ADJUSTMENT OF SYSTEM REFILL

Flood Risk Management Requirements
Report #7 for Water Year 2017
Issue Date: 08 May 2017

A. Purpose of Flood Risk Management Requirements. These requirements provide maximum end-of-month reservoir elevations and/or minimum outflows for flood risk management projects in the Columbia River Basin. These requirements are for use by U.S. Army Corps of Engineers, Bureau of Reclamation, Idaho Power, Energy Keepers, BC Hydro and Bonneville Power Administration for operations planning and include all formally approved deviations to date. Any deviation from the flood risk management requirements herein will require approval from the Chief, Columbia Basin Water Management Division (CBWM) per the Northwestern Division's (NWD) Deviation Policy (NWDR 1110-2-6). Requirements are in accordance with the Columbia River Treaty Flood Control Operating Plan (FCOP) and any project-specific water control manuals, with variations as described below. These flood risk management requirements will be revised and re-issued as new information becomes available.

B. List of Approved Flood Deviations from Water Control Manuals.
Grand Coulee (GCL): On Monday, April 17, 2017, a request was made by Washington Emergency Management and the Colville Tribes to hold the GCL pool above 1232 feet to keep the Inchelium-Gifford Ferry in service. Runoff in the region near the ferry has resulted in multiple washouts of primary roads which has caused an immediate impact to the local residents in need of access to emergency and medical services. FRM elevations for GCL will be maintained above 1232 feet through the 2017 spring freshet season.

C. Flood Risk Management Requirements
These requirements (shown in Table 1) have been prepared using the most recent official seasonal volume forecasts. The April-August volume forecast at The Dalles Dam based on the May 2017 official forecast is 111,123 kaf. All other water supply forecasts can be found in Table 2 or at: http://www.nwd-wc.usace.army.mil/report/colsum/

Table 1 shows the flood risk management elevations, draft and flow limits for the evacuation, holding and refill periods. The Initial Controlled Flow (ICF) based on the April forecast is 368 kcfs and the ICF date has been declared as May 4, 2017. See the FCOP for how the ICF is computed. This has been revised due to the May rising water supply forecasts and heavier than expected runoff from the Snake River, the new control flow is 420 kcfs. More details on the values used can be found at: http://www.nwd-wc.usace.army.mil/report/storcorr/

D. System Flood Risk Management Refill Requirement Discussion.
The ICF date was declared as May 4, for an ICF of 368 kcfs. Controlled Flow (CF) of 411 kcfs was calculated based on the official May 2017 seasonal runoff volume forecasts. However, based upon the shape of the most recent ESP traces, there is a need to increase the CF to 420 kcfs. If needed, the CF will be further updated as the system is managed for flood risk. Table 1 below shows values based on the official seasonal runoff volume forecasts that were issued on May 3.

E. Individual Project Flood Risk Management Requirements Discussion.

This guidance is to be used for planning purposes and will be revised as updated stream flow forecasts become available.

1. MCDB – DOP minimum outflow is 8.7 kcfs during refill. A constant outflow of 21 kcfs will get Mica to the treaty target Aug 15th content of 3364.2 ksfd.

2. ARDB – Continue with regulated outflows to meet downstream flow objectives at TDA (between 390 and 450 kcfs at TDA).

3. DCDB – Release project outflows near minimum of 100 cfs and refill by end of July.

4. LIB – Per the Seattle District USACE the current minimum VARQ outflow is 15.9 kcfs. For the remainder of the month, Libby Dam will maintain the VARQ outflow and initiate a sturgeon pulse, resulting in an average outflow for the remainder of the month of approximately 20 kcfs. The following is a summary of the Libby Dam Water Control Manual (updates December 2007) procedure for VARQ:

> The VARQ flow is computed using the steps two through six of the eight step VARQ process and adjusted to aid in refill and avoid spill. In accordance with VARQ step seven, use stream flow forecasts to evaluate the performance of the VARQ outflows in meeting system and local flood risk management objectives. Reduce outflows if necessary to provide protection from local flooding. Return to VARQ outflows once local flooding is over. Per VARQ step eight, during the final stages of refill, increase outflows during the final stages of refill to avoid overfilling and unwanted spill. Likewise, decrease outflows if the present outflow would otherwise not fill the reservoir. Use streamflow forecasts and engineering judgment to select the appropriate outflows.

5. HGH – Per the Bureau of Reclamation, the VARQ outflow is 8.7 kcfs, though project outflows expected to be higher than VARQ. The VARQ flow was computed using the steps two through six of the eight step VARQ process per the Water Control Manual. The guidance during refill is in accordance with steps seven and eight, and is the same procedure as for Libby as stated above in paragraph 4.

6. SKQ – Current elevation and discharge are 2888.3 ft and 25.4 kcfs respectively. Due to high inflows and channel restriction, discharge at channel capacity to meet flood control targets. Operating at channel restrictions is expected to result in an end of May elevation of approximately 2891 feet.

7. ALF – Per the Seattle District USACE, release project outflows to free flow channel capacity as necessary, and refill in a manner that prohibits or minimizes pool level above 2062.5 ft. Target the full pool elevation of 2062.5 at the end of June.

8. GCL – Grand Coulee is being operated as per the deviation described above.

9. BRN – Regulated outflows are expected to average 50 kcfs – 55 kcfs over the monthof May. Current end of month FRM elevation is 2050 feet.

10. DWR – Refill on minimum flows of 2.0 kcfs where possible while meeting local flood risk management objectives and preventing spill. Refill by June 30th.

11. JDA – The storage space between 264 and 268 feet is to be used if warranted to reduce peak downstream flow. The reservoir is to be below 264 feet as needed based on forecasted stages at Vancouver.

12. TDA - Primary flow objective at this location is to keep daily average flows between 390 and 450 kcfs.

Table 1. Flood Risk Management Requirements

Project	31Jan	28Feb	31Mar	15 Apr	Date Refill Starts	30 Apr	31 May[3]	30 Jun[3]	31 Jul[3]
MCDB (kaf) [2]	1662	2810	4080	4080	29 Apr	4080	2448	286	0
ARDB (ft)	1430.5	1422.9	1414.1	1414.1	02 May	1414.1	1427.0	1442.0	1444.0
DCDB (ft)	1839.3	1815.3	1812.8	1807.7	24 Apr	1807.7	1828.8	1872.5	1892.0
LIB (ft) [4]	2396.2	2433.7	2382.1	2325.4	24 Apr	2325.4[4]	Est	Est	2459.0
LIB (kcfs)	n/a	n/a	n/a	n/a	24 Apr	n/a	15.9	n/a	n/a
HGH (ft)	3543.8	3549.0	3539.8	3533.6	01 May	3531.3	3547.0	3560.0	3560.0
SKQ (ft)[5]	n/a	n/a	n/a	2883.0	-	n/a	2890.0	2893.0	2893.0
ALF (ft) [1]	2060.0	2060.0	2056.0	n/a	-	2056.0	2062.5	2062.5	2062.5
GCL (ft)	1290.0	1290.0	1267.1	1234.0	03 May	1232[6]	1262.0	1289.5	1290.0
BRN (ft)	2077.0	2048.3	2036.0	2024.0	03 May	2012.6	2050.0	2077.0	2077.0
DWR (ft)	1528.3	1531.1	1493.1	1471.1	03 May	1530	1580.0[7]	1600.0	1600.0

Notes:
1. Albeni Falls flood risk management elevations are based on readings at the Hope gage.
2. KAF units refer to required flood risk management space (draft) in the reservoir.
3. Flood risk management requirements for May, June and July are based on historical estimated normal runoff shape. Under certain circumstances, the Refill Guide Curve (also known as Flood Control Refill Curve) procedure may be used to determine when refill is to begin at each project where applicable.
4. Per the Libby Dam WCM, Rule 1 of the VarQ operating procedures, releases will be limited to the hydraulic capacity of the powerhouse to the best extent possible.
5. Sèliš Ksanka Qĺispė Dam, formerly known as Kerr Dam.
6. Grand Coulee is operating per a deviation request (see discussion above). Minimum pool is 1232 feet.
7. Dworshak elevation based on Refill Guide Curve calculation.

Table 2. Water Supply Forecasts (Kaf)

Project	Forecast Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Current month Forecast % of Normal	Residual Runoff [3] (%)
MCDB	Apr-Aug	11569	10737	10798	11503	11392			104	94%
ARDB	Apr-Aug	23045	21065	21248	22530	23320			106	90%
DCDB	Apr-Aug	2010	1954	1942	2036	2103			105	91%
LIB	Apr-Aug	6861	5583	6783	7654	8190			139	88%
HGH	May-Sep	1828	1489	1691	1769	2018			119	94%
SKQ[1,2]	Apr-Jul	5649	5790	6327	7364	7527			130	78%
ALF[1]	Apr-Jul	11413	11505	12255	14894	15206			129	74%
GCL[1]	Apr-Aug	54930	53656	57336	64955	68159			120	81%
BRN[1]	Apr-Jul	4801	5327	7560	10845	11277			206	61%
DWR	Apr-Jul	3055	2541	2867	2984	2941			122	63%
TDA[1]	Apr-Aug	84945	82821	92337	105039	111123			127	76%

Notes:
1. Official water supply forecasts for SKQ (KERM), ALF, GCL, BRN and TDA are the ESP 5-day-QPF median values published by the NWRFC on the following days for 2017: Jan 5, Feb 3, Mar 3, Apr 5, May 3, Jun 5.
2. Sèliš Ksanka Qĺispė Dam, formerly known as Kerr Dam.
3. Residual runoff values are applicable beginning in April. Residual runoff (%) is the percentage of the current

month's seasonal volume forecast that has yet to runoff during the forecast period. For example, 88% of the forecasted April through August runoff volume for Libby has yet to runoff.

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