FISH OPERATIONS PLAN IMPLEMENTATION REPORT

July 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 July. 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 July 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 July, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on July 1 and end on July 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 July 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 July 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.

July Operations

The month of July was characterized by below average precipitation and flows for the lower Snake and lower Columbia Rivers. The July 2021 observed precipitation was 81% of average on the Snake River above Ice Harbor and 37% of average on the Columbia River above The Dalles. The NOAA Northwest River Forecast Center runoff summary for July indicated that the adjusted runoff for the Snake River at Lower Granite was 42% of the 30-year average (1981-2010) with a volume of 1.0 MAF (Million acre-feet)[6]. The July 2021 adjusted runoff for the Columbia River at The Dalles was 71% of the 30-year average (1981-2010) with a volume of 10.4 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 August 3, 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 July, 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

1. Lower Granite Dam

Effective July 3, through July 16, the Corps reduced the Lower Granite Dam, 2021 Summer Spill Operation of 18 kcfs / 24 hours per day, to 7 kcfs 0900 to 2300 and 18 kcfs from 2300 to 0900 hours. The Corps made this spill change based on the Idaho Department of Fish and Game (IDFG) request identified in System Operational Request (SOR) 2021-3, "Requested operations to mitigate for and reduce high water temperatures in the lower Snake River reservoirs," dated July 1, 2021. The goal of this operation was to provide cooler water temperature in the project tailrace for migrating adult Snake River sockeye salmon. This was coordinated during the July 2, 2021, TMT Meeting, and Regional Sovereigns either supported or did not object to this operational adjustment.

Operations associated with implementation of SOR 2021-3 were subsequently adjusted with the TMT on the following dates: 1) on July 16, hours associated with the spill operations were shifted 4 hours earlier in the day to 7 kcfs from 0500 to 1900 hours and 18 kcfs 1900 to 0500 hours, and 2) on July 21, to operate the single priority unit at minimum generation on all hours and spill the remainder of project outflow. Regional Sovereigns either supported or did not object to these additional operational adjustments associated with implementation of SOR 2021-3.

2. Little Goose Dam

Effective July 3 through July 31, Little Goose Dam reduced the 2021 Summer Spill Operation of 30%[9] 24 hours per day, to 7 kcfs 0900 to 2300 and 30% from 2300 to 0900 hours. The Corps made this spill change after the receipt of System Operational Request 2021-3, "Requested operations to mitigate for and reduce high water temperatures in the lower Snake River reservoirs," from IDFG. The goal of this operation was to provide cooler water temperature in the project tailrace for migrating adult sockeye salmon. This was coordinated during the July 2, 2021, TMT Meeting. Regional Sovereigns either supported or did not object to this operation.

[9] Except during low flows as noted in the 2021 FOP, section 8.2.3.

Table 2: Spill Variances – July 2021 (7/1 to 7/31)

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
Lower Granite	Reduced Spill	7/25	1500-1900	5	Human Error	Hourly spill was 7 kcfs (less than adjusted spill target of 11 kcfs) while generation was 17 kcfs, greater than the minimum range for Unit 1 (11.8-12.9 kcfs[11]) due to a misinterpretation of the Operational Adjustment.
Little Goose	Reduced Spill	7/29	0900	1	Human Error	Hourly spill was 7 kcfs (less than adjusted spill target of 9 kcfs) due to a delay in changing to the appropriate target.[12]
Little Goose	Additional Spill	7/31	0900-1100	3	Maintenance	Hourly spill was 7 kcfs (greater than adjusted spill target of 0 to 3 kcfs) while generation was reduced to between 0 and 8 kcfs, less than the minimum range for Unit 1 (11.3-11.8 kcfs[13]) to perform transformer maintenance.
Lower Monumental	Additional Spill	7/22	2000-2100	2	Human Error	Hourly spill increased to 20 kcfs (greater than adjusted spill target of 17 kcfs) due to miscalculation of the required spill.

[10] 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.

[11] 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.

[12] Based on the previous day's outflow, the spill target changed from 7 kcfs to 9 kcfs. See FOP section 8.2.3.

[13] 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 1, the range is 11.1 – 12.0 kcfs. See 2021 FOP section 4.3.1.

Table 3: Pre-Coordinated Operations – July 2021 (7/1 to 7/31)

Project	Parameter	Date	Time[14]	# of Hours	Type	Reason
Lower Granite	Reduced Spill	7/3 7/4 7/5 7/6 7/7 7/8 7/9 7/10 7/11 7/12 7/13 7/14 7/15 7/16 7/17 7/18 7/19 7/20	1000-2300 1000-2300 1000-2300 1000-2100 1000-2100 1000-1900 1000-2300 1000-2300 1400-2300 1000-2300 1800-2300 1000-1100 1000-2200 1000-2200 1600-2200 1800-2200 0700-1900 0600	14 14 14 12 12 10 14 14 10 14 6 2 13 13 7 5 13 1	Adaptive Management	Hourly spill decreased to between 7 and 10 kcfs (less than adjusted spill target of 10 to 18 kcfs). Regionally coordinated at the 7/2/21 TMT meeting. See the Operational Adjustments section for more details.
Little Goose	Reduced Spill	7/3 7/4 7/5 7/7 7/10 7/11 7/12 7/13 7/14 7/15 7/16 7/17 7/18 7/20 7/21 7/29	1000-2300 1000-2300 1000-2300 1200-2300 1000-2300 1000-2300 1000-2300 1900-2300 1000-2300 1000-2300 1000-2300 1600-2300 1900-2300 1000-2300 1000-1300 1000-2300	14 14 14 12 14 14 14 5 14 14 14 8 5 14 4 14	Adaptive Management	Hourly spill decreased to 7 kcfs (less than adjusted spill target of 9 to 11 kcfs). Regionally coordinated at the 7/2/21 TMT meeting. See the Operational Adjustments section for more details.
Little Goose	Additional Spill	7/13	0600-1700	12	Maintenance	Hourly spill increased to 11 kcfs (greater than adjusted spill target of 0 to 4 kcfs) while generation was reduced to station service only to perform transformer maintenance. Regionally coordinated via FPOM (Fish Passage Operations and Maintenance), the 2021 FPP LGS Section 4.3.10 and Appendix A.

[14] 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.

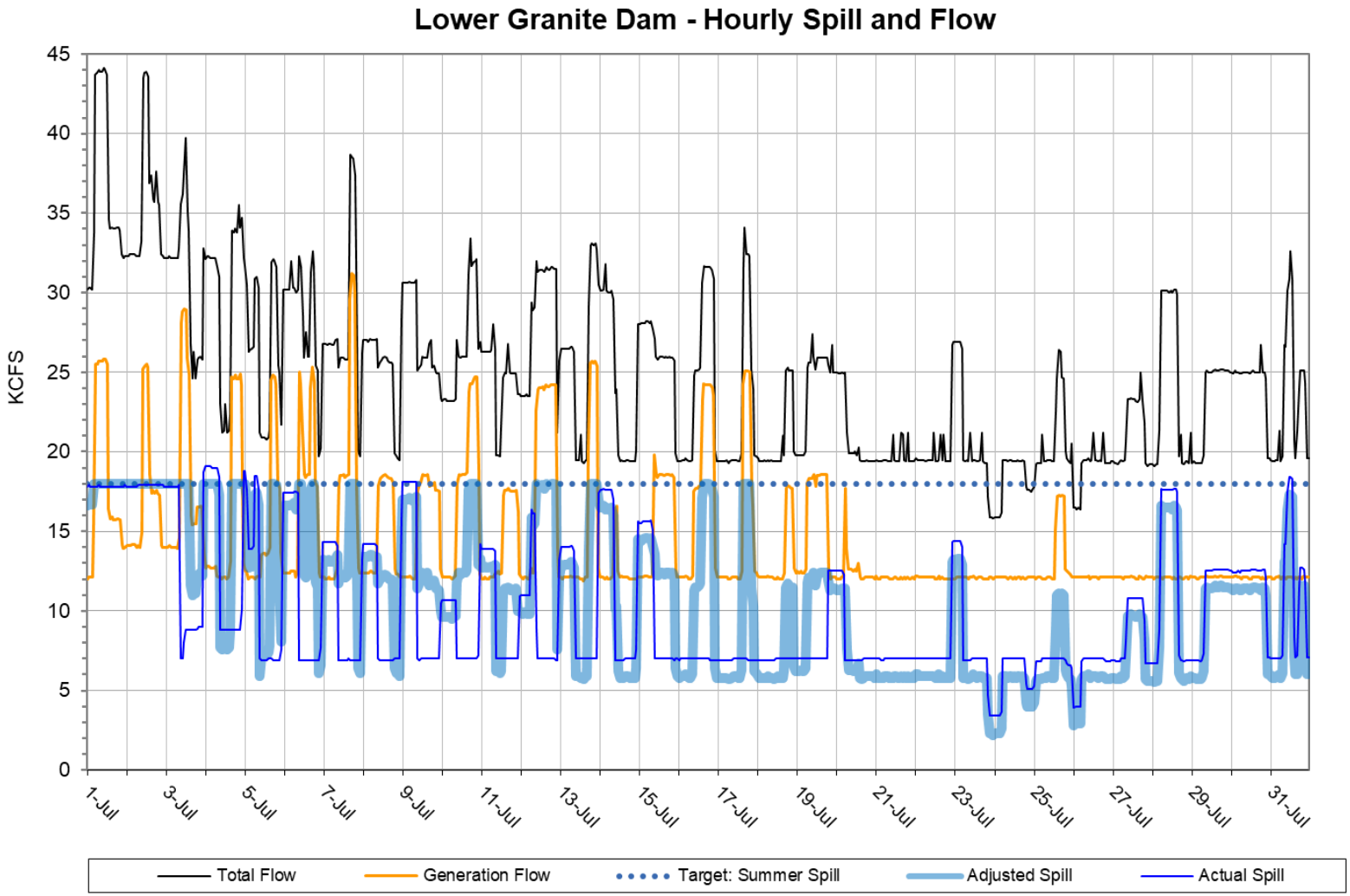
Ice Harbor	Reduced Spill	7/2 7/3 7/10 7/11 7/12 7/13 7/14 7/15 7/17 7/18 7/19 7/20 7/21 7/22 7/23 7/24 7/25 7/26 7/27 7/28 7/29 7/30 7/31	1600 1600 0400, 2200 1000, 1200-1300 0200, 1000, 1300 0200, 1300 0400 0600, 1100, 1300, 2100 1100 0100, 0400, 1000, 2000 0700, 1000, 1200 2400 0400, 1300, 1500, 2100 0200, 0900, 2300 0300 0100, 0500, 1600, 1900-2000, 2400 0900, 1100, 1300, 2400 0300, 2000 0600, 1400-1500 0100, 0800, 2400 0400-0500, 2100 0400, 1000, 1300 0900-1000, 1300	1 1 2 3 3 2 1 4 1 4 3 1 4 3 1 6 4 2 3 3 3 3 3	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.
John Day	Reduced Spill	7/8 7/31	0700 2200	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 2021 FOP, Section 4.4.1.
John Day	Additional Spill	7/10 7/21 7/31	0200-0300 0100 1700	2 1 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.
John Day	Reduced Spill	7/22	0700	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.
The Dalles	Additional Spill	7/1	0300	1	Transmission Reliability	Hourly spill increased to 42% (greater than adjusted spill target of 40% ± 1%) to provide reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
The Dalles	Reduced Spill	7/8	0700-0800	2	Transmission Reliability	Hourly spill decreased to 38% (less than adjusted spill target of 40% ± 1%) due to an increase in generation to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.

Table 4: July 2021 Average Percent TDG Values (7/1 to 7/31)

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
7/1/2021	105	115	113	113	115	114	114	113	114	117	112	116	109	115	107	117
7/2/2021	104	115	112	113	114	114	113	113	111	118	110	115	108	115	106	117
7/3/2021	104	114	112	113	114	114	112	113	109	117	108	115	109	115	107	117
7/4/2021	104	115	112	113	113	114	111	112	110	117	107	115	108	114	107	117
7/5/2021	103	115	111	113	113	114	110	112	110	116	105	115	107	114	107	117
7/6/2021	103	114	112	113	114	116	111	112	110	118	105	115	108	115	107	117
7/7/2021	103	116	112	113	114	117	112	112	110	117	105	115	108	114	106	117
7/8/2021	103	116	111	112	114	117	111	112	109	116	105	115	106	113	106	117
7/9/2021	102	114	110	116	114	116	111	112	108	116	105	115	107	114	107	117
7/10/2021	103	115	110	110	113	113	112	108	108	116	105	114	110	114	106	116
7/11/2021	102	116	110	110	113	113	111	108	108	116	105	115	107	114	107	116
7/12/2021	101	115	110	110	113	115	112	108	109	117	105	115	108	114	106	117
7/13/2021	101	117	110	113	112	114	113	109	109	117	106	115	107	115	105	117
7/14/2021	102	115	111	111	111	114	113	108	110	117	105	115	108	114	105	117
7/15/2021	102	114	111	110	109	111	112	106	109	117	105	115	106	113	104	117
7/16/2021	102	114	111	110	109	113	111	106	108	115	104	114	105	112	104	117
7/17/2021	102	115	110	110	108	113	110	107	106	116	104	114	105	113	105	117
7/18/2021	102	115	109	110	107	110	109	106	106	116	104	115	107	114	106	117
7/19/2021	102	115	109	110	107	113	109	106	106	116	103	114	106	113	106	117
7/20/2021	101	115	109	110	106	113	107	106	107	116	103	115	104	113	105	117
7/21/2021	101	115	109	109	107	110	107	105	107	115	102	115	104	112	104	117
7/22/2021	101	116	108	109	107	111	107	106	106	114	102	115	105	101	116	108
7/23/2021	100	116	107	109	106	113	107	106	106	116	102	115	107	114	104	116
7/24/2021	101	116	109	109	105	109	107	106	106	115	103	116	108	114	107	117
7/25/2021	101	115	109	110	105	111	108	107	107	116	104	115	108	115	107	117
7/26/2021	101	115	109	109	107	111	107	107	108	116	105	116	107	114	107	117
7/27/2021	101	116	108	108	107	111	107	107	108	116	105	116	107	114	106	117
7/28/2021	100	115	108	110	107	113	108	108	108	115	105	115	108	114	107	117
7/29/2021	101	110	108	109	107	111	108	108	108	115	107	115	110	115	110	117
7/30/2021	101	109	109	110	107	111	108	107	107	115	109	115	111	116	111	117
7/31/2021	102	•[15]	109	109	107	109	108	107	107	114	109	115	110	115	110	115
Exceedances:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

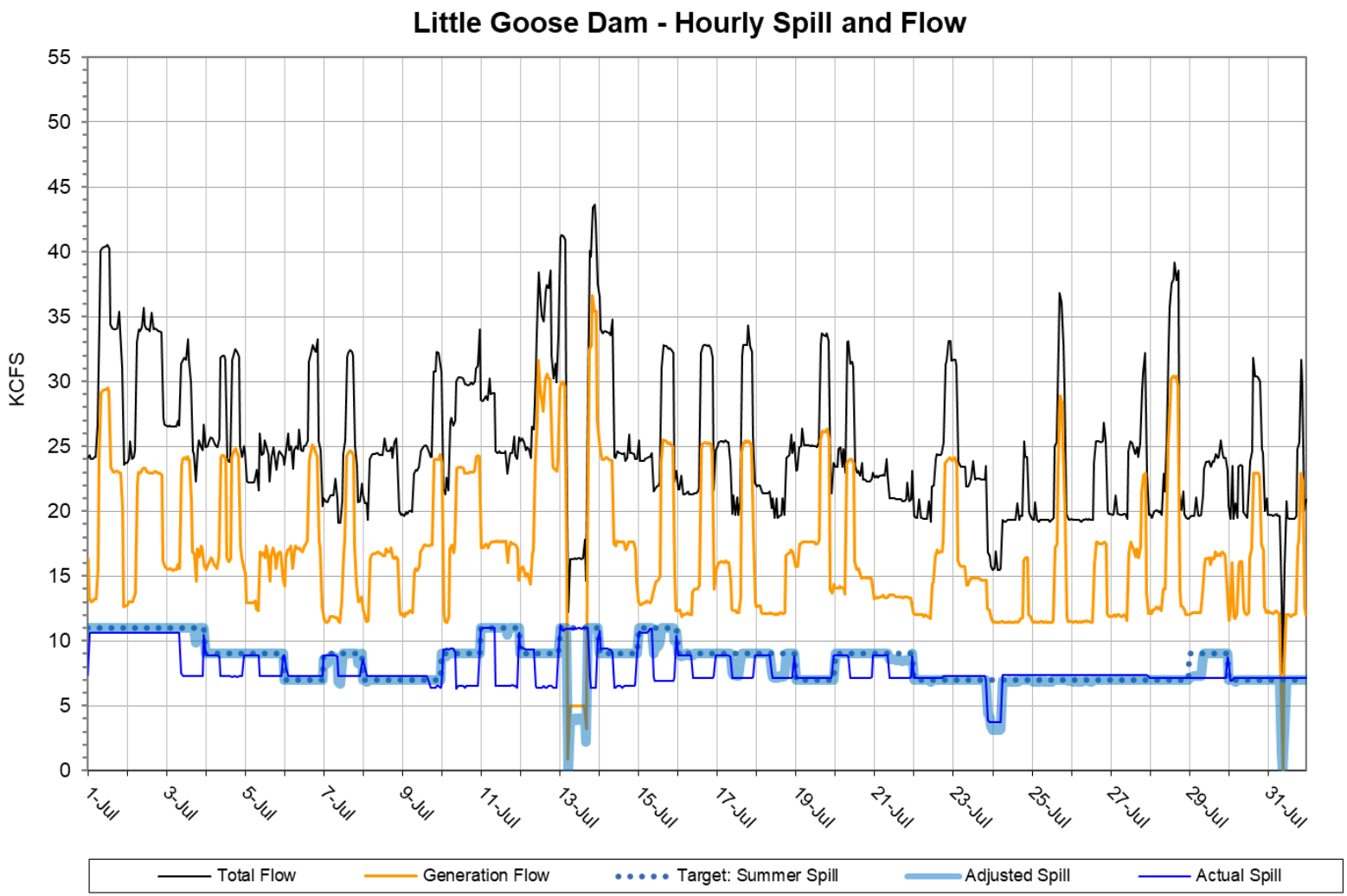
[15] Cells with '•' indicate no data due to malfunctioning gauge.

Figure 1[16]



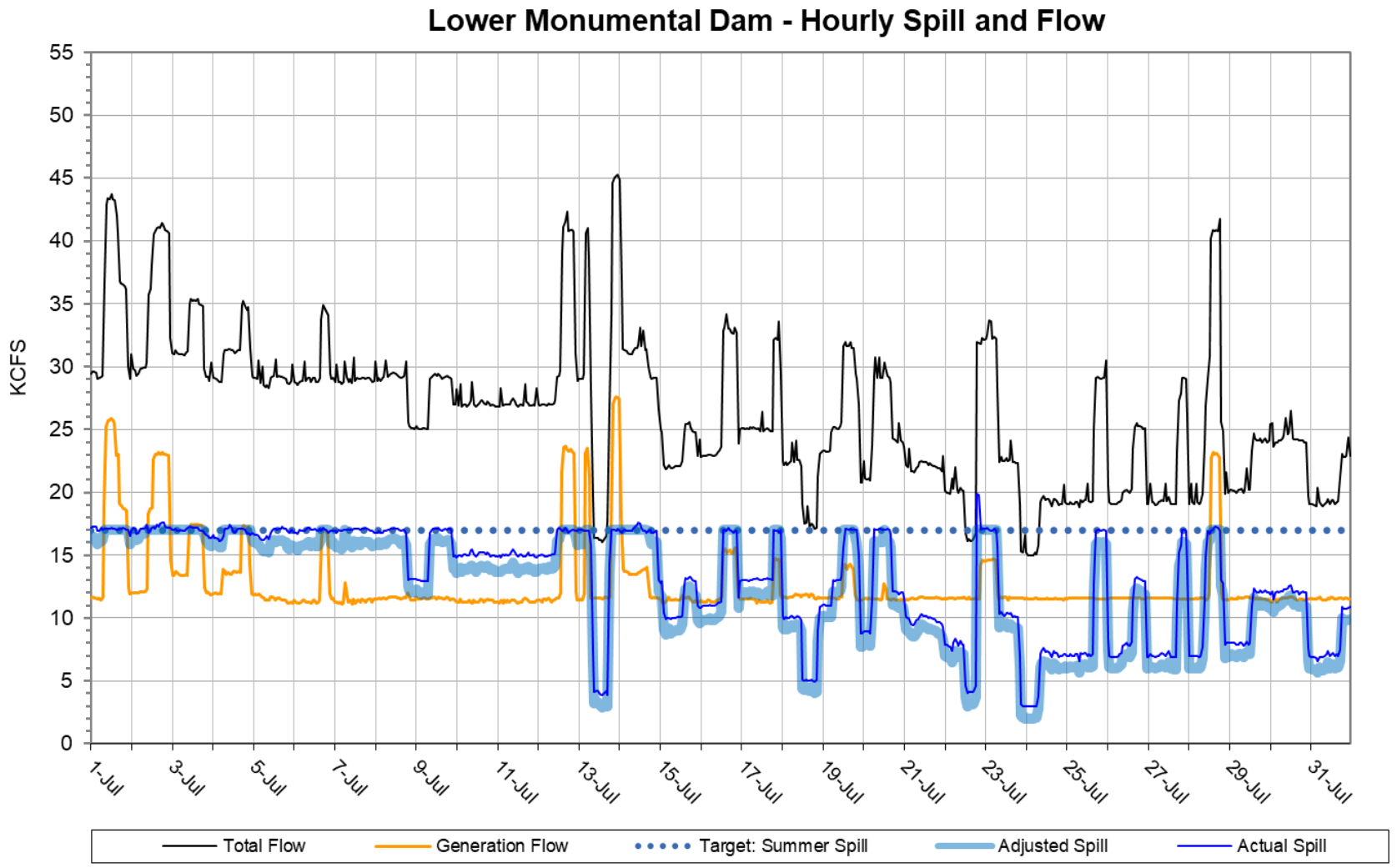
[16] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[17]



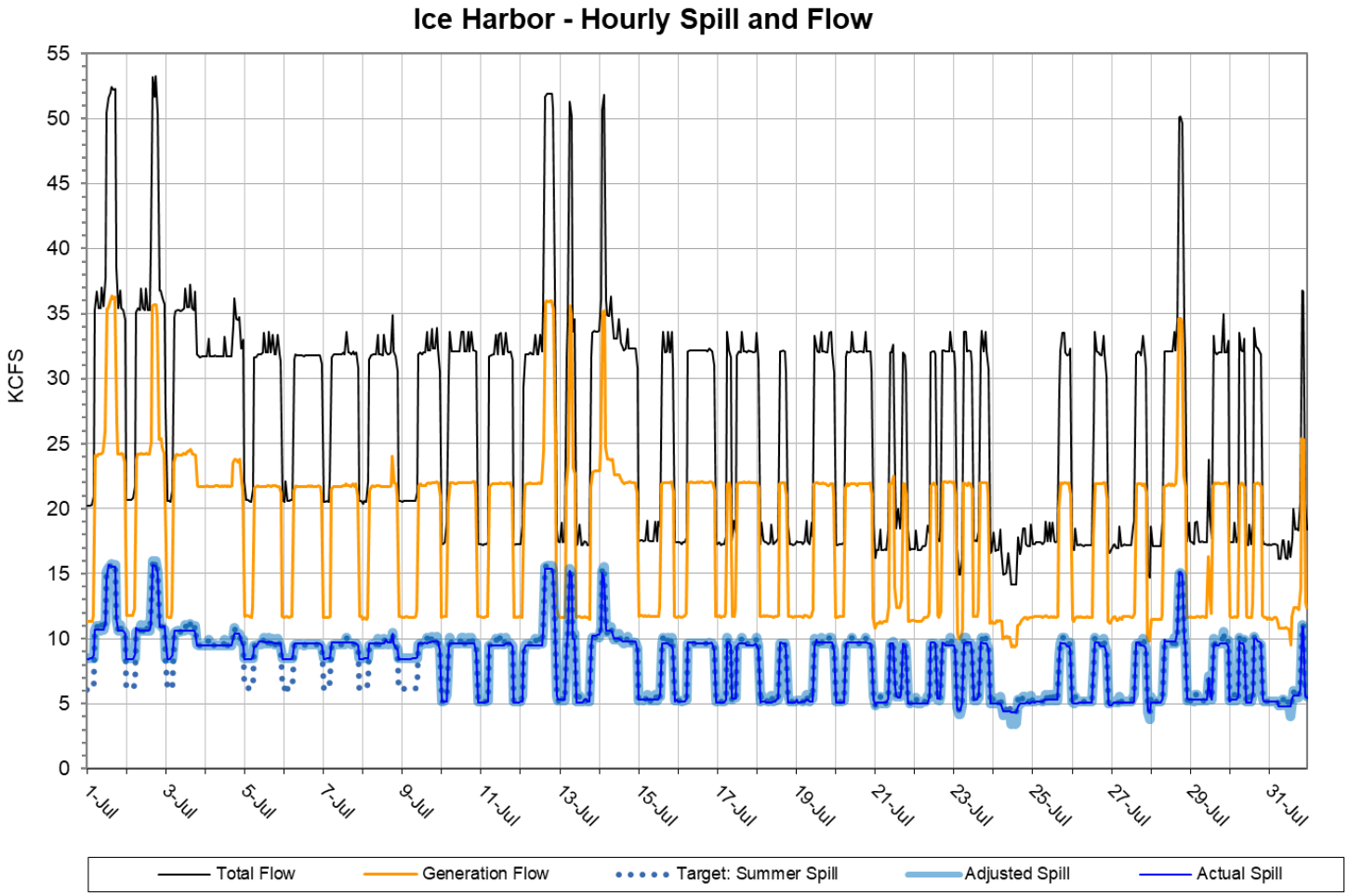
[17] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[18]



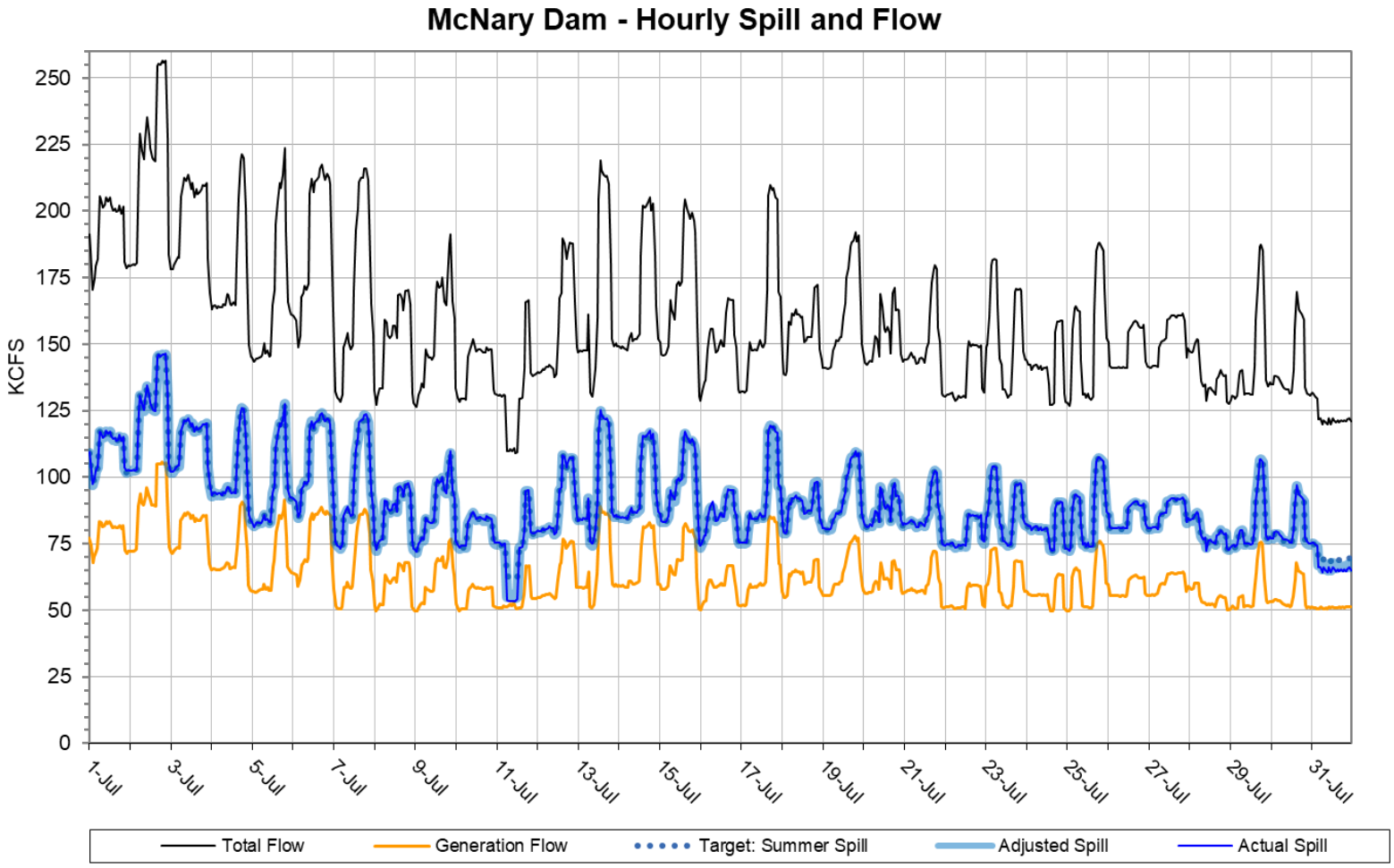
[18] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[19]



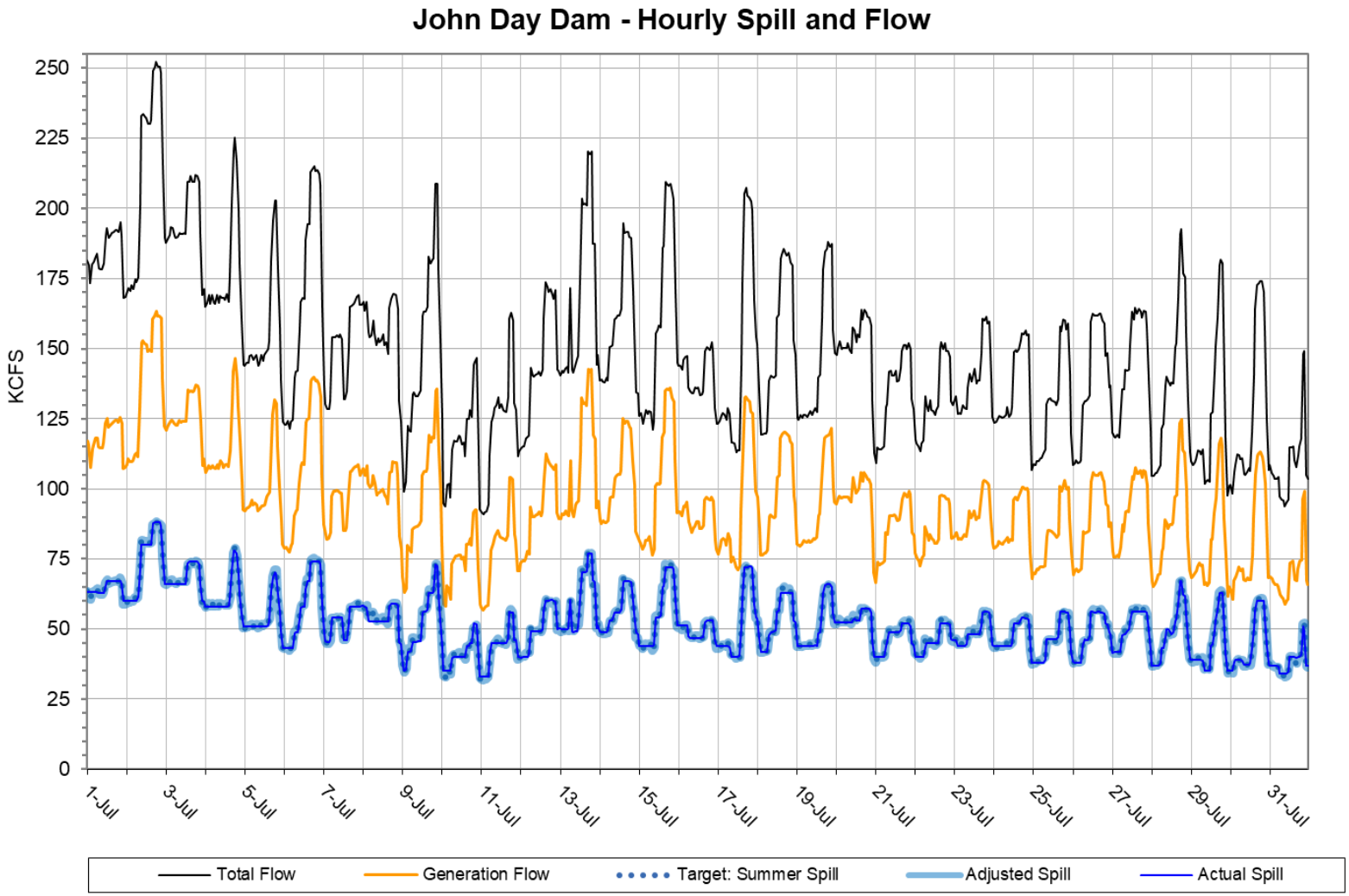
[19] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations. When the SW is open, the minimum project spill level is fixed at approximately 8.4 kcfs (i.e., spill 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. Per FPP section 2.3.2.7, the SW is closed when day average outflow is below 30 kcfs and forecasted to stay below 30 kcfs for at least 3 days. However, outflow may drop below 28 kcfs on an hourly basis while the SW is still open, resulting in spill greater than 30% for those hours

Figure 5[20]



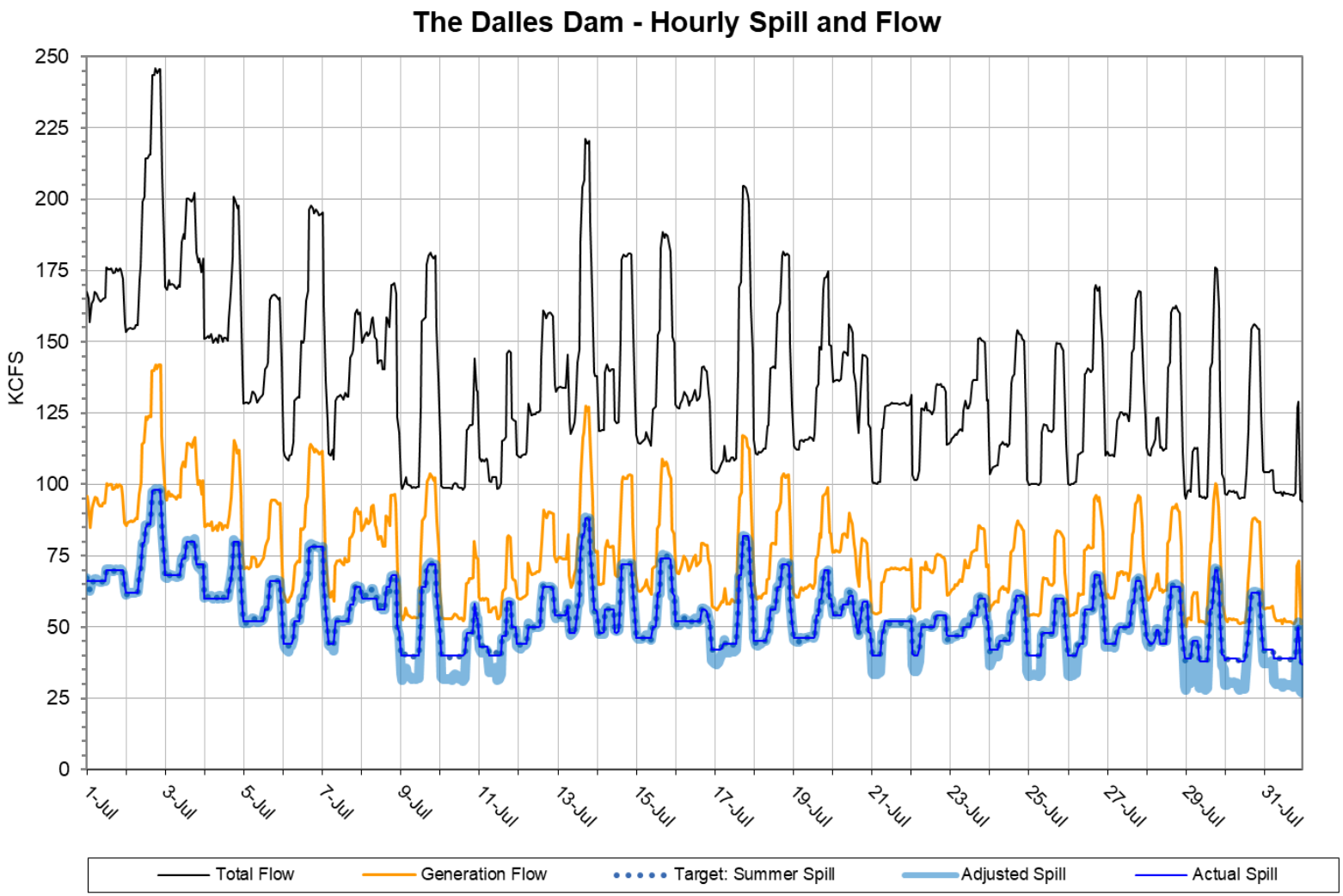
[20] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[21]



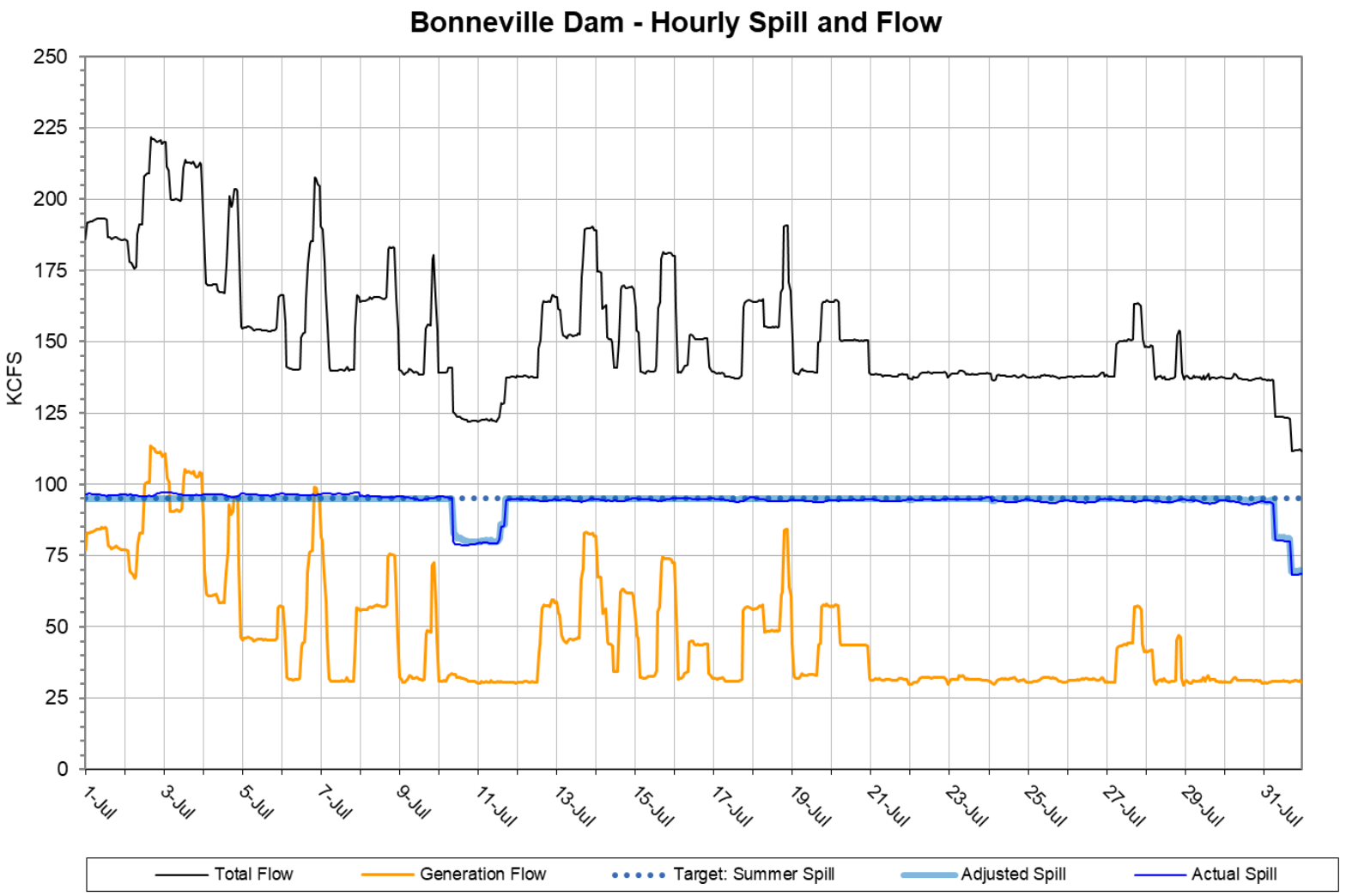
[21] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[22]



[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.

Figure 8[23]



[23] 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.