

FISH OPERATIONS PLAN IMPLEMENTATION REPORT

May 2024

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

Introduction

The 2024 Fish Operations Plan (2024 FOP) describes the U.S. Army Corps of Engineers' (Corps) planned operations for fish¹ passage at its four lower Snake River and four lower Columbia River dams during the 2024 surface spill operations in March through early April, spring, and summer fish migration seasons, generally April 3 through August 31, and surface spill operations September through mid-November. The 2024 FOP is consistent with spill operations for 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) and U.S. Fish and Wildlife Service (USFWS) Columbia River System (CRS) Biological Opinions (2020 CRS BiOps)², the Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions), the Corps' requirements under the Endangered Species Act (ESA), and the ongoing communication with the relevant wildlife agencies to ensure consistency with the Act. The 2024 FOP also incorporates operations outlined in Appendix B of the "U.S. Government Commitments in Support of the Columbia Basin Restoration Initiative" (USG Commitments). The USG Commitments were agreed to as part of the 2023 Memorandum of Understanding (collectively named the "Resilient Columbia Basin Agreement"). Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2024 Water Management Plan (WMP), seasonal WMP updates, and the 2024 Fish Passage Plan (FPP).

The FOP Implementation Reports are produced to reflect implementation of the 2024 FOP for spring and summer fish passage spill. This report describes the Corps' implementation of the 2024 FOP during the month of May. 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

¹ ESA-listed salmon and steelhead.

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.

subject to routine operational adjustments that limit the ability to spill to the target spill (see 2024 FOP, Section 4.1);

- actual spill: the hourly flow over the spillway; and,
- resultant 12-hour average total dissolved gas (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 2024 FOP in May 2024.

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 May, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on May 1 and end on May 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 (2024 FOP section 4.1).

II. The average daily %TDG for the 12 highest hourly TDG measurements in a calendar day for all projects is shown in the May 2024 Average Percent TDG Values Table (Table 4). Red numbers indicate that the project exceeded the %TDG cap - i.e. 125% (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 May 2024 Spill Variance Table (Table 2).³ 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 2024 FOP, 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 or over a spillway weir crest). 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.

³ 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.

May Operations

The month of May was characterized by below average precipitation and flows for the lower Snake and lower Columbia rivers. The observed precipitation was 74% of average on the Snake River above Ice Harbor and 85% of average on the Columbia River above The Dalles.⁴ The NOAA Northwest River Forecast Center runoff summary for May indicated that the adjusted runoff for the Snake River at Lower Granite was 76% of the 30-year average (1991-2020) with a volume of 5.6 MAF (Million acre-feet). The adjusted runoff for the Columbia River at The Dalles was 67% of the 30-year average (1991-2020) with a volume of 18.4 MAF.⁵

Spring spill operations occur April 3–June 20 at the four lower Snake River projects, and April 10–June 15 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 spring 2024 at each project are defined in Table 1 (Table 4 in the 2024 FOP). If deleterious impacts of the proposed spill operations are observed in-season, existing adaptive management processes may be employed to address the cause of the impacts. Spill may be temporarily reduced at any project to ensure navigation safety or transmission reliability, or in the event of adult salmonid migration delay (see 2024 FOP section 7.1). In order to operate consistently with state water quality standards, spill may also be reduced if observed gas bubble trauma (GBT) levels exceed those identified in state water quality standards (See [WASH. ADMIN. CODE § 173-201A-200\(1\)\(f\)\(ii\)\(B\)\(III\)](#) and *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem*, page 5).

Spill up to the 125% Gas Cap is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state laws. This includes a criterion for not exceeding 126% TDG for the average of the two greatest hourly values within a day.

⁴ Retrieved June 4, 2024: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5

⁵ Retrieved June 4, 2024: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

Table 1.— Summary of 2024 spring target spill levels at lower Snake River (April 3 – June 20) and lower Columbia River (April 10 – June 15) projects (Table 4 in the 2024 FOP).

PROJECT	SPRING SPILL DATES	SPRING SPILL OPERATION
Lower Granite ^{A, C}	April 3 - June 20	24 hours/day: 125% Gas Cap
Little Goose ^{B, C}	April 3 – June 20	125% Gas Cap 24 hours/day (until adult criteria met), <i>then</i> 16 hours/day: 125% Gas Cap 8 hours/day: 30% Performance Standard
Lower Monumental ^A	April 3 - June 20	24 hours/day: 125% Gas Cap
Ice Harbor	April 3 – June 20	24 hours/day: 125% Gas Cap
McNary	April 10 – June 15	24 hours/day: 125% Gas Cap
John Day ^D	April 10 – June 15	40% Daytime 125% Gas Cap Nighttime
The Dalles ^E	April 10 – June 15	24 hours/day: 40% Performance Standard
Bonneville ^F	April 10 – June 15	24 hours/day: 125% Gas Cap

A. Lower Granite and Lower Monumental Adult Delay Criteria – See Section 7.1 of the 2024 FOP

B. Little Goose Adult Criteria –Within 1 business day of when the earliest of the following conditions occurs: (1) a cumulative total of 25 adult spring Chinook salmon (not including jacks) pass Lower Monumental Dam; or (2) a cumulative total of 50 adult spring Chinook salmon (not including jacks) pass Ice Harbor Dam; or (3) April 24, 2024, the Corps will implement performance standard spill at Little Goose Dam for 8 consecutive AM hours (April 3–15 starting at 0500 hours; April 16–June 20 starting at 0400 hours) to target hours of peak adult passage. If lack of load conditions preclude the implementation of performance standard spill during the targeted periods, performance standard spill will begin as soon as practicable during AM hours and continue for up to 8 consecutive hours. If a second block is needed, it will start as soon as load conditions allow, continue for at least two consecutive hours, and conclude no later than 2000.

C. During periods of high river flow that exceeds powerhouse hydraulic capacity, implementing 8 consecutive hours of spill as described in Footnotes A and B may result in storing additional inflow in the forebay above MOP. If it is necessary to pond water to achieve the 8-hour block of spill during high inflow, water stored above MOP should be drafted out over the remaining hours by increasing spill to pass inflow from 1200-1600 hours, then increasing spill as necessary from 1600-0400 to draft the pool back to MOP. If it is forecasted that the drafting spill will result in exceeding 130% TDG in the tailrace, all 16 hours will be used to return the pool to MOP. In lack of load conditions performance standard spill blocks will be prioritized at Little Goose, Lower Monumental, and Lower Granite dams, in that order.

D. John Day Dam – Daytime hours are defined in FPP Chapter 4, Table JDA-5. Daytime hourly spill target of 40% river flows with $\pm 5\%$ flexibility in river flow for balancing reserves, consistent with current target spill level calculations.

E. The Dalles Dam –TDG in The Dalles tailrace may fluctuate up to 125% prior to reducing spill at upstream projects or reducing spill at The Dalles below 40%. Maintain 40% spill for 24 hours at The Dalles and reduce John Day spill below the 125% TDG spill cap as needed for TDG management. Spill above 40%, up to 125% TDG, may occur for TDG management or for carrying reserves.

F. Bonneville Dam – Spill for fish passage should not exceed 150 kcfs due to erosion concerns.

In its implementation of the 2024 FOP in May, 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).⁶ 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. Lower Monumental

On May 4, the adult delay criteria specified in the 2024 FOP section 7.1 were met to reduce spill to performance standard levels at Lower Monumental for eight hours per day. Because an unplanned line outage resulting in loss of the powerhouse occurred on May 1, performance standard hours could not be implemented. Had turbine capacity permitted, performance standard hours would have been implemented starting on Sunday, May 5 and continuing through May 7 when adult delay was no longer observed. Instead, the project operated Unit 1 at speed-no-load for station service and spilled the remainder of project outflow. This operation was coordinated during the May 8 TMT meeting.

⁶ See 2024 FOP, Section 2.2

Table 2: Spill Variance Table – May 2024 (5/1 to 5/31)

Project	Parameter	Date	Time ⁷	# of Hours	Type	Reason
Lower Monumental	Additional Spill	5/1	0700-2400	18	Maintenance	Hourly spill was between 30 and 80 kcfs (greater than adjusted spill target of between 23 and 74 kcfs) due to an unscheduled powerhouse outage. Regionally reported through MFR 24 LMN 01. ⁸
		5/2	0100-2400	24		
		5/3	0100-2400	24		
		5/4	0100-2400	24		
		5/5	0100-2400	24		
		5/6	0100-2400	24		
		5/7	0100-2400	24		
		5/8	0100-2400	24		
		5/9	0100-1200	12		
Ice Harbor	Reduced Spill	5/23	1600-1700	2	Maintenance	Hourly spill decreased to 69 kcfs (less than adjusted spill target of 73 kcfs) while the Unit 2 exciter was tested in preparation to bring the unit online.
The Dalles	Reduced Spill	5/22	1900	1	Human Error	Hourly spill decreased to 38% (less than adjusted spill target of 40% \pm 1%) due to a delay in changing to the appropriate spill level.
John Day	Additional Spill	5/22	1000	1	Human Error	Hourly spill was 42% (greater than the adjusted spill target of 40% \pm 1%) due to a delay in changing to the appropriate spill level.

⁷ 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 table as an hour.

⁸<https://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/LMN%20MOC%20and%20MFR/>

Table 3: Pre-Coordinated Operations – May 2024 (5/1 to 5/31)

Project	Parameter	Date	Time	# of Hours	Type	Reason
Lower Monumental	Reduced Spill	5/18	1800-1900	2	Navigation	Hourly spill decreased to between 18 and 56 kcfs (less than adjusted spill target of between 41 and 71 kcfs) for navigation. Regionally coordinated via 2024 FOP, Sections 4.1 and 4.6.
		5/20	1800-2000	3		
		5/22	1800-2000	3		
		5/24	1800-2000	3		
		5/26	1800-1900	2		
		5/28	1900-2100	3		
		5/30	1800-1900	2		
Ice Harbor	Reduced Spill	5/21	1800-1900	2	Maintenance	Hourly spill decreased to between 69 and 70 kcfs (less than adjusted spill target of between 72 and 75 kcfs) for transformer testing. Regionally coordinated via MOC 24 IHR 04. ⁹

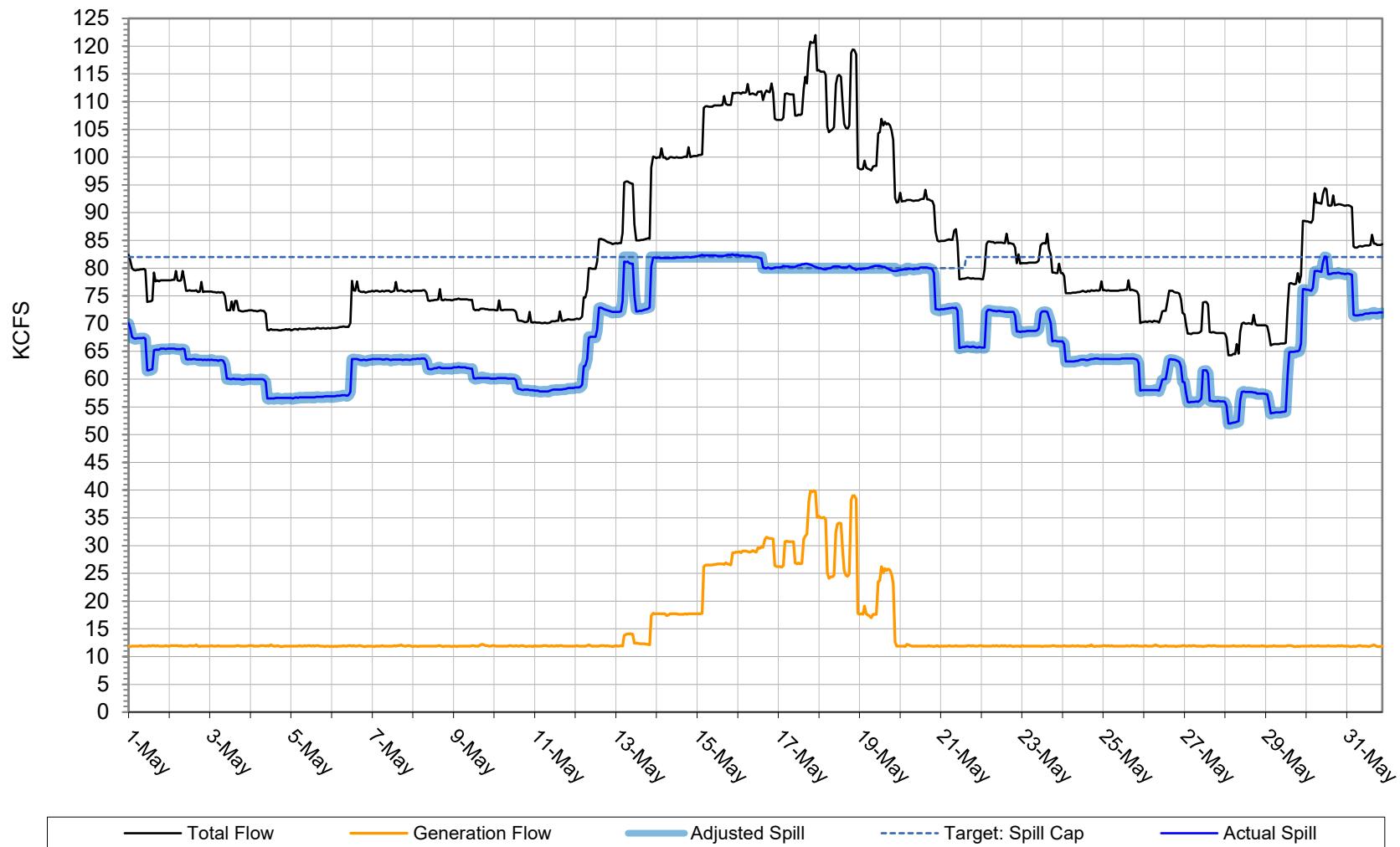
⁹<https://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/IHR%20MOC%20and%20MFR/>

Table 4: May 2024 Average Percent TDG Values Table (5/1 to 5/31)

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDOD	BON	CCIW
Gas Cap %:		125		125		125		125		125		125		125		125
5/1/2024	102	122	114	122	118	120	116	118	107	117	108	116	112	117	112	117
5/2/2024	103	121	115	122	119	120	118	117	109	117	107	116	113	117	113	117
5/3/2024	104	121	117	122	121	120	119	117	112	117	108	115	115	118	115	119
5/4/2024	106	121	119	121	122	119	121	117	112	117	109	116	116	119	116	120
5/5/2024	105	120	119	121	121	118	119	116	110	117	107	115	111	116	112	117
5/6/2024	103	120	117	121	116	118	114	116	108	119	105	115	108	114	108	117
5/7/2024	101	120	113	122	113	120	111	116	105	118	104	115	110	114	107	116
5/8/2024	100	120	110	122	114	119	112	116	104	116	104	116	109	115	108	117
5/9/2024	101	121	110	122	117	118	117	116	107	117	106	116	113	118	111	118
5/10/2024	103	121	114	122	121	118	119	117	111	118	107	116	116	119	115	120
5/11/2024	105	121	120	122	123	118	121	117	114	118	107	117	117	119	119	120
5/12/2024	106	123	122	123	124	120	121	117	115	118	108	117	116	119	118	120
5/13/2024	105	124	121	123	123	122	120	118	115	118	108	116	113	118	113	119
5/14/2024	103	125	120	124	121	122	120	119	113	122	111	117	114	118	113	120
5/15/2024	103	126	120	124	123	122	122	122	114	123	115	118	118	120	115	121
5/16/2024	105	126	121	125	126	122	124	122	114	123	115	120	116	120	115	121
5/17/2024	104	125	120	124	123	122	122	120	111	121	113	118	113	117	112	121
5/18/2024	103	125	119	124	120	122	120	122	110	122	111	118	114	118	111	121
5/19/2024	103	125	117	124	123	121	120	121	109	122	109	119	113	118	110	121
5/20/2024	104	124	117	124	121	121	120	118	111	121	108	118	115	117	111	121
5/21/2024	104	122	117	122	122	119	119	116	112	121	107	118	115	118	112	120
5/22/2024	105	123	117	122	120	121	119	117	111	122	108	117	113	117	111	120
5/23/2024	104	122	117	123	119	121	115	117	107	122	108	117	113	117	110	120
5/24/2024	104	121	118	123	121	120	118	117	109	122	110	117	115	118	112	121
5/25/2024	104	121	117	121	120	118	118	117	110	120	109	115	112	116	112	120
5/26/2024	103	120	116	121	118	119	115	116	108	118	107	115	111	115	111	120
5/27/2024	103	120	116	121	118	118	115	116	109	118	107	115	113	116	113	119
5/28/2024	103	120	116	120	120	118	118	116	110	120	108	115	113	116	112	120
5/29/2024	103	121	116	121	119	119	117	117	110	119	108	116	112	116	111	119
5/30/2024	103	123	116	123	118	121	115	117	108	121	107	116	114	118	112	119
5/31/2024	103	123	117	123	122	121	119	117	111	122	109	117	118	120	116	121
Exceedances:		2		0		0		0		0		0		0		0

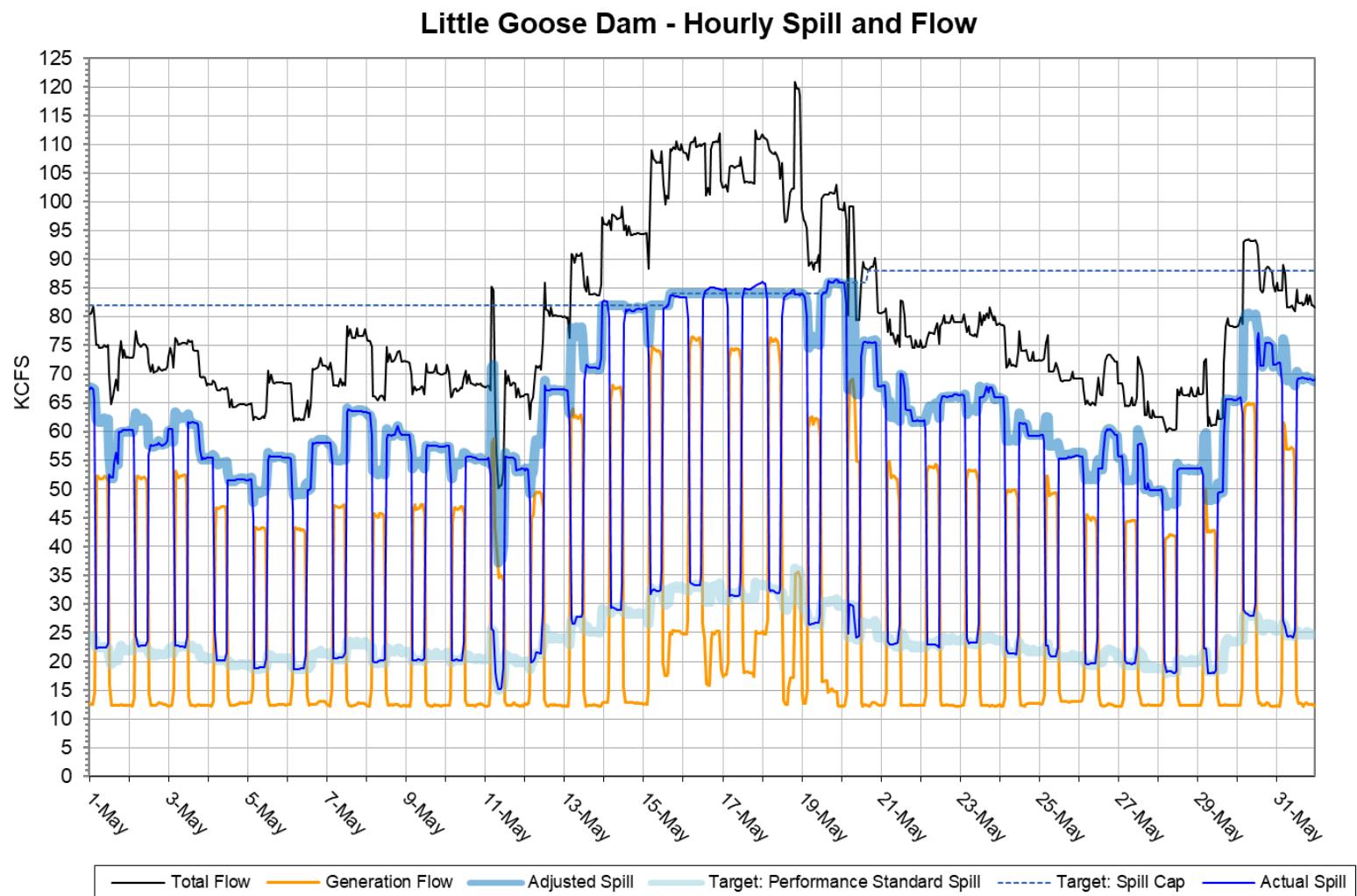
Figure 1¹⁰

Lower Granite Dam - Hourly Spill and Flow



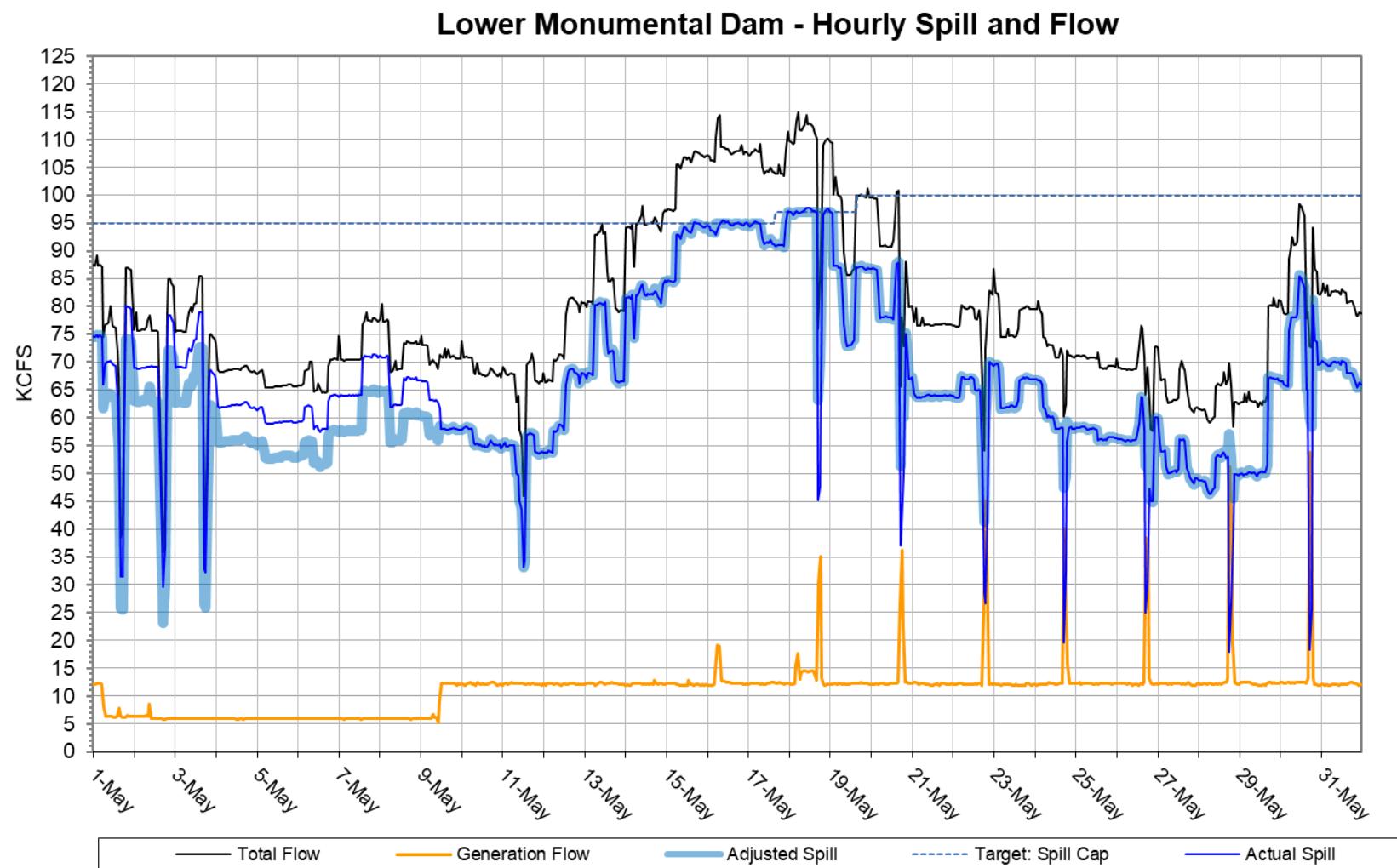
¹⁰ The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2¹¹



¹¹ 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.

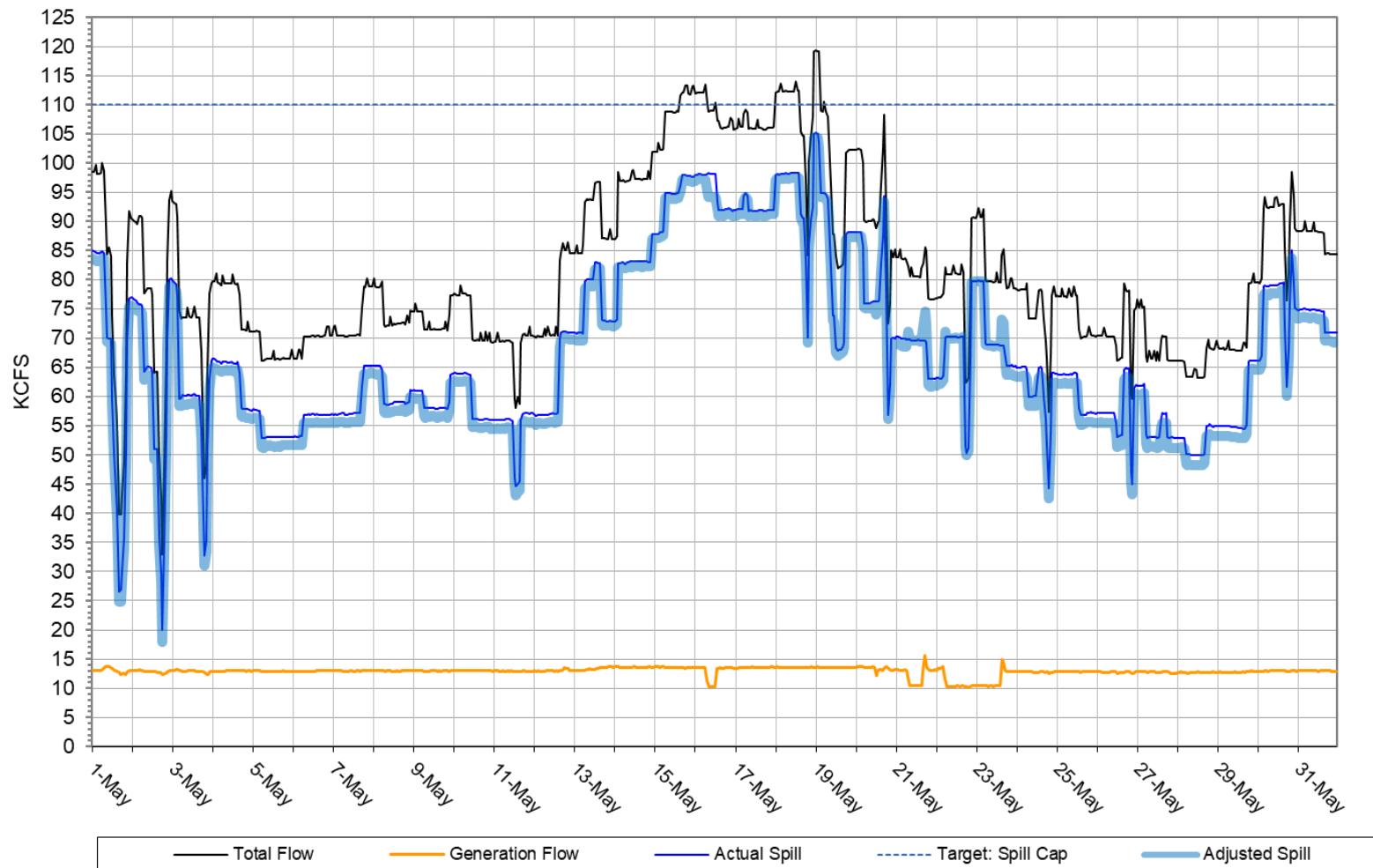
Figure 3¹²



¹² 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.

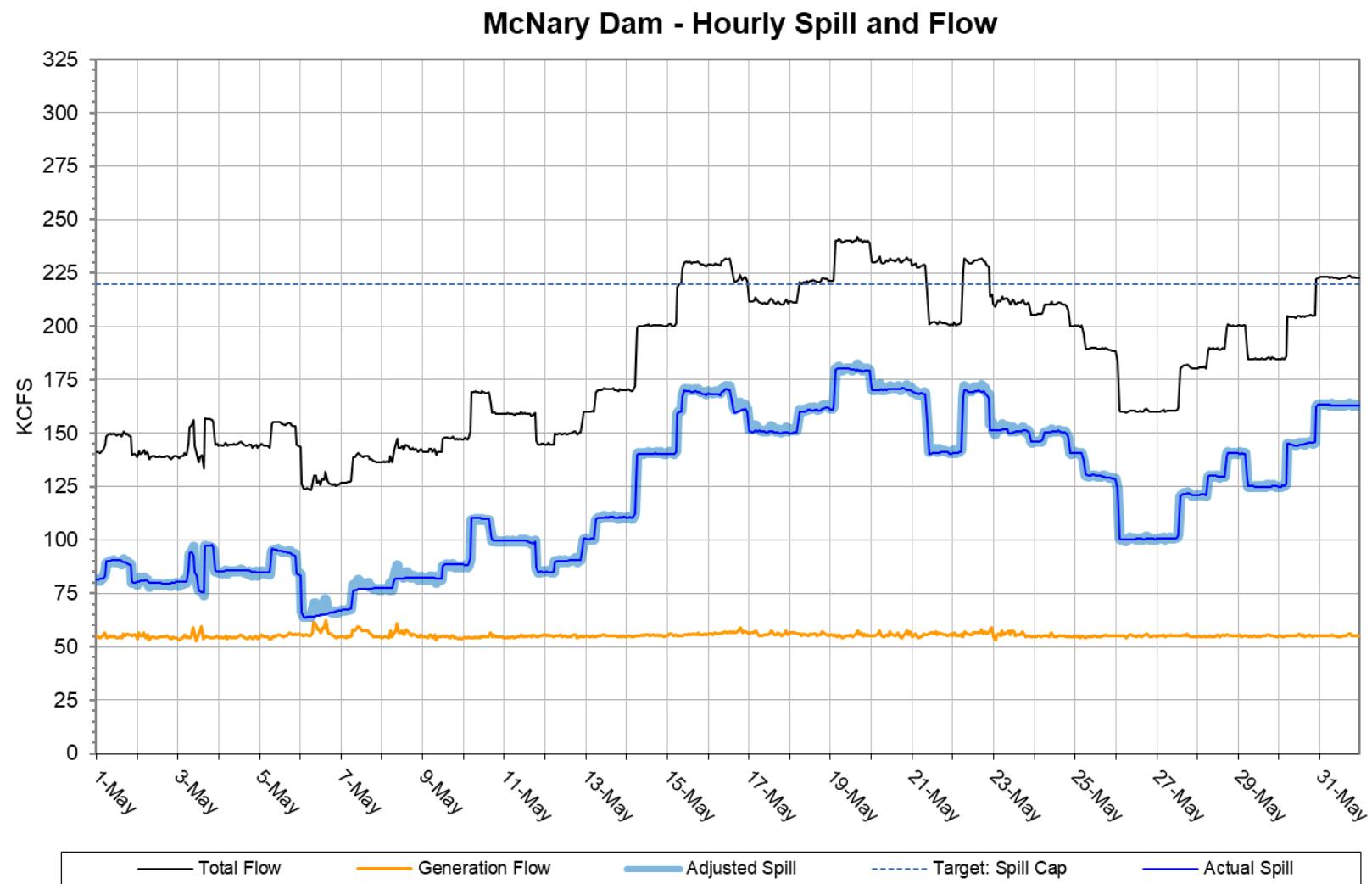
Figure 4¹³

Ice Harbor - Hourly Spill and Flow



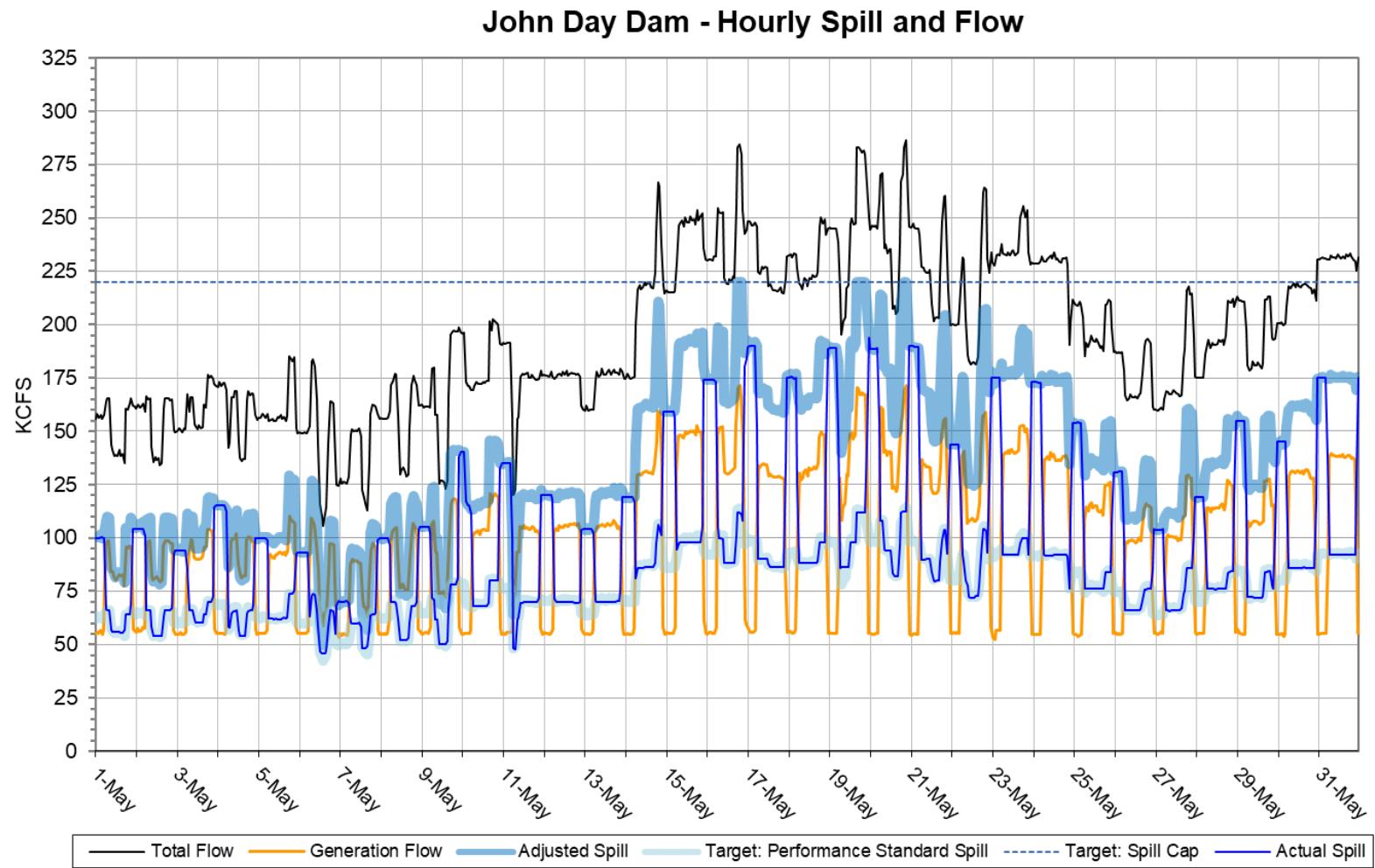
¹³ The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5¹⁴



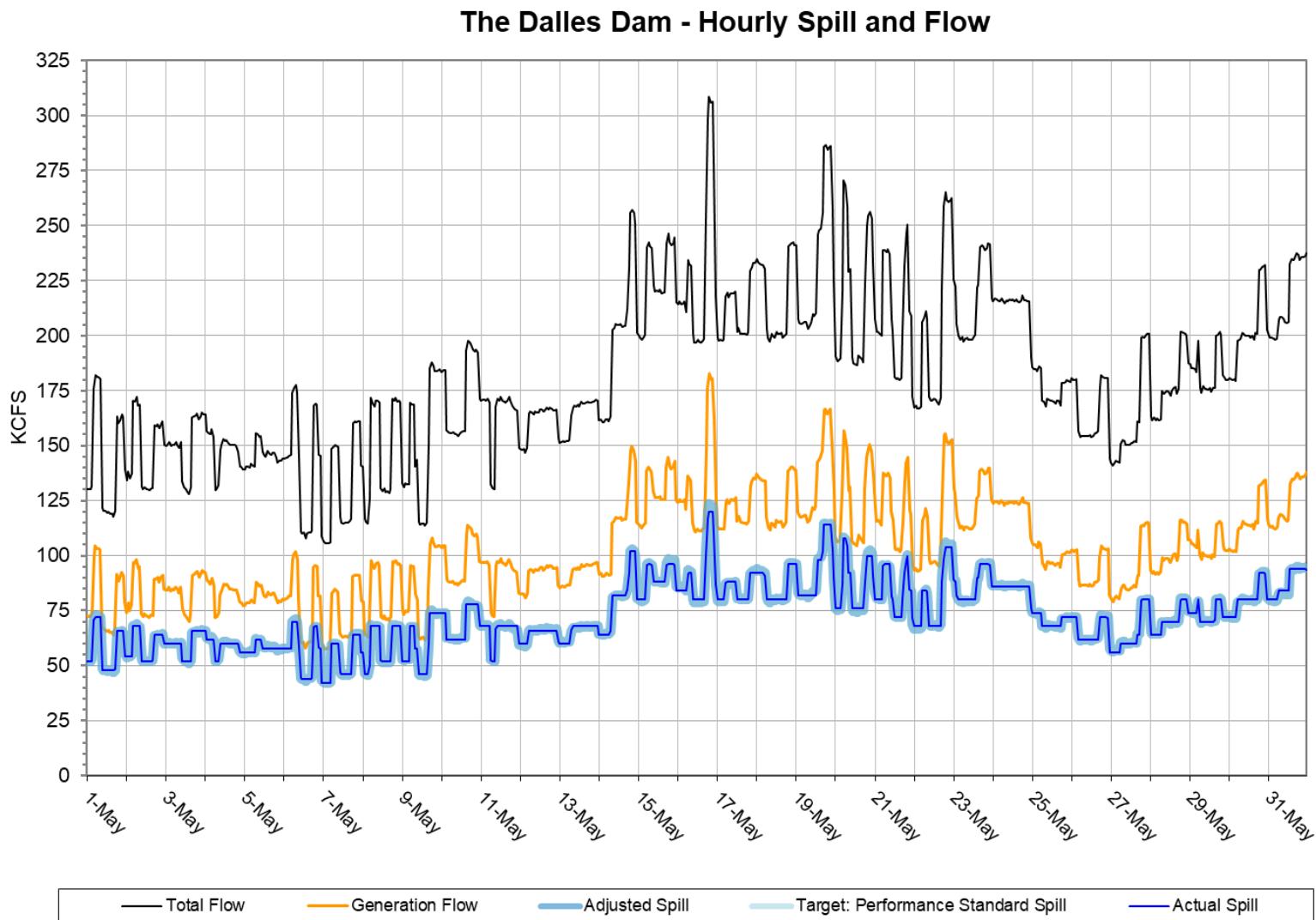
¹⁴ The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6¹⁵



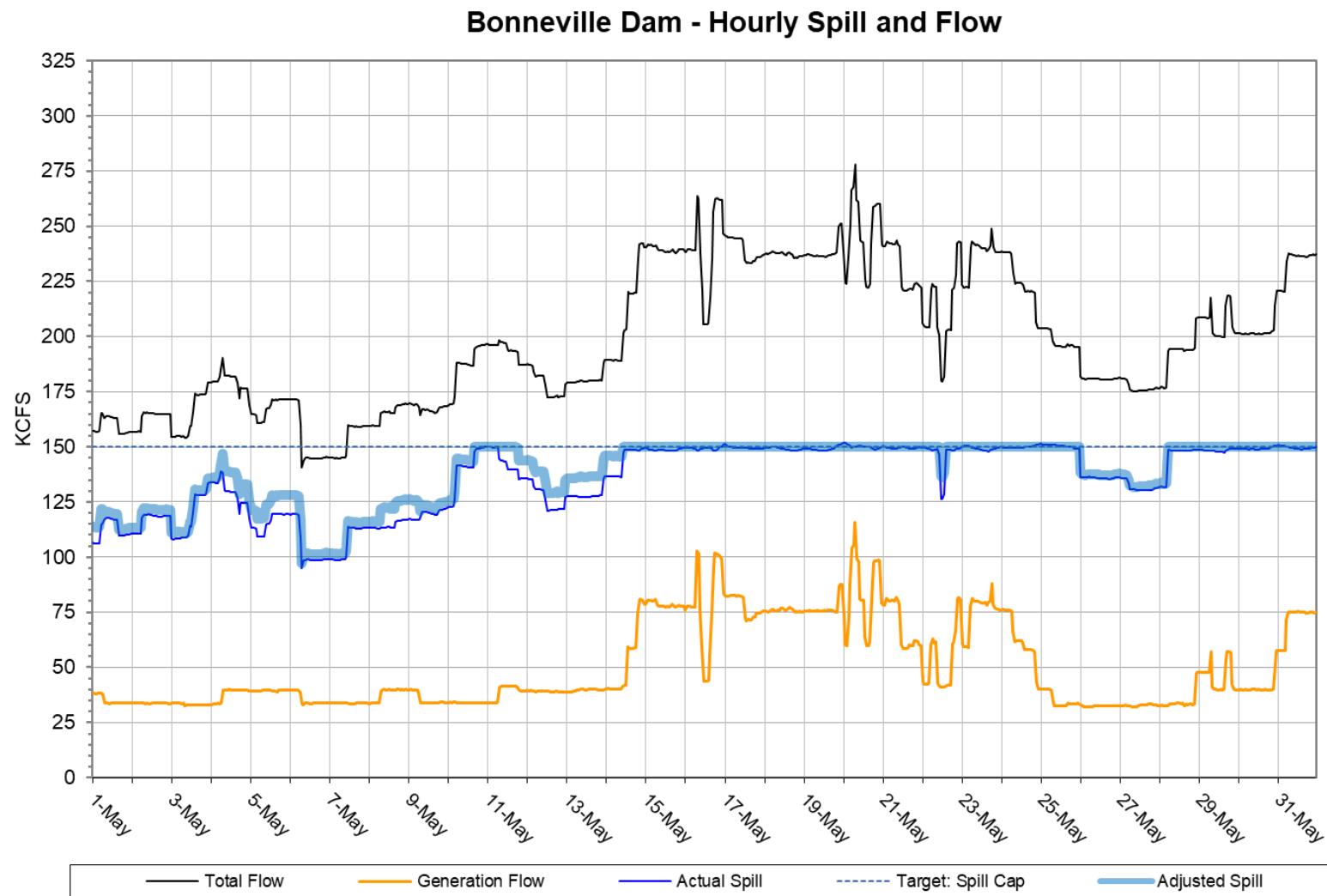
¹⁵ The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7¹⁶



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 8¹⁷



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.