FISH OPERATIONS PLAN IMPLEMENTATION REPORT

August 2021

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 2021 Fish Operations Plan[1] (2021 FOP). The 2021 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2021 spring and summer fish migration seasons, generally April 3 through August 31. The 2021 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 2020 NOAA Fisheries Columbia River System Biological Opinion (2020 BiOp)[2], the 2008 Columbia Basin Fish Accords[3], the Corps' requirements under the Endangered Species Act (ESA), and is the subject of ongoing 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 2020 BiOp and other guiding operative documents, including the 2021 Water Management Plan (WMP), seasonal WMP updates, and the 2021 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2021 FOP during the month of August. In particular, information in this report includes the following:

- total flow: the total hourly river flow 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 2021 FOP, Section 4.1);
- actual spill: the hourly flow over the spillway; and,

[1] The 2021 FOP was posted to the Technical Management Team (TMT) website on March 31, 2021 (http://pweb.crohms.org/tmt/documents/fpp/2021/).
[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.
[3] The 2020 Amendment to and 2018 Extension of the 2008 Columbia Basin Fish Accords are available at https://www.salmonrecovery.gov/Partners/FishAccords.aspx

- resultant 12-hour average TDG for the tailwater at each project.

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2021 FOP in August 2021.

Data Reporting

I. For each project providing fish passage operations, this report contains a graph displaying the performance of the spring 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 target summer spill in kcfs.
- The thick dark blue line represents the adjusted target 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 (2021 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the August 2021 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 125% (tailwater) for each project.

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 2021 Spill Variance Table (Table 2).[4] The Spill Variance Table includes average hourly data; but 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).

[4] Forced spill conditions shown in the graphs are not considered variances and are not reported in the Spill Variance Table. Forced 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.

"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 2021 FOP for Bonneville and The Dalles dams,[5] which may range up to ±3 kcfs) as compared to a target spill. 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).

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 above average precipitation and below average flows for the lower Snake and lower Columbia Rivers. The August 2021 observed precipitation was 131% of average on the Snake River above Ice Harbor and 114% of average on the Columbia River above The Dalles. The NOAA Northwest River Forecast Center runoff summary for August indicated that the adjusted runoff for the Snake River at Lower Granite was 66% of the 30-year average (1981-2010) with a volume of 0.8 MAF (Million acre-feet)[6]. The August 2021 adjusted runoff for the Columbia River at The Dalles was 74% of the 30-year average (1981-2010) with a volume of 5.7 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).

[5] As specified in the 2021 FOP Section 3.
[6] Retrieved September 2, 2021: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[7] Retrieved August 3, 2021: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

Table 1: Summary of 2021 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	SUMMER SPILL[A] (June 21/16 – August 14) (24 hrs/day)	SUMMER SPILL[A] (August 15 – August 31) (24 hrs/day)
Lower Granite[B]	18 kcfs	Spillway weir (SW) flow or ~7 kcfs spill
Little Goose[B]	30%	SW flow or ~7 kcfs spill
Lower Monumental[B]	17 kcfs	SW flow or ~7 kcfs spill
Ice Harbor[B]	30%	SW flow or ~8.5 kcfs spill
McNary	57%	20 kcfs
John Day	35%	20 kcfs
The Dalles	40%	30%
Bonneville	95 kcfs	50 kcfs

A. Spill may be temporarily reduced below the FOP target summer spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.

B. Summer spill from August 15-August 31 may be through the SW or through conventional spillbays using the appropriate FPP spill pattern for each project. The SWs will be operated consistent with the SW operational criteria in the FPP.

In its implementation of the 2021 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 or target TDG 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).

[8] See 2021 FOP, Section 2.2

Operational Adjustments

There were no operational adjustments during the month of August 2021.

Table 2: Spill Variances – August 2021 (8/1 to 8/31)

Project	Parameter	Date	Time[9]	# of Hours	Type	Reason
Lower Granite	Additional Spill	8/5	1100	1	Maintenance	Hourly spill was 15 kcfs (greater than adjusted spill target of 11 kcfs) while generation was 9 kcfs, less than the minimum range for Unit 1 (11.8-12.9 kcfs[10]) due to an unscheduled transmission line outage.
Little Goose	Additional Spill	8/3	1100-1200	2	Maintenance	Hourly spill was 7 kcfs (greater than adjusted spill target of 0 kcfs) while generation was reduced to 0 kcfs, less than the minimum range for Unit 2 (11.3-11.8 kcfs[11]) to perform transformer maintenance.
Ice Harbor	Additional Spill	8/2	1800	1	Maintenance	Hourly spill increased to 32% (greater than adjusted spill target of 30% ± 1%) due to an unscheduled outage of Unit 2.
Lower Monumental	Reduced Spill	8/24	2300	1	Program Error	Hourly spill decreased to 5.3 kcfs (less than the adjusted spill target of 7.2 kcfs) because the spill control program malfunctioned.
John Day	Additional Spill	8/17 8/18	2400 0100-0200	1 2	Human Error	Hourly spill increased to between 23 to 40 kcfs (greater than adjusted spill target of 20 +/- 2 kcfs) due to a misinterpretation of the planned spill operation.

[9] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.

[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 Granite turbine Unit 1, the range is 11.6 – 13.2 kcfs. See 2021 FOP section 4.3.1.

[11] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Little Goose turbine Unit 2, the range is 11.1 – 12.0 kcfs. See 2021 FOP section 4.3.1.

Table 3: Pre-Coordinated Operations – August 2021 (8/1 to 8/31)

Project	Parameter	Date	Time[12]	# of Hours	Type	Reason
Lower Granite	Additional Spill	8/9 8/10 8/11 8/12 8/17	0700-2000 0700-2000 0700-1900 0700-1900 0900-1500	14 14 13 13 7	Maintenance	Hourly spill increased to between 10 and 19 kcfs (greater than adjusted spill target of 6 to 11 kcfs) while generation was reduced for station service due to units taken offline to perform transformer maintenance. Regionally coordinated 2021 FPP LWG Section 4.3.10 and Appendix A.
Ice Harbor	Reduced Spill	8/4 8/5 8/6 8/7 8/8 8/9 8/10 8/11 8/12 8/13 8/14	0200, 1100-1200, 2100 2000 0400, 0900, 1500, 2100 0400, 0600-0700, 1000, 1500, 2300 0200-0300, 1000, 1300 0200 0500, 0800, 1000-1100, 1300 0500, 0800, 1000, 1500 0700, 1300 1000, 1800 1300	4 1 4 6 4 1 5 4 2 2 1	Navigation	Hourly spill decreased to between 27% and 28% (less than adjusted spill target of 30% ± 1%) for navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
McNary	Additional Spill	8/28	1300-1800	6	Maintenance	Hourly spill increased to between 34 and 35 kcfs (greater than adjusted spill target of 20 kcfs) while Units 9-12 were out of service due to transmission line maintenance. Regionally coordinated via 2021 FOP, Section 4.1.5.
John Day	Reduced Spill	8/2	0600	1	Navigation	Hourly spill decreased to 33% (less than adjusted spill target of 35% ± 1%) for navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
John Day	Additional Spill	8/7	0900	1	Transmission Reliability	Hourly spill increased to 37% (greater than adjusted spill target of 35% ± 1%) to provide reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
The Dalles	Reduced Spill	8/27	2400	1	Transmission Reliability	Spill decreased to 28% (less than the spill target of 30% ± 1%) to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.

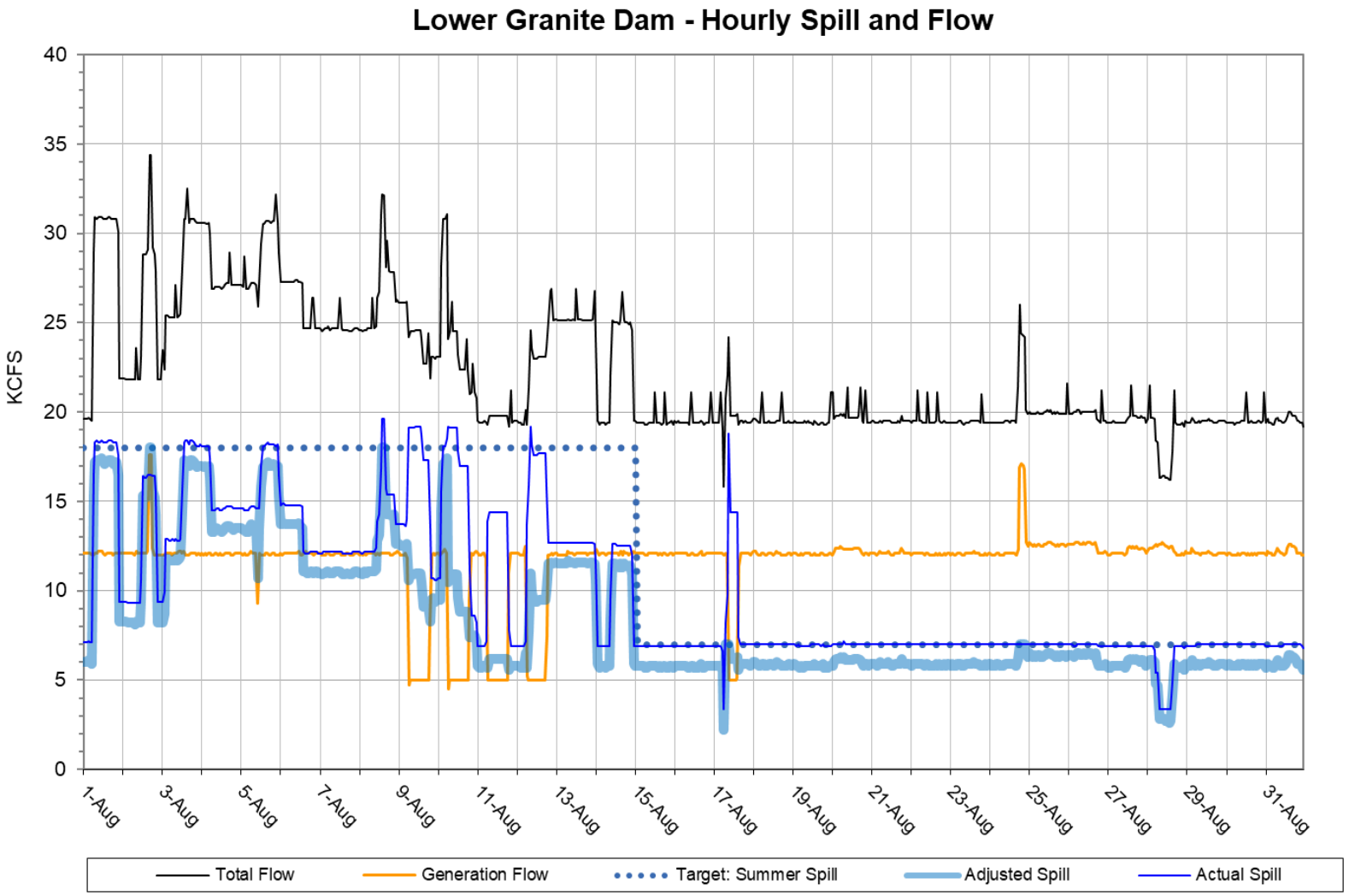
[12] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.

Table 4: August 2021 Average Percent TDG Values (8/1 to 8/31)

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
Gas Cap %:	115	120	115	120	115	120	115	120	115	120	115	120	115	120	115	120
8/1/2021	101	•[13]	108	109	107	112	108	107	107	114	109	115	110	115	109	113
8/2/2021	100	•	108	109	107	110	108	108	108	116	109	116	111	•	108	114
8/3/2021	101	•	108	109	108	112	109	108	107	115	109	116	113	117	109	117
8/4/2021	101	•	108	109	108	113	108	108	107	116	109	116	111	116	109	117
8/5/2021	101	•	108	109	108	112	108	107	108	115	109	116	111	115	108	117
8/6/2021	100	•	106	109	107	110	108	107	108	114	107	115	107	113	105	116
8/7/2021	101	•	105	108	107	110	109	107	107	114	106	114	107	112	105	113
8/8/2021	101	•	104	107	107	110	108	107	106	113	104	114	106	112	104	113
8/9/2021	101	•	103	107	105	113	107	108	103	114	103	115	106	113	105	114
8/10/2021	100	•	104	108	104	112	107	107	104	115	104	115	110	115	106	116
8/11/2021	101	•	102	108	103	110	105	107	105	116	105	115	111	116	110	117
8/12/2021	100	120	102	107	104	112	105	106	107	115	106	115	110	116	112	117
8/13/2021	99	116	102	108	104	113	106	106	108	117	107	115	110	116	113	117
8/14/2021	99	117	104	108	105	114	108	107	108	117	106	115	109	115	112	117
8/15/2021	99	115	104	109	104	109	108	107	108	112	106	113	108	112	109	113
8/16/2021	102	115	110	109	104	108	109	107	109	112	107	114	107	111	107	113
8/17/2021	101	118	109	108	103	108	108	107	108	111	106	113	104	109	104	113
8/18/2021	100	115	108	109	105	109	109	108	105	110	105	113	104	109	102	113
8/19/2021	100	115	108	109	107	109	109	108	105	110	105	113	107	111	103	113
8/20/2021	101	115	107	109	103	108	108	107	104	109	104	112	105	110	103	113
8/21/2021	101	115	107	109	•	108	107	107	104	110	103	112	104	109	103	113
8/22/2021	101	115	107	109	104	109	105	107	105	110	103	111	104	108	103	113
8/23/2021	100	115	105	109	104	109	105	•	103	109	101	111	103	109	102	113
8/24/2021	100	115	106	109	104	109	105	107	103	109	102	111	105	111	104	113
8/25/2021	100	115	106	109	103	109	104	107	103	109	101	110	106	111	106	113
8/26/2021	100	114	105	108	103	108	103	107	103	109	100	109	105	110	105	113
8/27/2021	99	114	105	108	103	109	103	107	103	109	100	111	103	109	105	113
8/28/2021	99	109	105	109	104	109	104	107	103	110	100	111	104	110	105	113
8/29/2021	100	115	106	109	105	109	105	107	103	109	101	111	107	112	107	113
8/30/2021	100	115	107	109	104	108	106	106	104	109	101	111	106	110	106	113
8/31/2021	101	114	106	108	104	108	106	106	103	109	101	111	103	108	104	113
Exceedances:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

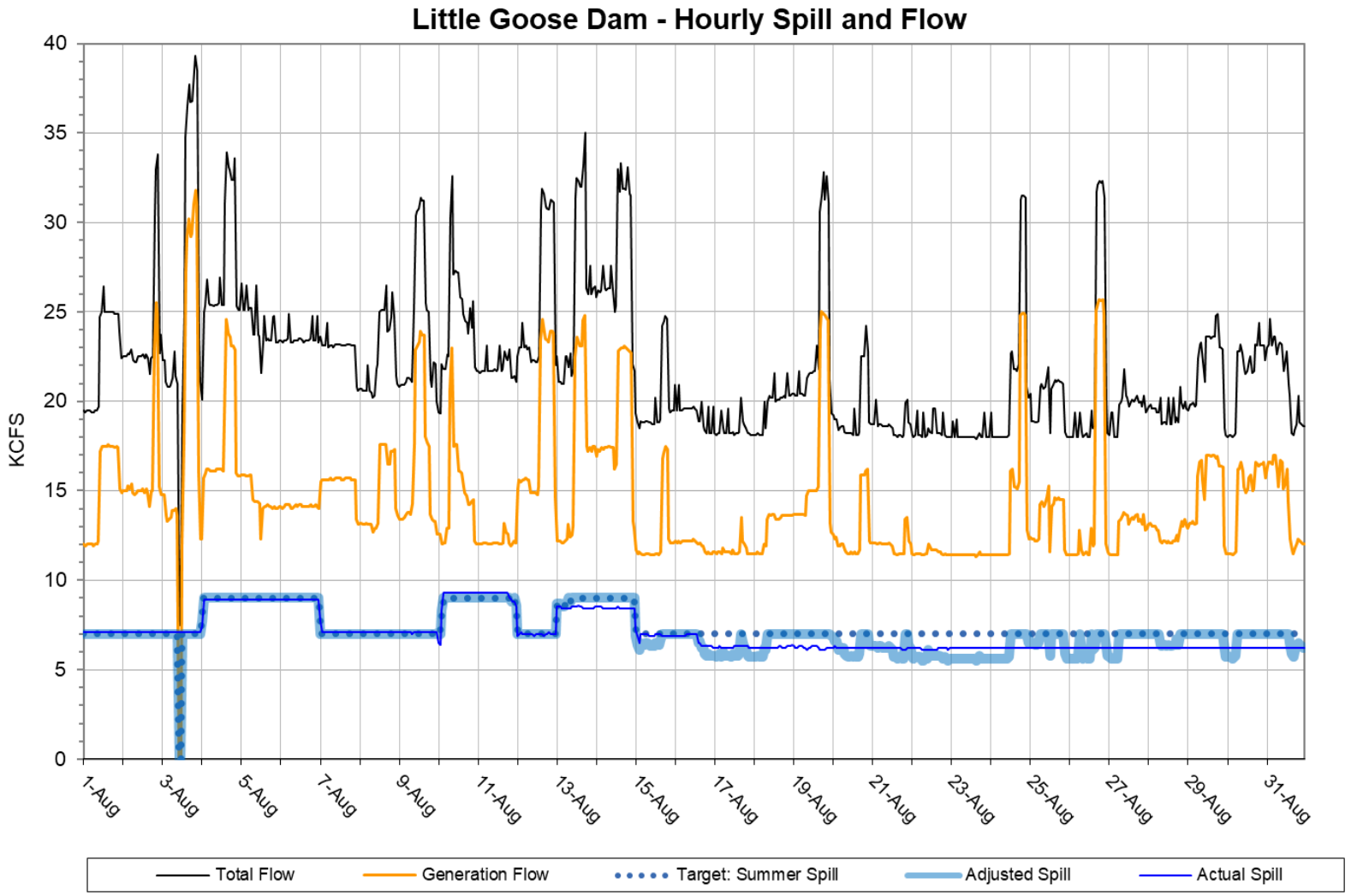
[13] Cells with '•' indicate no data due to malfunctioning gauge.

Figure 1[14]



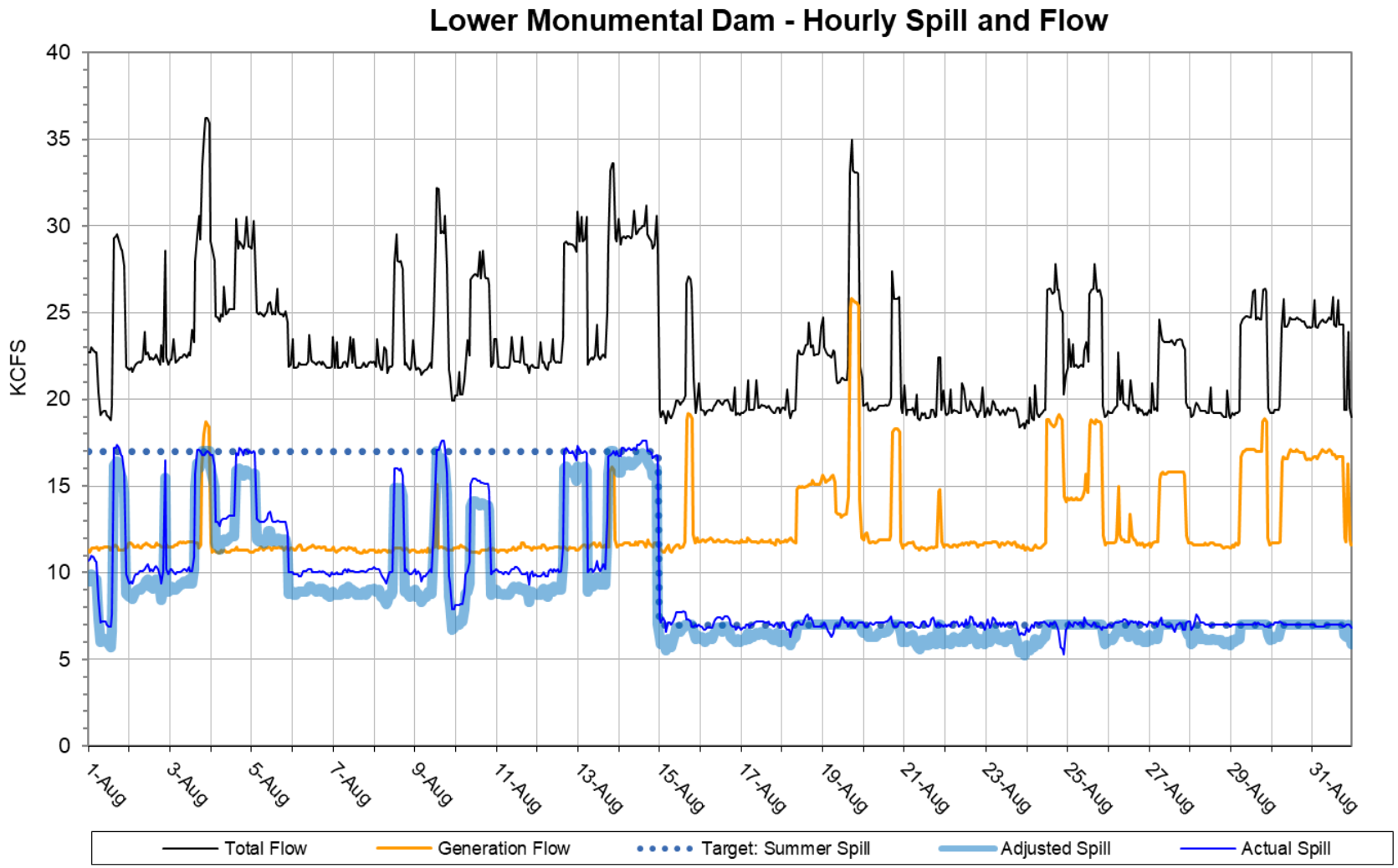
[14] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[15]



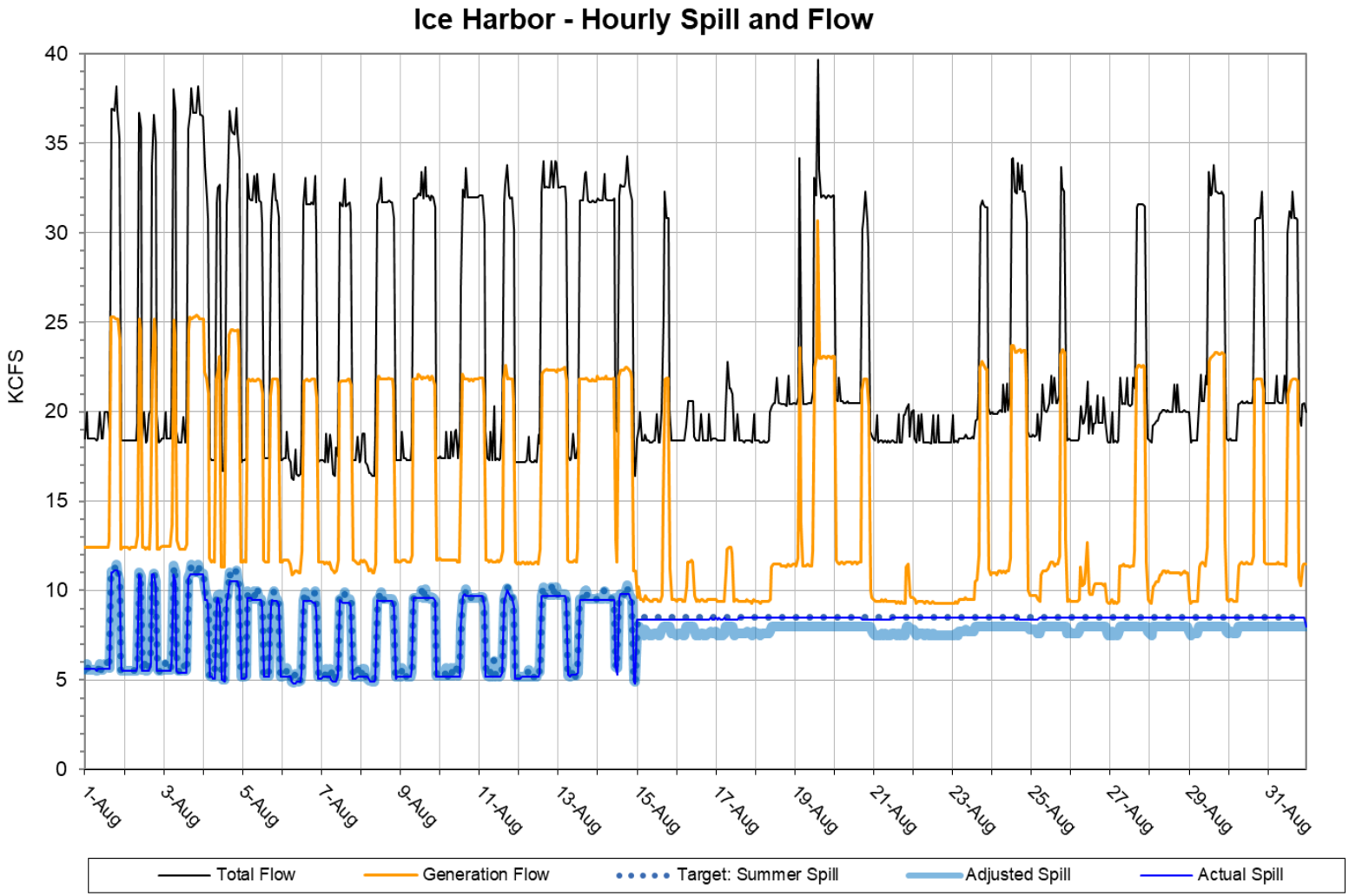
[15] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[16]



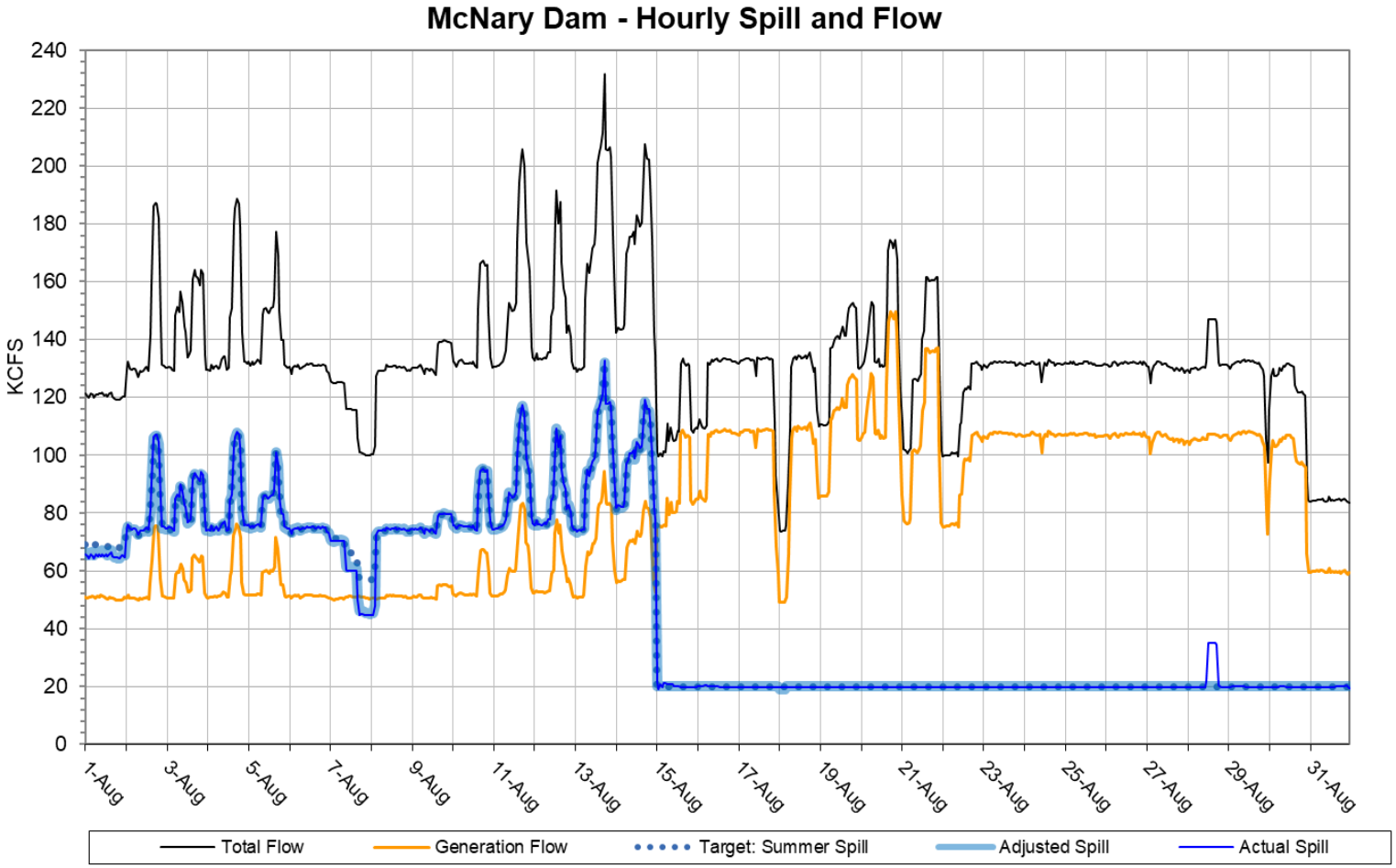
[16] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[17]



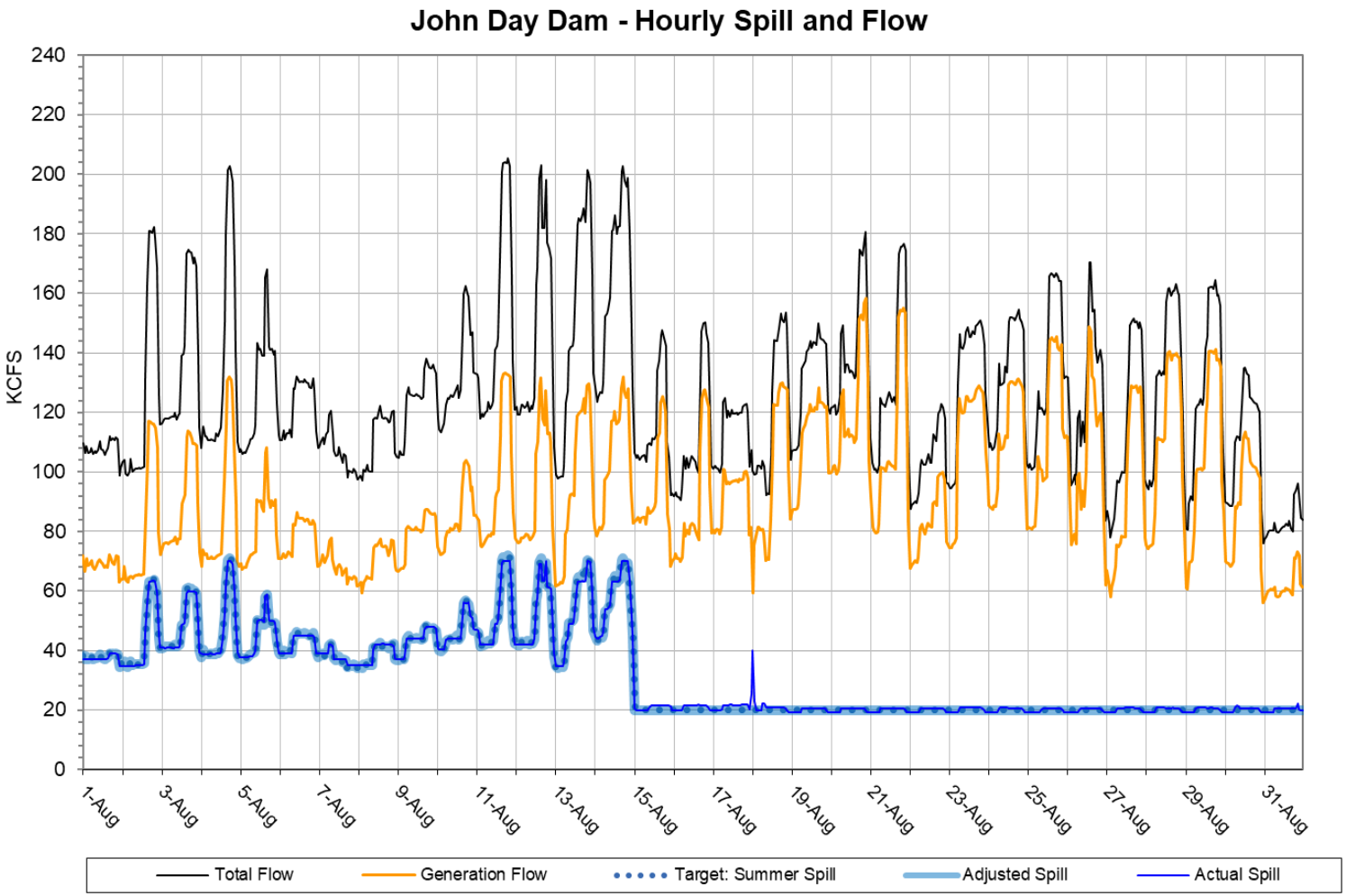
[17] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5[18]



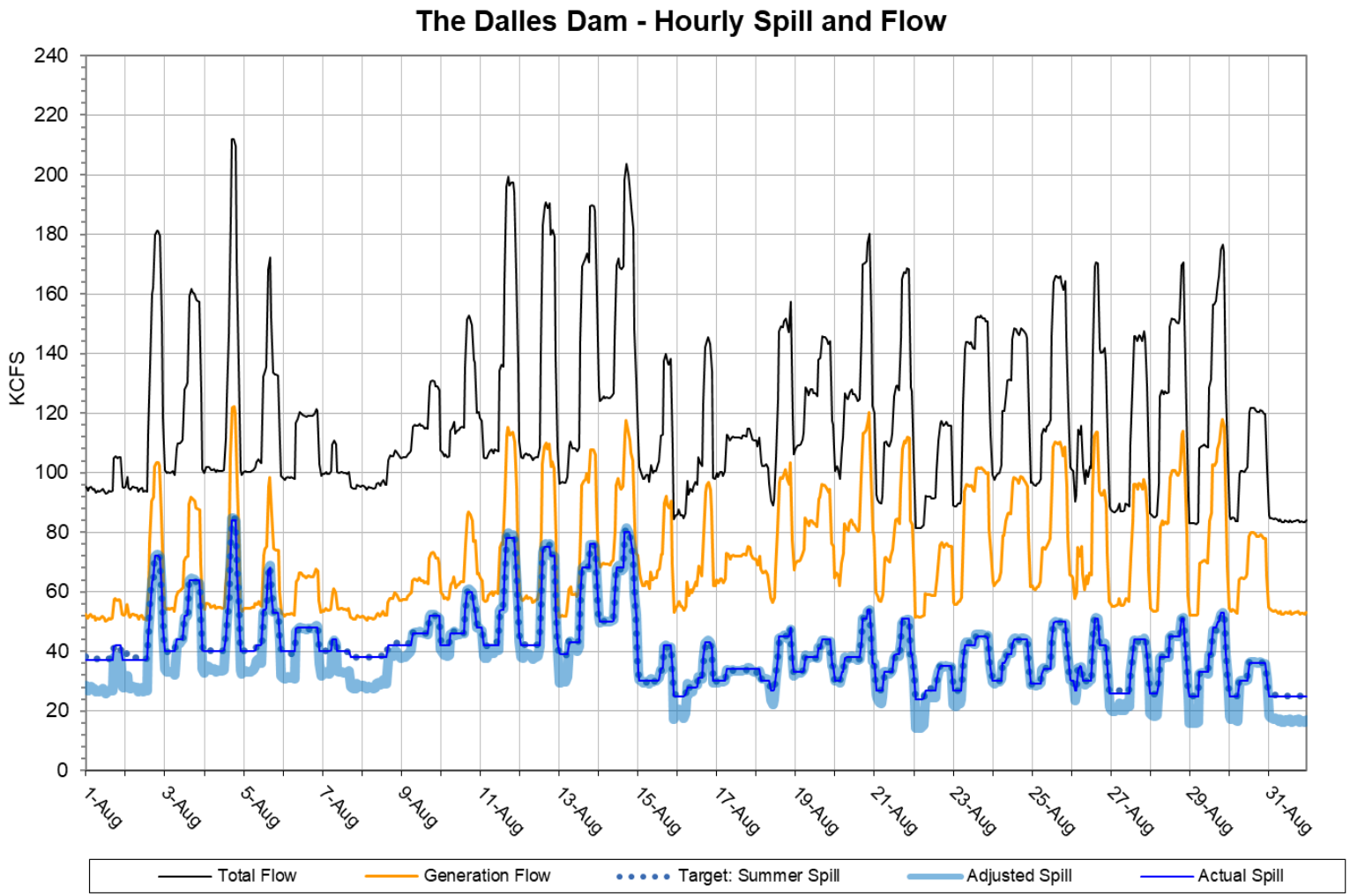
[18] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[19]



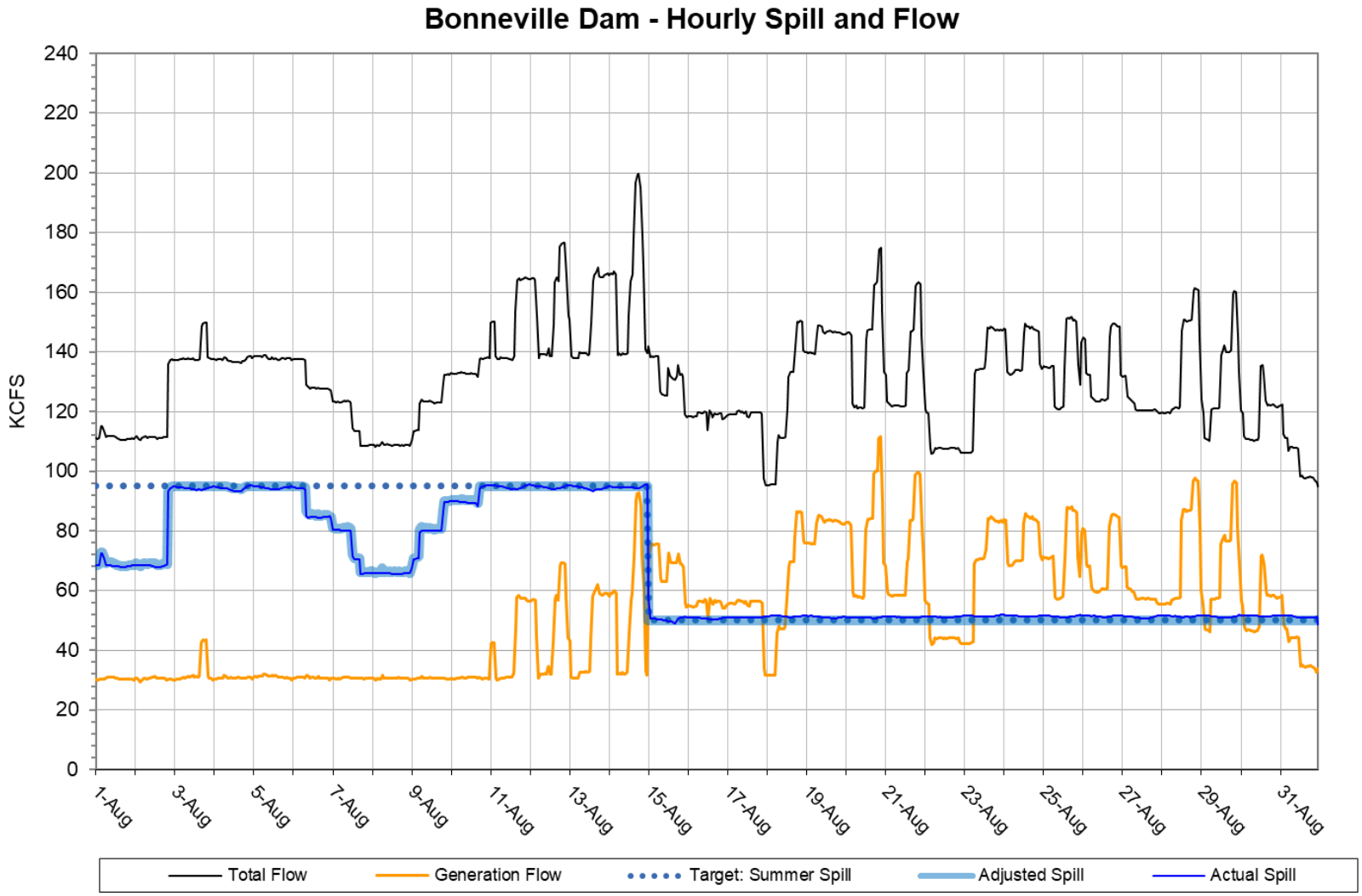
[19] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[20]



[20] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 8[21]



[21] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.