FISH OPERATIONS PLAN IMPLEMENTATION REPORT

August 2019

U.S. Army Corps of Engineers
Northwestern Division
Portland, OR.

Introduction

The U.S. Army Corps of Engineers (Corps) developed this report in accordance with the 2019 Fish Operations Plan[1] (2019 FOP). The 2019 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2019 spring and summer fish migration seasons, generally April 3 through August 31. The 2019 FOP is consistent with spill operations for juvenile fish passage and the regional forum process for adaptive management and in-season management provisions outlined in the 2019 NOAA Fisheries Columbia River System Biological Opinion (2019 BiOp)[2], the 2018 Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions), the 2019-2021 Spill Operation Agreement (Agreement), the Corps' requirements under the Endangered Species Act (ESA), and is the subject of ongoing consultation and communications with the relevant wildlife agencies to ensure consistency with the ESA. Other project operations and water management actions not specifically addressed in this document will be consistent with the 2019 BiOp and other guiding operative documents, including the 2019 Water Management Plan (WMP), seasonal WMP updates, and the 2019 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2019 FOP during the month of August 2019. In particular, information in this report includes the following:

- total flow: the total hourly river outflow rate;
- generation flow: the hourly flow through the powerhouse units;
- target spill: the spill target for that hour (Table 1);
- adjusted spill: the hourly spill level that can be achieved taking into consideration that spill may vary as a function of total river flow, forebay elevation and generator capacity, and is subject to routine operational adjustments that limit the ability to spill to the target spill (see 2019 FOP, section 4.1);
- actual spill: the hourly flow over the spillway; and,

[1] The 2019 FOP was posted to the Technical Management Team (TMT) website on April 1, 2019 (http://pweb.crohms.org/tmt/documents/fpp/2019/).
[2] The Corps, in coordination with the other Action Agencies, and National Marine Fisheries Service (NMFS), employs the Regional Implementation Oversight Group (RIOG) and technical teams including the Technical Management Team (TMT) and Fish Passage Operations & Maintenance (FPOM), to coordinate with state, tribal and other federal experts for recommendations for implementing operations consistent with NMFS' Columbia River System Biological Opinions.

- resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream[3].

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2019 FOP in August 2019.

Data Reporting

I. For each project providing fish passage operations, this report contains a graph displaying the performance of the summer fish passage spill program for the month of August, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on August 1 and end on August 31 and reflect the following operations for the lower Snake River and the lower Columbia River projects:

- The black line represents the average hourly total river flow through the project in thousand cubic feet per second (kcfs).
- The orange line represents the average hourly generation flow through the powerhouse each hour in kcfs.
- The thin solid blue line represents the actual average hourly spill level through the spillway in kcfs.
- The dotted blue line represents the hourly target summer spill in kcfs.
- The thick dark blue line represents the adjusted spill cap spill: the hourly spill cap level that can be achieved taking into consideration that spill may vary as a function of total river flow, forebay elevation, and generator capacity, and is subject to routine operational adjustments that limit the ability to spill to the target spill (2019 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the August 2019 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 120% (tailwater) for each project and 115% (forebay of the next downstream dam).

General Implementation Remarks

For all projects that spill for fish passage, the actual spill may vary from the adjusted spill due to various conditions as described below. When actual spill varied from adjusted spill levels during periods of voluntary spill, the change in spill level is described below in the August 2019 Spill Variance Table (Table 2).[4] The Spill Variance Table includes average hourly data; but

[3] Averages reported are consistent with the current and applicable Oregon TDG standard modification (120% tailwater) and Washington TDG criteria adjustments (120% tailwater/115% forebay during summer spill). The Oregon TDG standard modification and the Washington TDG criteria adjustments during summer spill have different methodologies for calculating TDG. When the standards vary or conflict, the Corps applies the more stringent standard. See 2019 FOP section 2.1.

[4] Involuntary spill conditions shown in the graphs are not considered variances and are not reported in the Spill Variance Table. Involuntary spill conditions may result from lack of load, high river inflows that exceed available powerhouse capacity, scheduled or unscheduled turbine unit outages or transmission outages of various durations, passing debris, etc.

when spill varies from adjusted spill for a portion of an hour, it is characterized as a variance for a full hour. There are instances when the hourly adjusted spill levels are not achievable due to mechanical limitations in setting spill gates to implement the regionally coordinated spill pattern. The project operator sets the spill gate stops to most closely approximate the adjusted spill to the extent practicable. Other routine activities that changed spill levels, which were coordinated with regional partners, are identified in the monthly Pre-Coordinated Operations Table (Table 3).

"Low flow" operations at the lower Columbia and lower Snake projects are triggered when inflow is insufficient to provide both minimum generation and the target spill levels. For this report, the decrease in target spill is represented as adjusted spill. In these situations, the projects operate at minimum generation and pass the remainder of project inflow as spill and through other routes, such as fish ladders, sluiceways, and navigation locks. As flows transition from higher flows to low flows, there may be situations when flows recede at a higher rate than forecasted. In addition, inflows provided by nonfederal projects upstream are variable and uncertain.

The combination of these factors may result in instances when unanticipated changes to inflow result in forebay elevations dropping to the low end of the Minimum Operating Pool (MOP). Since these projects have limited operating flexibility, maintaining minimum generation, MOP elevation, and the target spill may not be possible throughout every hour.

Actual spill levels at Corps projects may vary up to ±2 kcfs within the hour (except as otherwise noted in the 2019 FOP for Bonneville and The Dalles dams,[5] which may range up to ±3 kcfs) as compared to a target spill rate. When target spill is a percentage of total outflow, the hourly spill level is calculated to be within +/-1% of the target percentage (or ±4% at Little Goose during low flows as described in Section 8 of the 2019 FOP). A number of factors influence actual spill, including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (e.g. a higher forebay results in a greater level of spill since more water can pass under the spill gate). Transition periods between gas cap spill and performance standard spill hours may result in actual hourly spill levels that are slightly higher or lower than target spill levels.

Occurrences requiring an adjustment in operations and/or regional coordination are described in greater detail in the "Operational Adjustments" section below.

August Operations

The month of August was characterized by below average flows for the lower Snake and lower Columbia Rivers with above average air temperatures and below average precipitation in the Columbia Basin. Observed precipitation in August was 53% of average on the Snake River above Ice Harbor and 64% of average on the Columbia River above The Dalles[6]. The NOAA Northwest River Forecast Center runoff summary for August indicated that the adjusted runoff for the Snake River at Lower Granite was 95% of the 30-year average (1981-2010) with a

[5] As specified in the 2019 FOP section 3.
[6] Retrieved 3 September 2019: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5

volume of 1.2 MAF (Million acre-feet). The adjusted runoff for the Columbia River at The Dalles was 86% of the 30-year average (1981-2010) with a volume of 6.6 MAF[7].

Summer spill operations occur June 21–August 31 at the four lower Snake River projects, and June 16–August 31 at the four lower Columbia River projects (Table 1).

Table 1: Summary of 2019 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	2019 SUMMER SPILL[1] (24 hrs/day)
Lower Granite	18 kcfs
Little Goose	30%[2]
Lower Monumental	17 kcfs
Ice Harbor	30%
McNary	57%
John Day	35%
The Dalles	40%
Bonneville	95 kcfs

1. Spill may be temporarily reduced below the 2019 FOP summer target spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.
2. When river flow is ≤ 32 kcfs at Little Goose, the project cannot maintain 30% spill. Therefore, the project will transition to constant spill of 7-11 kcfs, as described in Section 4.3.3 of the FOP.

In its implementation of the 2019 FOP in August, the Corps evaluated conditions every day to establish spill caps at a level that was estimated to meet, but not exceed, the gas cap in the tailrace (see Table 4).[8] This evaluation considered: environmental conditions (e.g., river flow, wind, water temperature, barometric pressure, incoming TDG from upstream, and water travel time) and project operations (e.g., spill level, spill pattern, tailwater elevation, proportion of flow through the turbines, and project configuration).

Operational Adjustments

1. Little Goose

From August 5 at 0500 hours through August 8 at 1700 hours, the Corps conducted testing and maintenance on Little Goose Transformer 1 (T1), which required T1 (Units 1–4) and T2 (Units 5, 6) to be out of service daily from 0500–1700. During these hours, Unit 6 was operated at speed no load (5 kcfs) for station service power and the remainder of project outflow was passed via the spillway. T2 was returned to service nightly from 1700–0500 but only Unit 6 was operated due to an ongoing Unit 5 outage.

This operation was a deviation from the operation coordinated in the 2019 FPP Appendix A that

[7] Retrieved 3 September 2019: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php?date=09/01/2019
[8] See 2019 FOP section 2.2

called for Doble testing of T2, which would have had T1 (Units 1–4) returned to service nightly. Due to configuration issues associated with the ongoing Unit 5 outage, the project was unable to conduct T2 Doble testing and instead conducted maintenance on T1. This resulted in reduced powerhouse capacity at night due to only having Unit 6 available to operate instead of Units 1–4.

The Corps notified regional salmon managers of this modified outage schedule at the July 31 TMT meeting. Due to concerns with the impacts of reduced powerhouse capacity and high spill on adult sockeye passage, the salmon managers requested a special operation to maintain spill at 30% nightly between the hours of 1800 and 0100 to the extent possible given the maintenance and testing schedule, while operating the forebay within the 1-foot raised MOP range of 634.0–635.5 feet (raised one foot for navigation safety). While adult sockeye predominantly pass Little Goose Dam during the daytime hours, they are able to pass during evening hours. Therefore, in order to provide tailrace conditions to facilitate adult sockeye passage at Little Goose Dam, the Corps and BPA implemented the operation as requested and spilled 30% from 1800-0100 hours and maintained the forebay within MOP. During the remaining hours when maintenance and testing was underway, spill ranged from 43.5% to 85.6% (average 76.2%).

Table 2: Spill Variances - August 2019 (8/1 to 8/31)

Project	Parameter	Date	Time[9]	# of Hours	Type	Reason
Lower Granite	Additional Spill	8/13/19	2000-2200	3	Human Error	Hourly spill increased to between 21 and 22 kcfs (greater than the spill target of 18 ±2 kcfs range) due to a delay in changing to the appropriate target.
Lower Granite	Additional Spill	8/26/19	0700-1700	11	Maintenance	Hourly spill increased while generation was reduced to speed no load (5 kcfs) for station service in order to perform unscheduled repairs on transformer bank T1.
Lower Monumental	Reduced Spill	8/27/19 8/28/19	1900 1100	1 1	Operational Limitation	Hourly spill remained at 12 kcfs (less than the spill target of 17 kcfs ±2 kcfs), while generation drifted above minimum generation range for Unit 1 (11.1 - 12.3kcfs[10]) to 12.7 kcfs.
Ice Harbor	Additional spill	8/1/19 8/2/19 8/3/19 8/6/19- 8/7/19 8/8/19 8/8/19– 8/9/19 8/9/19- 8/10/19 8/10/19 8/10/19- 8/11/19 8/11/19	0700-1800 1100-1800 0100-0200 2300-0800 0200-0700 2200-0600 2000-0300 1300-1800 2300-0800 1700-2400	12 8 2 10 6 9 8 6 10 8	Operational Limitation	Hourly spill increased to between 32% and 40% of total flow (greater than the spill target of 30% ±1% range) due to the removable spillway weir (RSW) in bay 1 that physically limits the minimum spill rate to 8 kcfs. Daily average spill ranged from 32% to 36%.
Ice Harbor	Reduced Spill	8/9/19	1700	1	Maintenance	Hourly spill decreased to 28% (less than the target spill of 30% ±1% range). Unit 1 was taken out of service for unscheduled installation of a new transformer. Daily average spill was 34% due to multiple operations or spill variances.
Ice Harbor	Additional Spill	8/14/19 8/23/19 8/25/19	0700 1400 1900	1 1 1	Human Error	Hourly spill increased between 32 and 33% of the total flow (greater than the spill target of 30% ± 1% range) due to a miscalculation of spill. Daily average spill was 30%.

[9] Data collected for reporting spill variances are reported as hourly averages. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented as an hour. The hourly average data is reported at the end of the hour (i.e., hour ending).

[10] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Lower Monumental turbine Unit 1, the range is 10.9-12.5 kcfs. See 2019 FOP section 4.3.1.

Project	Parameter	Date	Time[9]	# of Hours	Type	Reason
McNary	Additional Spill	8/5/19	1800-2100	4	Maintenance	Hourly spill increased to between 65% and 97% (greater than 57% ±1% range) due to an unscheduled transmission substation outage. Daily average spill was 61%.
The Dalles	Reduced Spill	8/6/19	1300	1	Human Error	Hourly spill decreased to 38% (less than the target spill of 40% ±1% range) due to a miscommunication of the planned spill operation. Daily average spill was 40%.
The Dalles	Additional Spill	8/14/19	2300	1	Human Error	Hourly spill increased to 44% (greater than the target spill of 40% ±1% range) due to a delay in changing to the appropriate target. Daily average spill was 40%.

Table 3: Pre-Coordinated Operations - August 2019 (8/1 to 8/31)

Project	Parameter	Date	Time[11]	# of Hours	Type	Reason
Lower Granite	Additional Spill	8/12/19 8/13/19 8/14/19 8/15/19 8/16/19	0700-1900 0700-1900 0700-1900 0700-1900 0700-1900	13 13 13 13 13	Maintenance	Hourly spill increased while generation was reduced to speed no load (5 kcfs) for station service due to units taken offline to perform Doble testing. Regionally coordinated via the 2019 FPP LWG Section 4.3.5 and Appendix A.
Lower Granite	Reduced Spill	8/27/19	0800	1	Maintenance	Spill remained at 14 kcfs (less than the spill target of 18 kcfs ±2 kcfs) while generation increased in order to perform pre-shutdown testing for annual maintenance of Unit 6. Regionally coordinated via the 2019 FOP Section 4.5.
Little Goose	Reduced Spill	8/1/19 8/8/19	1900 2300	1 1	Navigation	Hourly spill decreased to 28% of total flow (less than the spill target of 30% ±1% range) due to volume of water needed to empty the navigation lock. Daily average spill was between 28% and 33% due to multiple operations or spill variances Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Little Goose	Reduced Spill	8/1/19	1100-1700	7	Maintenance	Hourly spill decreased to between 17% and 28% of total flow (less than 30% ±1% range) due to ramping rate testing of Unit 6. Daily average spill was 28%. Regionally coordinated via the 2019 FPP LGS Section 4.3.2.
Little Goose	Additional Spill	8/5/19 8/6/19 8/7/19 8/8/19	0600-1800 0600-1800 0600-1800 0600-1800	13 13 13 13	Maintenance	Hourly spill increased to between 42% and 85% of total flow (greater than 30% ±1 % range) due to units taken offline to perform Doble testing. Daily average spill ranged between 56% and 64%. Regionally coordinated via the 2019 FPP LGS Section 4.3.5 and Appendix A.
Little Goose	Additional Spill	8/6/19 8/7/19 8/8/19	0200-0600 0200-0600 0200-0600	4 4 4	Adaptive Management	Hourly spill increased to between 47% and 86% of total flow (greater than 30% ±1 % range). Daily average spill ranged between 60% and 64%. Regionally coordinated at the 7/31/19 TMT meeting. See the Operational Adjustments section for more details.

[11] Data collected for reporting pre-coordinated operations are reported as hourly averages. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented as an hour. The hourly average data are reported at the end of the hour (i.e., hour ending).

Project	Parameter	Date	Time[11]	# of Hours	Type	Reason
Little Goose	Reduced Spill	8/6/19	1900-2400	6	Adaptive Management	Hourly spill decreased to 7 kcfs (less than the spill target, 11 kcfs based on the previous day's average outflow). Regionally coordinated at the 7/31/19 TMT meeting. See the Operational Adjustments section for more details.
Lower Monumental	Additional Spill	8/1/19 8/2/19	0600-1700 0600-1800	12 13	Maintenance	Hourly spill increased while generation was reduced to speed no load (5 kcfs) for station service due to units taken offline to perform Doble testing. Regionally coordinated via the 2019 FPP LMN Section 4.3.5 and Appendix A.
Lower Monumental	Reduced Spill	8/28/19	1500-1600	2	Maintenance	Hourly spill remained at 12 kcfs (less than the spill target of 17 kcfs ±2 kcfs range) due to post-maintenance testing of Unit 4 after annual maintenance. Regionally coordinated via the 2019 FPP LMN Section 4.3.2.
Ice Harbor	Reduced Spill	8/4/19 8/5/19 8/11/19 8/12/19 8/13/19 8/15/19 8/16/19 8/17/19 8/18/19 8/19/19 8/20/19 8/22/19 8/23/19 8/24/19 8/26/19 8/27/19 8/28/19 8/29/19 8/30/19 8/31/19	0200-0300,0600 0600 1300 1300 1600 0700 0800-1000 0700 & 1100 0200, 0700, 1300, 1700 0300, 0700, 1600 0600 2100 1600 1700 & 2100 1300 0300, 0700, 1300 0200 0600 & 0900 1000 & 1300 0800	3 1 1 1 1 1 3 2 4 3 1 1 1 2 1 3 1 2 2 1	Navigation	Hourly spill decreased to between 27% and 28% of the total flow (less than the spill target of 30% ±1% range) for safe navigation. Daily average spill was between 29% and 36% due to multiple operations or spill variances. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Ice Harbor	Additional Spill	8/28/19	1800	1	Navigation	Hourly spill increased to 32% of the total flow (greater than the spill target of 30% ± 1% range) for safe navigation. Daily average spill was 30%. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Ice Harbor	Reduced Spill	8/13/19	1100	1	Maintenance	Hourly spill decreased to 28% of the total flow (less than the spill target of 30% ±1% range). Project was switching units on and off for annual maintenance repair. Daily average spill was 30%. Regionally coordinated via the 2019 FOP Section 4.5.

Project	Parameter	Date	Time[11]	# of Hours	Type	Reason
Ice Harbor	Reduced Spill	8/14/19	0800	1	Maintenance	Hourly spill decreased to 28% of the total flow (less than the spill target of 30% ±1% range). Unit 6 was taken out of service for a scheduled 6-year overhaul. Daily average spill was 30%. Regionally coordinated via the 2019 FOP Section 4.5.
Ice Harbor	Reduced Spill	8/14/19	1500	1	Maintenance	Hourly spill decreased to 27% of the total flow (less than the spill target of 30% ±1% range) due to post-maintenance testing before Unit 4 was returned to service after an oil leak repair. Daily average spill was 30%. Regionally coordinated via the 2019 FPP IHR Section 4.3.2.
Ice Harbor	Additional Spill	8/14/19	1600	1	Maintenance	Hourly spill increased to 32% of the total flow (greater than the spill target of 30% ±1% range) due to post-maintenance testing of Unit 4 before it returned to service after an oil leak repair. Daily average spill was 30%. Regionally coordinated via the 2019 FPP IHR Section 4.3.2.
Ice Harbor	Reduced Spill	8/15/19	1000	1	Maintenance	Hourly spill decreased to 28% of the total flow (less than the spill target of 30% ±1% range) while performing STS screen inspection. Daily average spill was 29%. Regionally coordinated via 2019 FPP, page IHR-10.
Ice Harbor	Reduced Spill	8/15/19	1200	1	Maintenance	Hourly spill decreased to 28% of the total flow (less than the spill target of 30% ±1% range) while performing testing after gear box repair. Daily average spill was 29%. Regionally coordinated via 2019 FOP, section 4.5

Table 4: August 2019 Average Percent TDG Values Table (8/1 to 8/31)

Date	FIXED MONITORING STATIONS															
	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
	Lower Granite FB	Lower Granite TW	Little Goose FB	Little Goose TW	Lower Monumental FB	Lower Monumental TW	Ice Harbor FB	Ice Harbor TW	McNary FB	McNary TW	John Day FB	John Day TW	The Dalles FB	The Dalles TW	Bonneville FB	Bonneville TW
Gas Cap %:	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**
8/1/2019	102	116	111	112	108	118	114	113	108	117	106	115	108	115	107	117
8/2/2019	101	116	111	111	108	118	114	113	108	117	106	114	108	115	108	117
8/3/2019	101	117	111	111	108	117	112	113	108	117	105	115	108	115	110	117
8/4/2019	102	116	111	111	108	117	113	112	109	117	107	115	110	116	112	117
8/5/2019	102	117	112	115	108	117	113	113	109	117	108	115	110	116	112	117
8/6/2019	102	117	113	116	108	116	114	113	110	117	109	115	111	116	112	117
8/7/2019	102	112	113	117	109	117	115	113	110	117	109	116	110	116	109	117
8/8/2019	103	112	113	116	109	117	115	113	110	117	109	116	109	115	106	117
8/9/2019	103	116	113	113	111	117	114	113	110	116	108	116	107	114	104	117
8/10/2019	103	116	113	111	112	116	114	112	109	116	108	116	108	114	104	114
8/11/2019	102	115	113	110	112	114	113	111	107	114	108	115	108	•[12]	104	114
8/12/2019	102	114	111	110	111	113	112	111	105	113	105	115	106	113	105	114
8/13/2019	102	115	109	110	110	113	111	107	106	115	106	115	110	115	106	117
8/14/2019	101	114	109	109	108	114	110	107	106	116	106	114	110	115	109	117
8/15/2019	101	114	109	109	107	113	110	107	107	116	105	114	109	115	108	117
8/16/2019	101	114	108	109	107	113	109	107	108	115	105	114	107	113	106	114
8/17/2019	100	112	108	109	107	113	110	107	108	115	104	114	105	112	105	114
8/18/2019	101	109	108	110	107	111	111	107	108	114	104	114	106	113	103	114
8/19/2019	101	108	108	109	107	112	111	107	108	114	104	114	106	113	103	113
8/20/2019	101	112	108	109	106	114	109	107	106	115	104	•	108	114	105	117
8/21/2019	101	112	108	109	106	114	109	107	107	116	104	115	108	114	105	117
8/22/2019	100	112	107	109	106	113	108	107	106	116	104	115	107	114	105	117
8/23/2019	101	110	108	109	106	113	108	107	106	115	104	115	108	115	107	117
8/24/2019	101	109	108	109	106	111	108	107	106	116	104	115	108	114	107	117
8/25/2019	101	110	106	108	106	110	108	107	105	114	103	113	107	113	106	112
8/26/2019	100	113	105	109	105	112	108	107	106	113	103	113	105	112	105	113
8/27/2019	99	111	105	109	107	113	109	108	107	114	105	114	110	115	105	114
8/28/2019	101	109	106	109	107	113	109	108	108	115	106	114	111	116	108	114
8/29/2019	101	109	107	109	106	111	109	108	106	115	105	114	111	116	109	117
8/30/2019	100	109	106	109	107	111	108	107	104	115	104	115	109	115	110	117
8/31/2019	101	109	105	109	107	110	109	108	104	115	105	114	107	114	108	115

[12] Red shaded cells indicate no data due to malfunctioning gauge.

Figure 1

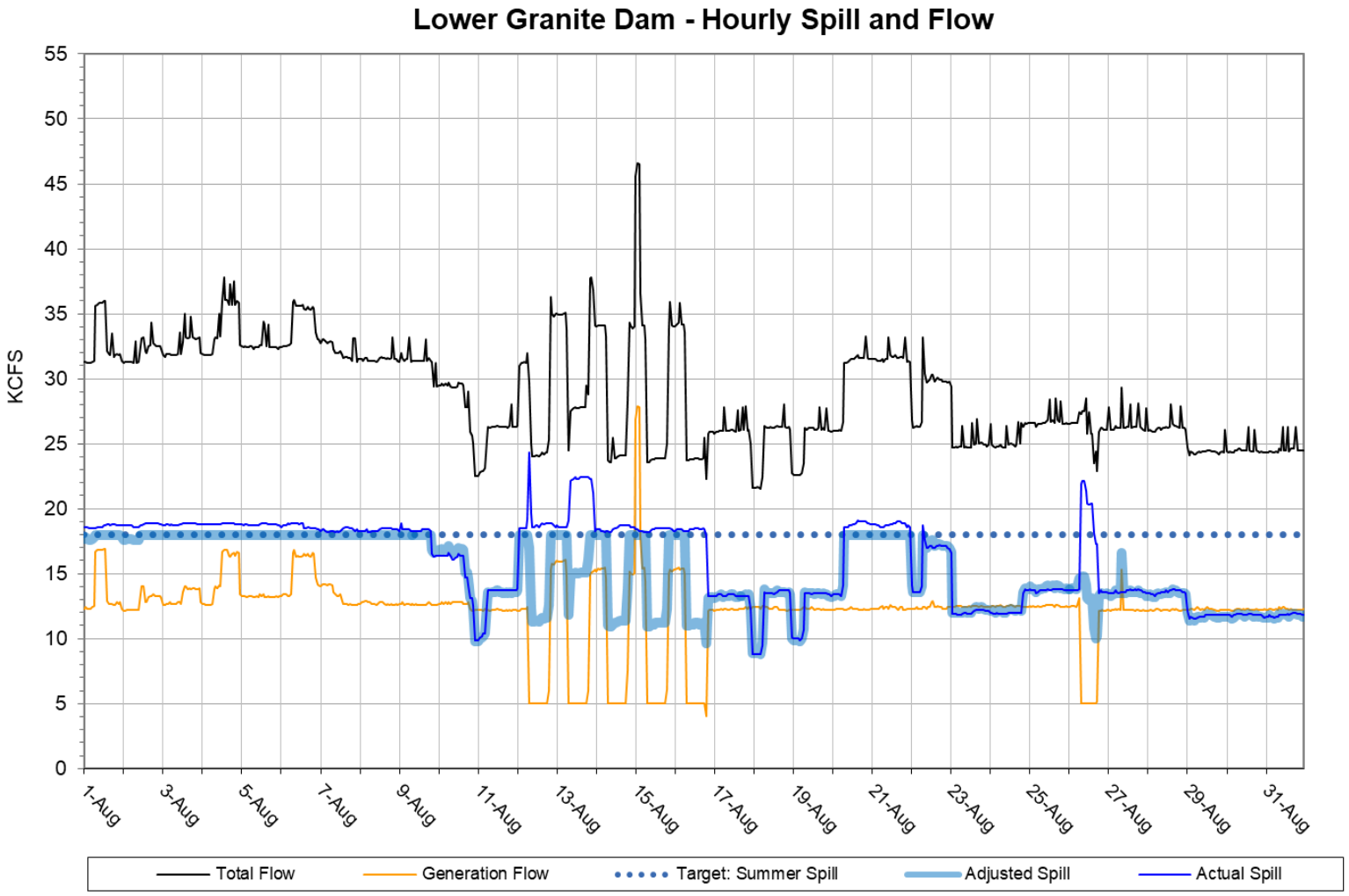
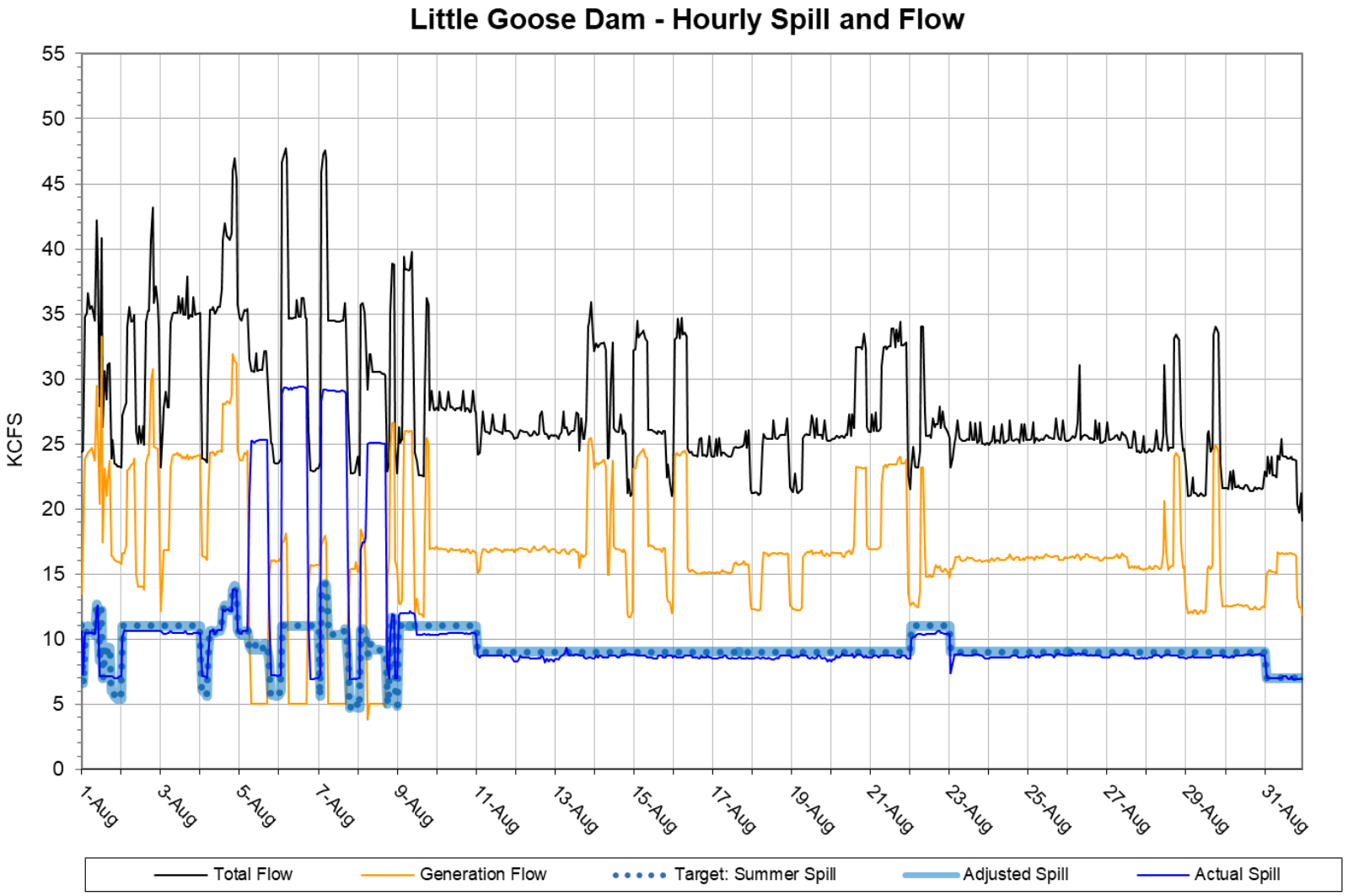

Lower Granite Dam - Hourly Spill and Flow
KCFS
55
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 2


Little Goose Dam - Hourly Spill and Flow
KCFS
55
50
45
40
35
30
25
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10
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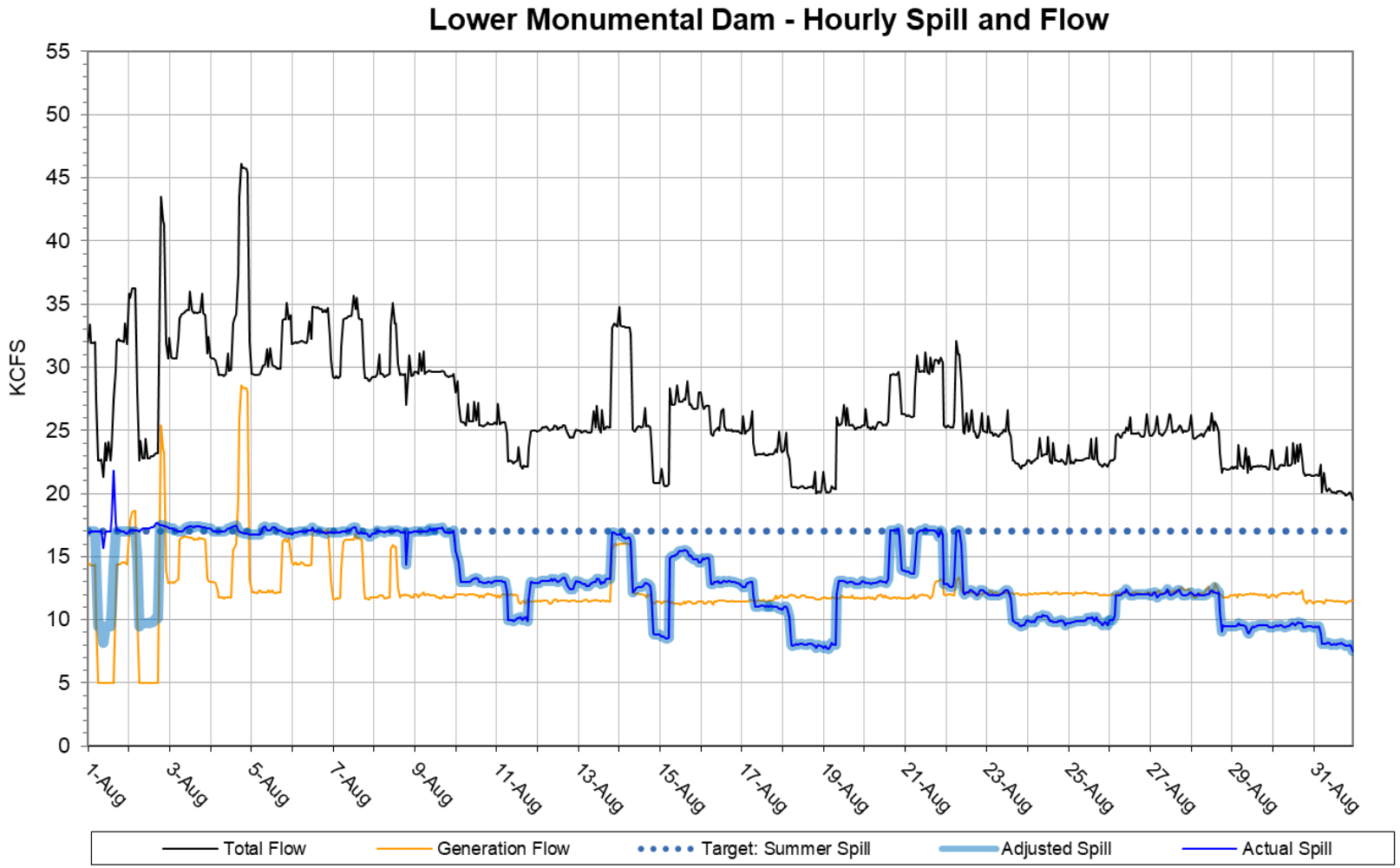
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 3


Lower Monumental Dam - Hourly Spill and Flow
KCFS
55
50
45
40
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30
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10
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1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 4

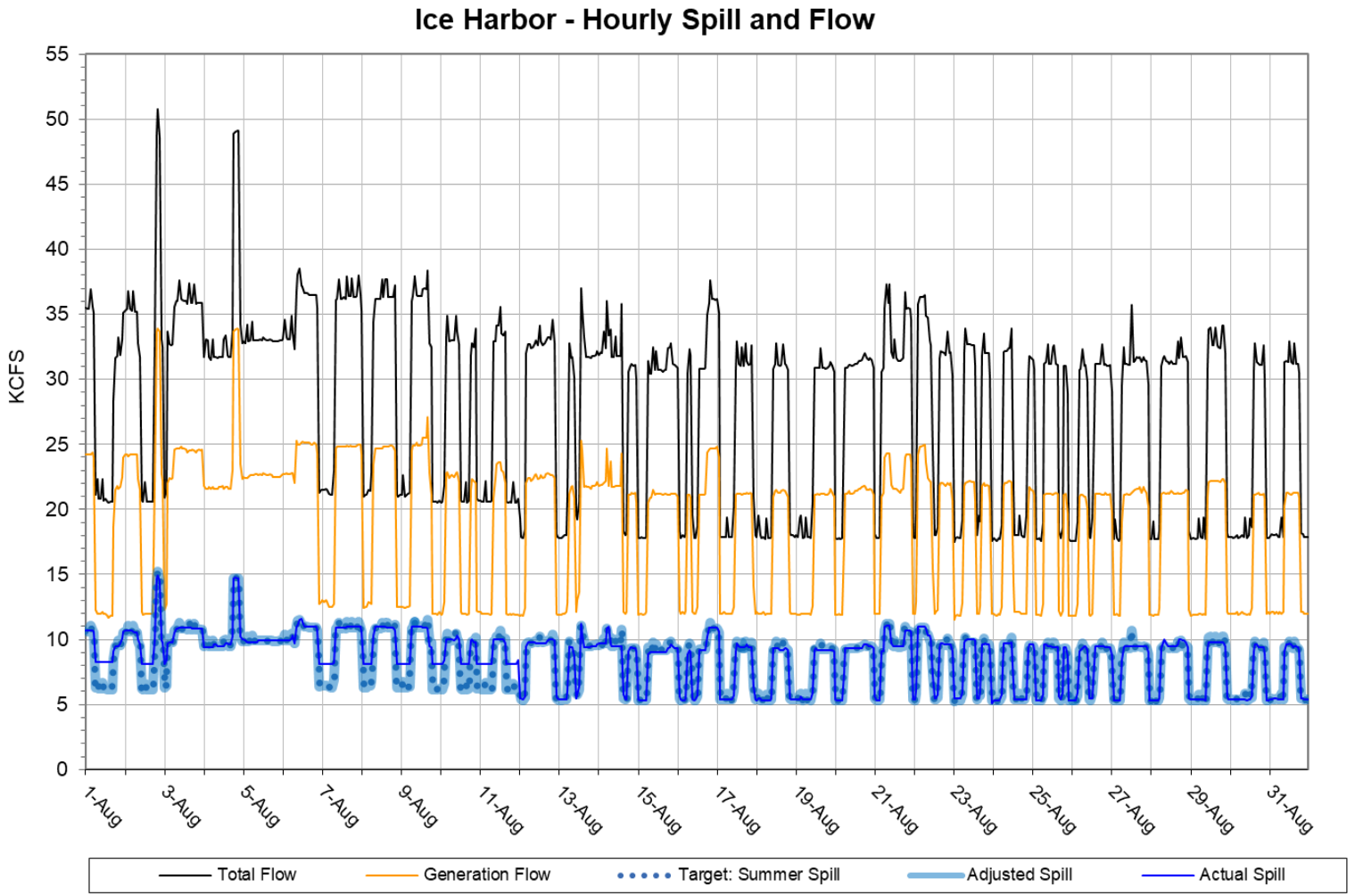

Ice Harbor - Hourly Spill and Flow
KCFS
55
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 5

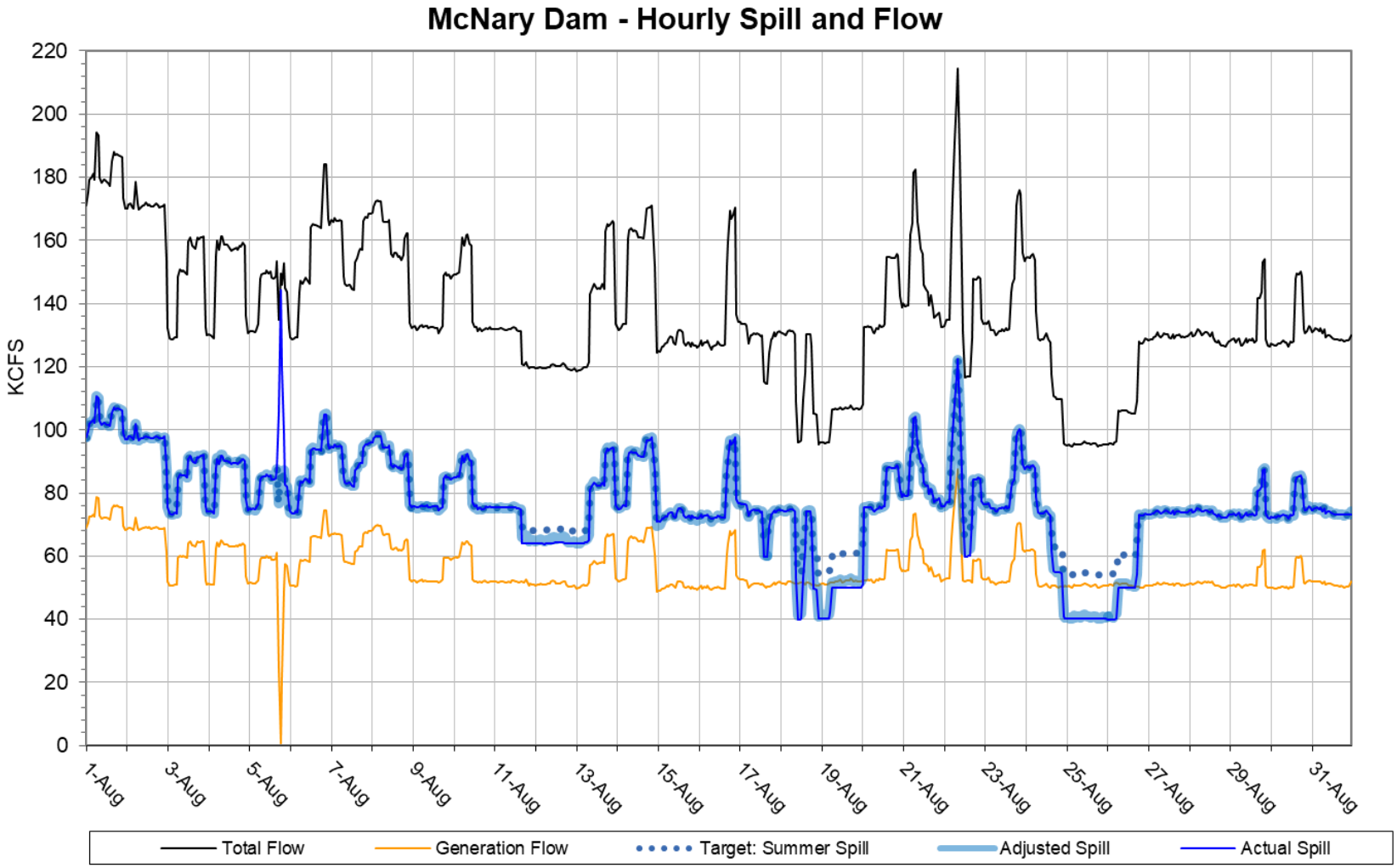

McNary Dam - Hourly Spill and Flow
KCFS
220
200
180
160
140
120
100
80
60
40
20
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 6

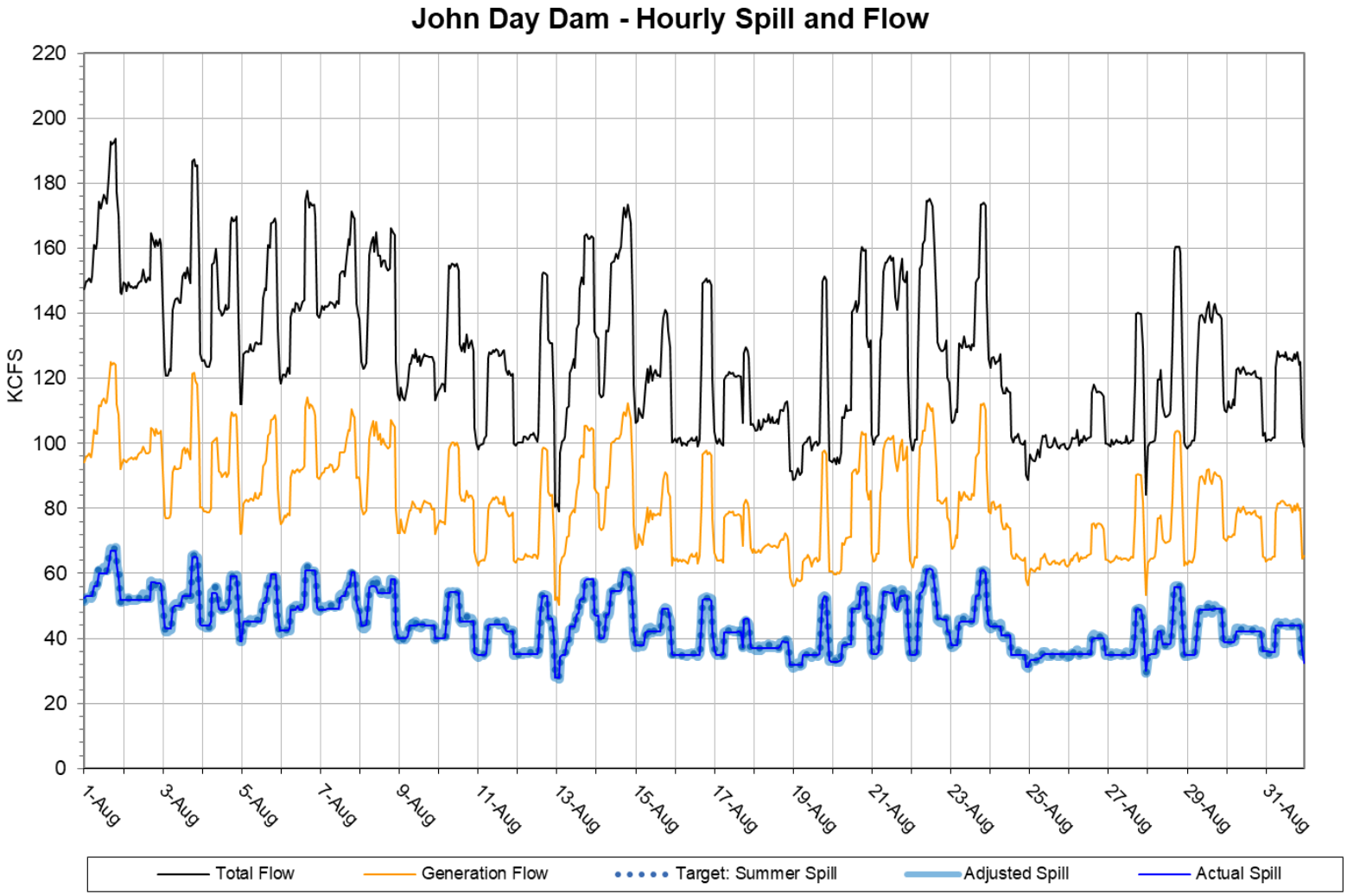

John Day Dam - Hourly Spill and Flow
KCFS
220
200
180
160
140
120
100
80
60
40
20
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 7

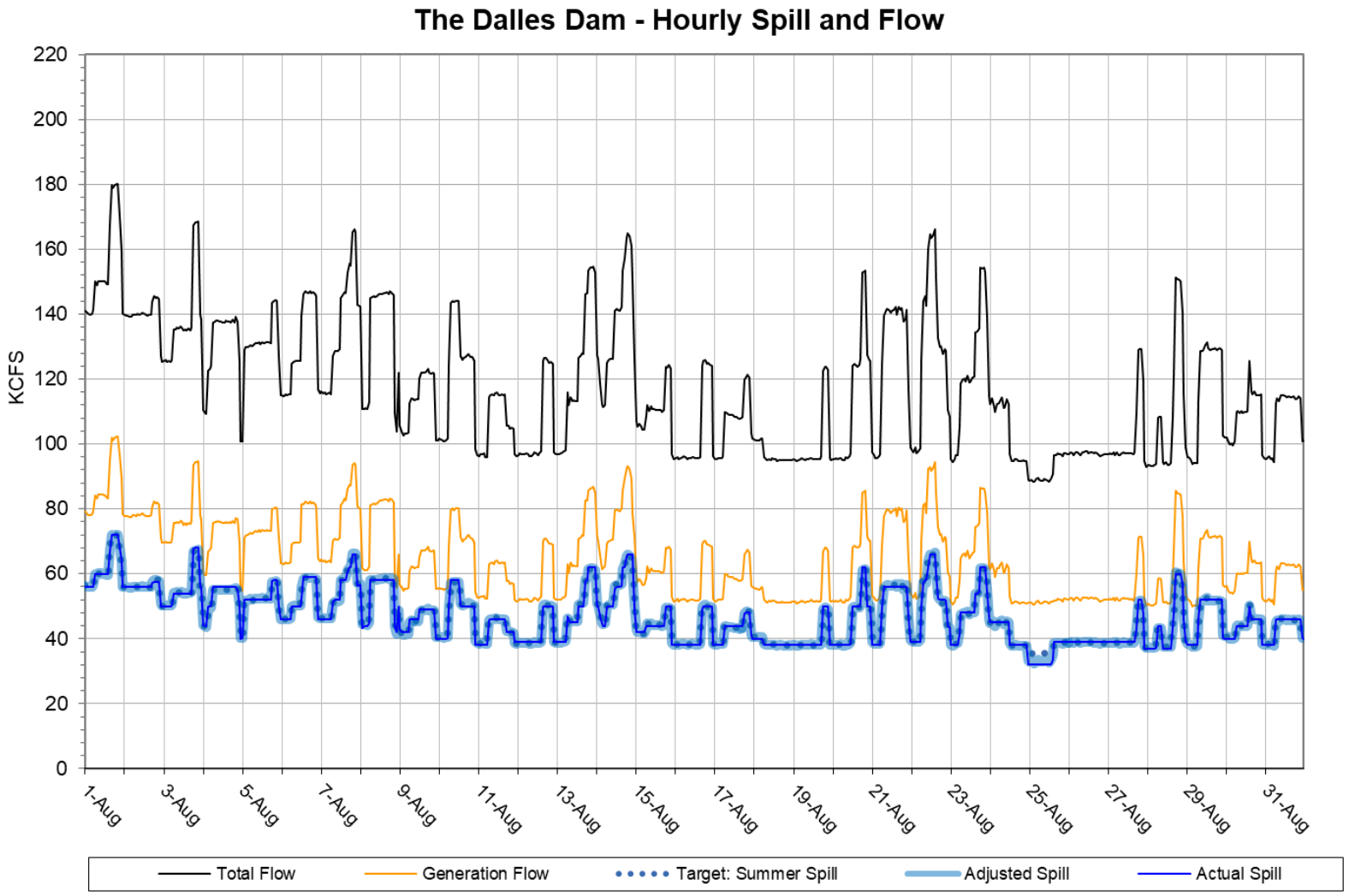
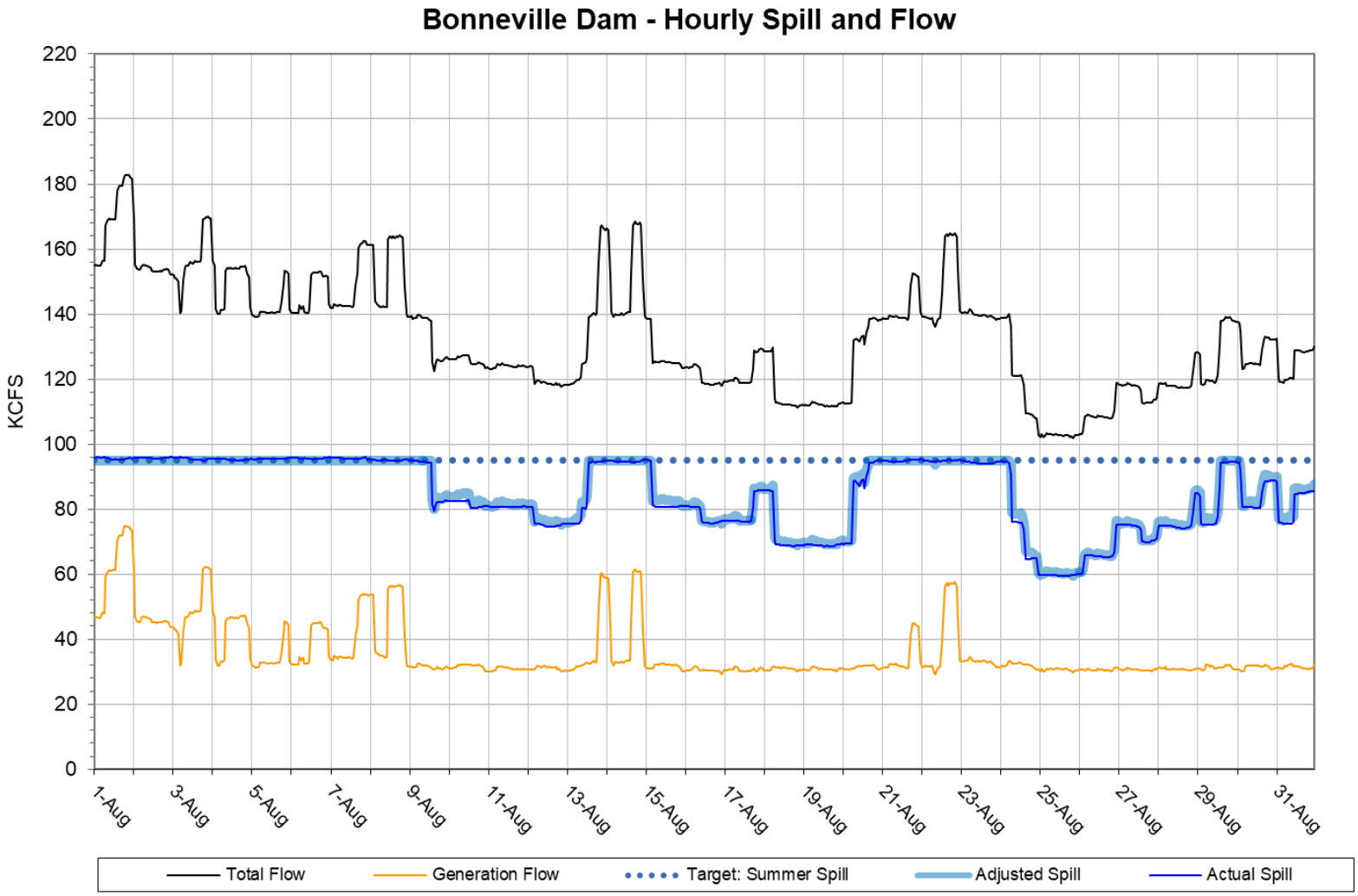

The Dalles Dam - Hourly Spill and Flow
KCFS
220
200
180
160
140
120
100
80
60
40
20
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 8


Bonneville Dam - Hourly Spill and Flow
KCFS
220
200
180
160
140
120
100
80
60
40
20
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill