FISH OPERATIONS PLAN IMPLEMENTATION REPORT

August 2023

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 2023 Fish Operations Plan[1] (2023 FOP). The 2023 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2023 spring and summer fish migration seasons, generally April 3 through August 31. The 2023 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 Record of Decision for the Columbia River System Operations Environmental Impact Statement (CRSO EIS ROD) dated September 28, 2020, CRSO Final EIS, 2020 National Marine Fisheries Service (NMFS) Columbia River System and U.S. Fish and Wildlife Service Biological Opinions (2020 BiOps)[2], the Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions)[3], the Corps' requirements under the Endangered Species Act (ESA), and the ongoing consultation and communications with the relevant wildlife agencies to ensure consistency with the Act. The 2023 FOP also incorporates spill operations agreed to in the Term Sheet for Stay of Preliminary Injunction Motion and Summary Judgment Schedule[4] for the *NWF et al. v. NMFS et al.* (3:01-cv-00640-SI) litigation, as extended and modified through the Administration's Commitments in Exhibit 2 of the Joint Motion to Extend the Litigation Stay filed August 4, 2022 (referred to collectively as 2022 Agreement). Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2023 Water Management Plan (WMP), seasonal WMP updates, and the 2023 Fish Passage Plan (FPP).

[1] The 2023 FOP was posted to the Technical Management Team (TMT) website on March 27, 2023 (http://pweb.crohms.org/tmt/documents/fpp/2023/).

[2] The Corps, in coordination with the other Action Agencies, and NMFS, employs the Regional Implementation Oversight Group (RIOG) and technical teams including the Technical Management Team (TMT) and Fish Passage Operations & Maintenance (FPOM) coordination group, to coordinate with state, tribal and other federal experts for recommendations for implementing operations consistent with the 2020 BiOps.

[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

[4] 2022 Agreement: https://pweb.crohms.org/tmt/JointMotion_TermSheet_CourtOrder_OCT2021.pdf

This report describes the Corps' implementation of the 2023 FOP during the month of August. 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 2023 FOP, Section 4.1);
- actual spill: the hourly flow over the spillway; and,
- 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 2023 FOP in August 2023.

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 dashed blue line represents the spill cap portion of the target spill estimated to reach the gas cap or target TDG.
- The thick light blue line represents the performance standard spill level portion of the target spill.
- 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 (2023 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the August 2023 Average Percent TDG Values Table (Table 4). Red numbers indicate that the project exceeded the %TDG cap - i.e. 115% (tailwater) or 120% (tailwater) on that day.

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 2023 Spill Variance Table (Table 2).[5] 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).

"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 2023 FOP for Bonneville and The Dalles dams,[6] 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). 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.

[5] 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.

[6] As specified in the 2023 FOP Section 3.

August Operations

The month of August was characterized by above average precipitation and near normal flows for the lower Snake and lower Columbia rivers. The August 2023 observed precipitation was 293% of average on the Snake River above Ice Harbor and 188% of average on the Columbia River above The Dalles.[7] The NOAA Northwest River Forecast Center runoff summary for August indicated that the adjusted runoff for the Snake River at Lower Granite was 94% of the 30-year average (1991-2020) with a volume of 1.1 MAF (Million acre-feet). The August 2023 adjusted runoff for the Columbia River at The Dalles was 95% of the 30-year average (1991-2020) with a volume of 8.1 MAF.[8]

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. The Corps initiates spill at 0001 hours, or shortly after midnight, at each of the projects on the start date. Target spill levels for summer 2023 at each project are defined in Table 1. At the Snake River Projects spill may range up to ±1 kcfs during the summer spill operation from August 15–August 31.

Table 1: Summary of 2023 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	SW flow (as river flow allows)
Little Goose [B, C]	30%	SW flow or 7 kcfs spill
Lower Monumental [B, D]	17 kcfs	SW flow or 8 kcfs spill
Ice Harbor [B, E]	30%	SW flow or 9 kcfs spill
McNary [F]	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. Late summer spill August 15-August 31 will be through the surface weir (SW) or a constant spill rate through conventional spillbays using the appropriate FPP spill pattern. The SW spill rate is a function of forebay elevation (as pool elevation increases, more water is spilled over the SW), as defined in the FPP. The SWs will be operated per FPP criteria and closed when low flow criteria are met. When the SW is closed, the spill target will transition to a constant spill rate through conventional spillbays and will not vary with a fluctuating forebay elevation.

[7] Retrieved September 5, 2023: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[8] Retrieved September 5, 2023: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

C. Flow corresponds to the SW high crest elevation as adjusted relative to the forebay operating range (see FPP Chapter 8, section 2.3.2.7).
D. Flow corresponds to a forebay elevation of 538.5 feet, the mid-point of the forebay range from 537-540 feet.
E. Flow corresponds to a forebay elevation of 438.5 feet, the mid-point of the forebay range from 437-440 feet.
F. From June 16-August 14, McNary will adjust spill once a day to 57% of the previous day's average project outflow. The intent is to reduce the frequency of spillgate changes while implementing a more uniform pattern to the extent it can be done safely (see FPP Chapter 5, section 2.2.1.1).

In its implementation of the 2023 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 (see Table 4).[9] 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).

[9] See 2023 FOP, Section 2.2

Operational Adjustments

1. Lower Granite Dam

During the August 30 TMT meeting, a TMT member requested an evaluation of spill at Lower Granite that occurred on August 20 and 22, 2023, claiming there was a deviation from the FOP[10]. On August 20, the surface weir was closed from 0400 to 2200, spill through the other bays was 3.4 kcfs, and the flow through Unit 1 ranged from 11.8 to 12.1 kcfs. On August 22, the surface weir was closed from 0200 to 0900, spill through the other bays was 1.9 kcfs for 1 hour and 3.4 kcfs for 7 hours, and the flow through Unit 1 ranged from 11.8 to 11.9 kcfs. Unit 1 is the priority unit and its minimum generation flow range is 11.6 to 12.7 kcfs. In the hours preceding both events, the forebay elevation was <= 733.2 feet while the MOP range was 733.0 to 743.5 feet. The late-summer spill target is surface weir flow (Table 1) which ranges from 5.6 to 11.4 kcfs, depending on forebay elevation. However, the FOP caveats that target with a footnote stating that "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." Additionally, the FPP states "if river flow is too low to maintain [removable spillway weir (RSW)] spill and minimum generation requirements, close the RSW and spill the remaining outflow according to “No RSW” patterns in Table LWG-8. Re-open the RSW if flows increase sufficiently to support both RSW spill and minimum generation. The intent is to keep the RSW open to maintain PIT-tag detection to the extent possible as flows allow."[11] The spill reduction was temporary given the spill through conventional spillbays occurred for a total of 27 out of the 408 hours (7% of the late summer period). Given the low pool elevation and low inflow, total outflow needed to be reduced to ensure navigation safety, and minimum generation was necessary to ensure transmission reliability. Therefore, these reduced spill rates do not deviate from the FOP and are not considered spill variances. These periods coincided with a drop in inflow from the Snake River into the Lower Granite pool and a restricted maximum forebay elevation (a fish protection measure) which further constrained operations.

[10] https://pweb.crohms.org/tmt/agendas/2023/ (pending)
[11] FPP page LWG-18

Table 2: Spill Variance Table – August 2023

Project	Parameter	Date	Time[12]	# of Hours	Type	Reason
Lower Granite	Additional Spill	8/15	1400-1600	3	Transmission Reliability	Hourly spill increased to 9-12 kcfs (greater than the adjusted spill target of 7 kcfs) due to a power restriction on the transmission line.
McNary	Additional Spill	8/17	1300-1700	5	Maintenance	Hourly spill increased to 26 – 35 kcfs (greater than adjusted spill target of 20 kcfs) due to an unplanned outage of Unit 11.
John Day	Reduced Spill	8/31	1000	1	Human Error	Hourly spill reduced to 17 kcfs (less than the adjusted spill target of 20 kcfs) due to a delay in opening the conventional spillway gates after closure of the surface weirs.
The Dalles	Additional Spill	8/2	0100	1	Program Error	Hourly spill increased to 42% (greater than adjusted spill target of 40% ± 1%) due to an error in the reported data.
The Dalles	Additional Spill	8/4	2400	1	Program Error	Hourly spill increased to 42% (greater than adjusted spill target of 40% ± 1%) due to a delay caused by a GDACS setting.

[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 3: Pre-Coordinated Operations – August 2023

Project	Parameter	Date	Time[13]	# of Hours	Type	Reason
Little Goose	Additional Spill	8/1 8/2 8/3 8/4 8/7 8/8 8/9 8/10	0500-1700 0500-1800 0600-1700 0600-1600 0600-1200, 1800 0600-1800 0600-1800 0600-1800	13 14 12 11 8 13 13 13	Maintenance	Hourly spill increased to between 9 and 26 kcfs (greater than adjusted spill target of between 7 and 11 kcfs) to perform transformer maintenance. Regionally coordinated via the 2023 FPP LGS Section 4.3.10 and Appendix A.
Lower Monumental	Additional Spill	8/2	0700-1800	12	Maintenance	Hourly spill increased to between 20 and 22 kcfs (greater than adjusted spill target of 17 kcfs) to perform transformer maintenance. Regionally coordinated via the 2023 FPP LMN Section 4.3.10 and Appendix A.
Ice Harbor	Reduced Spill	8/4 8/6 8/8 8/10 8/11 8/12 8/13	0900 1600 1300, 2100, 2300 1200, 1700 1700 0900, 1800, 2000, 2300 1300	1 1 3 2 1 4 1	Navigation	Hourly spill decreased to between 27 and 28% (less than adjusted spill target of 30% ± 1%) for navigation. Regionally coordinated via 2023 FOP, Sections 4.1 and 4.6.
John Day	Additional Spill	8/2	0800-1000	3	Maintenance	Hourly spill increased to 38 and 41% (greater than adjusted spill target of 35% ± 1%) while performing a fish screen inspection. Regionally coordinated via 2023 FPP, JDA Section 2.3.2.
John Day	Reduced Spill	8/2 8/4	1100 2300	1 1	Transmission Reliability	Hourly spill decreased to 33% (less than adjusted spill target of 35% ± 1%) due to an increase in generation to deploy reserves. Regionally coordinated via 2023 FOP, Section 4.4.1.
Bonneville	Additional Spill	8/15	1500	1	Debris Spill	Hourly spill was increased to 62 kcfs (greater than adjusted pill target of 50 kcfs) to pass debris. Regionally coordinated via 2023 FPP, page BON-43, Section 6.

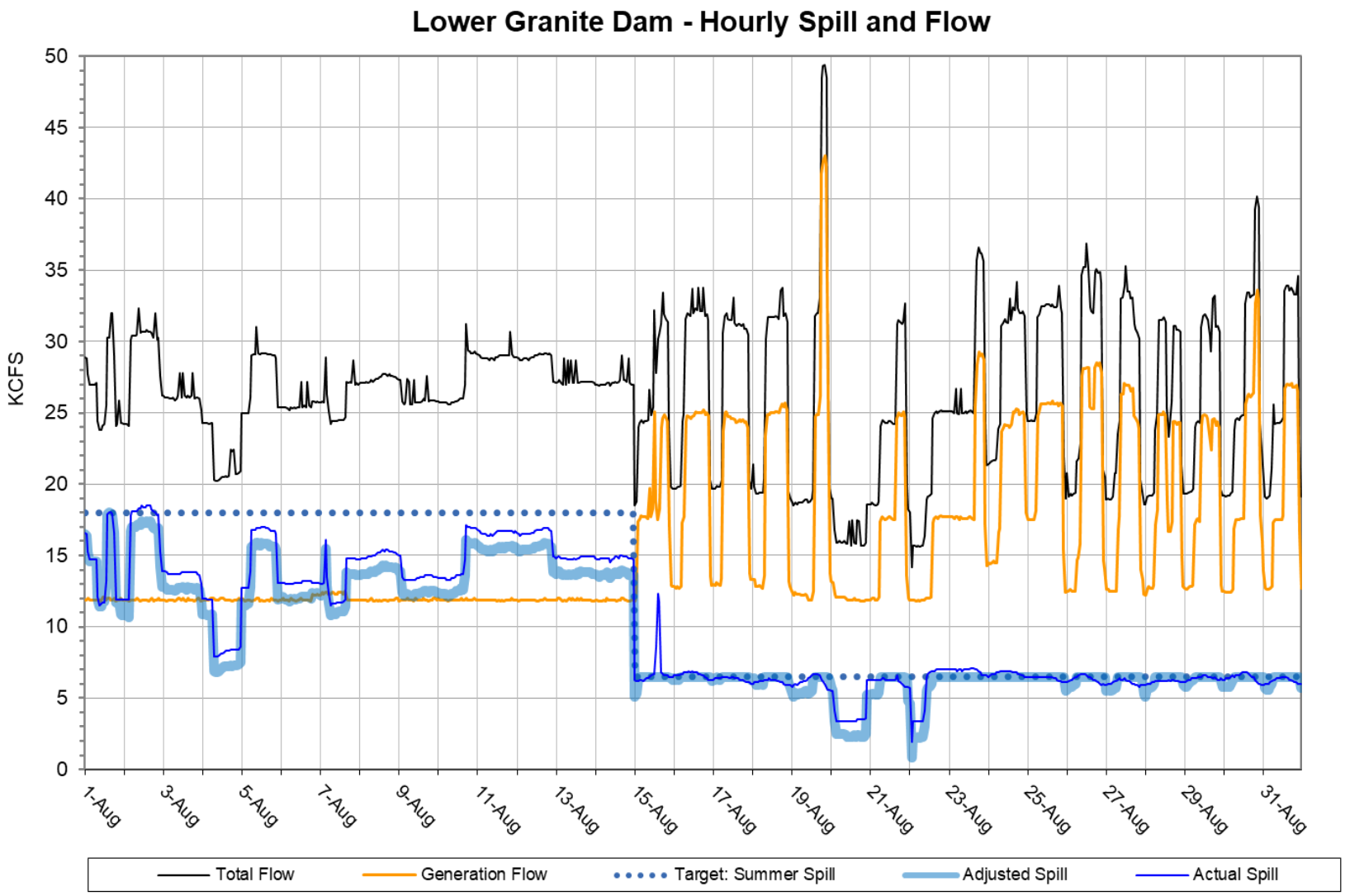
[13] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Pre-Coordinated Operations Table as an hour.

Table 4: August 2023 Average Percent TDG Values

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
8/1/2023	102	113	108	118	110	115	113	111	108	118	104	114	108	113	107	117
8/2/2023	102	113	109	116	110	117	112	109	108	116	105	115	108	113	107	115
8/3/2023	102	116	109	114	110	116	112	109	108	116	105	114	107	112	107	114
8/4/2023	102	113	109	113	110	112	112	108	108	115	104	114	106	112	106	114
8/5/2023	102	113	108	109	110	112	112	109	107	116	105	116	109	113	107	114
8/6/2023	102	115	108	109	109	113	111	108	107	117	105	115	108	•[14]	107	116
8/7/2023	102	114	109	112	109	112	111	108	106	116	106	115	107	•	106	115
8/8/2023	101	112	110	114	108	112	111	109	106	115	107	115	110	•	107	116
8/9/2023	101	115	109	114	109	112	110	108	107	116	107	115	110	•	107	116
8/10/2023	100	115	109	114	108	113	109	108	107	115	106	115	107	•	106	116
8/11/2023	100	111	108	108	108	114	109	108	107	116	105	116	107	•	106	116
8/12/2023	100	112	107	108	108	113	108	108	107	118	105	116	107	114	106	116
8/13/2023	99	112	107	108	107	113	108	108	107	117	106	115	109	•	108	116
8/14/2023	100	112	107	111	108	113	109	108	109	117	108	115	112	•	111	117
8/15/2023	100	111	109	110	108	111	109	108	109	112	108	114	112	•	113	113
8/16/2023	100	109	109	110	108	109	111	108	109	111	108	114	110	114	113	114
8/17/2023	101	109	109	109	109	110	112	108	110	112	108	115	109	113	111	113
8/18/2023	101	109	109	109	108	109	112	108	109	110	109	115	107	•	108	113
8/19/2023	101	110	108	109	108	110	112	108	107	110	109	115	107	•	105	113
8/20/2023	101	105	107	109	107	109	110	108	104	109	110	115	110	•	106	113
8/21/2023	101	110	107	108	107	108	109	107	103	109	109	115	110	•	108	113
8/22/2023	100	110	106	107	105	108	106	107	103	108	106	113	107	•	106	113
8/23/2023	99	110	103	107	103	108	104	107	102	109	104	112	106	•	105	113
8/24/2023	99	108	104	107	104	108	104	107	103	109	104	112	107	•	105	113
8/25/2023	99	108	105	107	104	108	104	107	101	109	104	114	108	•	107	113
8/26/2023	99	108	104	108	103	108	104	107	102	108	103	115	108	•	108	113
8/27/2023	100	108	103	108	103	108	103	107	103	109	103	116	108	•	109	113
8/28/2023	100	109	103	107	104	109	104	107	105	109	103	116	108	•	108	113
8/29/2023	100	109	104	107	104	108	105	106	103	109	102	116	105	109	104	112
8/30/2023	100	109	103	107	104	109	104	107	102	108	101	116	102	108	102	112
8/31/2023	100	109	105	107	104	109	104	107	102	108	101	111	104	110	104	113
Exceedances:																

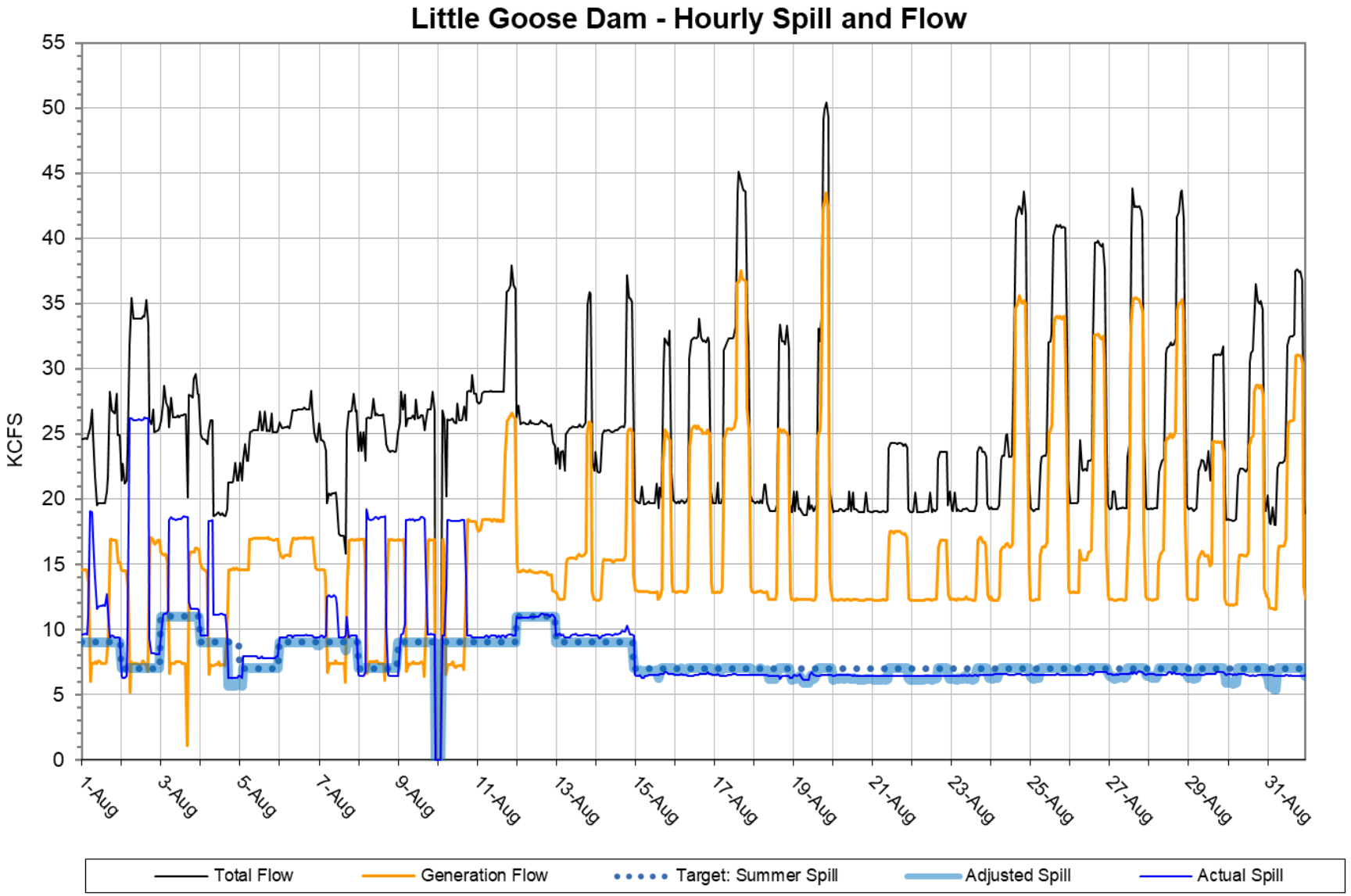
[14] Indicates missing or erroneous data. TDG data was missing due to ruptured membranes and a malfunctioning instrument cable. Repairs were delayed due to workload, unhealthy levels of smoke and ordering a replacement cable.

Figure 1[15]



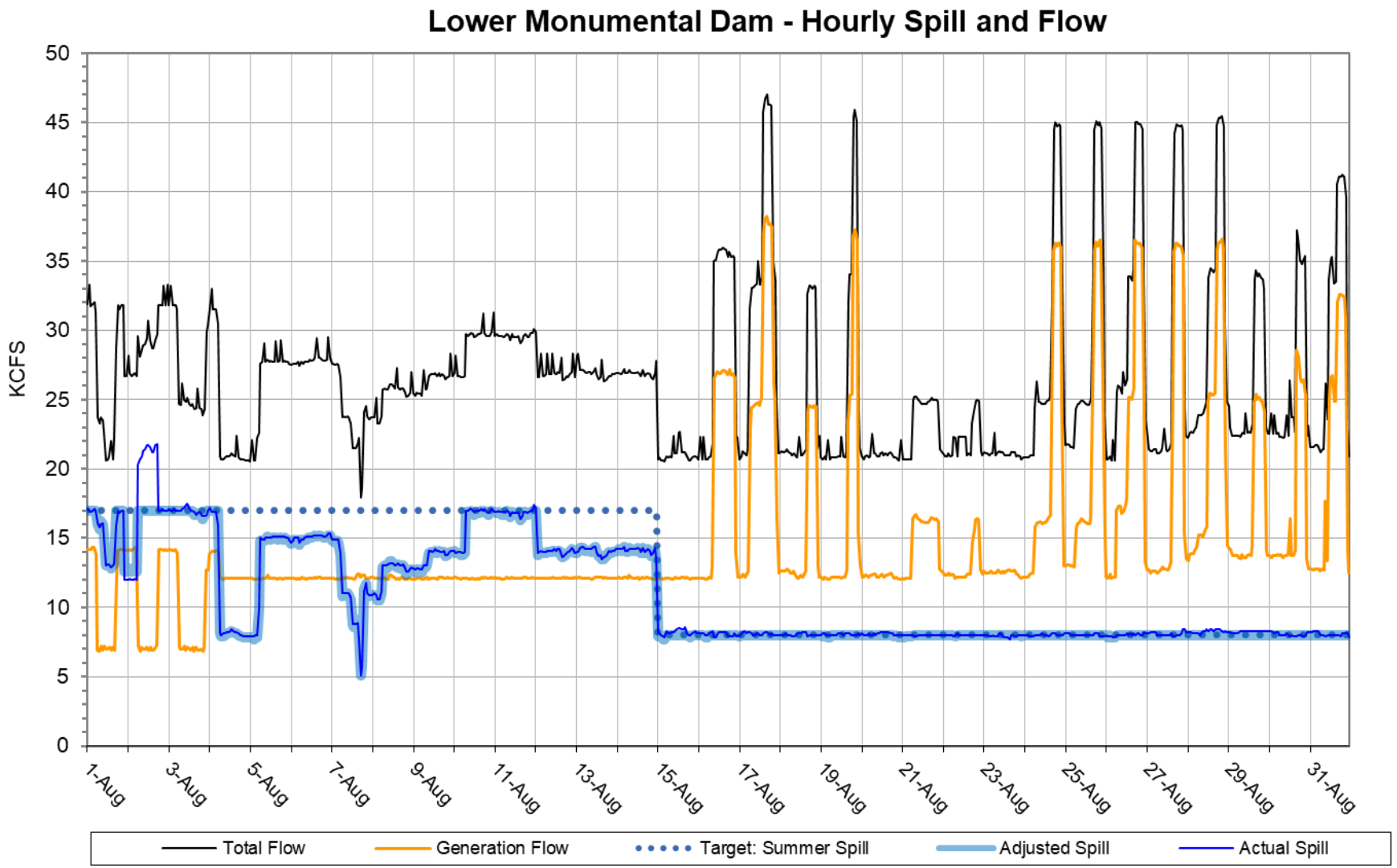
[15] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[16]



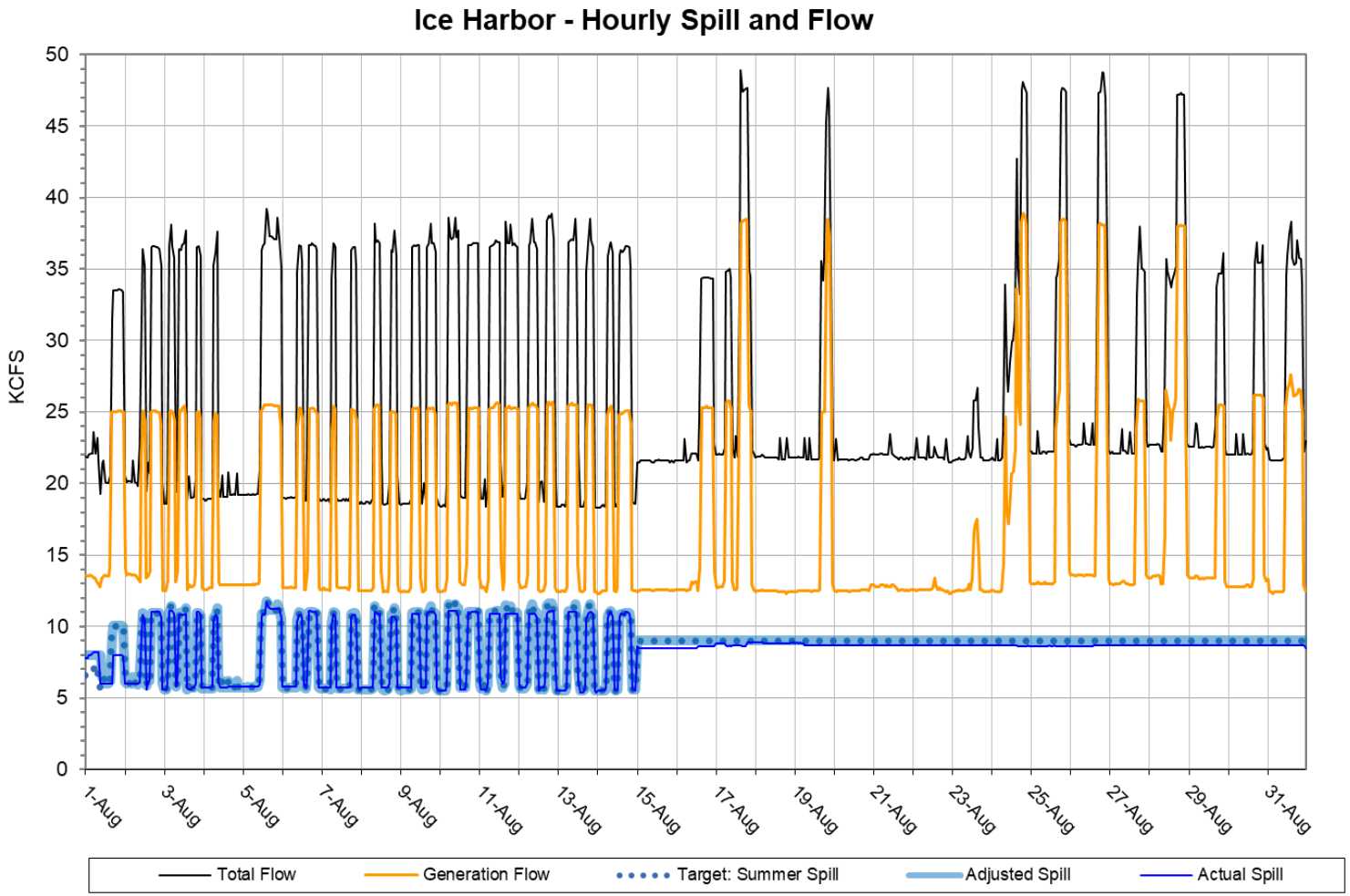
[16] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[17]



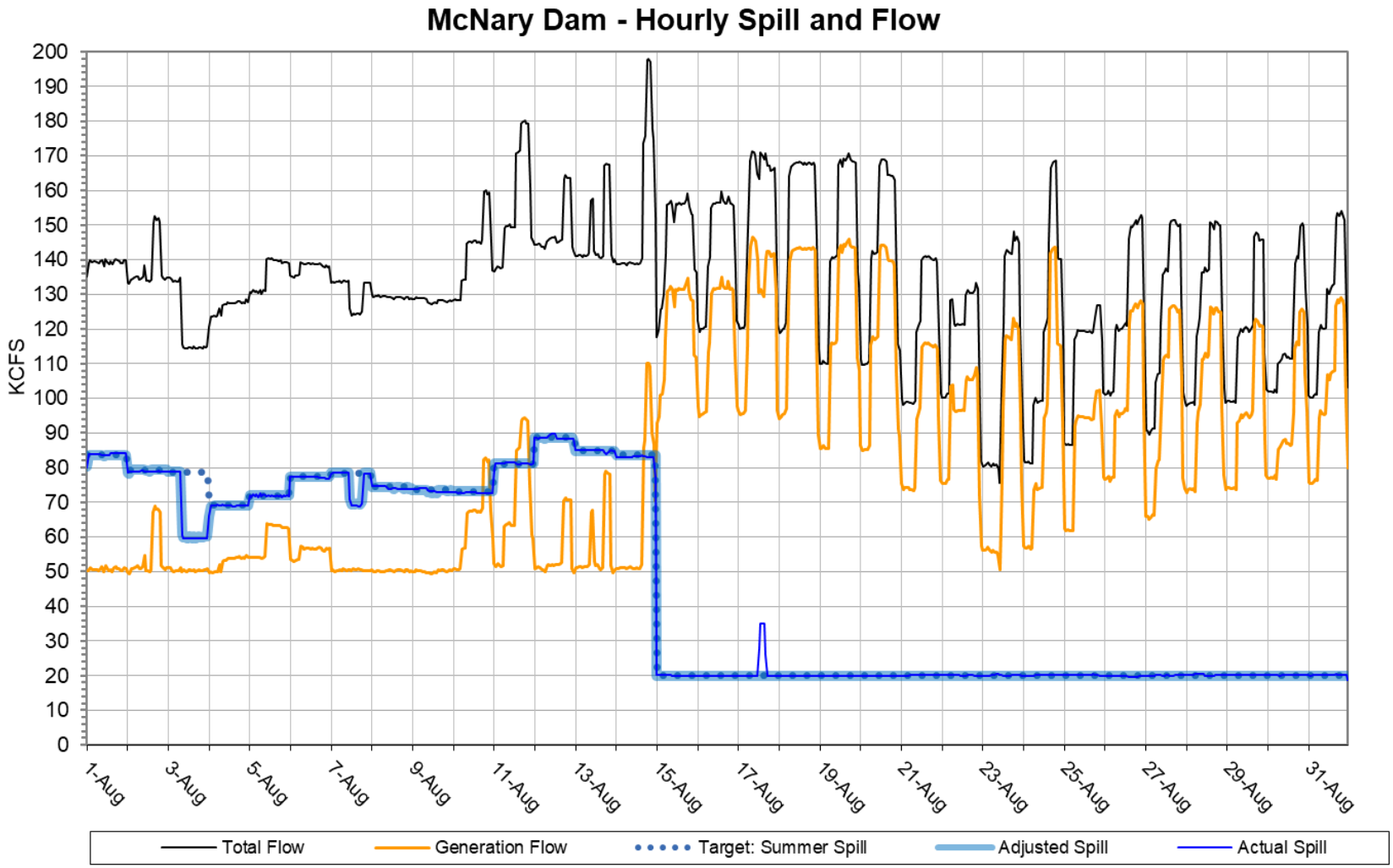
[17] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[18]



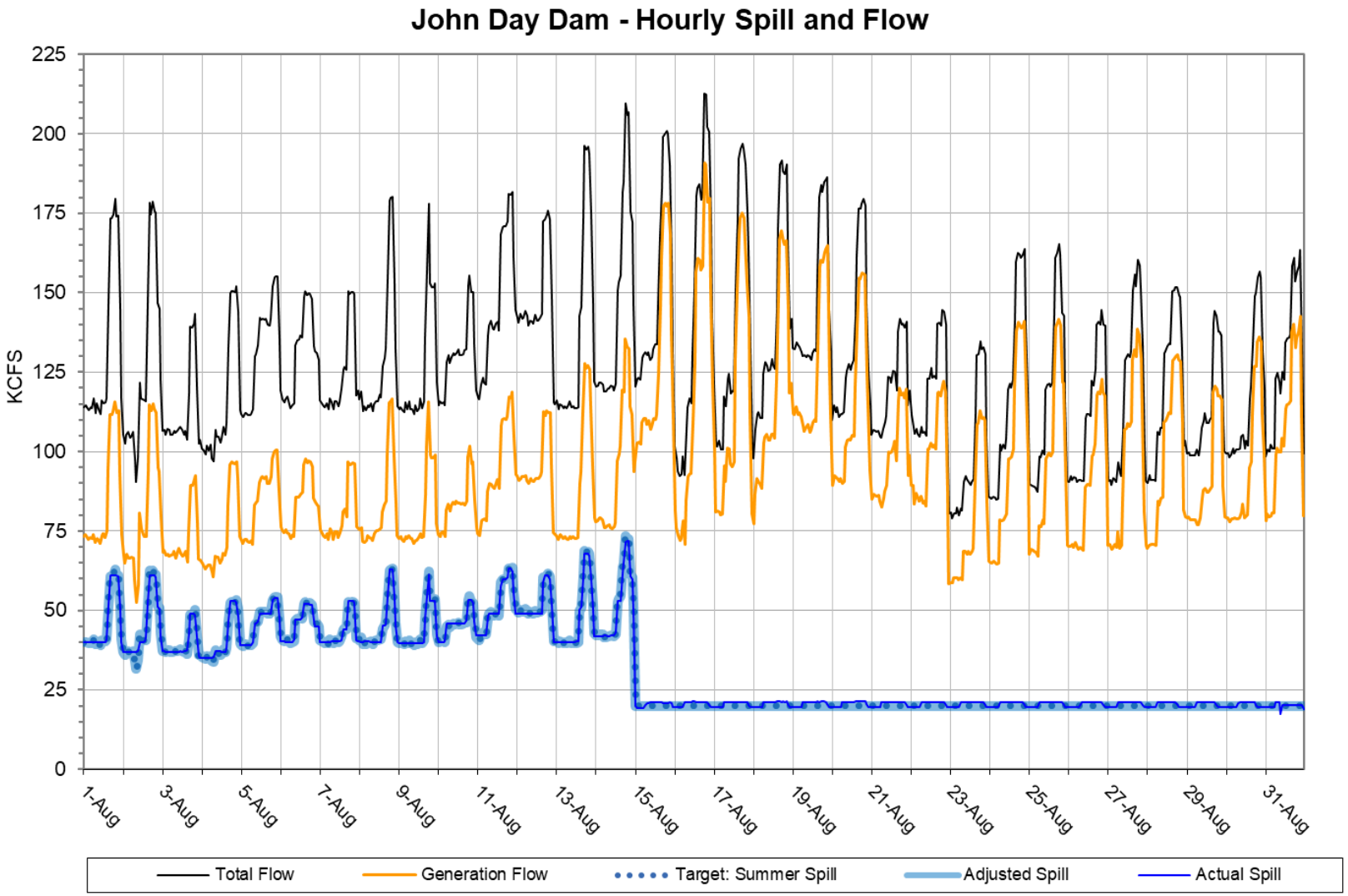
[18] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations. When the SW is open, the minimum project spill level is fixed at approximately 7.1-8.7 kcfs, depending on forebay elevation (i.e., spill cannot be reduced below the fixed volume through the SW). This operational limitation results in spilling more than 30% when total outflow drops below approximately 28 kcfs Additionally, all but one of the five available turbine units at Ice Harbor have runner blades that are locked at a set angle (non-adjustable) and a smaller operating range (also referred to as "fixed-blade" or "locked-blade" units). Only Unit 1 has adjustable blades. As a result, turbine outflow cannot achieve some flow ranges, referred to as deadbands. When targeting spill as a percent of outflow, these deadbands will result in a spill percentage that is above or below the target percentage at certain outflows.

Figure 5[19]



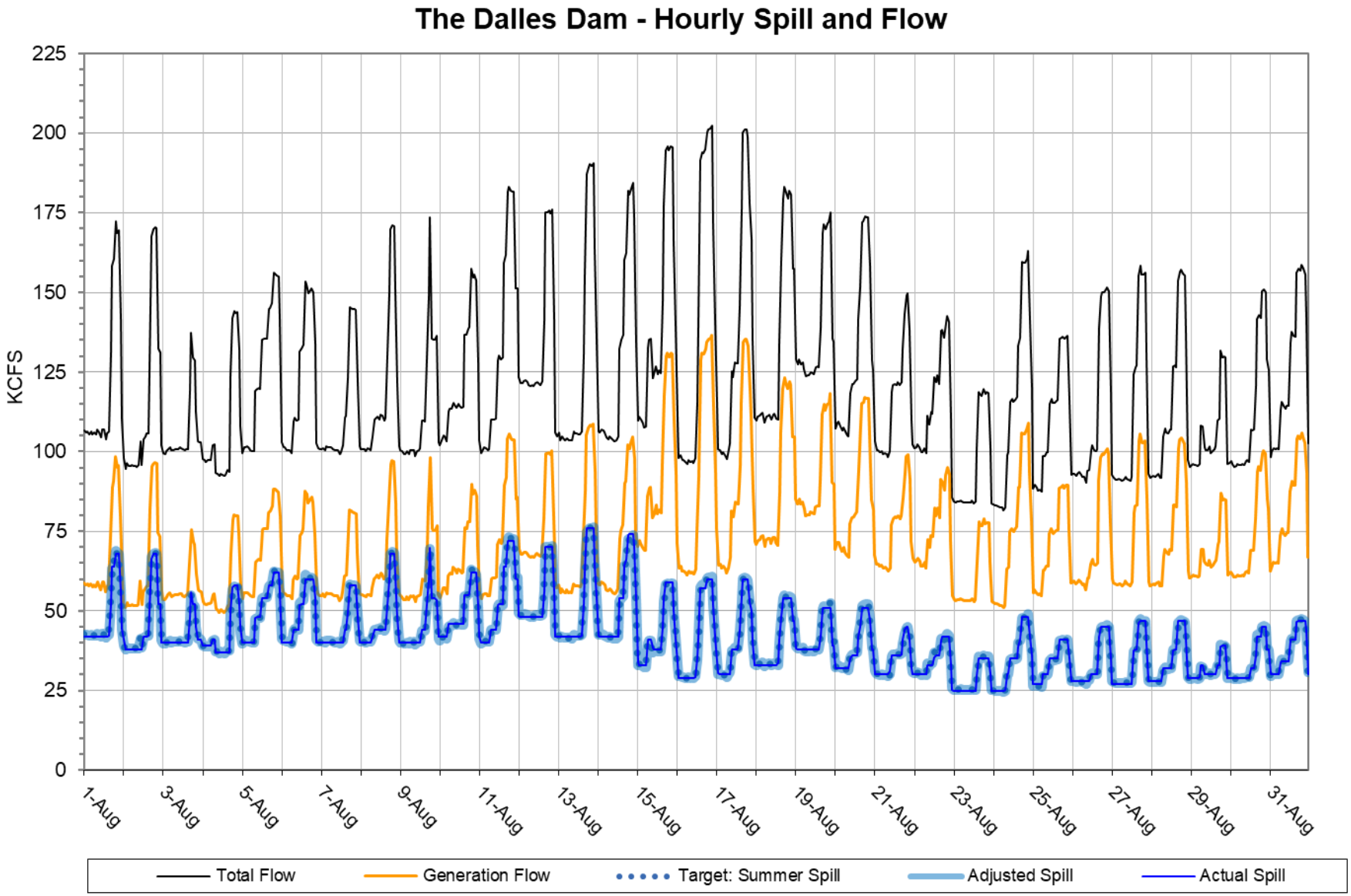
[19] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[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.

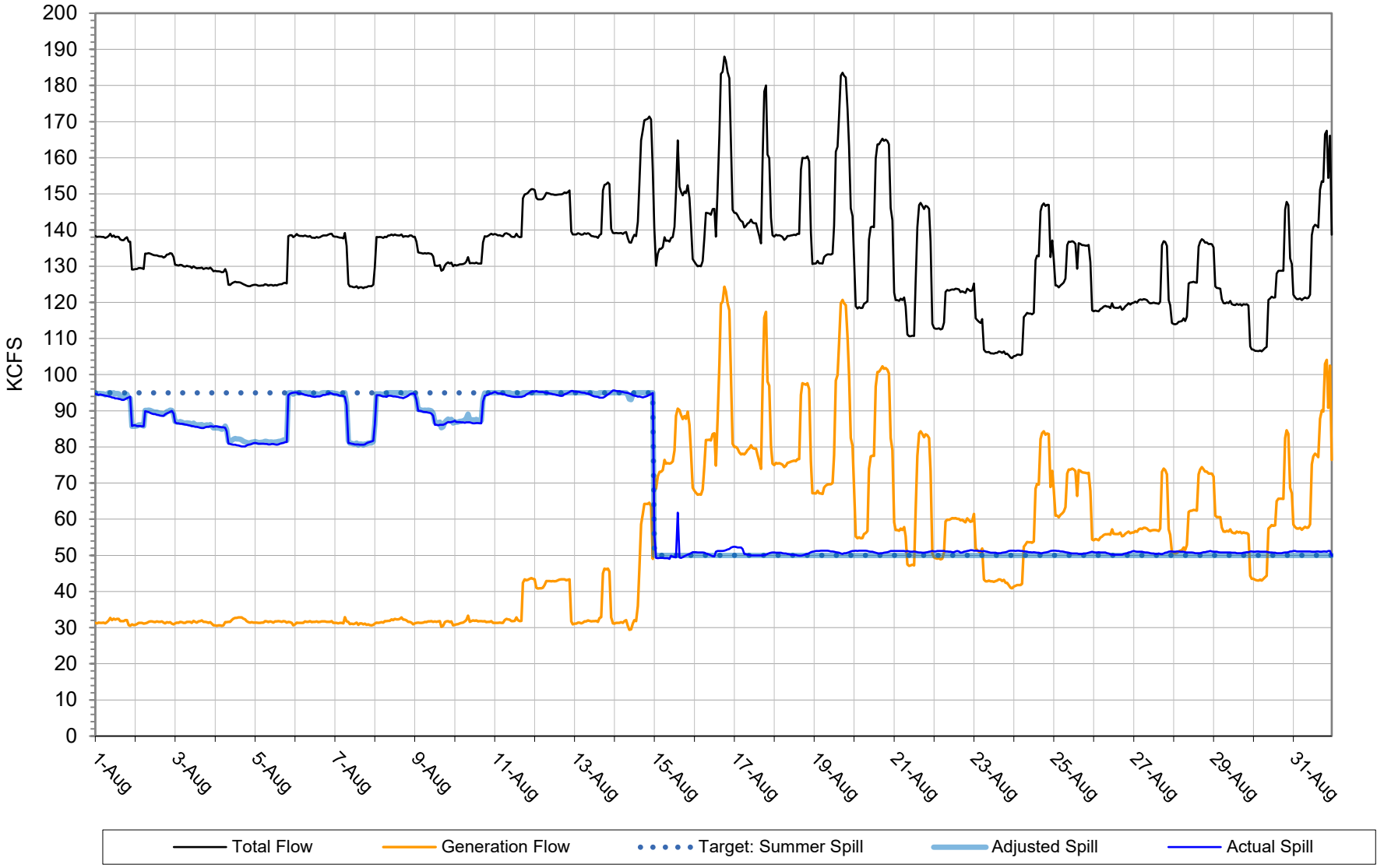
Figure 7[21]



[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.

Figure 8[22]

Bonneville Dam - Hourly Spill and Flow



[22] 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.