDG levels in the Dworshak tailrace are below 110%, and about 100% in the hatchery collection channel. Water temperatures at the Lower Granite tailrace averaged 67.3° F., though diurnal fluctuations caused brief periods above 68° F. yesterday afternoon. This situation might reoccur and is common during hot weather. However, smoky conditions from Northwest forest fires continue to shield solar radiation and keep temperatures lower.

The Lewiston forecast is for smoky conditions for the next ten days, with temperatures in the mid-80s to 90° F. There is a chance of precipitation Friday and Saturday. The Corps developed a modelled scenario showing the impact of a 7 kcfs Dworshak outflow on water temperatures in the Lower Granite tailrace. According to the model, water temperatures would remain below 68° F., at about 67° F. The Corps reported that the Dworshak Board agreed to hold discharge at 7 kcfs unless conditions change, at which point the Board will reconvene.

September 20, 2017, TMT Meeting. The Corps, summarized operations at Dworshak Dam. Pool elevation is currently at 1520.5 feet, with 4.8 kcfs discharge. Per the Dworshak Board agreement, the Corps will hold 4.8 kcfs discharge through 9/21, and then reduce to 2.4 kcfs for two days, reducing to 1.6 kcfs on 9/22. TDG levels in the Dworshak tailrace are 101%, and about 97% in the hatchery collection channel. Water temperatures at the Lower Granite tailrace averaged 65.5-66.5° F., though diurnal fluctuations caused brief periods above 68° F. in the afternoons. Weather is forecasted to cool down and stay cool through the rest of the year.

The USFWS, provided a fish health report for the hatchery and noted that there are low levels of gas bubbles in the gills and some in the lateral lines. Fish sampled had mostly full stomachs. Generally, fish are starting to recover from the long-term elevated TDG levels.

2.5. Water Quality

The AAs have coordinated the following spill priority lists with the TMT to date, and they may be found on the following website.

http://pweb.crohms.org/tmt/documents/spill-priority/

2.6. Burbot Spawning Flows (Libby Dam)

Under the terms of a Memorandum of Understanding (MOU) prepared in 2005 by the Kootenai Valley Resource Initiative (KVRI) and signed by the Corps, the selective withdrawal gate system at Libby Dam has been set to release cool water in November and December, before temperature stratification limits the temperature control capability. The purpose of this operation is to

provide cooler river temperatures downstream of Libby Dam (closer to normative thermal conditions). This operation will likely result in November and December temperatures being slightly cooler than the existing selective withdrawal temperature rule curve. Corps staff at Libby Dam removed selective withdrawal gates incrementally during late October to assure that daily temperature change remains within 2°F. per day; gates were removed systematically to slowly lower river temperature by early November (a span of about 8 °F.). Temperature will not be minimized this fall until isothermal conditions develop due to constraints and precautions that will be observed related to selective withdrawal crane rehabilitation that will occur over the winter, necessitating a more conservative gate removal pattern. Rather than removing all gates (resulting in withdrawal elevation of 2222 feet), the Corps removed all but 3 rows of gates (resulting in withdrawal elevation of 2253 feet).

2.7. Lake Pend Oreille Kokanee Spawning Flows (Albeni Falls Dam)

Regard ing the 2015-2016 operation the the AAs implemented an MCE of 2051 feet (operating range of 2051-2052 feet) with no flexible winter power operation) to facilitate IDFG habitat restoration work on the Clark Fork River Delta, near Clark Fork, Idaho.

2.8. Upper Snake Flow Augmentation

BOR released 487 KAF of flow augmentation from the Upper Snake Basin in 2017.

2.9. Chum Operation

Date	TMT Coordination Summary
October 19, 2016	NOAA Fisheries shared an update on chum operations and noted that spawning ground surveys below Bonneville Dam are underway. Presently, no chum have been observed on the spawning ground, however, two have been counted at Bonneville Dam. Crews will continue to survey throughout the season, redd locations will be marked electronically and information on the elevation of the redd and the depth of the water will be provided once available. Additionally, BPA will conduct electronic marking of the redds, 1-2 times throughout the season. The group looked at the April-September official water supply forecast for The Dalles. It was noted that the rains have come and it is looking like a La Niña year with above average temperatures and precipitation. NOAA predicts a 70% possibility that La Niña will occur in the fall and 55% possibility in the winter. For the 30-day forecast, NWRFC is predicting above normal precipitation. At Bonneville Dam, outflows were 102 kcfs and tailwater elevation was 11.8 feet, above the average so far this year. BPA, pointed to the *2016 Water Management Plan Seasonal Update,* noting that it provides a look back at last year's operations. TMT was encouraged to review the operation to inform upcoming conversations on the chum operation. Chum operations typically begin the first week of November and TMT will have a conference call next week to discuss operations. ACTION: TMT members will review 2016 chum operations in preparation for a conference call on October 26 at 9:00 am.

Date	TMT Coordination Summary
October 26, 2016	NOAA Fisheries, shared an update on chum operations. Presently, no chum have been observed on the spawning grounds downstream of Bonneville Dam, however, three have been counted at Bonneville Dam. The April-August median water supply forecast volume for The Dalles is 90.96 MAF (106% of the 10-year average). The NWRFC 10-day forecast is predicting above average temperatures and precipitation over the next six to ten days. The 30-day climate outlook shows a similar pattern of above average precipitation and temperature in the Columbia River Basin. For the 90-day outlook, above average precipitation, likely due to La Niña and average to slightly above average temperatures are predicted. At Bonneville Dam, tailwater elevation is under 12 feet as of 0400 hours. BPA, noted that they are ready to start the chum operation on November 1. The Corps, noted that the project is currently operating under a soft constraint to keep tailwater under 13 feet from 0600-1700 hours. Last year's chum operation maintained a 1 foot range, 11.5-12.5 feet, during daylight hours when possible. Due to constraints at the project, this year's operation will seek to maintain a tailwater range of 11.5-13.0 feet during daytime hours, with nighttime increase up to 16.5 feet if needed, with the highest flows occurring at 2400 hours. NOAA Fisheries noted that this year may present challenges due to high flows and powerhouse maintenance issues. BPA acknowledged that there will be less flexibility with the project and periods of spill may be required. DSC, checked in with Salmon Managers asking for any input on the recommended operation. WA, and NOAA Fisheries stated that the operation sounds good at this point and the region will continue to pay close attention to the conditions as the season progresses. The group will revisit the chum operation at the next TMT meeting on November 2. ACTION: The Corps will initiate the official chum spawning operation on Tuesday, November 1, 2016, at 0600 hours. The operation will maintain tailwater elevations of 11.5-13.0 feet from 0600-1700 hours, and increase tailwater up to 16.5 feet at night. Additional measures will be in place for operations in case unusually high flow conditions exist. TMT members will follow up on the operation at the November 2 meeting.

Date	TMT Coordination Summary
November 2, 2016	NOAA Fisheries, shared an update on chum operations. Presently, no chum have been observed on the spawning grounds downstream of Bonneville Dam, however, seven have been counted at Bonneville Dam. There are nearly 1,000 Chinook utilizing the spawning grounds at this point. The Corps, recounted the current operation which started on November 1 and will continue until further notice: 1. At all hours, operate project tailwater to provide an elevation between 11.5 and 13.0 feet. 2. Then, if necessary to increase project outflow, the tailwater may be operated up to 16.5 feet during nighttime hours (1700 - 0600). Concentrate highest elevations around 2400 hours. 3. Then, if necessary to increase project outflow, the tailwater may be operated up to 18.5 feet during nighttime hours (1700 - 0600). 4. Then, if increasing river flow precluded the ability to manage tailwater within the steps above, operate to provide a tailwater in the range of 13.0 - 16.5 feet during daytime hours (0600 - 1700) and up to the maximum within project 24 hour ramp rate limits during nighttime hours (1700 - 0600). WA, asked TMT members for input, noting that Washington would prefer that the project maintain 16.5 feet for 24 hours if needed instead of bumping up to 18 feet. WA noted that the tailwater of 18 feet is likely to push fish off active redds and out of preferred spawning areas. According to last year's surveys, chum did not utilize spawning grounds made available at the higher elevations. Thus, WA is not as concerned about the risk of chum establishing new redds at higher elevations and more concerned with the potential of moving chum off active redds and preferred spawning areas, which flows above 16.5 feet are more likely to do. NOAA Fisheries cautioned that holding 16.5 feet would risk placing the chum at a high elevation. NOAA Fisheries noted that the water supply thus far has been manageable and looks to be drying out in the near future. BPA, suggested that TMT members think on this and discuss at the next TMT meeting. ACTION: The Corps will continue to implement the chum operation as coordinated through TMT. TMT members will revisit the chum operation at the next TMT meeting, which will be a conference call on November 9.

Date	TMT Coordination Summary
November 16, 2016	NOAA Fisheries, shared an update on chum operations. NOAA Fisheries noted that chum counts at Bonneville are at 42, with 39 live and 3 dead. Chinook have the largest presence below Bonneville at this time, with close to 3,000 live Chinook observed in the Ives/Pierce Island Complex on November 8. The group revisited the current chum operation: 1. Effective Tuesday, November 1, at 0600 hours until further notice. 2. Operation of the Bonneville Dam tailwater in the following order of operating ranges as project outflow increases. 3. During all hours, operate project outflow to provide a tailwater elevation in the range of 11.5 to 13.0 feet. 4. Then, if necessary to increase project outflow, the tailwater may be operated up to 16.5 feet during nighttime hours (1700 - 0600). Concentrate highest elevations around 2400 hours. 5. Then, if necessary to increase project outflow, the tailwater may be operated up to 18.5 feet during nighttime hours (1700 - 0600). 6. Then, if increasing river flow precluded the ability to manage tailwater within the steps above, operate to provide a tailwater in the range of 13.0-16.5 feet during daytime hours (0600 - 1700) and up to the maximum within project 24-hour ramp rate limits during nighttime hours (1700 - 0600). Synopsis of TMT discussion: WDFW expressed an interest in adjusting the chum operation to avoid tailwater elevations above 16.5 feet. The TMT discussion covered the information that shows that spawning chum salmon are moved out of the area when the TW exceeds 16.5 feet and the potential for the higher flow during the daytime setting a higher chum protection level. No decision and revisit at next TMT.

Date	TMT Coordination Summary
November 22, 2016	NOAA Fisheries, shared an update on chum operations. NOAA Fisheries noted that chum counts at Bonneville are at 46, compared to historical averages of more than 100 chum for this time of the season. The November 15 chum spawning ground surveys show 125 live and 38 dead, with no redds noted in the Ives/Pierce Island Complex. These numbers are consistent with past years, with peak spawning occurring in the third week of November. Chinook numbers continue to be strong in the Ives/Pierce Island Complex, with 2911 live Chinook observed on November 8 and 1311 observed on November 15. Additionally, over 2000 Chinook redds were observed on November 8 and November 15. The group then revisited the current chum operation (available on TMT website). WA, suggested a change in the chum operation, which increase nighttime hours from 1700-0600 to 1500-0900. This is intended to allow the project to maintain the tailwater of 16.5 feet and move more water through in order to avoid jumping up to 18.5 feet and is based on research conducted by the USGS, Cook Lab, (Ken Tiffan et al, in Annual Reports submitted to BPA for 2002-3, 2003-4 and 2005) that chum can maintain spawning at velocities up to 1m/sec (which roughly equates to 16.5 feet tailwater elevation). Chum, however, move off the redds and out of the area with tailwater elevations in excess of 16.5 feet. WA acknowledges that there is a risk fish may spawn at higher elevations, there may not be sufficient water to protect those redds, and that spring refill at Grand Coulee is the top priority for the region. WA also noted that the region will be able to review data and conditions in December to continue the discussion on appropriate protection elevations going forward into 2017. TMT other discussion covered the potential impact of setting chum redds at higher elevations. **ACTION**: The Corps will implement the revised chum operation which modifies the nighttime hours from 1700-0600 to 1500-0900 hours.

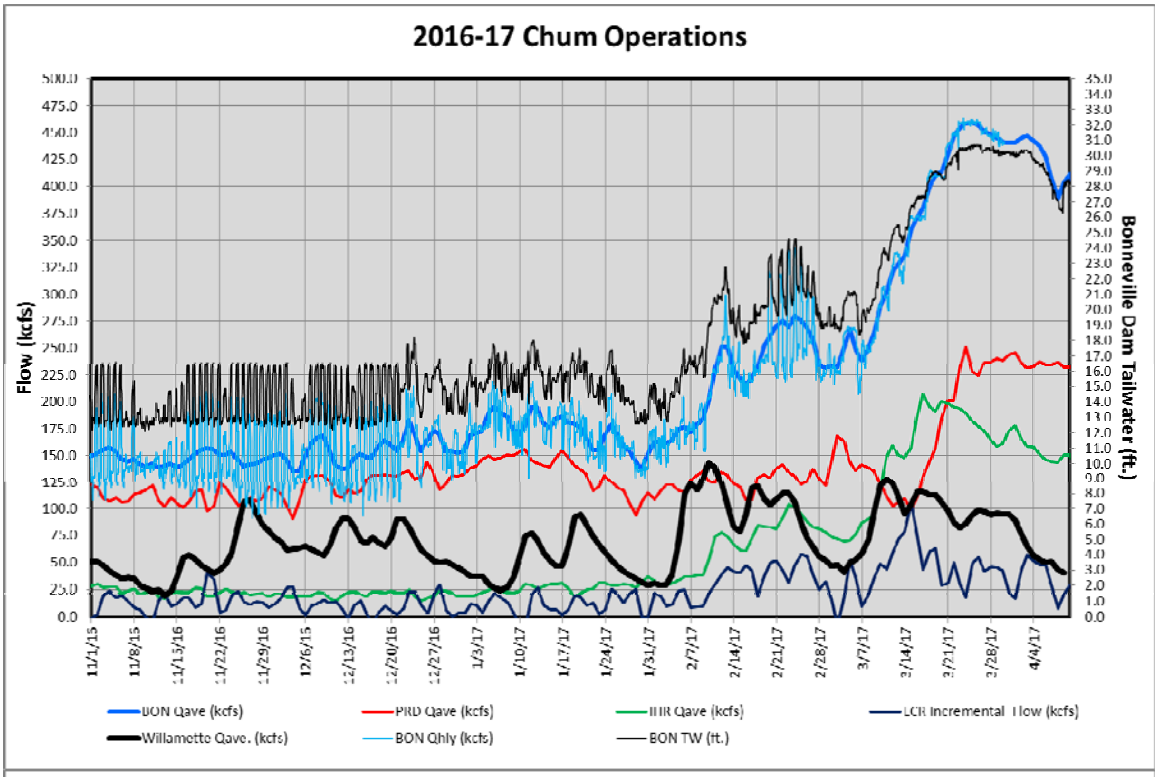
Date	TMT Coordination Summary
December 14, 2016	NOAA Fisheries, shared an update on chum operations and noted that chum counts at Bonneville are at 47, with no additional fish passing Bonneville in the last week. The December 6 chum spawning ground surveys show 22 live fish in the Ives/Pierce Island Complex. So far, it appears that the peak was 125 live on November 15, followed by 122 on November 22. The peak for redds appears to be on November 22 with 52 redds recorded. The counts have been falling since the end of November and the WDFW Crew thinks that November 15-22 was the peak; they are working to get out on another survey for confirmation. The Corps, noted that pending additional information and coordination with the WDFW crew, the TMT will need to discuss the shift from the spawning operation to the incubation operation. The Corps suggested that ideally, the TMT will be able to determine an incubation elevation at the December 21 TMT meeting. BPA, shared that the extension of nighttime hours coordinated on November 22 has allowed the project to manage the flows well. WA, thanked the region for implementing the revised operation on November 22. There was inquiry as to what the expected incubation elevation would be. BPA, shared that it is typically within 11.5-13.0 feet, however, they will need to talk to the WDFW crew to get a better idea of the appropriate range for this year. TMT will revisit the Chum operation at their December 21 meeting.
December 21, 2016	WA, shared an update on chum operations and noted that adult numbers remain unchanged since the last TMT meeting (December 14). The WDFW crew surveyed the Ives/Pierce Island Complex and observed no live chum as of yesterday; additionally 8 redds were observed in the higher elevations of the side channel. BPA and WDFW will conduct another survey to help inform the tailwater elevation needed during incubation. WA suggested setting an interim protection level of 13 feet until the next round of survey data is available and TMT can meet to discuss, which is expected to be on January 4. The Corps, asked if the protection level would be set at 12.9 feet rather than 13 feet, per BPA's recommendations yesterday of a 12.9 feet tailwater. BPA, clarified that typically BPA pads the minimum tailwater, thus 12.9 feet would realistically be closer to 13 feet. WA asked that tailwater elevations be set at 13 feet based on his discussion with BPA. BPA is fine with a tailwater elevation of 13 feet. TMT will revisit the chum operation at the next TMT meeting on January 4. ACTION: The Corps will implement the interim chum protection elevation with a 13 foot minimum tailwater elevation at Bonneville Dam, effective on December 21 at 1400 for all hours. TMT will revisit this operation at their meeting on January 4, 2017.

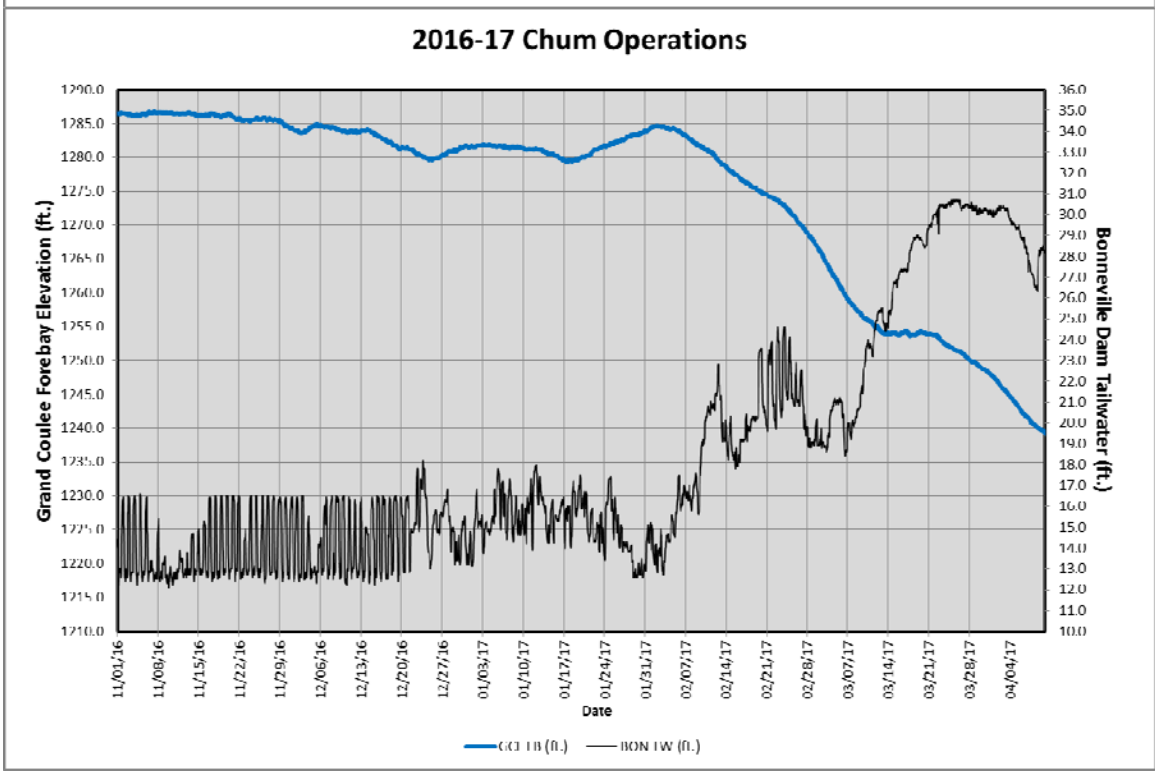
Date	TMT Coordination Summary
January 4, 2017	NOAA Fisheries, shared an update on chum operations and noted that cumulative annual chum counts at the Bonneville adult fish ladder were 47. The last observation of live chum was on December 6 at the Ives/Pierce Island Complex, surveyors counted 22. Two surveys have been conducted since, however, no live chum were observed. Currently, Bonneville tailwater is ranging 14-15 feet. BPA presented GPS survey data results. TMT discussion resulted in a reduction of the protection level to elevation 12.5 feet (See Minutes for full discourse).
January 18, 2017	NOAA Fisheries reported on the chum operation and noted that the current operation maintains a 12.5 feet minimum tailwater elevation at Bonneville Dam during all hours. This operation has been consistently met the past two weeks and currently tailwater elevation is at 14 feet. WA, reported that the shallowest redd reported at the last TMT meeting was not an outlier, and is actually a normal occurrence in the Ives complex area. WA is planning to present on the status of chum populations and carcass surveys at the next TMT meeting.
January 25, 2017	WDFW, provided an update on chum and noted that 208 adults were collected at the Duncan trap, roughly 330 adults were collected at the Hamilton Springs trap, and approximately 1800 adults were collected in Hamilton Creek Basin (similar to last year). WDFW shared that the biggest surprise was out of the Grays River Basin, where total chum counts were near 31,000. Estimates for the Grays River were based on carcass mark and recapture methods. The 2016 total chum counts from Bonneville, tributaries and Gray's River were near 46,000. WDFW addressed why spawning ground survey counts do not reflect final population estimates. WDFW noted that the Multnomah numbers are low due to missed counts during peak spawning. The other reasons the population estimates and survey results differ is due to how survey data is collected, using observer efficiency and apparent residency timing. These methods provide an index and assume 100% observer efficiency, yet are not as accurate as population estimate methods. BPA, asked that WDFW if he is willing to come back to TMT to provide more depth on the 2016 and previous years' survey results and the location and process for carcass work. WDFW agreed, noting that after February would be best. ACTION: WDFW will provide a presentation on 2016 and previous year survey results, as well as the process and location for carcass surveys at the March 15 TMT meeting.
February 8, 2017	BOR has decided to perform drumgate maintenance at Grand Coulee in 2017. This decision was made after considering the official February water supply forecast at The Dalles, which is 95% of average. The maintenance will require the Grand Coulee reservoir to be drafted down to 1255 feet by mid-March, and to stay at that elevation or lower for eight weeks. This decision will not change if weather conditions become dryer, but could change for flood risk management, if necessary.

Date	TMT Coordination Summary
April 5, 2017	The Corps, noted that the spill season in the Lower Columbia starts on April 10. This transition to the spill season marks the end of the Chum operation. The Corps noted that tailwater levels are sufficient to keep the chum redds covered and thus chum will not be impacted by the change.

Dates	Chum Water Management Summary
November 1-8, 2016	A very wet fall got the chum operation started daytime elevations at or below 13.0 feet with nighttime peaks up to 16.5 feet. High streamflows were the primary driver with Grand Coulee passing inflow with a forebay elevation of ~1286 feet. Day average outflow from Bonneville Dam was approximately 150 kcfs.
November 9-13, 2016	Persistant high streamflows continued to result in daytime TW elevations below Bonneville Dam at or below 13.0 with nighttime elevations up to 16.5 feet. Day average outflow from Bonneville Dam dropped to approximately 140 kcfs.
Nov 14-Dec 22, 2016	Persistant high streamflows continued to result in daytime TW elevations below Bonneville Dam at or below 13.0 with nighttime elevations up to 16.5 feet. Coordination through TMT extended the nighttime hours of operation for chum to avoid night time tailwater elevations above 16.5 feet. The day average outflow from Bonneville Dam ranged from 135 kcfs to 175 kcfs as continued high stream flows which included peaks in the Willamette River close to and above 100 kcfs. Grand Coulee Dam was drafted slowly over this period to ensure that sufficient space was available to accomadate potential peaks in the Willamette River and other side flows. During this period Grand Coulee was constrained with limited turbine capability and high inflows the draft of Grand Coulee over this period ensured sufficient space was available to accommodate any additional unplanned turbine outages. The Chum spawning operation was declared completed on December 22. The interim chum protection level for chum was set to 13.0 feet.
Dec 23, 2016-Jan 18, 2017	During this period the day average outflow from Bonneville Dam was approximately 175 kcfs. Relatively high inflow into Grand Coulee and the uncertainty surrounding the decision to perform drum gate maintenance resulted in no net fill or draft across this period.
Jan 19-Feb 2, 2017	The day average outflow form Bonneville Dam was approximately 160 kcfs. The water supply forecasts for The Dalles fell off significantly during this period. Considering that this trend reduced the likelihood that Reclamation would choose to perform drum gate maintenance this year Grand Coulee was gradually filled to approximately elevation 1285 feet.
Feb 3-April 10	The last week of January and first days of February saw a run up of the water supply forecast at The Dalles resulting in a forcasted April 30 FRM elevation at Grand Coulee of 1252.0 feet. Reclamation made the decision to move foreward with drum gate maintenance for 2017. Grand Coulee was drafted to elevation 1255.0 feet by March 15. Continued high precipitation and low temperatures across the basin increased the across March. Subsequent increases in water supply and streamflow conditions resulted in tailwater elevations downstream of Bonneville Dam in excess of 20 feet through April.

Dates	Chum Water Management Summary





Chum survey data gathered at the Ives/Pierce Island Complex will be summarized in the table below. Data from all Chum survey areas, including the Ives/Pierce Island Complex, are provided by the Fish Passage Center and available on the following website:

http://www.fpc.org/spawning/spawning_surveys.html

Table 9. Chum Data from Surveys of the Ives/Pierce Island Complex

Date	Lives	Dead[i]	Redds[ii]	Visibility (feet)
September 20, 2016	0	0	0	12
September 22, 2016	0	0	0	12
September 26, 2016	0	0	0	12
September 30, 2016	0	0	0	12
October 3, 2016	0	0	0	12
October 7, 2016	0	0	0	10
October 12, 2016	0	0	0	8
October 14, 2016	No survey – High winds			
October 17, 2016	No survey – High winds			
October 21, 2016	0	0	0	11 ft. vis.
October 24, 2016	0	0	0	10 ft. vis.
October 28, 2016	0	0	0	12 ft. vis.
October 30, 2016	0	0	0	8 ft. vis.
November 1, 2016	1	1	0	10 ft vis.
November 4, 2016	0	0	0	8 ft. vis.
November 8, 2016	39	3	10	8 ft. vis.
November 15, 2016	125	38	0	7 ft. vis.
November 22, 2016	122	44	52	10 ft. vis.
November 29, 2016	71	33	0	10 ft. vis.
December 6, 2016	22	3	0	8 ft. vis.
December 13, 2016	NS	NS	NS	Snow Blocked ramp
December 20, 2016	0	0	NS	4 ft. vis.
December 27, 2016	0	0	0	6 ft. vis.

i. Dead are newly samply fish only.
ii. Redds are an instantaneous count for the day, not cumulative.

2.10. Vernita Bar/Hanford Reach Fall Chinook Protection Program Operations (Non-BiOp Action)

The Hanford Reach Fall Cinook Protection Agreement (Agreement) ebstablishes the obligations of the Parties with respect to the protection of fall Chinook in the Hanford Reach of the Columbia River. The Parties agree that during the term of the Agreement these flow regimes address all issues in the Hanford Reacth with respect to fall Chinoook protection and the impact of operation of the seven dams operatin under Mid'Columbia Hourly Coordination, including the

obligations of Grant, Chelan, and Douglas under any new licenses issued by the Federal Energy Regulatory Commission (FERC).

Beginning in mid-October, under the terms of the Hanford Reach Fall Chinook Protection Program Agreement, river flows are reduced every Sunday morning (day of lowest power demand) to the Priest Rapids Dam minimum operating discharge of 36,000 cubic feet per second (ft^3/s) [1000 cubic meters per second (m^3/s)]. This allows the Agency and Utility Party Monitoring Team to manually survey for redd distribution at Vernita Bar just downstream of Priest Rapids Dam. These drawdowns occur every Sunday morning until the initiation of fall Chinook spawning has been set both above and below the 50,000 ft^3/s (1,416 m^3/s) flow elevations. A final drawdown is conducted on the Sunday prior to Thanksgiving to establish the minimum critical flow needed to protect pre-emergent fall Chinook. Given the previously described limitations, this weekly reduction in river flow affords the best viewing conditions for aerial flights. Aerial flights are therefore scheduled to be conducted concurrent with the Sunday morning drawdowns, when possible.

Date	Summary
October 5, 2016	Operations to support the Hanford Reach Fall Chinook Protection Program will begin on October 15, 2016. Reverse Load Factoring will begin at 0000 hours on Saturday the October 15 and continue through the end of the Spawning Period. The Spawning Period is scheduled to end on November 20, 2016 (last Sunday prior to Thanksgiving), but may be extended if spawning activity is observed during the redd survey on that day. During Reverse Load Factoring, Priest Rapids Outflows (as measured at the USGS gauge) must remain between 55 and 70 kcfs during daylight hours. Reduced daytime flows (38 kcfs) below Priest Rapids Dam on Sundays during the Spawning Period will be required to support redd counts on Vernita Bar. The first redd count will be conducted on Sunday, October 16. Specific details for operational support during Vernita Bar redd counts will be updated throughout the season and be provided in individual flow requests.

Date	Summary
October 6, 2016	On Sunday, October 16, 2016, the first Vernita Bar spawning ground survey will take place. The spawning ground surveys require that flows measured at the USGS gauging station be near 38 kcfs. Please schedule Priest Rapids Dam discharge to be approximately 38 kcfs from 0500 to 1500 hours. The redd count will begin at approximately 0900 hours. When crews have completed the survey and are off Vernita Bar they will contact Dispatch. This will be the first ground redd survey this year as required by the 2004 Hanford Reach Fall Chinook Protection Program Agreement. This redd count will be used to help determine this year's initiation of spawning date. Accompanying Grant PUD staff will be a Washington Department of Fish & Wildlife (WDFW) representative.
October 16, 2016	On Sunday, October 16, 2016, representatives from Grant PUD and Washington Department of Fish & Wildlife conducted the first 2016 Vernita Bar spawning ground survey. Two redds were observed in the 36-50 kcfs elevation zone. Five redds are required for the Initiation of Spawning, therefore the date for the Initiation of Spawning has not been set. A second spawning ground survey will be conducted next Sunday, October 23.
October 23, 2016	On Sunday, October 23, 2016, representatives from Grant PUD and Washington Department of Fish & Wildlife conducted the second 2016 Vernita Bar spawning ground survey. Twelve redds were observed in the 36-50 kcfs elevation zone and 7 redds were observed above 50 kcfs. Five redds are required for the Initiation of Spawning, therefore spawning has initiated in both the below and above the 50 kcfs zone. The date for the Initiation of Spawning has been set as October 19, 2016. The next spawning ground survey will be used to determine the Critical Elevation and will be conducted on Sunday, November 20.
November 20, 2016	On Sunday, November 20, 2016, the third Vernita Bar redd survey was conducted to determine the 2016-2017 Hanford Reach Critical Elevation and Protection Level Flow. The Monitoring Team consisted of WDFW, GCPUD, and CRITFC. Flows from Priest Rapids Dam at Vernita Bar were approximately 48 kcfs.
February 2, 2017	Colder than average temperatures has pushed back the projected data for the start of the Emergence and Rearing Periods, which in include anti-stranding measures. Emergence and Rearing will be begin on 3/2/2017. As always, this date is subject to change based on accumulated temperature.
February 9, 2017	We are now projecting that Emergence and Rearing, which includes anti-stranding measures, will be begin on 3/5/2017. As always, this date is subject to change based on accumulated temperature.

Date	Summary
February 21, 2017	We are now projecting that Emergence and Rearing, which includes anti-stranding measures, will be begin on 3/10/2017. As always, this date is subject to change based on accumulated temperature.
February 28, 2017	GCPUD is projecting that Emergence and Rearing, which includes anti-stranding measures and flows no less and 70 kcfs, will be begin on 3/11/2017.
April 25, 2017	GCPUD is projecting that this weekend (4/29/2017) will be the start of Section C.5(b)(6) of the Agreement (also known as the CJAD II weekends). Constraints will be in effect on Saturdays and Sundays from 4/29/2017 to 5/21/2017. Constraints under Section C.5(b)(6) are as follows: On four consecutive weekends...Priest Rapids Outflow will be maintained to at least a minimum flow calculated as the average of the daily hourly minimum flow from Monday through Thursday of the current week.
May 8, 2017	In summary, there are two weekends remaining of the extra weekend minimum flow constraints (CJAD II protections). GCPUD is projecting that the Emergence Period, which includes the 70 kcfs minimum flow constraint, will end on 5/19/2017. The Rearing Period, which includes the daily flow fluctuation constraints, is projected to end on 6/20/2017.
May 17, 2017	On 5/19/2017 the Emergence Period of the Hanford Reach Agreement will end. The Emergence Period requires a minimum flow at the Critical Elevation (70 kcfs) below Priest Rapids Dam. This coming weekend will be the final weekend of the enhanced minimum flow constraints (CJAD II). The Rearing Period, which requires flow fluctuation constraints, is projected to end on 6/20/2017.
June 15, 2017	GCPUD is projecting that flow protections under the Hanford Reach Flow Protection Program will end on 6/20/2017. This date may change depending on water temperature.
June 20, 2017	Today at 24:00 flow protections under the Hanford Reach Flow Protection Program will end.

2.11. Snake River Zero Generation (Non-BiOp Action)

According to the Lower Snake projects' operating manuals, from December 1 through February 28, "zero" minimum project discharge is permitted on a limited basis. Under an agreement between the Corps of Engineers and the fishery agencies, zero river flow is allowed for water storage during low power demand periods (at night and on weekends) when there are few, if any, actively migrating anadromous fish present in the Snake River. Water stored under zero river flow conditions may maximize power production from the Columbia River Basin system, but zero river flow operations are not recommended at Lower Snake projects when fish are actively migrating in the Snake River."

Salmon Managers submitted System Operations Request (SOR) 2005-22 Snake River Zero Nighttime and Weekend Flow, to the Action Agencies (AA) on December 6, 2005. The SOR may be found on the following website.

http://pweb.crohms.org/tmt/sor/2005/2005-22.pdf

In the SOR the Salmon Managers provided the AAs with the following table to clarify the criteria of "… few, if any …" prior to the implementation of the Zero Generation Operation.

The few migrating adult criterion trigger will be defined on a sliding scale outlined in the following table. The table applies to both "wild" and "total" categories of returning adult steelhead.

Run to date>#	**Run to date< #**	**Few criteria< #**
0	30,000	10
30,000	60,000	20
60,000	100,000	35
100,000	150,000	50
150,000	200,000	65
200,000	250,000	80
250,000		100

The AAs will implement the Snake River Zero Nightime Generation Operation on the Lower Snake River during winter of 2016/2017 in coordination with the TMT.

At the December 14, 2016 TMT meeting, NOAA Fisheries reported that the 2016 steelhead run was approximately 94,000, and the wild run was approximately 20,000, which means that the criteria for zero generation are 35 and 10 respectively. The three-day moving average required by the criteria was been met as of December 14 and thus the Snake River projects can shift to the zero nighttime generation operation as needed.

2.12. Minimum Operating Pool (MOP)

In accordance with Reasonal Prudent Alternative 5 in the NOAA Fisheries 2014 Supplemental BiOp the Action Agencies operate the Lower Snake River projects (Ice Harbor, Lower Monumental, Little Goose and Lower Granite) at MOP (unless adjusted to meet authorized project purposes, primary navigation) from April 3 through August 31 as specified in the 2016 Fish Operations Plan (FOP). MOP ranges at Lower Snake River Projects are found in Table 9 below.

Table 9. MOP Elevation Ranges for Lower Snake River Projects

Project	Minimum Operating Pool Elevation (feet)	Upper Limit of 1-foot Operating Range (feet)
Ice Harbor	437.0	438.0
Lower Monumental	537.0	538.0
Little Goose	633.0	634.0
Lower Granite	733.0	734.0

Additional information regarding MOP operations are described in the FOP on the following website.

http://pweb.crohms.org/tmt/documents/fpp/2017/

At John Day Dam from April 10 to September 30, the forebay is operated within a 1.5 foot range (262.5 to 264.0 feet) of the minimum elevation that provides irrigation pumping. The initial range is 262.5 to 264.0 feet. The minimum elevation will be adjusted upward as necessary to facilitate irrigation pumping.

May 3, 2017, TMT Coordination.
Ice Harbor Dam Forebay Operating Range Increased to 1.5 feet.
Effective May 3, through approximately June 20, the Corps will change the Ice Harbor Dam (IHR) 1.0 foot Minimum Operating Pool (MOP) forebay operation of 437.0 to 438.0 feet to a 1.5 foot forebay operating range of 437.0 to 438.5 feet because of high flows and current limitations upstream at Lower Monumental Dam (LMN). It is not possible for IHR to maintain MOP (437.0 to 438.0 feet) because of current limited turbine capacity at LMN and spill cessation associated with barge transit in the tailrace at LMN, therefore providing IHR with a 1.5 foot operating range today will ensure IHR does not operate below the minimum pool elevation of 437.0 feet.

May 5, 2017, TMT Coordination.
Ice Harbor Dam Forebay Operating Range Increased to 2.0 feet. Effective May 5, the Corps adjusted the Ice Harbor Dam (IHR) forebay operating range to 437.0 to 439.0 feet, due to an increase in forecasted inflow at IHR. As previously described the Corps will continue this operation through approximately, June 20, 2017. It is not possible for IHR to maintain MOP (437.0 to 438.0 feet) because of current limited turbine capacity at Lower Monumental Dam (LMN) and spill cessation associated with barge transit in the tailrace at LMN, therefore providing IHR with a 2.0 foot operating range today will ensure IHR does not operate below the minimum pool elevation of 437.0 feet for navigation safety.

July 7, 2017, TMT Coordination.
Little Goose Dam Forebay Operating Range Increased to MOP+0.5 Feet. Effective July 7, at 1:26pm, the Corps increased the Little Goose Dam (LGS) Minimum Operating Pool (MOP) range (633.0 to 634.0 feet) up to MOP + 0.5 feet (633.5 to 634.5 feet) for the purpose of navigation safety. This operational adjustment was made in order to provide the required depth

at the entrance of the Lower Granite Dam navigation lock as described in the 2017 Fish Operations Plan (page 7). This LGS MOP + 0.5 feet operation will be effective through the remainder of the summer spill operation which ends on August 31 at 2400 hours.

July 21, 2017, TMT Coordination.

Little Goose Dam Forebay Operating Range Increased to MOP+1.0 Feet. Effective July 21, at 9:47 am, the Corps increased the Little Goose Dam (LGS) Minimum Operating Pool (MOP) range (633.0 to 634.0 feet) up to MOP + 1.0 feet (634.0 to 635.0 feet) for the purpose of navigation safety. This operational adjustment was made in order to provide the required depth at the entrance of the Lower Granite Dam navigation lock as described in the 2017 Fish Operations Plan (page 7). This LGS MOP + 1.0 feet operation will be effective through the remainder of the summer spill operation which ends on August 31 at 2400 hours. The Corps will provide an update to the TMT on this operation at our next meeting which is scheduled for Wednesday, July 26.

August 9 and 16, 2017, TMT Coordination.

Little Granite Dam Forebay Operating Range Increased to MOP+1.0 Feet. On Saturday, August 12, begin filling the Lower Granite Dam forebay at a gradual rate to attain a Lower Granite Dam MOP +1 operation for the hours described in the SOR (0600 hours, Monday, August 15 to 1700 hours, Monday, August 15). After the operation described in the SOR is complete then draft the Lower Granite Dam forebay to MOP by Friday, August 18. This operation would be assuming use of unit 5 or 6 and would not exceed minimum generation while releasing the water.

August 16, 2017, TMT Meeting. The cruise ship landed without incident, and FOP spill of 18 kcfs was maintained throughout. As of August 16 the project is only a tenth of a foot away from drafting back to MOP. Oregon and Washington expressed appreciation to the COE for getting Lower Granite unit 3 back on line in time for this operation.

August 11, 2017, TMT Coordination.

Ice Harbor Dam Forebay Operating Range Increased to MOP+1.0 Feet.

Effective August 11, the Corps increased the Ice Harbor Dam (IHR) Minimum Operating Pool (MOP) range (437.0 to 438.0 feet) up to MOP + 1.0 feet (438.0 to 439.0 feet) for the purpose of navigation safety. As described in the 2017 Fish Operations Plan (page 7) adjustments to the IHR forebay may be necessary to accommodate safe entrances to the navigation lock at Lower Monumental Dam. This IHR MOP + 1.0 feet operation will be effective through the remainder of the summer spill operation which ends on August 31 at 2400 hours. The Corps will provide an update to the TMT on this operation at our next meeting which is scheduled for Wednesday, August 16.

2.13. Ice Harbor Transmission Emergency

July 6, 2017, TMT Coordination.
On July 6, at 1958 hours, Bonneville Power Administration Transmission Dispatch declared a System Emergency to increase the generation at Ice Harbor Dam (IHR). This was initiated as a result of a forced outage of a Tri-Cities area transformer due to loss of cooling. The System Emergency resulted in a 1 hour reduction in spill at IHR from 85.2% down to 66.8% at 2100 hours because powerhouse outflow was increase by approximately 11.4 kcfs to 21.2 kcfs to address the System Emergency. Spill operations resumed in accordance with the 2017 Fish Operation Plan at 2200 hours. The Bonneville Power Administration provided additional information regarding this incident at our TMT meeting on Monday, July 10.

2.14. Little Goose Dam Spill Operations for Fish Passage

June 2, 2017, TMT Coordination.
NOAA Fisheries explained that there is a passage issue at Little Goose Dam; over 19,000 Chinook have passed Lower Monumental Dam, however, only 12,578 have made it past Little Goose. NOAA Fisheries continued that FPAC met to discuss the situation and potential operational changes that may increase passage at Little Goose over the next couple of weeks. The group reviewed the hourly inflow, forecasted inflows, passage, and percent spill. The Corps, noted that spill has been around 50% for the past few days. Inflows are expected to peak on Monday and then start receding.

NOAA Fisheries continued with the suggested operation that was discussed at FPAC (note: this was not a consensus recommendation from FPAC, however, there were no objections):

- Provide 40% spill during the hours of 4:00am until 10:00am June 3 through June 8.
- Pass inflow during the hours 10:00am until 4:00pm.
- This operation will violate the MOP operation at the project. Thus to limit the impact on juvenile out-migrants, increase the project discharge to return to MOP during the hours 4:00pm through 4:00am.
- Maintain constant turbine operation during the hours of 4:00am until 10:00am to the extent possible.

Although there were no objections on this operation, OR, noted that this is a special operation implemented during unmanaged river conditions and should not be considered a long term operation. WA, suggested a careful review after the operation to see if the region can pinpoint whether it was effective and what variables had an impact.

Additionally, the Corps, noted that debris has been a concern this year at Little Goose and that screen cleaning is planned to take place starting Monday at 7:00 am. The Corps agreed to request a 10:00 am start time for the duration of this operation to allow for the full 6 hours of reduced spill. Screen cleaning will take two units out of service while the cleaning is underway. An additional unit is out of service until 2018.

The group discussed the duration of the operation. The Corps recommended a shortened duration with a check in on Monday, June 5 to see if the operation had impact and if so, what the next steps should be. The Corps also indicated that as a result of decreasing spill and the unit outages, this operation will cause the project to go above MOP in order to achieve 40% spill. The increase will likely be most noticeable on Monday when inflows are expected to peak.

ACTION: The AA's will implement the operation as outlined by NOAA Fisheries, however, the TMT will reconvene on Monday, June 5 at 11:30 am to discuss whether to extend the operation past June 5. At that point, the region will review fish passage data.

June 5, 2017, TMT Coordination.
The Corps, reported on the effects of an operation to attempt to increase adult Chinook passage at Little Goose Dam. The TMT coordinated the operation at its June 2 meeting, to be implemented on June 3-5 and revisited at TMT on June 5. The operation called for implementing spill at 40% from 4 AM to 10 AM to encourage adult passage. This operation would result in filling above the minimum operating pool (MOP) range of 633 to 634 feet. To alleviate the impact to MOP and downstream juvenile fish passage, the project would increase spill to pass inflow from 10 AM to 4 PM, then increase spill to draft the pool back to MOP by 4 AM the next morning.

On June 2, before the operation was implemented, 762 adult Chinook passed Little Goose Dam. The counts were 793 for June 3, 578 for June 4. The maximum forebay elevation on Saturday June 3, was 634.7 feet and on Sunday June 4 was 634.5 feet. The current water supply forecast is showing a peak at 182 kcfs on Tuesday, then receding for the next 7-10 days to 160 kcfs, then to the low 130s on 6/14.

The Corps, reported that scheduled screen cleaning operations began at Little Goose at 10 AM this morning, after the 40% spill operation concluded. Screen cleaning will continue and will cause temporary unit outages potentially through Wednesday, June 7.

Idaho, reported out on FPAC conversations earlier in the morning. Idaho expressed appreciation for the coordination and implementation of the operation by the Corps, however, noted that the response desired was not seen in the passage data. FPAC considered shifting to a 30% spill operation after screen cleaning is complete. They noted the importance of continuing with screen cleaning and did not want to interrupt that process. The Corps noted that the operation could continue alongside the screen cleaning if time is of the essence. The group discussed a

number of options, including delaying the start of the revised operation (30% spill) until screen cleaning is complete and the peak flow has passed; moving the retained water out sooner than 4 PM; and not returning the pool to MOP to require less water to be moved out.

After discussion, there was consensus at TMT to implement the following operation starting Tuesday, June 6, with a check in on Wednesday, June 7.

- 4 AM to 10 AM -operate with 30% spill;
- 10 AM to 4 PM – pass inflow;
- 4 PM to 4 AM – draft to MOP while remaining under 130% TDG; if unable to draft to MOP while remaining under 130% TDG, store excess water.

ACTION: The action agencies could implement the operation. The Corps will prepare a written memo outlining what changes were noticed from the previous operation and will post it on the TMT website.

Salmon Managers present shared their input on the operation: NOAA, ID, WA, USFWS, MT, Nez Perce, Warm Springs and Umatilla supported the operation. It was noted that TDG needs to be managed and that due to the complexity of the situation, it will be difficult to determine the impact of the operation. OR noted that they would not elevate this issue, however, does not want to see the operation continue in the long-term and that there were too many moving pieces to obtain a clear answer of effectiveness; OR emphasized that this operation was being considered only because of current high water conditions.

June 7, 2017, TMT Coordination.
NOAA Fisheries, reported on the special spill operation coordinated at the TMT meeting on June 5 and summarized on the TMT web site, noting that the 30% spill was more effective than the 40% spill operation in getting fish to pass. The operation took place on Tuesday and Wednesday, June 6-7. Its main feature was to reduce spill to 30% from 4 AM to 10 AM, pass inflows through the afternoon, then at 4 PM proceed to return to MOP by 4 AM the next morning. The operation was designed to lessen the energy and velocity of an eddy caused by high levels of spill, which formed between the peninsula and the navigation lock. It is hypothesized that the eddy is confusing Chinook and limiting passage into the ladder entrance. The operation as scheduled will end at 4 AM Thursday, June 8.

The Corps, reported that a trash screen cleaning operation at Little Goose was conducted on June 5 and 6 and is complete. Because of a debris mat in the forebay, the trash rack cleaning was only partially effective. Due to concerns of debris impact to juvenile fish, an emergency debris spill was conducted on June 6 and was also somewhat effective, removing between ½ and 2/3 of the debris. As the debris travels downstream, a debris spill at Lower Monumental may be needed.

During the operation, TDG levels ranged between 120 and 128%. The sole exception was for the one-hour debris spill operation at 4 PM on June 6. Spill went to 81%, and TDG levels crested at 143.6%, returning to below 130% by the third hour. Because water was held in the forebay during reduced spill, the pool elevation went above MOP (at 634), to MOP+1. There was no evidence of gas bubble trauma in either adults or juveniles as a result of the operation.

On June 6, the first day of the operation, 1542 adult spring Chinook passed Little Goose. This compares to 578 (6/4) and 390 (6/5) the previous two days. The hourly report shows that most passed from 8 AM to 10 AM. Idaho, reported on FPAC conversations.

Idaho noted that although there is only a day of data, said it appears the 30% spill operation is helping adult passage. Idaho recommended continuing the operation for a week unless data show concern for high TDG levels. Members discussed whether to change the start time from 4 AM to a later time; whether to extend the duration of reduced spill; whether to close or decrease flow over the TSW, and whether to reduce spilling to the 125% spill cap and keep water at a higher MOP to allow for lower TDG.

Oregon, shared the perspective that the river is currently "unmanaged", because river flow conditions are so far outside of the normal range and have been for some time. The Corps, asked why the term unmanaged continues to be used when describing current conditions in the Snake River. The current TMT coordinated operation to reduce spill down to 30% at Little Goose Dam to facilitate adult Chinook passage is being implemented because the BPA and the Corps are able to manage flows in the Snake River. Flows are above average at this time but there are numerous management actions (e.g., operation outside of 1%, removal of screens, and the current operation above MOP) that have been previously coordinated with the TMT and discussed in the BiOp to manage flows to address fish passage issues.

It was noted that subgroup has been stood up to discuss various management tools at Little Goose.

TMT reached consensus -- the majority of members present voiced support (BOR, BPA, Colville, Corps, ID, MT, Nez Perce, NOAA, Umatilla, USFWS, Warm Springs, and WA), and Oregon did not oppose the following operation: Beginning June 8 at 4 AM and continuing until June 15 at 4 AM:

- Maintain 30% spill from 4 AM to 12 PM;
- Pass inflow from 12 PM until 4 PM;
- Increase spill evenly from 4 PM until 4 AM to return to MOP, unless TDG levels exceed 130%;

- If a TMT member raises concern that may require a change in this operation, TMT will hold an unscheduled meeting. Salmon Managers should contact NOAA Fisheries or the Umatilla to request such a meeting; Action Agencies should contact the Corps.
- A check in meeting is tentatively scheduled for 11:00 AM on Monday, June 12; this meeting will be cancelled if there are no concerns at the time.

June 14, 2017, TMT Coordination.
The Corps and NOAA Fisheries, reported on special spill operations for adult fish passage at Little Goose Dam. The Corps prepared a summary of the operations that have been coordinated through TMT since June 2nd; the summary is available on the TMT web site.

Pursuant to the consensus agreement at the June 7 meeting, 30% spill occurred each day between 4 AM and Noon, spill then increased to pass inflow until 4 PM, when spill increased again to return to MOP if possible by 4 AM without exceeding 130% TDG in the tailrace. Flow was capped at 140 kcfs to keep TDG below 130% at the tailrace. It was clarified that the chart provided in the summary shows hourly minimum and maximum flows throughout the day, as well as the average 24 hour flow.

NOAA Fisheries reported that adult Chinook passage has improved since starting the 30% spill operation and counts at Little Goose continue in the 1000 +/- range. The deficit between fish numbers between Little Goose and Lower Monumental has now been reduced to 3400 (from ~9000 when the operations were initiated). NOAA Fisheries shared that there was a consensus at FPAC to continue with this operation for an additional week, to June 21 with the intention of assisting passage. NOAA Fisheries noted that the inflow forecast for the week has been revised, and flows are expected to drop to the 30% FOP spill zone in the near future. Spill over the last 24 hours has been between 30-40%.

The Corps will extend the operation until June 21. The Corps noted there may be some screen cleaning outages at Little Goose next week and that inflows are starting to recede.

ACTION: The Corps will continue the current adult passage operation to maintain 30% spill from 4 AM to 12 PM. If inflows are high enough that holding 30% spill for that 8-hour period results in filling the Little Goose pool above MOP, the project will pass inflow from 12 PM until 4 PM, and increase spill evenly from 4 PM until 4 AM to return to MOP, if possible without exceeding 130% TDG. This operation will be implemented through 4 AM on June 21.

The Corps noted that debris has been reduced from last week; however, there is still 1000 square feet by the powerhouse. Wind events have helped move debris and last week Lower Monumental conducted an emergency spill to pass debris. Ice Harbor Dam (IHR) debris is

minimal and variable. Last week saw an emergency spill at IHR and there is still some debris by the fish pumps in the tailrace. Debris is cleared daily at the Washington-side fish ladder at McNary.

June 21, 2017, TMT Coordination.
NOAA Fisheries and the Corps reported on special spill operations for adult fish passage at Little Goose Dam. The Corps pointed TMT to a summary of the operations coordinated through TMT starting on June 2; the summary is available on the TMT web site.

Pursuant to the consensus agreement at the June 7 meeting, 30% spill occurred each day between 4 AM and Noon, spill then increased to pass inflow until 4 PM, when spill increased again to return to MOP if possible by 4 AM without exceeding 130% TDG in the tailrace. Flow was capped at 140 kcfs to keep TDG below 130% at the tailrace. It was clarified that the chart provided in the summary shows hourly minimum and maximum flows throughout the day, as well as the average 24-hour flow. The Corps noted that as coordinated, the operation is set to conclude today. No additional requests to extend the operation were provided by FPAC, and the inflows are receeding, eliminating the need for the operation. The Corps, noted that the operation has not caused MOP exceedances since June 13.

NOAA Fisheries reported that adult Chinook passage has improved since starting the 30% spill operation and that the deficit between counts at Little Goose and Lower Monumental is within 2000 fish (from ~9000 when the operations were initiated). ID, explained that a portion of the 2000 fish not counted passing Little Goose are actually destined for the Tucannon River, a tributary that comes in between the two projects. IDFG has looked at the average conversion rates between Ice Harbor and Lower Granite, compared to in season counts, and the passage numbers are matching up well.

The Corps noted that the Snake River FOP summer spill operations have begun, effective today, June 21. OR, asked whether any of the projects had been able to drop down to the FOP spill values yet or if flows are still too high. The Corps responded that projects are still spilling more than the target FOP summer spill rates due to the high flows.

2.15. Spill for Juvenile Fish Passage

Annual spring and summer spill operations for juvenile fish passage are defined in the Fish Operations Plan (FOP), included in the FPP as Appendix E. In 2016, spring spill (Table 10) will occur April 3 through June 20 at the Lower Snake River projects (Lower Granite, Little Goose, Lower Monumental, Ice Harbor), and April 10 through June 15 at the Lower Columbia River projects (McNary, John Day, The Dalles, Bonneville). Summer spill (Table 11) will begin on

June 21 at the Lower Snake projects and on June 16 at the Lower Columbia projects, and will continue through August 31 at all projects.

Table 10. FOP Spring Spill Operations for Fish Passage in 2016.

Project	Spring Dates	2016 FOP Spring Spill Operations
Lower Granite	April 3 – June 20	20 kcfs
Little Goose	April 3 – June 20	30%
Lower Monumental	April 3 – June 20	Gas Cap w/ bulk pattern (approx 20-29 kcfs)
Ice Harbor Day=0500-1800 / Night=1800-0500	April 3 – April 28	Day 45 kcfs/Night Gas Cap (approx 75-95 kcfs)
	April 28 – June 20	2-day blocks of: 30% vs. Day 45 kcfs/Night Gas Cap (approx 75-95 kcfs)
McNary	April 10 – June 15	40%
John Day	April 10 – April 28	30%
	April 28 – June 15	2-day blocks of: 30% vs 40%
The Dalles	April 10 – June 15	40%
Bonneville	April 10 – June 15	100 kcfs

Table 11. FOP Summer Spill Operations for Fish Passage in 2016.

Project	Dates	2016 FOP Summer Spill Operations
Lower Granite	June 21 – Aug 31	18 kcfs
Little Goose	June 21 – Aug 31	30%
Lower Monumental	June 21 – Aug 31	17 kcfs
Ice Harbor Day=0500-1800 / Night=1800-0500	June 21 – July 13	2-day blocks of: 30% vs. Day 45 kcfs/Night Gas Cap (approx 75-95 kcfs)
	July 13 – Aug 31	Day 45 kcfs/Night Gas Cap (approx 75-95 kcfs)
McNary	June 16 – Aug 31	50%
John Day	June 16 – July 20	2-day blocks of: 30% vs 40%
	July 20 – Aug 31	30%
The Dalles	June 16 – Aug 31	40%
Bonneville Day/Night hours per FPP Table BON-5	June 16 – Aug 31	2- day blocks of: Day 85 kcfs/Night 121 kcfs vs. 95 kcfs

2.16. Juvenile Trasportation

Daily fish collection for transportation began May 1 and the daily barge transportation began May 2 at Lower Granite, Little Goose and Lower Monumental dams. Every other day barge transportation began May 26 and continued through August 2nd at Lower Granite Dam and through August 14th at Little Goose and Lower Monumental dams. Collection and transportation from Lower Granite Dam ended on August 2 and the collection channel was dewatered for an extended work window associated with the juvenile bypass system upgrades. Transport operations are anticipated to continue through approximately September 30 at Lower Monumental and through October 31 at Little Goose.

Union Pacific Railroad Bridge Mechanical Failure on the Columbia River
On the afternoon of July 19, 2017 the Union Pacific Columbia River vertical lift railroad bridge approximately 1 mile downstream of the Snake River confluence had a mechanical failure while in the down position blocking all commercial navigation past Columbia River mile 323. The Union Pacific initial estimate for return to normal commercial navigation was between 48 and 168 hours (one week). On the morning of July 20 the Union Pacific revised their estimate to return to commercial navigation by 1600 hours on July 20. By late afternoon, Union Pacific revised the length of the navigational outage by an additional 48-hours (return to normal late afternoon July 22) due to more extensive problems.

Late afternoon on July 20 the CENWW Transportation Coordinator consulted with NOAA Fisheries. A decision was reached to change to secondary bypass (end collection) at Lower Granite, Little Goose, and Lower Monumental dams as soon as possible. Fish already collected for transportation would be held until morning, at which time the navigation outage would be reassessed. Depending on this assessment, collected fish would either be transported if commercial navigation had resumed or bypassed to the river.

At approximately 1900 hours on July 20 Lower Granite and Lower Monumental dams switched from juvenile fish collection for transportation to secondary bypass operation. Little Goose switched from juvenile fish collection for transportation to secondary bypass operation at 0700 hours on July 21 when experienced staff were on-site. Previously collected juvenile fish in the Lower Granite Dam raceways were transported downstream approximately 1 mile by barge and released mid-channel at 0830 hours on July 21. At Little Goose Dam, previously collected juvenile fish in the raceways were bypassed to the river at 0900 on July 21. Previously collected juvenile fish in the raceways at Lower Monumental Dam were bypassed to the river at approximately 1100 hours on July 21.

Lower Granite, Little Goose, and Lower Monumental dams will remain in secondary bypass until commercial navigation in the Columbia River past mile 323 resumes. When commercial navigation in the Columbia River past mile 323 resumes Lower Granite, Little Goose, and Lower Monumental dams will resume collection/transportation operations as described in the FPP. Repairs to the bridge were completed the evening of 23 July and Lower Granite, Little Goose, and Lower Monumental dams returned to collection by 0800 hours on 24 July.

Additional information regarding this incident may be found in Memorandum for the Record: 17 JFT 01 dated 7/20/17, and 17 JFT02 dated 7/21/17 on the following website.

http://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/JFT%20MOC%20and%20MFR/

Rock Creek Fire in the Columbia River Gorge
The juvenile fish facilities were switched to secondary bypass and collected fish were trucked to the closest boat ramp downstream of Little Goose and Lower Monumental dams due to emergency road closures on both sides of the Columbia River from forest fires.

During the evening of September 4, 2017, Interstate 84 was closed due to the Eagle Creek wildfire which started on September 2, 2017. The morning of September 5, 2017, the fire jumped the Columbia River near the Bridge of the Gods. All lanes of Interstate 84 remain closed from Troutdale to Hood River. On the Washington side of the Columbia River SR-14 was closed to commercial traffic in both directions, but open to passenger vehicles. Thus the fish transport trucks can not get to the designated fish release site at Bonneville Dam or the alternative release site at Dodson Boat Ramp due to the road closures from the fires.

Currently smolts are being collected and truck transported every other day (odd numbered days) from Little Goose and Lower Monumental dams. Lower Granite Dam is not collecting and transporting smolts because the bypass was dewatered in early August to facilitate upgrades to the bypass system.

On the morning of September 5 the CENWW Transportation Coordinator directed the project biologist at Little Goose and Lower Monumental dams to change from collection for transportation to secondary bypass until access to the release sites is restored. Collected smolts at Lower Monumental and Little Goose dams had been loaded into trucks and were getting ready to depart when SR-14 was closed. The potential of releasing the smolts into the McNary bypass outfall was considered, however, was not an option for the mini-tankers due to the tank release being lower than the McNary bypass access port. The CENWW Transportation Coordinator instructed the project biologist to release the fish trucks at the nearest downstream boat ramp. These changes in operation were coordinated with NOAA Fisheries.

At approximately 0830 hours on September 5, Little Goose and Lower Monumental dams switched from juvenile fish collection for transportation to secondary bypass operation. Previously collected smolts in the fish transport truck from Little Goose Dam were released at the Texas Rapids boat ramp. Previously collected smolts loaded into the fish transport truck from Lower Monumental Dam were released at the Windust boat ramp.

Little Goose and Lower Monumental dams remained in secondary bypass from September 5 through September 21. During the transportation outage a total of 1243 smolts (primarily subyearling Chinook salmon) were bypassed at Lower Monumental and Little Goose dams. Collection of smolts and transportation by truck resumed September 21 when reliable access to the downstream release sites was restored.

Additional information regarding this incident may be found in Memorandum for the Record: 17 JFT 03 updated 9/25/17 on the following website.

http://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/JFT%20MOC%20and%20MFR/

2.17. Fish Passage Research in 2017

Fish research activities described below are excerpted from the 2017 Fish Passage Plan Appendix A that is availible on the following website.

http://pweb.crohms.org/tmt/documents/fpp/2017/

- **Bonneville Dam Studies**

April 2017–July 2017: Post-Construction FGE Evaluation (Year 1 of 2). During the 2016/2017 winter maintenance period, the Corps completed gatewell modifications at all Bonneville Dam Powerhouse 2 (PH2) main units 11-18 with the intention to improve fish passage conditions (per BiOp RPA 18). This study will use hydroacoustic technology to estimate post-construction fish passage metrics for spring and summer juvenile salmonids at all PH2 routes for two consecutive years (2017-2018).

- **The Dalles Dam Studies**

There are no studies scheduled for The Dalles Dam in 2017.

- **John Day Dam Studies**

There are no studies scheduled for John Day Dam in 2017.

- **McNary Dam Studies**

Ongoing: Evaluation of Adult Fish Ladder Modifications to Improve Pacific Lamprey Passage at McNary Dam. This study will use half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey at McNary Dam, the four Lower Snake River projects and associated river segments. Adult Lamprey were captured and tagged at John Day Dam in 2014 and 2015, and tags remain active. This study will continue to require electrical power for electronics and access to maintain and download data from the PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.

- **Ice Harbor Dam Studies**

Ongoing: Evaluation of Adult Pacific Lamprey Migration Behavior and Passage Success in the Lower Snake River. This study will use half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey at McNary Dam, the four Lower Snake River projects

and associated river segments. Adult Lamprey were captured and tagged at John Day Dam in 2014 and 2015, and tags remain active. This study will continue to require electrical power for electronics and access to maintain and download data from the PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.

- **Lower Monumental Dam Studies**

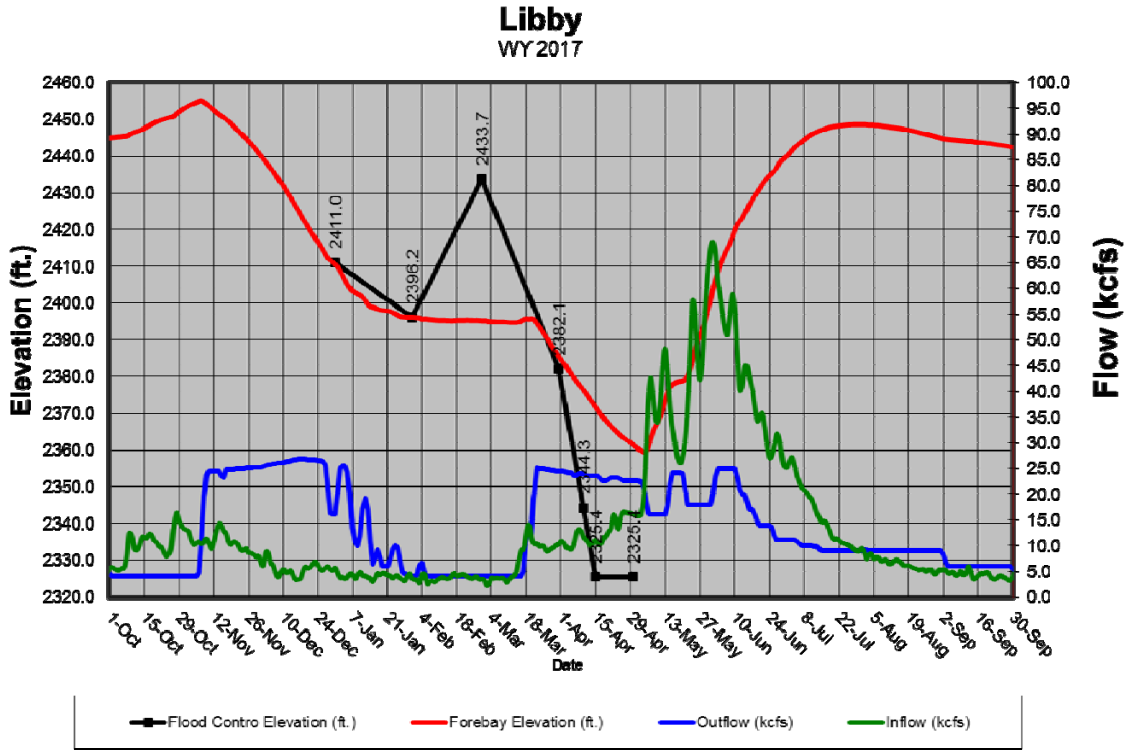
Ongoing: Evaluation of Adult Pacific Lamprey Migration Behavior and Passage Success in the Lower Snake River. This study will use half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey at McNary Dam, the four Lower Snake River projects and associated river segments. Adult Lamprey were captured and tagged at John Day Dam in 2014 and 2015, and tags remain active. This study will continue to require electrical power for electronics and access to maintain and download data from the PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.

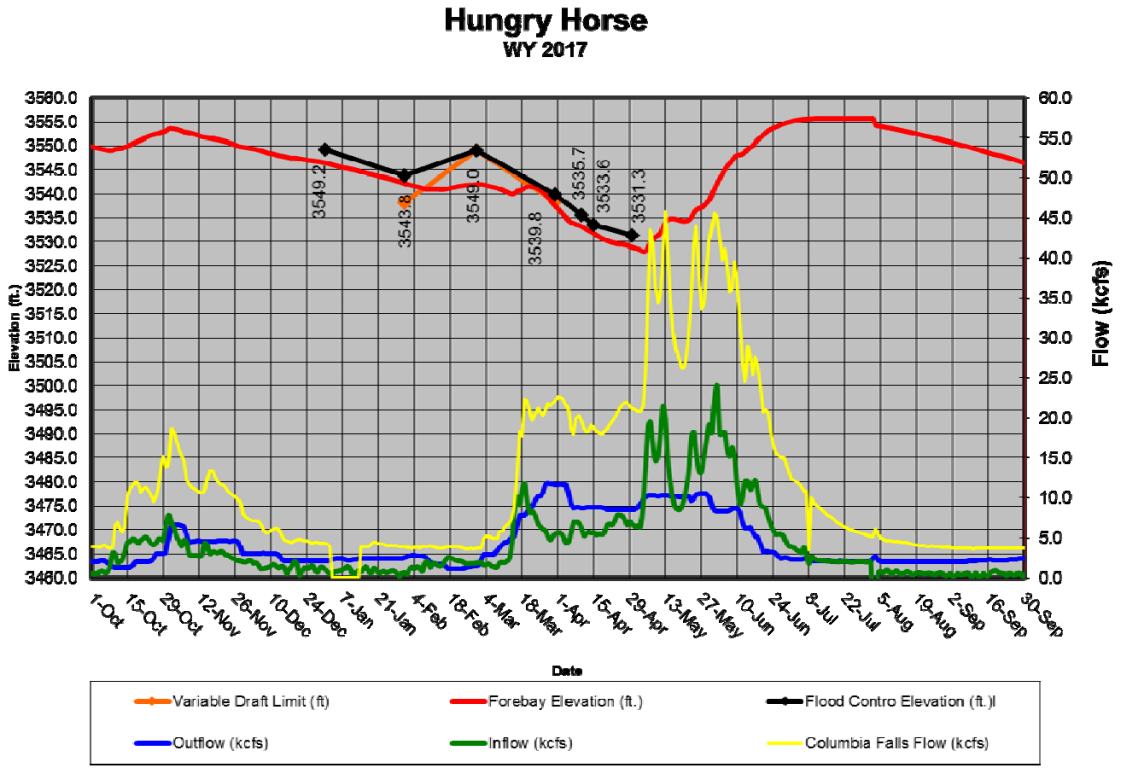
- **Little Goose Dam Studies**

Ongoing: Evaluation of Adult Pacific Lamprey Migration Behavior and Passage Success in the Lower Snake River. This study will use half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey at McNary Dam, the four Lower Snake River projects and associated river segments. Adult Lamprey were captured and tagged at John Day Dam in 2014 and 2015, and tags remain active. This study will continue to require electrical power for electronics and access to maintain and download data from the PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.

- **Lower Granite Dam Studies**

Ongoing: Evaluation of Adult Pacific Lamprey Migration Behavior and Passage Success in the Lower Snake River. This study will use half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey at McNary Dam, the four Lower Snake River projects and associated river segments. Adult Lamprey were captured and tagged at John Day Dam in 2014 and 2015, and tags remain active. This study will continue to require electrical power for electronics and access to maintain and download data from the PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.


Libby
WY 2017
Elevation (ft.)
Flow (kcfs)
2460.0
2450.0
2440.0
2430.0
2420.0
2410.0
2400.0
2390.0
2380.0
2370.0
2360.0
2350.0
2340.0
2330.0
2320.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2411.0
2396.2
2433.7
2382.1
2344.3
2325.4
2325.4
1-Oct
15-Oct
29-Oct
12-Nov
26-Nov
10-Dec
24-Dec
7-Jan
21-Jan
4-Feb
18-Feb
4-Mar
18-Mar
1-Apr
15-Apr
29-Apr
13-May
27-May
10-Jun
24-Jun
8-Jul
22-Jul
5-Aug
19-Aug
2-Sep
16-Sep
30-Sep
Date
Flood Contro Elevation (ft.)
Forebay Elevation (ft.)
Outflow (kcfs)
Inflow (kcfs)


Hungry Horse
WY 2017
Elevation (ft.)
Flow (kcfs)
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3555.0
3550.0
3545.0
3540.0
3535.0
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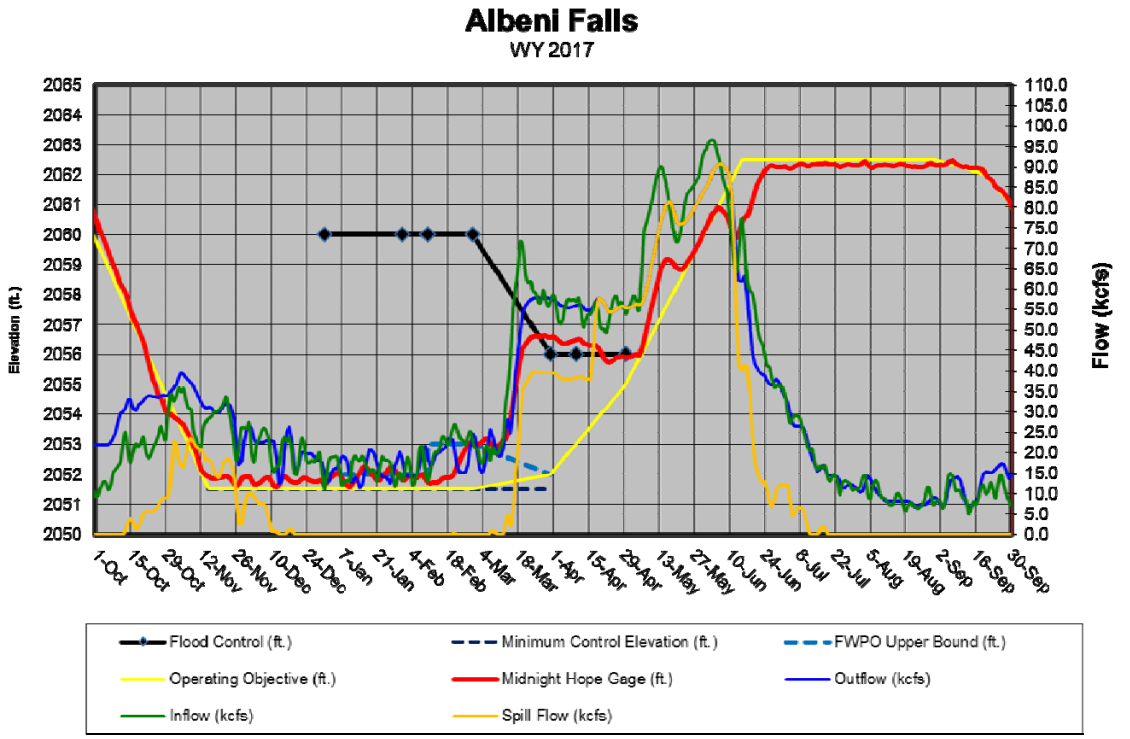
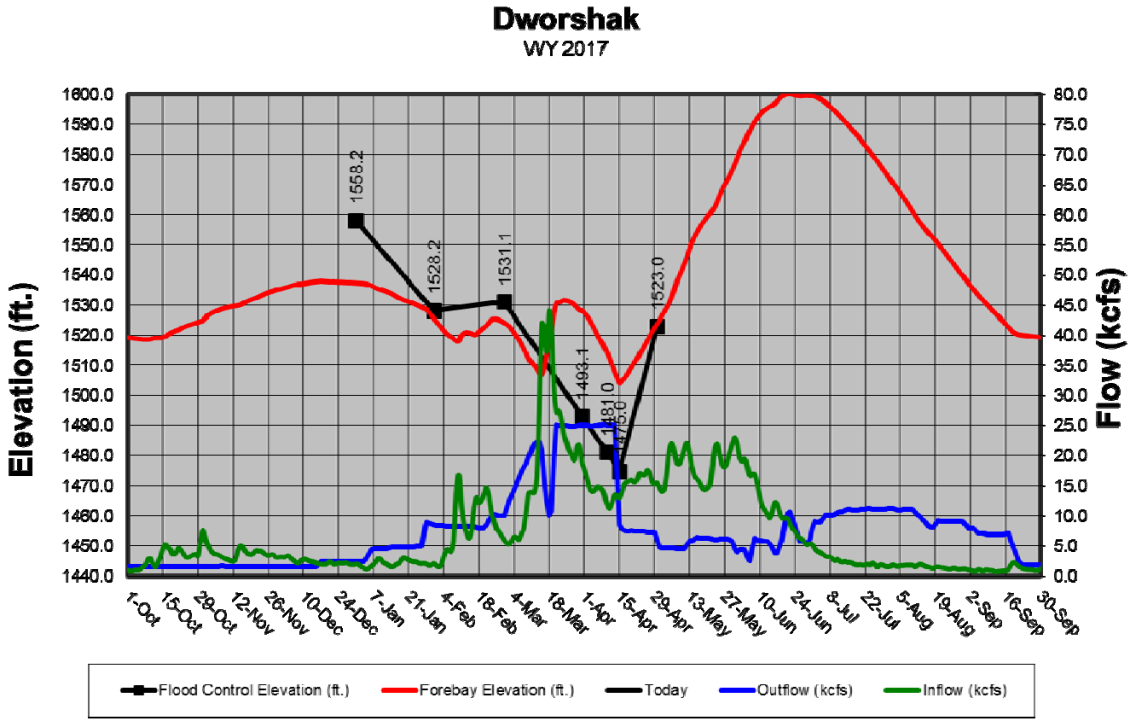
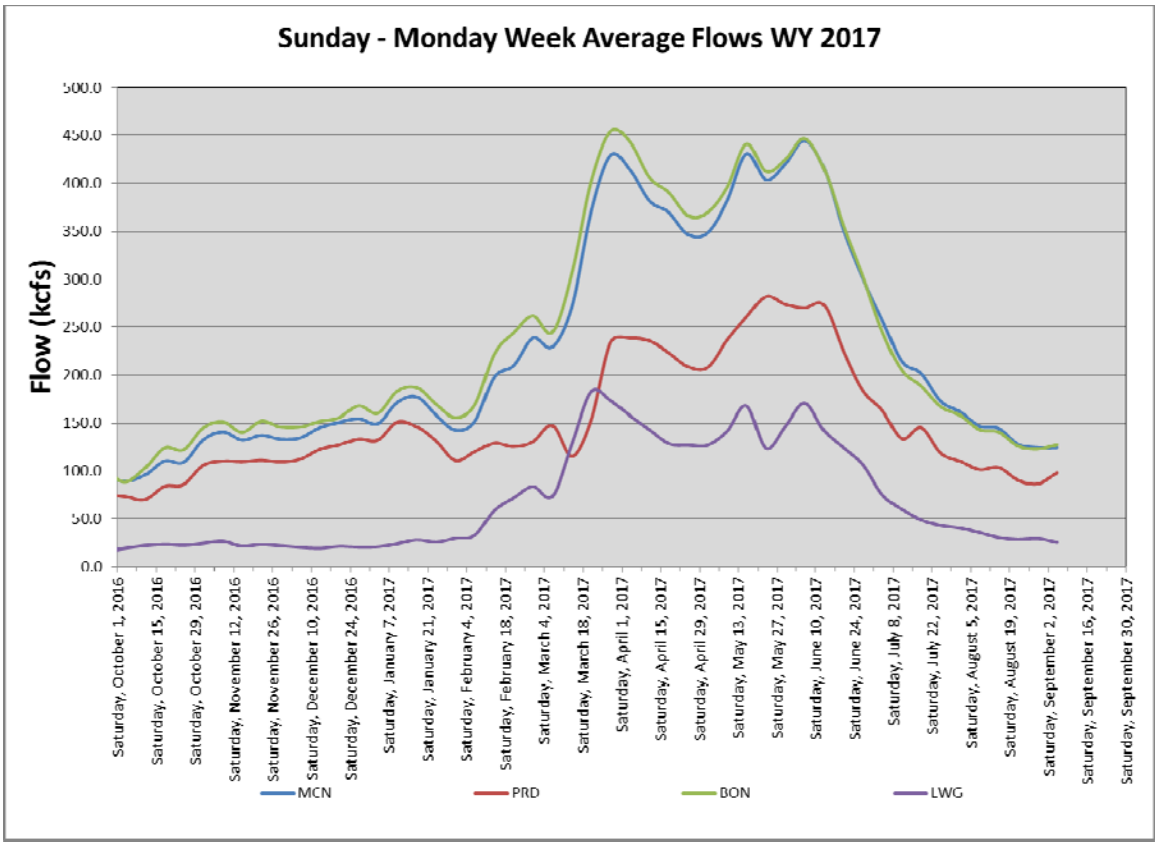
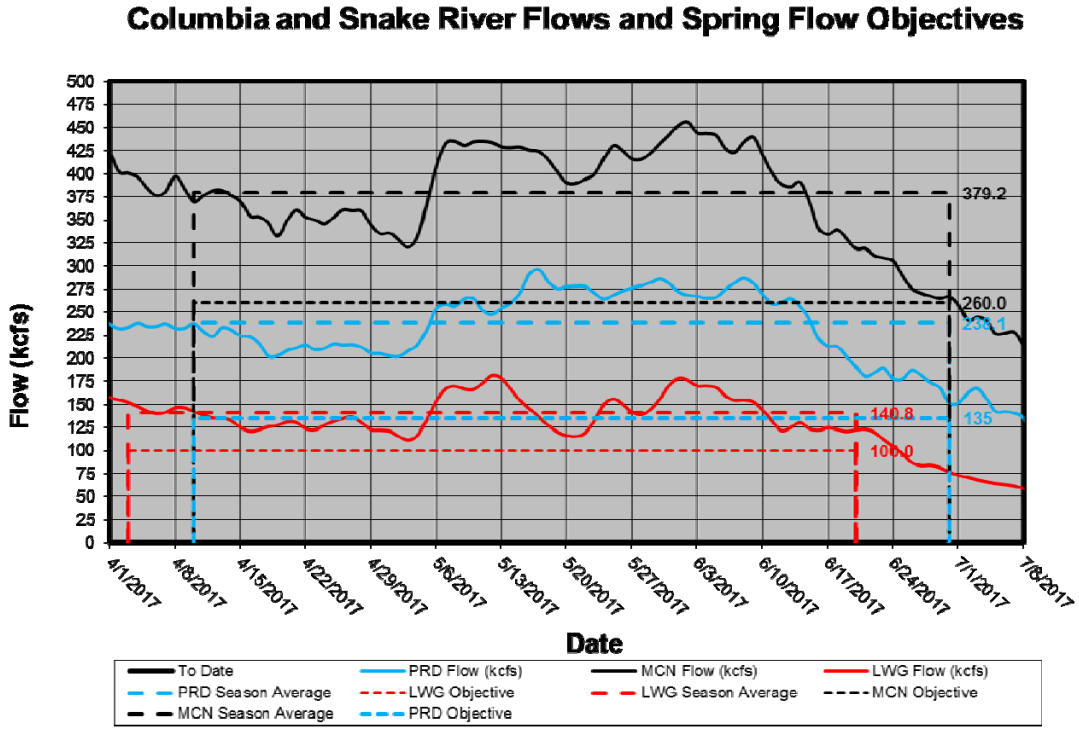
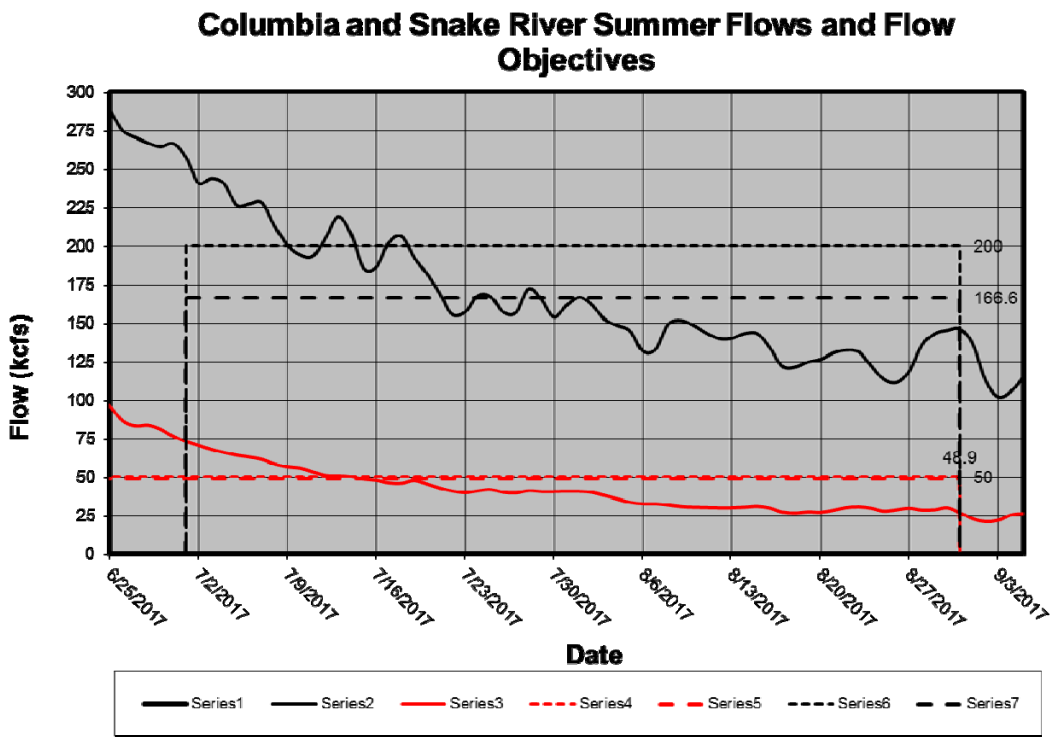
3525.0
3520.0
3515.0
3510.0
3505.0
3500.0
3495.0
3490.0
3485.0
3480.0
3475.0
3470.0
3465.0
3460.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
3549.2
3543.8
3549.0
3539.8
3535.7
3533.6
3531.3
1-Oct
15-Oct
29-Oct
12-Nov
26-Nov
10-Dec
24-Dec
7-Jan
21-Jan
4-Feb
18-Feb
4-Mar
18-Mar
1-Apr
15-Apr
29-Apr
13-May
27-May
10-Jun
24-Jun
8-Jul
22-Jul
5-Aug
19-Aug
2-Sep
16-Sep
30-Sep
Date
Variable Draft Limit (ft)
Forebay Elevation (ft.)
Flood Contro Elevation (ft.)l
Outflow (kcfs)
Inflow (kcfs)
Columbia Falls Flow (kcfs)


Albeni Falls
WY 2017
Elevation (ft.)
Flow (kcfs)
Flood Control (ft.)
Minimum Control Elevation (ft.)
FWPO Upper Bound (ft.)
Operating Objective (ft.)
Midnight Hope Gage (ft.)
Outflow (kcfs)
Inflow (kcfs)
Spill Flow (kcfs)


Dworshak
WY 2017
Elevation (ft.)
Flow (kcfs)
1558.2
1528.2
1531.1
1493.1
1481.0
1475.0
1523.0
Flood Control Elevation (ft.)
Forebay Elevation (ft.)
Today
Outflow (kcfs)
Inflow (kcfs)


Sunday - Monday Week Average Flows WY 2017
Flow (kcfs)
500.0
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Saturday, October 1, 2016
Saturday, October 15, 2016
Saturday, October 29, 2016
Saturday, November 12, 2016
Saturday, November 26, 2016
Saturday, December 10, 2016
Saturday, December 24, 2016
Saturday, January 7, 2017
Saturday, January 21, 2017
Saturday, February 4, 2017
Saturday, February 18, 2017
Saturday, March 4, 2017
Saturday, March 18, 2017
Saturday, April 1, 2017
Saturday, April 15, 2017
Saturday, April 29, 2017
Saturday, May 13, 2017
Saturday, May 27, 2017
Saturday, June 10, 2017
Saturday, June 24, 2017
Saturday, July 8, 2017
Saturday, July 22, 2017
Saturday, August 5, 2017
Saturday, August 19, 2017
Saturday, September 2, 2017
Saturday, September 16, 2017
Saturday, September 30, 2017
MCN
PRD
BON
LWG


Columbia and Snake River Flows and Spring Flow Objectives
Flow (kcfs)
500
475
450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
379.2
260.0
235.1
140.8
135
100.0
4/1/2017
4/8/2017
4/15/2017
4/22/2017
4/29/2017
5/6/2017
5/13/2017
5/20/2017
5/27/2017
6/3/2017
6/10/2017
6/17/2017
6/24/2017
7/1/2017
7/8/2017
Date
To Date
PRD Flow (kcfs)
MCN Flow (kcfs)
LWG Flow (kcfs)
PRD Season Average
LWG Objective
LWG Season Average
MCN Objective
MCN Season Average
PRD Objective


Columbia and Snake River Summer Flows and Flow Objectives
Flow (kcfs)
300
275
250
225
200
175
150
125
100
75
50
25
0
200
166.6
48.9
50
6/25/2017
7/2/2017
7/9/2017
7/16/2017
7/23/2017
7/30/2017
8/6/2017
8/13/2017
8/20/2017
8/27/2017
9/3/2017
Date
Series1
Series2
Series3
Series4
Series5
Series6
Series7