

# 2016 Water Management Plan

## Seasonal Update

### March 14, 2016

## 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 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<sup>st</sup> of each year. The first update for the primary elements of Spring and Summer will be posted by March 1<sup>st</sup> 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 (WSF, Streamflows)	October	July	March 14, 2016
2.2	Seasonal Flow Objectives	April	August	-
2.3	Flood Control	January	June	March 14, 2016
2.4	Storage Project Operations	October	September	March 14, 2016
2.6	Water Quality (Spill Priority Lists)	January	December	March 14, 2016
	<b>Specific Operations</b>	<b>Start Date</b>	<b>End Date</b>	<b>Last Updated</b>
2.11	Chum Flows (Bonneville Dam)	November 1	April 10	March 14, 2016
2.8	Spring Creek Hatchery Releases (Bonneville)	April	May	-
2.7	Burbot Spawning Flows (Libby)	November	December 30	November 10, 2010
2.10	Upper Snake Flow Augmentation	April 1	August 31	-
2.9	Lake Pend Oreille Kokanee (Albeni Falls)	September 1	December 30	-
2.15	Transportation	May 1	September 30	March 14, 2016
2.15	Spill Operations	April 3	August 31	March 14, 2016
0	Fish Passage Research	March	October	March 14, 2016
2.13	Snake River Zero Generation	December	February	-
2.12	Hanford Reach Fall Chinook Protection	November	June	February 5, 2016

## 2. Seasonal Update Elements & Specific Operations

### 2.1. Current Conditions

#### 2.1.1. 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 5<sup>th</sup> 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 2016		April-August 2016	
	Volume (MAF)	% of 30-year Average (101.4 MAF)	Volume (MAF)	% of 30-year Average (87.5 MAF)
January 8, 2016	94.1	93	82.6	94
February 5, 2016	95.2	94	83.2	95
March 7, 2016	86.5	99	102.9	102
April 7, 2016				
May 6, 2016				
June 7, 2016				
July 8, 2016				

**Table 3. Grand Coulee Dam Final Water Supply Forecasts.**

Forecast Issue Date	January-July 2016		April-August 2016	
	Volume (MAF)	% of 30-year Average (59.6 MAF)	Volume (MAF)	% of 30-year Average (56.8 MAF)
January 8, 2016	54.8	93	53.3	94
February 5, 2016	56.8	95	54.5	96
March 7, 2016	61.2	103	56.4	99
April 7, 2016				
May 6, 2016				
June 7, 2016				
July 8, 2016				

**Table 4. Lower Granite Dam Final Water Supply Forecasts.**

Forecast Issue Date	January-July 2016		April-August 2016	
	Volume (MAF)	% of 30-year Average (27.4 MAF)	Volume (MAF)	% of 30-year Average (21.1 MAF)
January 8, 2016	24.3	89	19.8	94
February 5, 2016	25.6	93	20.7	98
March 7, 2016	25.7	93	19.3	91
April 7, 2016				
May 6, 2016				
June 7, 2016				
July 8, 2016				

### 2.1.2. 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/WaterManagement/ColumbiaRiverBasin/ColumbiaRiverFloodControl.aspx>

**Table 5. Libby Dam Water Final Supply Forecasts.**

Forecast Issue Date	April-August 2016	
	Volume (KAF)	% of 78-year (1929-2008) Average (6,282 KAF)
November		
December	5,793	92%
January	6,249	99%
February	6,318	101%
March	6,472	103%
April		
May		
June		

**Table 6. Dworshak Dam Final Water Supply Forecasts.**

Forecast Issue Date	April-July 2016	
	Volume (KAF)	% of 79-year (1929-2008) Average (2,696 KAF)
December	1,676	62%
January	1,913	71%
February	1,986	74%
March	2,025	75%
April		
May		
June		

### 2.1.3. 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 Month	April-August 2016		January-July 2016		May-September 2016	
	Volume (KAF)	% of 30-yr Average (2,070 KAF)	Volume (KAF)	% of 30-yr Average (2,224 KAF)	Volume (KAF)	% of 30-yr Average (1,835 KAF)
January	1,858	96	2,019	96	1,625	96
February	1,742	90	1,885	90	1,524	90
March	1,801	93	1,969	94	1,574	93
April						
May						
June						

## 2.1.4. Weekly Weather & Precipitation Retrospectives

Week	Weekly Weather / Precipitation Retrospective
Oct 5, 2015	<p><b>Temperatures:</b> Above average.</p> <p><b>Precipitation:</b> Increased to above average, except in far southern parts of the basin.</p> <p><b>Streamflows:</b> Minor rises resumed over the weekend in BC where soils are now quite moist. Flat flows elsewhere as rain went into moistening soils.</p>
Oct 12, 2015	<p><b>Temperatures:</b> Well above average. Several record highs on Friday.</p> <p><b>Precipitation:</b> Well below average.</p> <p><b>Streamflows:</b> Receding in BC; flat elsewhere.</p>
Oct 19, 2015	<p><b>Temperatures:</b> Above average, driven mostly by warm overnight lows.</p> <p><b>Precipitation:</b> Above average southern ID, otherwise well below average despite significant rain west of the Cascades yesterday.</p> <p><b>Streamflows:</b> Flat or receding. All rains this weekend went into moistening soils.</p>
Oct 26, 2015	<p><b>Temperatures:</b> Above average for most of the week, then fell to near average yesterday.</p> <p><b>Precipitation:</b> <b>First major storms of the fall. Well above average northwest half (200-500% of average) with several daily rainfall records broken.</b> Storm totals over 10 inches in parts of the WA Cascades and WA/OR coast. Below average SE 1/3<sup>rd</sup>, but significant rains are spreading into that area this morning.</p> <p><b>Streamflows:</b> Sharp but rather modest rises in the Willamettes, lower Columbia and mid-Cs; minor rises elsewhere except the Upper Snake where the heavy rain is just now starting to arrive.</p>
Nov 2, 2015	<p><b>Temperatures:</b> Below average initially, then rose to slightly above average. .</p> <p><b>Precipitation:</b> Well above average SE 1/3<sup>rd</sup> through Wed, then dried out. Below average through NW 2/3<sup>rd</sup> thru Thu, then turned wetter again over the weekend.</p> <p><b>Streamflows:</b> Crests on Tuesday were followed by gradual basinwide recessions</p>
Nov 9, 2015	<p><b>Temperatures:</b> Slightly above average, except well above average Fri-Sat</p> <p><b>Precipitation:</b> Well above average northwest half, with significant snowpack gains. Below average southeast half.</p> <p><b>Streamflows:</b> Minor rises on the Willamettes, mid-Cs and above Arrow, which receded later in the week. Mostly flat elsewhere.</p>
Nov 16, 2015	<p><b>Major wind storm on Tuesday with gusts of 60-100 mph in the mountains, and 40-60 mph in the valleys.</b></p> <p><b>Temperatures:</b> Above average through Tuesday, then fell below average. First widespread freeze west of the Cascades this weekend.</p> <p><b>Precipitation:</b> Well above average, especially along and west of the Cascades. Dried out over the weekend.</p> <p><b>Streamflows:</b> Moderate rises on the Willamettes, mid-Cs, Lower Columbia peaked on Thursday; minor rises elsewhere in the basin peaked on Wednesday. All flows have since diminished.</p>
Nov 23, 2015	<p><b>Temperatures:</b> Below average.</p> <p><b>Precipitation:</b> Well above average south half, with 6-12 inches of snow in lower elevations of southern Oregon and Idaho. Below average elsewhere.</p> <p><b>Streamflows:</b> Flat or receding. Upper tributary river ice formation noted.</p>
Nov 30, 2015	<p><b>Temperatures:</b> Rose to well above average.</p> <p><b>Precipitation:</b> Increased to well above average (Heaviest amounts in BC and western WA). Significant icing in the Columbia Gorge Wed-Thu.</p> <p><b>Streamflows:</b> Moderate flow increases into the Willamette, lower Columbia, mid-Cs and Spokane. Mostly flat elsewhere.</p>
Dec 7, 2015	<p><b>Temperatures:</b> Record warmth and unusually high snow levels Mon-Wed, then fell to near average.</p> <p><b>Precipitation:</b> Very heavy basinwide. Numerous daily rainfall records Mon-Wed from Pineapple Express event. As temperatures cooled, significant snowpack gains above 4000ft.</p> <p><b>Streamflows:</b> Significant flow spikes in most US basins, especially the Willamette, lower Columbia and Yakima where several tributaries flooded. Willamette mainstem flows nearing peak, while other streams recede due to colder temperatures.</p>

<b>Week</b>	<b>Weekly Weather / Precipitation Retrospective</b>
Dec 14, 2015	<p><b>Temperatures:</b> Near average east of the Cascades; above average west.</p> <p><b>Precipitation:</b> Above average US basins; below average in BC. <b>Several locations in western OR and WA approaching wettest Dec on record.</b></p> <p><b>Streamflows:</b> Bankfull flows on the Willamette with several tributaries near or above flood stage. Flows slightly elevated in the Lower Columbia and mostly flat elsewhere as precipitation fell mostly as snow.</p>
Dec 21, 2015	<p><b>Temperatures:</b> Slightly above average through Wed, then fell below average with low snow levels.</p> <p><b>Precipitation:</b> Slightly below average.</p> <p><b>Streamflows:</b> Bankfull flows on the Willamette finally began to recede a bit over the weekend. Flat or receding elsewhere.</p>
Dec 28, 2015	<p><b>Temperatures:</b> Well below average. Load center temps bottomed out at 11°F below average on Sat.</p> <p><b>Precipitation:</b> Well below average..Low elevation snow and ice event western WA, OR on Sun.</p> <p><b>Streamflows:</b> Flat or receding. Natural flows below normal for the first time since early Dec.</p>
Jan 4, 2016	<p><b>Temperatures:</b> Started significantly below average and warmed to just about average by the end of the week</p> <p><b>Precipitation:</b> Significantly below average basin wide.</p> <p><b>Streamflows:</b> Flat or receding. Natural flows continue below average.</p>
Jan 11, 2016	<p><b>Temperatures:</b> Slightly above average</p> <p><b>Precipitation:</b> Above average US basins, especially along and west of Cascades. Below average in BC.</p> <p><b>Streamflows:</b> Gradual but significant rises on the Willamettes, with minor flow increases in the lower Columbia, and Clearwater. Mostly flat elsewhere.</p>
Jan 18, 2016	<p><b>Temperatures:</b> Above average.</p> <p><b>Precipitation:</b> Well above average basinwide. Significant snowpack gains, except upstream of Mica, BC</p> <p><b>Streamflows:</b> Near bankfull flows on the Willamette, but receded slightly over the weekend. Minor flow increases lower Columbia and Clearwater. Mostly flat elsewhere.</p>
Jan 25, 2016	<p><b>Temperatures:</b> Above average initially, then fell to near average. Several record highs on Wed. Snow levels well above pass levels Mon-Thu, then below pass levels this weekend.</p> <p><b>Precipitation:</b> Well above average.</p> <p><b>Streamflows:</b> Moderate flow increases crested on the Willamettes, Lower Columbia, Clearwater, Spokane, lower Snake and mid-Cs over the weekend. Mostly flat elsewhere.</p>
Feb 1, 2016	<p><b>Temperatures:</b> Rose to above average west of Cascades with a few record highs Sunday. Remained slightly below average east of Cascades.</p> <p><b>Precipitation:</b> Above average north, especially above Arrow, BC. Little precipitation south.</p> <p><b>Streamflows:</b> Flat or receding.</p>
Feb 8, 2016	<p><b>Temperatures:</b> Well above average, with several record highs this weekend.</p> <p><b>Precipitation:</b> Dry initially, then well above average. <b>Lower elevation snowmelt offset by significant high elevation snowpack gains.</b></p> <p><b>Streamflows:</b> Significant rises on the Clearwater, Spokane, lower Snake and mid-Cs.. More modest rises on the lower Columbia, Willamettes and Pend Oreille. Mostly flat in BC where snowpack gains were most pronounced.</p>
Feb 15, 2016	<p><b>Temperatures:</b> Near record highs Mon-Tue, then fell closer to average with snow levels lowering back to near pass levels.</p> <p><b>Precipitation:</b> Well above average, with rain changing back to snow in mid and high elevation mountains.</p> <p><b>Streamflows:</b> Flood crest on the Yakima, significant crests on the Clearwater, Spokane, lower Snake and mid-Cs, and modest crests on the lower Columbia, Willamettes and Pend Oreille. Flows crested Tue, and have since receded due to colder temps. Unregulated flows at The Dalles crested near 210k cfs on Wed.</p>
Feb 22, 2016	<p><b>Temperatures:</b> Above average.</p> <p><b>Precipitation:</b> Mostly dry though Thu, then turned much wetter and above average this weekend.</p> <p><b>Streamflows:</b> Receded through Saturday, then minor rises resumed in the Clearwater, Spokane, mid-Cs and lower Columbia due to warmer temps and rainfall.</p>

<b>Week</b>	<b>Weekly Weather / Precipitation Retrospective</b>
Feb 29, 2016	<b>Temperatures:</b> Above average. <b>Precipitation:</b> Well above average (200-300% of normal). <b>Streamflows:</b> Mostly flat through Sat, then rises began on many low elevation streams, especially the Clearwater, Spokane, mid-Cs, lower Columbia and Willamette. Unregulated flows at The Dalles rose to 200kcf/s this weekend.
Mar 7, 2016	<b>Temperatures:</b> Generally above normal with one day below normal. <b>Precipitation:</b> Well above average (200-400% of normal). <b>Streamflows:</b> Moderate rises on many low elevation streams, especially the Clearwater, Spokane, mid-Cs, lower Columbia and Willamette.
Mar 14, 2016	
Mar 21, 2016	
Mar 28, 2016	
Apr 4, 2016	
Apr 11, 2016	
Apr 18, 2016	
Apr 25, 2016	
May 2, 2016	
May 9, 2016	
May 16, 2016	
May 23, 2016	
May 30, 2016	
June 6, 2016	
June 13, 2016	
June 20, 2016	
June 27, 2016	
July 4, 2016	
July 11, 2016	
July 18, 2016	
July 25, 2016	
Aug 1, 2016	
Aug 8, 2016	

Week	Weekly Weather / Precipitation Retrospective
Aug 15, 2016	
Aug 22, 2016	
Aug 29, 2016	
Sep 5, 2016	
Sep 12, 2016	
Sep 19, 2016	
Sep 26, 2016	

## 2.2. Seasonal Flow Objectives

Project	Planning Dates	BiOp Season Average Flow Objective (kcfs)	To-Date Season Average Flow (kcfs)
Priest Rapids	Spring 4/10–6/30	135 kcfs	
McNary	Spring 4/10–6/30	220-260 kcfs <sup>i</sup>	
	Summer 7/1–8/31	200 kcfs	
Lower Granite	Spring 4/3–6/20	85-100 kcfs <sup>i</sup>	
	Summer 6/21–8/31	50-55 kcfs <sup>ii</sup>	

i. Varies according to NWRFC April forecast.

ii. Varies according to NWRFC June forecast.

## 2.3. Flood Control

Flood Control Elevations and April 10<sup>th</sup> 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<sup>th</sup> elevations shown in the table below are calculated by linear interpolation between the March 31<sup>st</sup> and April 15<sup>th</sup> forecasted flood control elevations.*

Project	Elevation Date Objective	Dec	Jan	Feb	Mar	Apr
Libby	Jan 31 <sup>st</sup>	2415.3	2411.0	2411.0		
	Feb 29 <sup>th</sup>		2409.7	2407.0		
	March 31 <sup>st</sup>		2409.0	2405.7	2397.8	
	April 10 <sup>th</sup>		2409.0	2405.7	2397.8	
	April 15 <sup>th</sup>		2409.0	2405.7	2397.8	

Project	Elevation Date Objective	Dec	Jan	Feb	Mar	Apr
	April 30 <sup>th</sup>		2409.0	2405.7	2397.8	
Hungry Horse	Jan 31 <sup>st</sup>		3547.0	3547.0		
	Feb 29 <sup>th</sup>		3545.1	3547.9		
	March 31 <sup>st</sup>		3542.8	3547.1	3545.4	
	April 10 <sup>th</sup>				3544.9	
	April 15 <sup>th</sup>		3541.8	3546.8	3544.7	
	April 30 <sup>th</sup>		3540.6	3546.4	3544.1	
Grand Coulee	Jan 31 <sup>st</sup>		1290.0	1290.0		
	Feb 29 <sup>th</sup>		1290.0	1290.0		
	March 31 <sup>st</sup>		1283.3	1283.3	1276.7	
	April 10 <sup>th</sup>				1253.0 (DG)	
	April 15 <sup>th</sup>		1271.2	1270.3	1260.3	
	April 30 <sup>th</sup>		1254.6	1253.6	1244.6	
Brownlee	Jan 31 <sup>st</sup>		2077.0	2077.0		
	Feb 29 <sup>th</sup>		2051.9	2051.6		
	March 31 <sup>st</sup>		2051.7	2050.7	2048.0	
	April 15 <sup>th</sup>		2053.8	2052.6	2049.3	
	April 30 <sup>th</sup>		2055.5	2053.9	2049	
Dworshak	Jan 31 <sup>st</sup>		1556.4	1556.4		
	Feb 29 <sup>st</sup>		1560.4	1557.0		
	March 31 <sup>st</sup>		1574.5	1570.9	1569.0	
	April 10 <sup>th</sup>		1581.8		1570.5	
	April 15 <sup>th</sup>		1585.4	1581.9	1571.2	
	April 30 <sup>th</sup>		-	-	1569.4	

## 2.4. Storage Project Operations

### 2.4.1. 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 9 on page 31 of the Water Management Plan on the following website: [http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2016/Final/20151231\\_WMP\\_FIN\\_NWD.pdf](http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2016/Final/20151231_WMP_FIN_NWD.pdf)

**April 10<sup>th</sup> and Refill Objectives:** This section will be updated throughout the season as new forecast information becomes available.

**Sturgeon Pulse:** This section will be updated throughout the season as new forecast information becomes available.

**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 NMFS FCRPS BiOp September 30 elevation of either 2,439 or 2,449 feet.

## 2.4.2. 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<sup>st</sup>. The final flow levels, for the remainder of the calendar year, are based on the March Final forecast. Reclamation’s March 2016 Final WSF for April-August was 1,800 (93% of average) which set the minimum flow requirements below Hungry Horse and at Columbia Falls at 900 cfs and 3,500 cfs, respectively. The minimum flows are set for the rest of the calendar year and will be updated following the January 2017 Final Forecast.

**April 10<sup>th</sup> and June 30<sup>th</sup> Refill Objectives:** The Bureau of Reclamation computes Hungry Horse’s final April 10<sup>th</sup> elevation objective by linear interpolation between the March 31<sup>st</sup> and April 15<sup>th</sup> forecasted flood control elevations based on the March Final WSF.

This section will be updated throughout the season as new forecast information becomes available.

**Summer Draft Limit:** The summer reservoir draft limit at Hungry Horse is 3,550 feet (10 feet from full) by September 30<sup>th</sup>, except in the lowest 20<sup>th</sup> percentile of water years (The Dalles April-August <72.2 MAF) when the draft limit is elevation 3,540 feet (20 feet from full) by September 30<sup>th</sup>. The RFC’s May Final April-August forecast is used to set the official draft limit.

## 2.4.3. Grand Coulee Dam

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

This section will be updated throughout the season as new forecast information becomes available.

**The Lake Roosevelt Incremental Storage Release Program:** This section will be updated throughout the season as new information becomes available.

**Table 8. Lake Roosevelt releases requested for 2016.**

“Bucket”	2016 Releases (acre-feet)	Total Lake Roosevelt Incremental Storage Releases Program (acre-feet)
Odessa		
M&I		
Instream Flow		

**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.

This section will be updated as information becomes available.

**Drum Gate Maintenance:** This section will be updated as information becomes available.

**Banks Lake:** This section will be updated as information becomes available.

### ***2.5. Dworshak Dam***

Unit 3 will be out of service due to an overhaul between the dates of approximately August 2016 and May 2017. In order to minimize impacts on fish the Corps coordinated the timing of the Dworshak Dam unit 3 outage with the FPOM during meetings on the following dates: November 12, 2016; December 17, 2015; and January 14, 2016. Additional information from these discussions may be found in FPOM notes for these meetings on the following website:

<http://www.nwd-wc.usace.army.mil/tmt/documents/FPOM/2010/>

With unit 3 out of service total project outflow will be reduced from 10 kcfs (unit 1 @ 2.5 kcfs + unit 2 @ 2.5 kcfs + unit 3 @ 5 kcfs = 10 kcfs total project outflow) down to 5 kcfs. The reduction in outflow may impact the projects ability to: provide spring and summer flow augmentation, refill, and/or achieve monthly elevation targets (e.g., April 10, August 31, September 30). The AAs will make best efforts to achieve monthly elevation targets and operations request by Salmon Managers operational requests but the AAs ability to achieve these targets and requests may be limited to the reduction in outflow associated with the unit 3 outage. The Corps will coordinate DWR operations with the TMT during the outage period.

This section will be updated as information becomes available.

### ***2.6. Water Quality***

Spill priority lists are coordinated with the TMT and available on the following website at:

<http://www.nwd-wc.usace.army.mil/tmt/documents/spill-priority/>

### ***2.7. 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 2,222 feet), the Corps removed all but 3 rows of gates (resulting in withdrawal elevation of 2,253 feet).

## ***2.8. Spring Creek Hatchery Release (Bonneville Dam)***

This section will be updated throughout the season as new information becomes available.

## ***2.9. Lake Pend Oreille Kokanee Spawning Flows (Albeni Falls Dam)***

This section will be updated throughout the season as new information becomes available.

## ***2.10. Upper Snake Flow Augmentation***

This section will be updated throughout the season as new information becomes available.

## ***2.11. Chum Operation***

<b>Date</b>	<b>TMT Coordination Summary</b>
Oct 21, 2015	<p>At this time the tentative plan for chum operation will be the same operation coordinated last year. The operation would begin with a tailwater elevation of 11.5 to 13.0 feet beginning on Nov 7. TMT will revisit the chum operation at the Nov 4<sup>th</sup> TMT meeting, unless there is significant rainfall and then an interim meeting will be scheduled.</p>
Nov 4, 2015	<p>NOAA, reported that as of midnight on Nov 3rd, Bonneville tailwater elevation was 11.2ft and flows were between 108-110kcs. NOAA continued that on Monday, BPA and NOAA visited Hamilton Springs and Hamilton Creek to see if the streams were watered; both were flowing well and pictures are available on the TMT agenda. WDFW, shared that chum were sighted in the springs on Tuesday.</p> <p>The group discussed when to initiate the chum operation. It was noted that at this point, there is not enough inflow at Bonneville to support a constant 11ft tailwater elevation without moving water from Grand Coulee, which takes 3 days to travel downstream to Bonneville. BPA noted that one option would be to hold off on implementing the chum operation and use flows to continue filling Grand Coulee for future use. USFWS explained that salmon managers would like to start the operation as soon as possible to ensure that chum have access to habitat, which WA noted is stated in the BiOp to be available at 11.3ft.</p> <p>After discussion, TMT members coalesced around an interim operation that set a range of 10.5-12.5ft tailwater elevation all hours, unless there is not enough water, in which case the project will prioritize daytime hours. Then on Saturday, Nov 7, the AAs will initiate the previously coordinated chum operation. BPA noted that they need to check and make sure there will be sufficient water for this operation.</p> <p>Starting today, Nov 4<sup>th</sup> at 0600, operate Bonneville tailwater elevations between 10.5-12.5ft at all times if possible; if there is not enough water, prioritize daytime hours. On Saturday, Nov 7<sup>th</sup> at 0600 hours shift to the previously planned chum operation.</p> <p>On Saturday, Nov 7<sup>th</sup> at 0600 hours implement the following operation:</p> <ol style="list-style-type: none"><li>1. Operate Bonneville tailwater within a 1-foot range of 11.5-12.5 feet during all hours.</li><li>2. If necessary to pass additional flow, operate as necessary up to 13.0 feet during all hours, returning to the range of 11.5-12.5 feet whenever possible.</li><li>3. If necessary to pass additional flow, operate Bonneville tailwater up to 16.5 feet during nighttime hours (5 pm-6 am). The highest tailwater elevations will be concentrated around midnight.</li><li>4. If necessary to pass additional flow, the Bonneville Dam tailwater will be operated up to 18.5 feet during nighttime (5 pm-6 am). The highest tailwater elevations will be concentrated around midnight.</li><li>5. If necessary to pass additional flow, operate tailwater between 13.0-16.5 feet during daytime hours (6 am-5 pm) with no upper limit during nighttime hours. The highest tailwater elevations will be concentrated around midnight. The AAs will notify TMT of this occurrence and coordinate further operations if necessary.</li></ol>

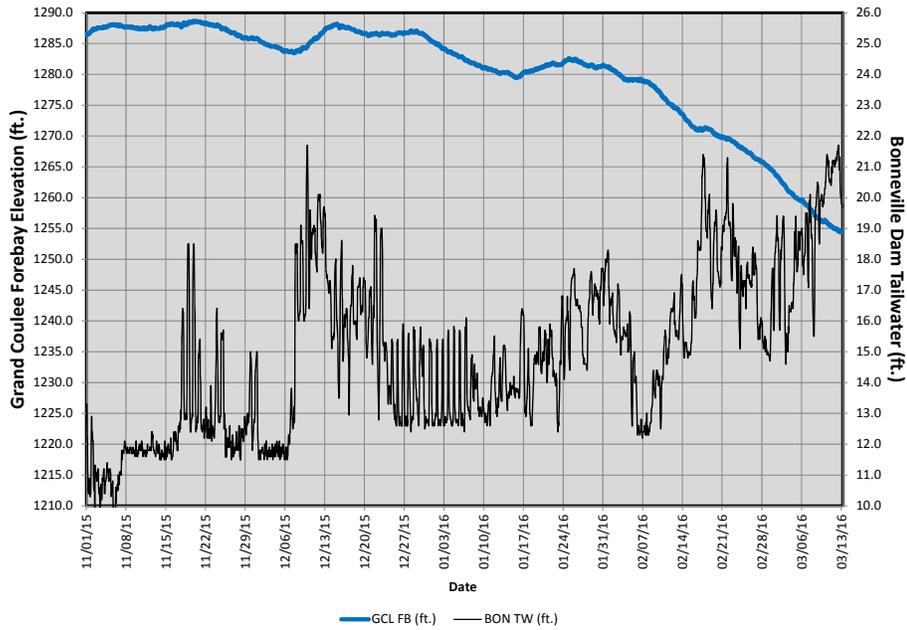
Date	TMT Coordination Summary
Nov 18, 2015	NOAA reported that the chum operation commenced on Nov 7 at 0600 hours. Chum were observed in the area. Tailwater elevations have ranged from 11.5-12ft, however, rose to 16ft on Nov 17 due to large amounts of rainfall. Chum counts observed at Woods Landing were around 160 and at Bonneville numbers were near 140. WA confirmed that Chum counts were abundant in most areas and also noted that the last time Chum counts were over 100 at Bonneville Dam was in 2010 and the current count of 146 is the highest number observed in the last 10 years.
Dec 11, 2015	Bonneville tailwater was 19ft due to increased streamflows. Forecasts suggest that by late next week flows should drop enough for the project to manage the flow. Per the coordinated chum operation, once possible, the project would drop back down to a minimum of 13ft, and operate between 13.0-16.5ft (step 6). NOAA reported that Salmon Managers met and discussed the operation, noting that they do not want to hold a 14ft minimum, considering the uncertainty of Jan-Mar flows, until they have more information regarding where the fish are spawning. They would prefer to dial back to 13ft during the day, and increase as necessary to rewet the redds at night (between 13-20ft). WDFW crew plans to survey for redds on Tuesday Dec 15, at which point they should have a better idea of where fish are spawning.
Dec 16, 2015	<p>Salmon Manager provided a recommendation for the chum protection operation as minimum 13ft tailwater elevation, and to re-wet redds, with a tailwater elevation up to 16ft for a four hour period at night. WA, noted that surveys were conducted on Monday and Tuesday, and that the survey crew reported that there were Chum in the area, however, no signs of redds in the exposed dry areas or edges of the water; the tailwater elevation was between 13.5 -15.0ft during the surveys. Both NOAA and WA noted that if there are no redds above 13ft, the tailwater could be stepped down when possible. BPA noted that there is still too much water in the system to significantly shape the flow; and did not expect flows to come down until Jan.</p> <p>The plan is to continue with the current chum operation through midnight Dec 31st. At 0000 hours on Jan 1st the AAs will switch to the incubation operation, tentatively set at a 12.5ft minimum. If more information becomes available TMT will revisit this operation. TMT will check in on the Chum operation at the Dec 22<sup>nd</sup> conference call.</p> <p>BPA and WDFW will coordinate the removal of the WDFW trap at Duncan Creek.</p>
Dec 22, 2015	<p>BPA reported that the survey crew saw one live chum and one live Chinook, both of which looked to be nearing their end. There were no fish caught in the WDFW sein and no new information regarding redd sightings. WDFW, noted that he did not have any additional information from the survey, or any changes to the suggested minimum tailwater elevation of 12.5 ft from last week's meeting. NOAA, shared that FPAC arrived at a recommended operation today on their call. FPAC suggests holding a 12.5ft minimum, with a four hour rewetting period of the tailwater elevation up to 15ft in case there are redds at higher elevations. It was noted that if possible, the preference is to not have the rewetting hours be a consecutive 4-hour period. WDFW noted that the survey crew intends to go back out to survey next week, so if conditions allow, there may be more information.</p> <p>BPA noted that the project should be able to hold the 12.5ft elevation with four hours up to 15ft, however, if something changes, a TMT meeting will be scheduled.</p>
Jan 6, 2016	<p>NOAA provided an update on the Chum and noted that despite regular surveys, the river conditions have made it a challenge to obtain precise data on the location and depth of redds. NOAA continued that it is expected that the spawning peak was in late Nov when hundreds of Chum were sighted at various locations.</p> <p>NOAA noted that, following the Nov surveys, flows increased and Chum observations decreased. Currently, the survey crew is reporting no visible redds at higher elevations, therefore FPAC recommends discontinuing the 12.5ft minimum, with a four hour rewetting period of tailwater elevation up to 15ft. Instead, FPAC would like to suggest a revised operation with a 12.2ft minimum tailwater and cease rewetting.</p> <p>The COE noted that the Corps will implement the 12.2ft tailwater minimum, however, it may be challenging to maintain beyond next week if water supply forecasts continue to decrease. The COE suggested holding a TMT meeting next week to check in on the operation. TMT members agreed that the operation should be revisited next week.</p>

<b>Date</b>	<b>TMT Coordination Summary</b>
Jan 13, 2016	BPA, provided an update on the chum operation and noted that Bonneville is operating with a minimum tailwater elevation of 12.2ft, however due to recent non-treaty storage releases out of Canada and an increase in incremental flows, the tailwater elevation has been between 13-14ft for the last few days. Considering the pending forecast and official water supply forecasts, BPA noted that the AAs recommend exercising caution and trying to conserve water through future operation. NOAA noted that members of FPAC were displeased to see elevations in the 13-14ft range, after being cautioned by AAs to reduce tailwater elevations, and then seeing elevations come back up. NOAA noted that the release of the Canadian water was unexpected and salmon managers were caught off guard by the higher than expected flows over the weekend.
Jan 20, 2016	<p>The COE noted that the Bonneville tailwater elevation as of 0800 hours was 14.6ft. and continued that Bonneville is continuing to operate with a minimum tailwater elevation of 12.2ft all hours. The RFC forecast for Bonneville shows inflows of 143kcf today and the 10 day inflow forecast is approximately 130kcf. NOAA and the Salmon Managers agreed with maintaining the current protection level with a minimum tailwater elevation of 12.2ft. Rainfall is forecasted over the next week and may cause an increase Bonneville tailwater elevations. It was suggested that TMT meet next Wednesday for an update and check in on the Chum operation. The COE also pointed TMT members to agenda attachment 4c, which provides a summary of hourly average tailwater elevations, coordinated tailwater operating ranges, and Chum surveys for each week from Nov 1 through Jan 19.</p> <p>ACTION: The AAs will continue operating Bonneville with a tailwater minimum of 12.2ft. A conference call will be held on Feb 27<sup>th</sup> at 9:00am to check in on the operation.</p>

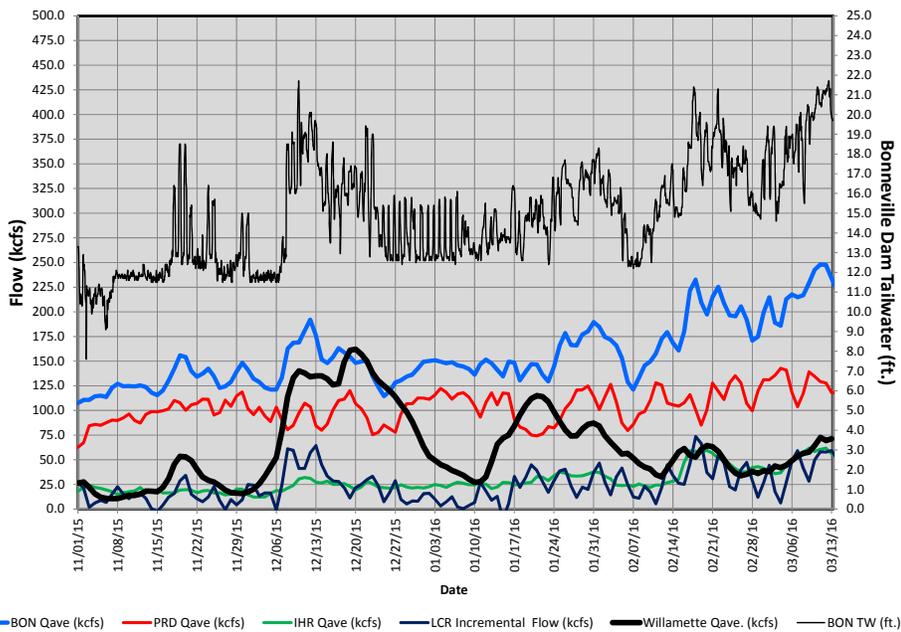
<b>Dates</b>	<b>Chum Water Management Summary</b>
Nov, 7-17, 2015	The chum operation began on Nov 7 <sup>th</sup> . Between the 7 <sup>th</sup> and the 17 <sup>th</sup> The TW was held steady on all hours between TW elevation 11.5 to 12.5 feet. Grand Coulee was generally passing inflow with the forebay within the top 2 feet.
Nov 17-25, 2015	Beginning on the 17 <sup>th</sup> well above average precipitation in the basin increased local streamflows with the Willamette River flow peaking at over 50 kcf. Daytime TW elevations remained at or below 13.0 feet with nighttime TW elevation reaching up to 18 feet during this period. During this period Grand Coulee was generally passing inflow with the forebay within the top 2 ft.
Nov 25-Dec 7, 2015	Precipitation continued to be well above average during this period with moderate rises in streamflows. The Tailwater elevations at Bonneville generally remained below 13.0 feet except for a few nights where nighttime TW elevations reached 15-16 feet. Grand Coulee was drafted during this period ~4 feet for power flexibility.
Dec 7-25, 2015	Very heavy precipitation basinwide with numerous rainfall records contributed to producing one of the wettest Decs on record. Local streamflows and incremental flows across the basin increased significantly. The Willamette River flow increased to over 150 kcf during this period. The result produced TW elevations downstream of Bonneville dam of 15-20 feet on all hours during this period. It wasn't until the end of this period that the daytime tailwater returned to under 13.0 on the 25 <sup>th</sup> . During this period Grand Coulee refilled to ~1287 feet.
Dec 25-Jan 15, 2016	Precipitation during this period was below average to start then picked up near the end with streamflows responding. The Willamette River flow increased to over 100 kcf during this period. The TW elevations below Bonneville Dam during this period were generally under 13 feet during the day with the 4 hours of rewetting protection operation to 15 feet on other hours. During this period Grand Coulee was drafted to elevation ~1280 feet primarily due to the support of the chum protection operation with a small portion due to power flexibility. Water supply forecasts during this period had been steadily dropping prompting concerns about the additional water required for the rewetting operation.

<b>Dates</b>	<b>Chum Water Management Summary</b>
Jan 15-31, 2016	Any further concerns regarding a precipitous continued drop in the water supply forecast faded across Jan as precipitation was generally above average during this period. Local streamflows once again increased with near bank full flows on the Willamette River. Bonneville Dam TW elevations during this periods were well above the required minimum of 12.2 feet. Higher TW elevations during this period were a combination of high local streamflows and passage of non-treaty storage releases. During this period Grand Coulee had a net fill of ~1 ft finishing up Jan at just over elevation 1,281 feet which is 4 feet above the Jan VDL at elevaton 1277.0 feet.
Jan 31 - Feb 12, 2016	Precipitation in portions of the basin increased water supply conditions closer to normal. Reclamation announced that they will schedule drumgate maintenance this year with water supply forecasts close to average. This requires Grand Coulee to be drafted to elevation 1255 feet by Mar 14 <sup>th</sup> . The result is that the TW elevations below Bonneville Dam will be well above the protection minimum through mid Mar.
Feb 12 – Mar 14, 2016	Grand Coulee was drafted to the drum gate maintenance elevation. This draft combined with robust Snake and Willamette River flows contributed to BON TW elevations of 15-21 feet.
Mar 14- April 30, 2016	Grand Coulee will be operated within a 5-foot operating range between 1250-1255 feet and will be filled to the coordinated April 10 Elevation Objective of 1253.0 on the 10 <sup>th</sup> . From April 10 Grand Coulee will be drafted to the April 30 FRM elevation currently forecasted to be 1244.6 feet.

### 2015-16 Chum Operations



### 2015-16 Chum Operations



Chum survey data gathered at the Ives/Pierce Island Complex are in **Table 9**. Data from all Chum survey areas are provided by the Fish Passage Center on the following website:  
[http://www.fpc.org/spawning/spawning\\_surveys.html](http://www.fpc.org/spawning/spawning_surveys.html)

**Table 9. Chum Survey Data from the Ives/Pierce Island Complex.**

Date	Lives	Dead <sup>i</sup>	Redds <sup>ii</sup>	Visibility (ft)
October 8, 2015	0	0	0	5
October 15	0	0	0	5
October 22	0	0	0	10
October 29	0	0	0	6
November 3	0	0	0	4
November 10	70	1	33	9
November 18	52	6	3	1
November 24	341	36	47	6
December 3	188	NC	NC	5
December 8	0	2	24	0.5
December 15	4	6	NC	3
December 22	1	1	NC	3
December 29	0	0	0	3
January 7, 2016	0	0	0	6

i. Dead are newly sampled fish only.

ii. Redds are an instantaneous count for the day, not cumulative.

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

The Hanford Reach Fall Chinook Protection Agreement (Agreement) establishes 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 Reach with respect to fall Chinook protection and the impact of operation of the seven dams operating 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<sup>3</sup>/s) [1,000 cubic meters per second (m<sup>3</sup>/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<sup>3</sup>/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
Oct 8, 2015	<p>Operations to support the Hanford Reach Fall Chinook Protection Program will begin on Oct 15, 2015. Reverse Load Factoring will begin at 000 hours on Thursday the 15<sup>th</sup> and continue through the end of the Spawning Period. The Spawning Period is scheduled to end on Nov 22, 2015 (last Sunday prior to Thanksgiving), but may be extended if spawning activity is observed during the redd survey on that day. During Reverse Load Factor, Priest Rapids Outflows (as measured at the USGS gauge) must remain between 55 and 70 kcfs during daylight hours.</p> <p>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, Oct 18. Specific details for operational support during Vernita Bar redd counts will be updated throughout the season and be provided in individual flow requests.</p>
Oct 18, 2015	<p>On Sunday, Oct 18, 2015 representatives from Grant PUD and Washington Department of Fish &amp; Wildlife conducted the first 2015 Vernita Bar spawning ground survey. One redd was observed in the 36 – 50 kcfs elevation zone (Table 1). 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, Oct 25.</p>
Oct 25, 2015	<p>On Sunday, Oct 25, 2015 representatives from Grant PUD and Washington Department of Fish &amp; Wildlife conducted the second 2015 Vernita Bar spawning ground survey. Fifty-one redds were observed in the 36 – 50 kcfs elevation zone and 16 redds were observed in the above 50 kcfs elevation zone (Table 1). 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 Oct 21, 2015. The next spawning ground survey will be used to determine the Critical Elevation and will be conducted on Sunday Nov 22.</p>
Nov 22, 2015	<p>On Sunday, Nov 22, 2015, the third Vernita Bar redd survey was conducted to determine the 2015-2016 Hanford Reach Critical Elevation and Protection Level Flow. Flows from Priest Rapids Dam at Vernita Bar were approximately 45 kcfs.</p> <p>Based on the survey count and the Hanford Reach Fall Chinook Protection Program Agreement, the <u>2015-2016 Critical Elevation is set at the 70 kcfs elevation</u>. The Monitoring Team agreed that the fish spawning season had ended and that Nov 22, 2015 be identified as the End of Spawning date. Reverse load factoring ended at 24:00 on Nov 22, 2015. A supplemental ground survey will not be required.</p> <p><u>GCPUD is projecting the Post-Hatch Period, which requires a minimum flow no less than 15 cm below the Critical Elevation, will begin on Nov 28, 2015.</u></p>
Nov 28, 2015	<p>Tonight at 24:00 GCPUD will transition from the Pre-Hatch Period to the Post-Hatch Period. The Post-Hatch Period requires that flow below Priest Rapids Dam be no less than 15 cm below the Critical Elevation/Protection Level Flow (70 kcfs). The transition to the Post-Hatch Period occurs when 500 temperature units have accumulated from the start of spawning.</p> <p>The next protection period is Emergence/Rearing. These periods have both minimum flow constraints and daily flow fluctuation constraints. We are projecting that these periods will begin in mid-Mar, 2016.</p>
Feb 1, 2016	<p>The next flow constraint periods are Emergence and Rearing. During this period there are limits to daily flow fluctuations below Priest Rapids Dam. These constraints are projected to begin on Feb 28, 2016. This date could change depending on water temperatures.</p>

### **2.13. 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 and the fishery agencies, zero discharge 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 flow conditions may maximize power production from the Columbia River Basin system, but zero flow operations are not recommended at Lower Snake projects when fish are actively migrating in the Snake River.

On December 6, 2005, Salmon Managers submitted System Operations Request (SOR) 2005-22 “Snake River Zero Nighttime and Weekend Flow” to the AAs (available online at: <http://www.nwd-wc.usace.army.mil/tmt/sor/2005/2005-22.pdf>). The SOR 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 trigger will be defined on a sliding scale outlined in the following table, based on counts of both “wild” and “total (wild + hatchery)” 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

November 18, 2015, TMT Meeting: NOAA shared the 2015 run-to-date count data for adult steelhead at Lower Granite, which will determine the “few, if any” criteria this year. For 2015, the run-to-date (June 1 through November 17) of adult steelhead counted at Lower Granite Dam is 33,000 wild and 127,000 combined (wild and hatchery). Using these run-to date numbers, the criteria this year for “few” fish is defined as: less than 20 wild steelhead and less than 50 combined wild and hatchery steelhead, measured as a rolling 3-day average. The Corps noted that only one count (wild or combined) needs to be higher than the criterion to show more than a “few” adults migrating. In other words, both wild and combined counts need to be less than the “few” criterion in order to trigger the zero generation operation. The Corps stated once the criteria (wild<20 and combined<50) have been achieved, then the AAs will be able to implement the operation at nighttime on an as-needed basis. If the “few” criteria of wild and combined are not achieved by December 30 when Lower Granite Dam adult ladder counts end, the operation will begin December 31<sup>st</sup> and continue through February. The Corps and NOAA will continue to track steelhead counts. When/if the criteria are met, NOAA will email the AAs to begin implementation of the zero generation operation at the Snake River projects. On December 4, 2015 steelhead passage at Lower Granite Dam met the "few, if any" criteria.

## 2.14. Minimum Operating Pool (MOP)

In accordance with RPA 5 in the NOAA Fisheries 2014 Supplemental BiOp, and as specified in the annual Fish Operations Plan (FOP), the AAs operate the Lower Snake River projects (Ice Harbor, Lower Monumental, Little Goose, Lower Granite) within the 1-foot MOP operating range (**Table 10**) from April 3 through August 31, unless adjusted to meet authorized project purposes (primarily navigation). Additional information may be found in the FOP, included in the Fish Passage Plan (FPP) as Appendix E on the following website:

<http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/>

**Table 10. MOP Elevation Ranges for Lower Snake River Projects.**

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

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.

## 2.15. Spill and Transportation in 2016

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 11**) 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 12**) 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 11. 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 12. 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

Transport will begin on May 1 at Lower Granite, Little Goose, and Lower Monumental dams, unless otherwise coordinated with TMT. The goal is to transport approximately 50% of juvenile steelhead in accordance with the 2014 Supplemental BiOp. Fish collection for transport will begin on May 1 and barging will begin the following day and continue daily or every-other-day (depending on the number of fish) throughout the migration season. Transport operations will be carried out at each project in accordance with all applicable FPP criteria.

### ***2.16. Fish Passage Research in 2016***

Fish research activities described below are excerpted from the 2016 FPP Appendix A.

- January 2016 – May 2016. McNary, Ice Harbor, Lower Monumental, Little Goose, Lower Granite - Evaluation of Adult Fish Ladder Modifications to Improve Pacific Lamprey Passage.** 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 for 2016. 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.

- February 2016 – July 2016. Little Goose - FGE Emergency Gate Closure Study.** This study is to estimate and compare fish guidance efficiency (FGE) at two adjacent units with head gates in the raised (control) and stored (treatment) operating positions, and to estimate impacts (if any) to FGE and Project juvenile fish passage performance when units are operated with head gates stored. Results will aid in determining the appropriate path forward for restoring the 10-minute emergency head gate closure criterion.

Hydroacoustic transducers will be installed on the trashrack and ESBS frames in turbine units 2 and 3. Installation is expected to occur during the in-water work window in February, 2016. A dive to install transducers on the trashracks will require a three-unit outage. Project personnel will assist with alternating unit 2 and unit 3 head gate orientation between raised and stored

operating positions once per week on a random block design for the duration of the study beginning approximately 4 April, 2016 through approximately 15 July, 2016. Should low flow limit the Project's ability to operate three turbine units in June and July, an alternating turbine unit operating priority between units 2 and 3 will be necessary to meet the study design, assuming river conditions will permit the operation of two units. Head gates will remain in either the raised or lowered position in units 2 and 3 and unit operation will alternate on the random block design rather than changing head gate position during the low flow period. Adult fish passage will not be affected as all in-water work will be conducted during the work window. No specific turbine unit operating points (MW) are requested for this study. The dive to remove transducers will occur during the in-water work window in FY17.

• **Ongoing through March 2017. Lower Granite - Juvenile Fish Bypass System Upgrade.** Construction activities associated with the Lower Granite Dam juvenile bypass system (JBS) upgrade began in 2014 and are expected to continue throughout 2016, with project completion expected in March 2017 (FPOM MOC: 15 LWG 004 and 13 LWG 17).

Construction activities in 2016 are anticipated to include the mining the existing juvenile collection channel during 2015/16 winter maintenance period (MOC: 15 LWG 023) and during the extended Juvenile Bypass System (JBS) outage (1 Aug 2016 to 24 March 2017) to widen the collection channel (MOC: 13 LWG 17), mining of the transportation channel through the south non-overflow section of the powerhouse; erection of the new primary and secondary dewatering structures and transportation flume; installation of new primary and emergency bypass outfall structures in the tailrace, and associated components. Work during 2016 will include work within the forebay associated with collection and transportation channel improvements and within the tailrace for outfall construction activities.

During the 2015/16 winter work period, the juvenile collection channel is being widened to the final 9.5' channel width in the vicinity of turbine units 5 and 6 (upstream end of collection channel). The collection channel will be widened within the vicinity of Turbine Units 1-4 during the extended winter maintenance period 1 August 2016 to 24 March 2017. Crossover activities involving permanent modifications to the existing juvenile bypass system (JBS) are anticipated to occur during the extended JBS outage starting August 2016. Lower Granite Dam RSW operations will be extended through 15 December 2016 as part of the extended JBS shutdown as described in MOCs 13 LWG 17 and 15 LWG 025. As discussed within NWW FFDRWG and FPOM, it may be necessary to adaptively manage RSW operations during the 1 September 2016 to 15 December 2016 period to improve fish passage conditions and facilitate in-water outfall construction activities.

Activities that require special project operations other than as described above will be coordinated through FPOM and/or FFDRWG, as appropriate. All fish salvage operations will follow standard dewatering procedures and will be coordinated through Lower Granite's fisheries staff in accordance with standard operation procedures. Any deviations from FPP operations will be coordinated through FPOM and/or FFDRWG as appropriate.