

# FISH OPERATIONS PLAN IMPLEMENTATION REPORT

May 2022

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 2022 Fish Operations Plan<sup>1</sup> (2022 FOP). The 2022 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2022 spring and summer fish migration seasons, generally April 3 through August 31. The 2022 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)<sup>2</sup>, the Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions)<sup>3</sup>, 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 2022 FOP also incorporates spill operations agreed to in the Term Sheet for Stay of Preliminary Injunction Motion and Summary Judgment Schedule (referred to as the 2022 Agreement)<sup>4</sup> for the *NWF et al. v. NMFS et al.* (3:01-cv-00640-SI) litigation. Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2022 Water Management Plan (WMP), seasonal WMP updates, and the 2022 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2022 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);

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<sup>1</sup> The 2022 FOP was posted to the Technical Management Team (TMT) website on March 24, 2022 (<http://pweb.crohms.org/tmt/documents/fpp/2022/>).

<sup>2</sup> 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.

<sup>3</sup> The 2020 Amendment to and 2018 Extension of the 2008 Columbia Basin Fish Accords are available at <https://www.salmonrecovery.gov/Partners/FishAccords.aspx>

<sup>4</sup> 2022 Agreement: [https://pweb.crohms.org/tmt/JointMotion\\_TermSheet\\_CourtOrder\\_OCT2021.pdf](https://pweb.crohms.org/tmt/JointMotion_TermSheet_CourtOrder_OCT2021.pdf)

- 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 2022 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 2022 FOP in May 2022.

## 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 (2022 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the May 2022 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 2022 Spill Variance Table (Table 2).<sup>5</sup> The Spill Variance Table includes average hourly data; but

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<sup>5</sup> 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

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  $\pm 2$  kcfs within the hour (except as otherwise noted in the 2022 FOP for Bonneville and The Dalles dams,<sup>6</sup> which may range up to  $\pm 3$  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.

## May Operations

The month of May was characterized by above average precipitation and below average flows for the lower Snake and lower Columbia rivers. The May 2022 observed precipitation was 111% of average on the Snake River above Ice Harbor and 103% of average on the Columbia River above The Dalles<sup>7</sup>. The NOAA Northwest River Forecast Center runoff summary for May indicated that the adjusted runoff for the Snake River at Lower Granite was 87% of the 30-year average (1981-2010) with a volume of 6.4 MAF (Million acre-feet). The May 2022 adjusted runoff for the Columbia River at The Dalles was 77% of the 30-year average (1981-2010) with a volume of 20.9 MAF.<sup>8</sup>

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capacity, scheduled or unscheduled turbine unit outages or transmission outages of various durations, passing debris, etc.

<sup>6</sup> As specified in the 2022 FOP Section 3.

<sup>7</sup> Retrieved June 1, 2022: [https://www.nwrfc.noaa.gov/water\\_supply/wy\\_summary/wy\\_summary.php?tab=5](https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5)

<sup>8</sup> Retrieved June 1, 2022: [https://www.nwrfc.noaa.gov/runoff/runoff\\_summary.php](https://www.nwrfc.noaa.gov/runoff/runoff_summary.php)

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 2022 at each project are defined in Table 1. 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. In order to operate consistently with state water quality standards, spill may also be reduced if observed GBT levels exceed those identified in state water quality standards (See [WASH. ADMIN. CODE § 173-201A-200\(l\)\(f\)\(ii\)\(B\)\(III\)](#) 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.

**Table 1.— Summary of 2022 spring target spill levels at lower Snake River (April 3 – June 20) and lower Columbia River (April 10 – June 15) projects.**

PROJECT	SPRING SPILL DATES	SPRING SPILL OPERATION
Lower Granite <sup>A, C</sup>	April 3 until adult criteria met (no later than April 24)	24 hours/day: 125% Gas Cap
	Adult criteria met (no later than April 24) – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 20 kcfs Performance Standard
Little Goose <sup>B, C</sup>	April 3 – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 30% Performance Standard
Lower Monumental <sup>A, C</sup>	April 3 until adult criteria met (no later than April 24)	24 hours/day: 125% Gas Cap
	Adult criteria met (no later than April 24) – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 30 kcfs Performance Standard
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 <sup>D</sup>	April 10 – June 15	16 hours/day: 125% Gas Cap 8 hours/day: 32% Performance Standard
The Dalles <sup>E</sup>	April 10 – June 15	24 hours/day: 40% Performance Standard
Bonneville <sup>F</sup>	April 10 – June 15	24 hours/day: 125% Gas Cap

- A. Lower Granite and Lower Monumental 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, 2022, the Corps will implement performance standard spill for 8 consecutive AM hours, 0400–1200, to target hours of peak adult passage. If lack of load conditions preclude the implementation of performance standard spill during the targeted AM period, performance standard spill will begin as soon as practicable during AM hours and continue for up to 8 consecutive hours.
- B. Little Goose Adult Criteria – Within 1 business day of a cumulative total of 25 adult spring Chinook salmon (not including jacks) passing Lower Monumental Dam, 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.
- C. During periods of high river flow that exceeds powerhouse hydraulic capacity, implementing performance standard spill for 8 consecutive hours 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 performance standard 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.
- D. John Day Dam – The 8 hours/day of performance standard spill may occur with some flexibility, in either a single 8-hour block or two separate blocks per calendar day. Performance standard spill will not be implemented between 2200-0300 hours.
- 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.
- F. Bonneville Dam – Spill for fish passage should not exceed 150 kcfs due to erosion concerns.

In its implementation of the 2022 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).<sup>9</sup> 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).

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<sup>9</sup> See 2022 FOP, Section 2.2

## Operational Adjustments

### 1. Lower Monumental

Beginning April 22, spillbays 1,2,6, and 7 were closed and removed from service because measurements of the spill bay trunnions exceeded the friction level for safe operations. Adjacent bays were closed while repairs were made to lower trunnion bushing friction levels, with in-criteria bays returned to operation at night. The decision to return bays to operation following repairs was made on a case-by-case basis. During repairs, the spill rate was averaged across the bays in service plus, at times, the spillway weir. The modified spill pattern necessitated reductions in the 125% TDG spill cap (Figure 3). FPOM members were made aware of this operational adjustment via email on April 23 and all bays were returned to service by May 12.<sup>10</sup>

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<sup>10</sup><https://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/LMN%20MOC%20and%20MFR/22%20LMN%2003%20MFR%20Spillbays%201%202%206%207%20OS.pdf>

**Table 2: Spill Variance Table – May 2022 (5/1 to 5/31)**

None.

**Table 3: Pre-Coordinated Operations – May 2022 (5/1 to 5/31)**

Project	Parameter	Date	Time <sup>11</sup>	# of Hours	Type	Reason
Little Goose	Reduced Spill	5/16	1900	1	Transmission Reliability	Hourly spill remained at 60 kcfs (less than a adjusted spill target of 63 kcfs) due to an increase in generation outside of the minimum generation range for Unit 1 (11.3 – 11.8 kcfs <sup>12</sup> ) to deploy reserves. Regionally coordinated via 2022 FOP, Section 4.4.1.
Lower Monumental	Reduced Spill	5/16	1900	1	Transmission Reliability	Hourly spill was reduced to 38 kcfs (less than adjusted spill target of 41 kcfs) due to an increase in generation outside of the minimum generation range for Unit 1 (11.3 – 12.3 kcfs <sup>13</sup> ) to deploy reserves. Regionally coordinated via 2022 FOP, Section 4.4.1.
Lower Monumental	Reduced Spill	5/8 5/10 5/17 5/18 5/19 5/20 5/21 5/28 5/30	1900-2100 2000-2200 2000-2200 2200 1800-2000 1800-1900 1900 1700-1900 1800-1900	3 2 3 1 3 2 1 3 2	Navigation	Hourly spill decreased to between 11 and 102 kcfs (less than adjusted spill target of 14 to 108 kcfs) for safe navigation. Regionally coordinated via 2022 FOP, Sections 4.1 and 4.6.
Ice Harbor	Reduced Spill	5/9	1100-1200	2	Maintenance	Hourly spill decreased to between 85 and 89 kcfs (less than a adjusted spill target of 87 to 93 kcfs) due to the post-annual testing of Unit 5. Regionally coordinated via the 2022 FOP Section 4.5.
Ice Harbor	Reduced Spill	5/31	1200	1	Maintenance	Hourly spill was 99 kcfs (less than a adjusted spill target of 105 kcfs) due to the post-annual testing of Unit 6. Regionally coordinated via the 2022 FOP Section 4.5.
McNary	Reduced Spill	5/26 5/31	2300 1000	1 1	Transmission Reliability	Hourly spill decreased to between 204 and 245 kcfs (less than adjusted spill target of 220 to 259 kcfs) due to an increase in generation to deploy reserves. Regionally coordinated via 2022 FOP, Section 4.4.1.

<sup>11</sup> 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.

<sup>12</sup> 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 - 13.2 kcfs. See 2022 FOP section 4.3.1.

<sup>13</sup> Range does not include ±2% due to generating unit governor “dead band.” When 2% is applied to the minimum generation flow ranges for Lower Monumental turbine Unit 1, the range is 10.9 – 12.5 kcfs. See 2022 FOP section 4.3.1.

<b>Project</b>	<b>Parameter</b>	<b>Date</b>	<b>Time<sup>11</sup></b>	<b># of Hours</b>	<b>Type</b>	<b>Reason</b>
<b>John Day</b>	Reduced Spill	5/20	1400-1500	2	Navigation	Hourly spill decreased to between 139 and 212 kcfs (less than adjusted spill target of 169 to 231 kcfs) for safe navigation. Regionally coordinated via 2022 FOP, Sections 4.1 and 4.6.
		5/22	1700	1		
		5/29	0900	1		
		5/30	1700	1		
		5/31	0300, 2400	2		
<b>The Dalles</b>	Additional Spill	5/9	0100	1	Transmission Reliability	Hourly spill increased to between 42% and 43% (greater than adjusted spill target of 40% ± 1%) to provide reserves. Regionally coordinated via 2022 FOP, Section 4.4.1.
		5/11	2000	1		
		5/12	2100	1		
<b>The Dalles</b>	Reduced Spill	5/16	2000	1	Transmission Reliability	Hourly spill decreased to 38% (less than a adjusted spill target of 40% ± 1%) due to an increase in generation to deploy reserves. Regionally coordinated via 2022 FOP, Section 4.4.1.
		5/18	0700-0800	2		
		5/24	2300	1		
		5/26	2300	1		

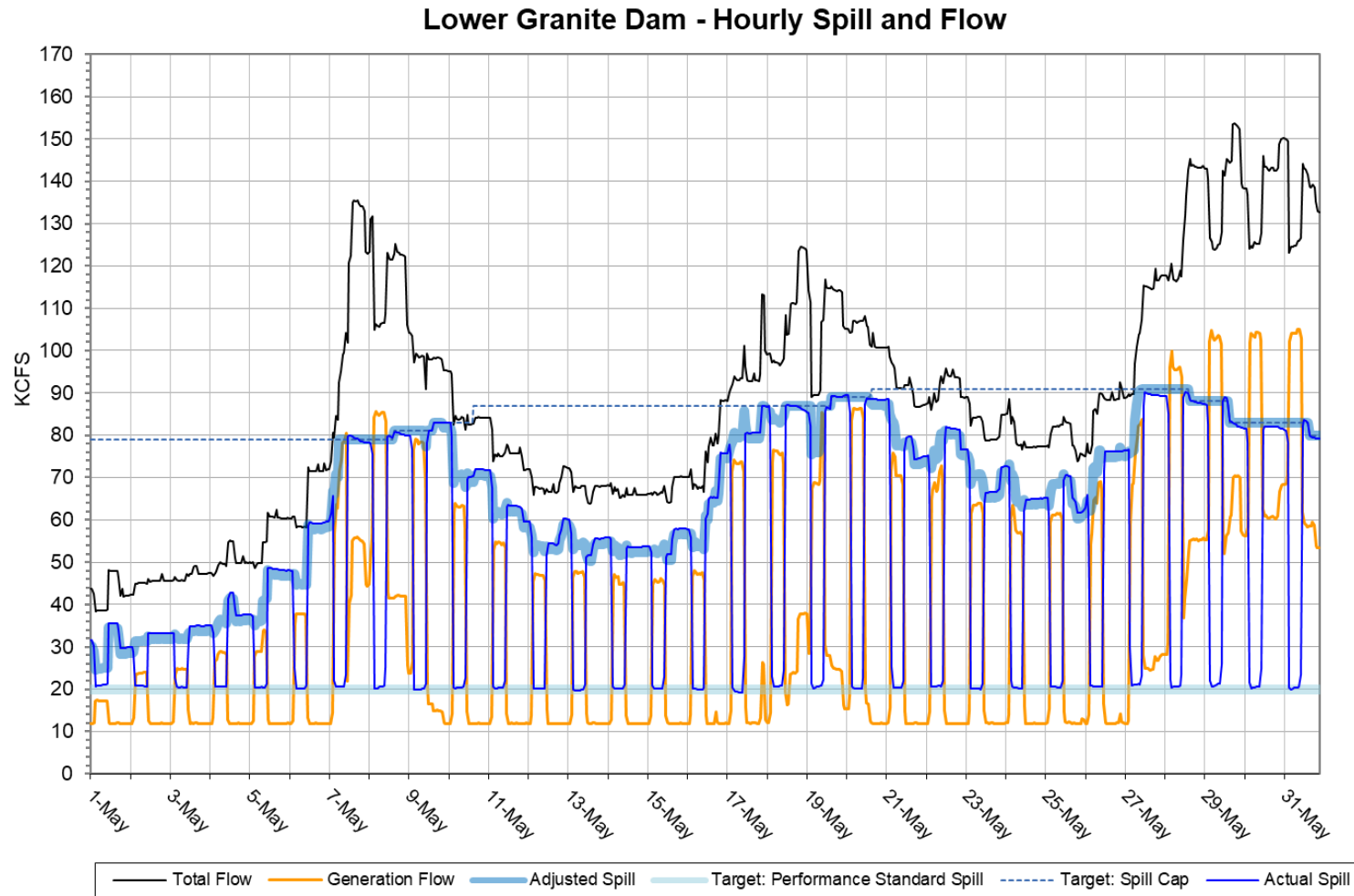


**Table 4: May 2022 Average Percent TDG Values Table (5/1 to 5/31)**

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
Gas Cap %:		125		125		125		125		125		125		125		125
5/1/2022	102	116	113	116	114	123	118	115	110	116	112	117	115	118	116	120
5/2/2022	102	116	114	116	116	122	120	114	112	116	112	116	116	118	115	119
5/3/2022	102	116	112	116	115	121	119	114	109	115	109	117	111	115	112	117
5/4/2022	103	116	113	118	116	122	119	114	110	115	110	117	114	117	112	119
5/5/2022	103	118	114	119	116	123	119	116	111	117	111	118	116	117	113	120
5/6/2022	104	120	115	120	118	124	120	116	112	118	111	118	117	118	114	120
5/7/2022	104	123	114	124	117	126	118	124	111	118	111	119	116	118	114	121
5/8/2022	102	124	114	125	118	126	116	124	108	119	110	121	118	120	114	121
5/9/2022	101	123	113	124	123	124	117	122	109	118	109	120	117	120	114	121
5/10/2022	101	122	112	123	121	124	117	117	109	119	108	119	114	118	114	120
5/11/2022	102	121	115	122	122	124	119	117	110	120	107	122	117	120	114	121
5/12/2022	102	119	115	120	121	121	120	116	110	120	107	121	120	121	116	121
5/13/2022	103	118	115	120	120	118	119	116	109	119	109	121	118	121	118	121
5/14/2022	104	118	115	120	119	119	119	116	109	119	112	123	121	122	119	121
5/15/2022	104	119	117	120	119	119	117	116	111	119	115	121	122	122	120	122
5/16/2022	103	120	116	122	120	119	117	116	110	118	114	121	119	120	119	121
5/17/2022	103	123	115	124	119	122	116	117	110	120	114	121	118	120	115	121
5/18/2022	103	124	116	125	121	123	117	124	111	119	115	122	120	121	115	122
5/19/2022	103	124	114	125	121	124	118	124	109	121	114	123	116	119	114	121
5/20/2022	102	124	113	124	120	123	118	124	109	121	110	124	119	122	114	122
5/21/2022	102	123	114	124	123	122	120	120	112	121	111	123	122	123	119	122
5/22/2022	104	123	117	124	124	121	121	117	112	121	111	123	123	123	121	122
5/23/2022	104	122	120	123	123	120	121	117	113	122	114	123	122	122	121	121
5/24/2022	104	121	119	123	123	120	121	117	113	123	117	121	120	121	119	121
5/25/2022	- <sup>14</sup>	121	120	123	123	120	120	117	113	123	118	123	122	122	118	122
5/26/2022	-	122	119	124	124	121	120	117	113	122	119	123	124	124	120	122
5/27/2022	104	125	119	124	123	122	119	123	113	122	119	124	123	123	120	122
5/28/2022	104	127	118	126	124	125	120	124	113	122	119	124	125	125	120	123
5/29/2022	104	127	118	126	124	125	121	125	113	123	118	126	120	123	119	122
5/30/2022	103	126	115	125	123	125	120	125	111	123	113	126	120	122	115	123
5/31/2022	103	126	117	125	123	124	121	126	113	124	113	124	123	125	120	123
<b>Exceedances:</b>		4		2		2		1				2				

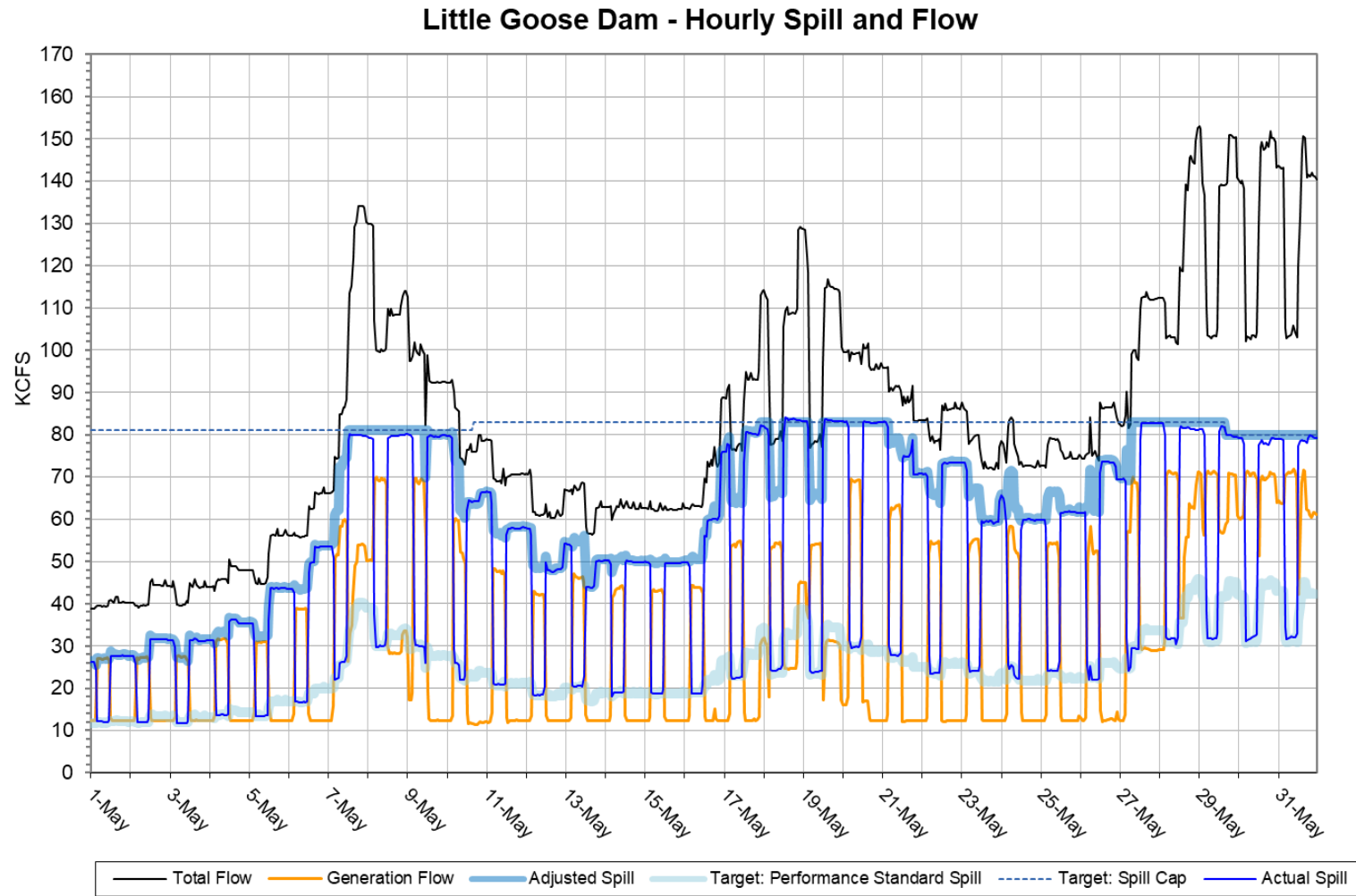
<sup>14</sup> Indicates missing data.

Figure 1<sup>15</sup>



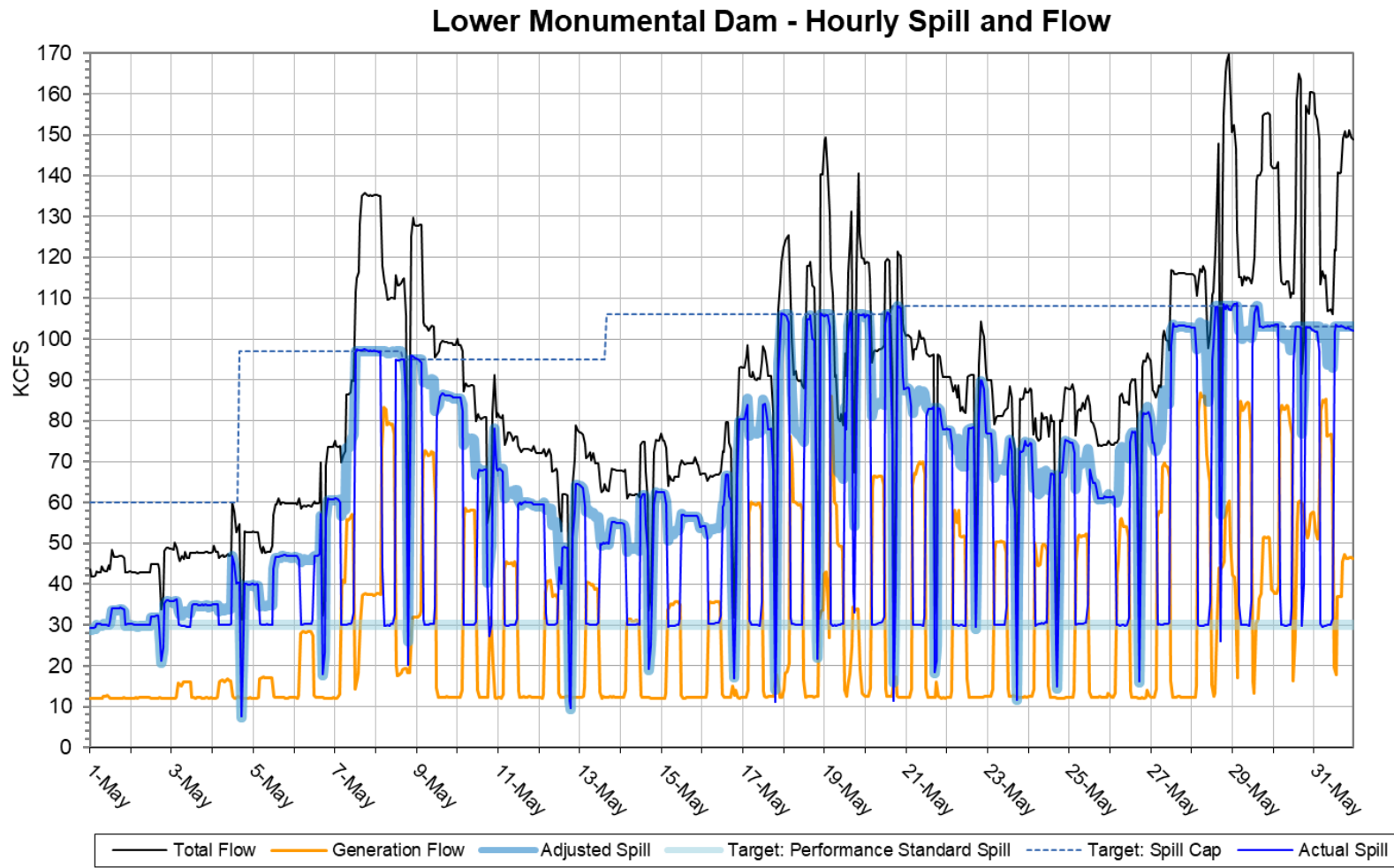
<sup>15</sup> The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2<sup>16</sup>



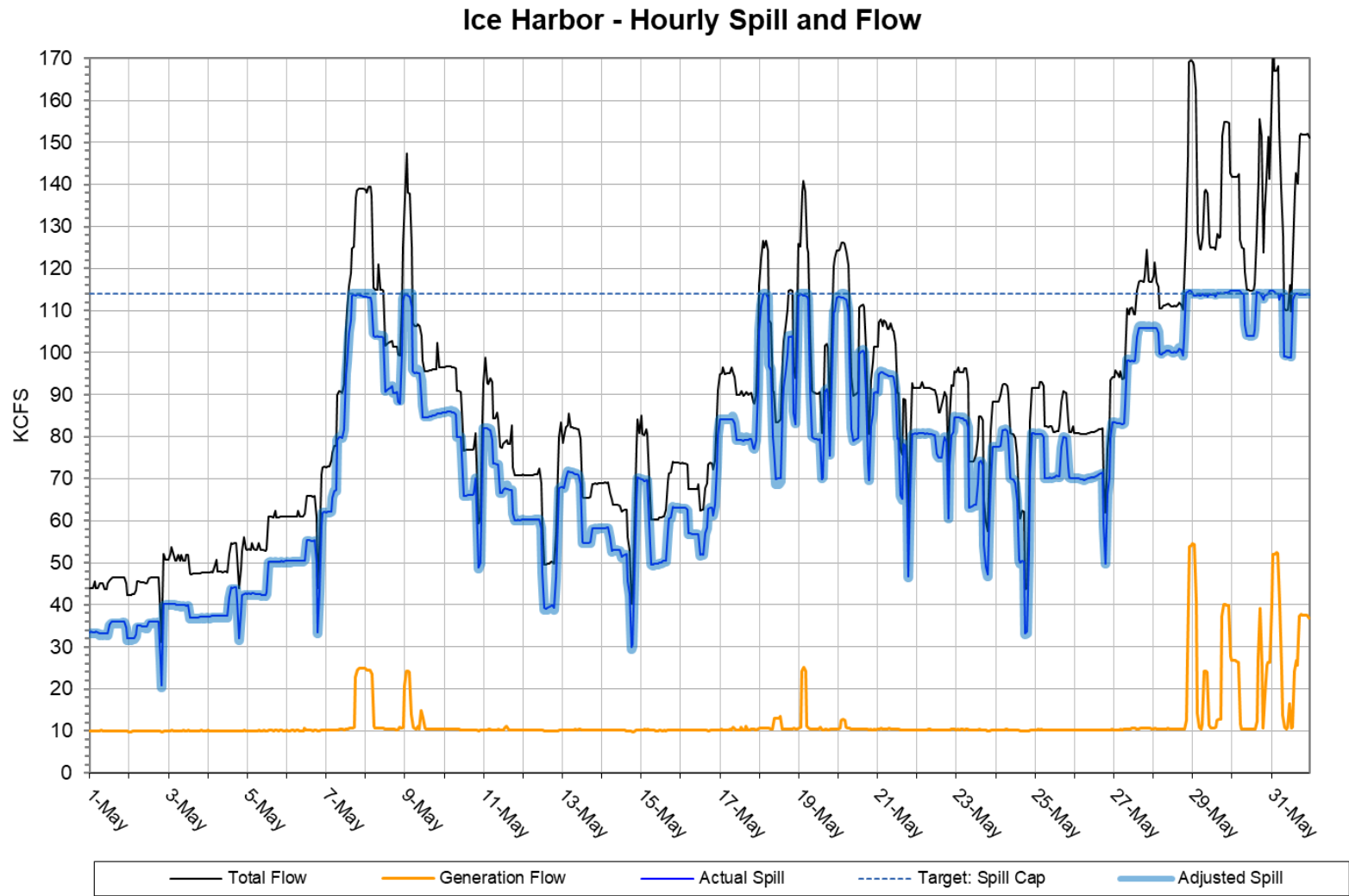
<sup>16</sup> The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3<sup>17</sup>



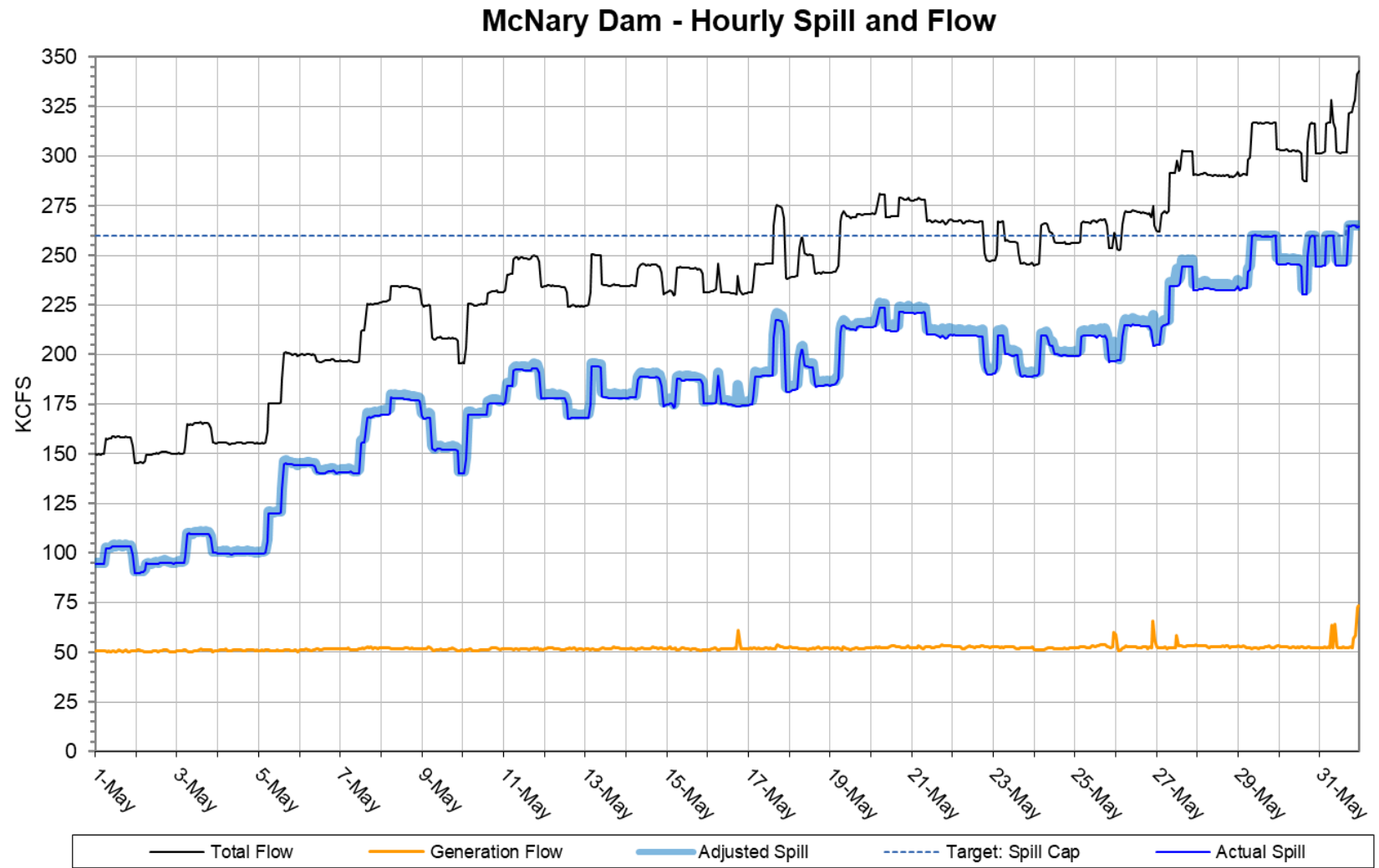
<sup>17</sup> The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4<sup>18</sup>



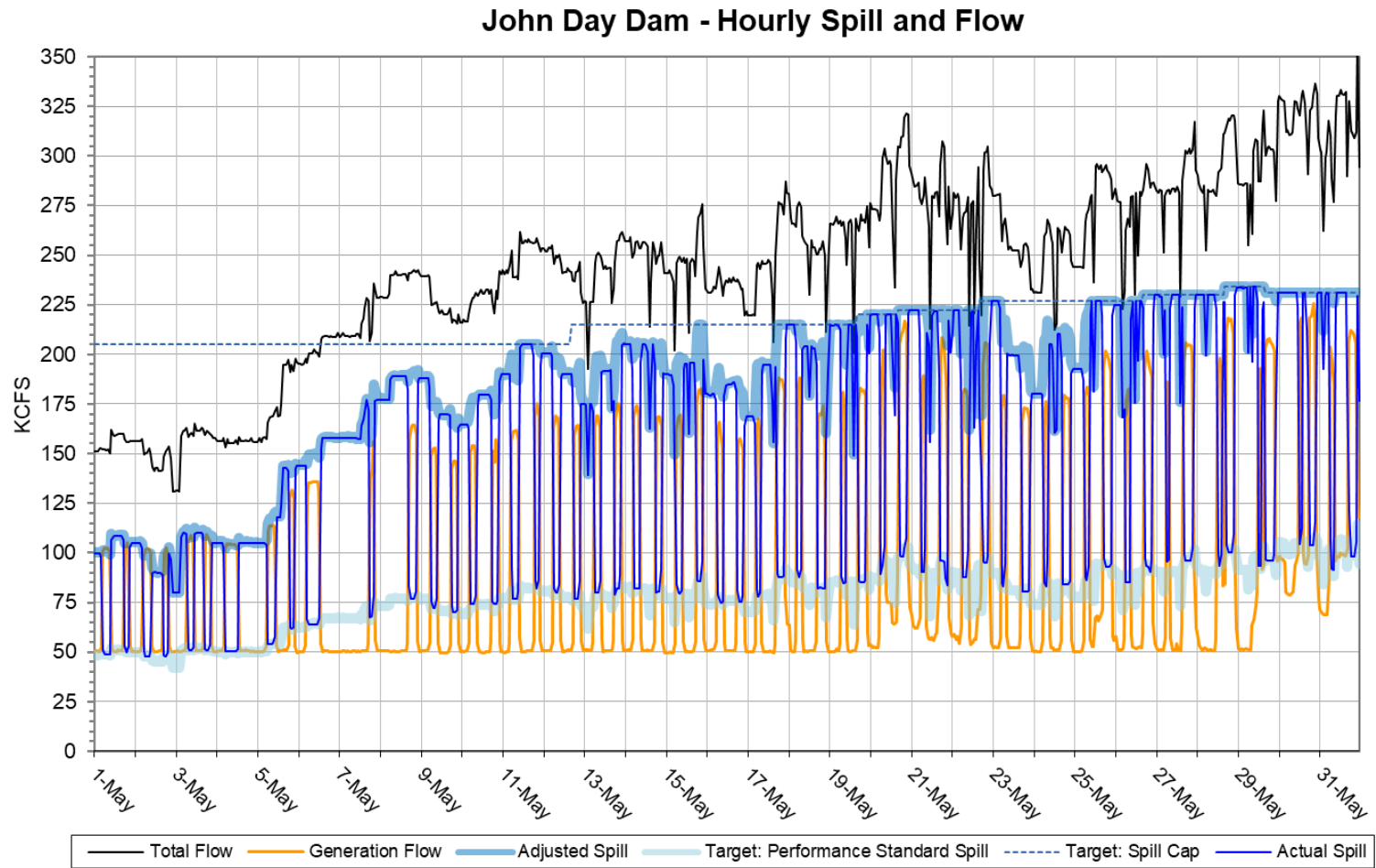
<sup>18</sup> The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5<sup>19</sup>



<sup>19</sup> 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.

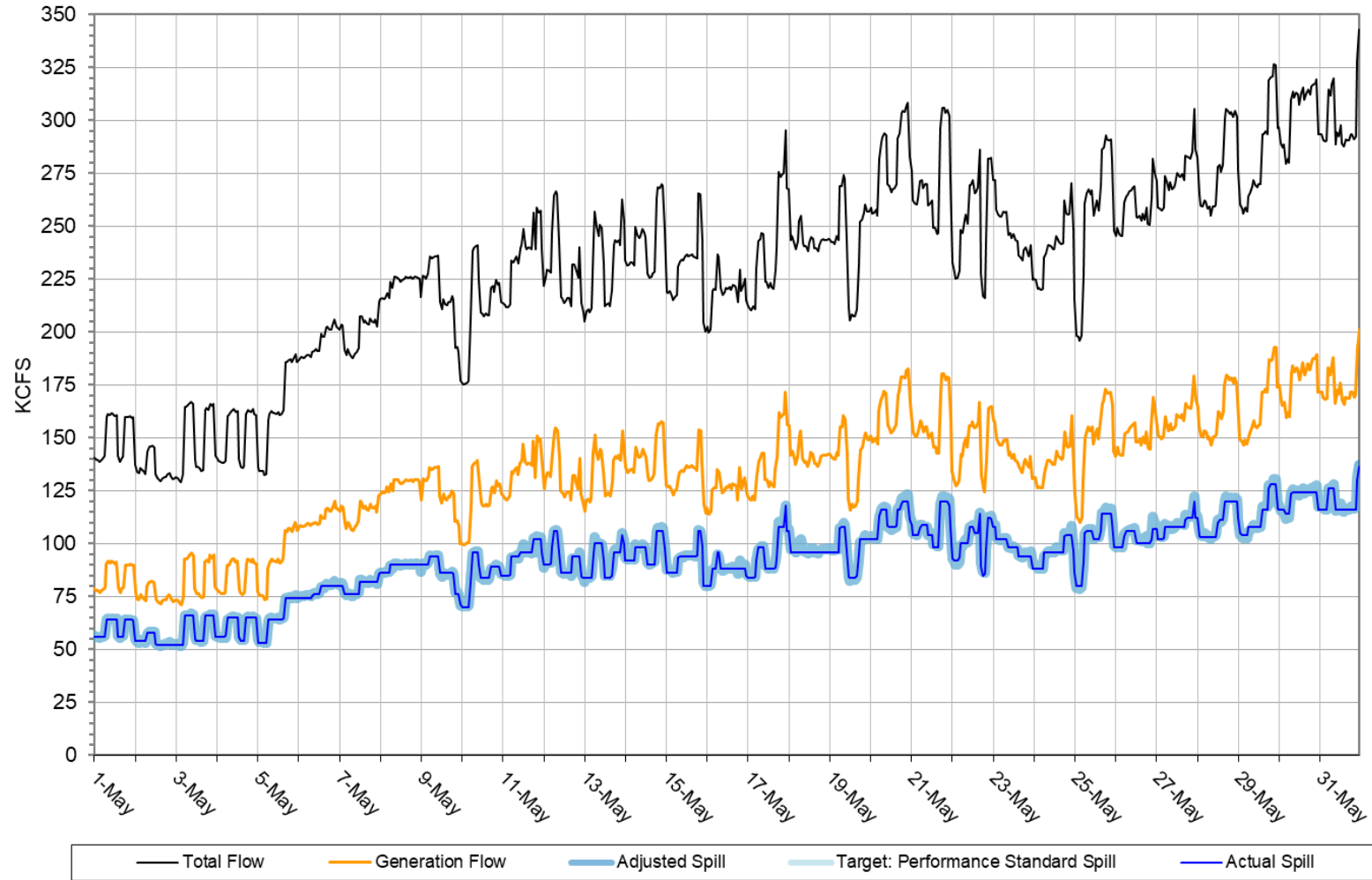
Figure 6<sup>20</sup>



<sup>20</sup> 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<sup>21</sup>

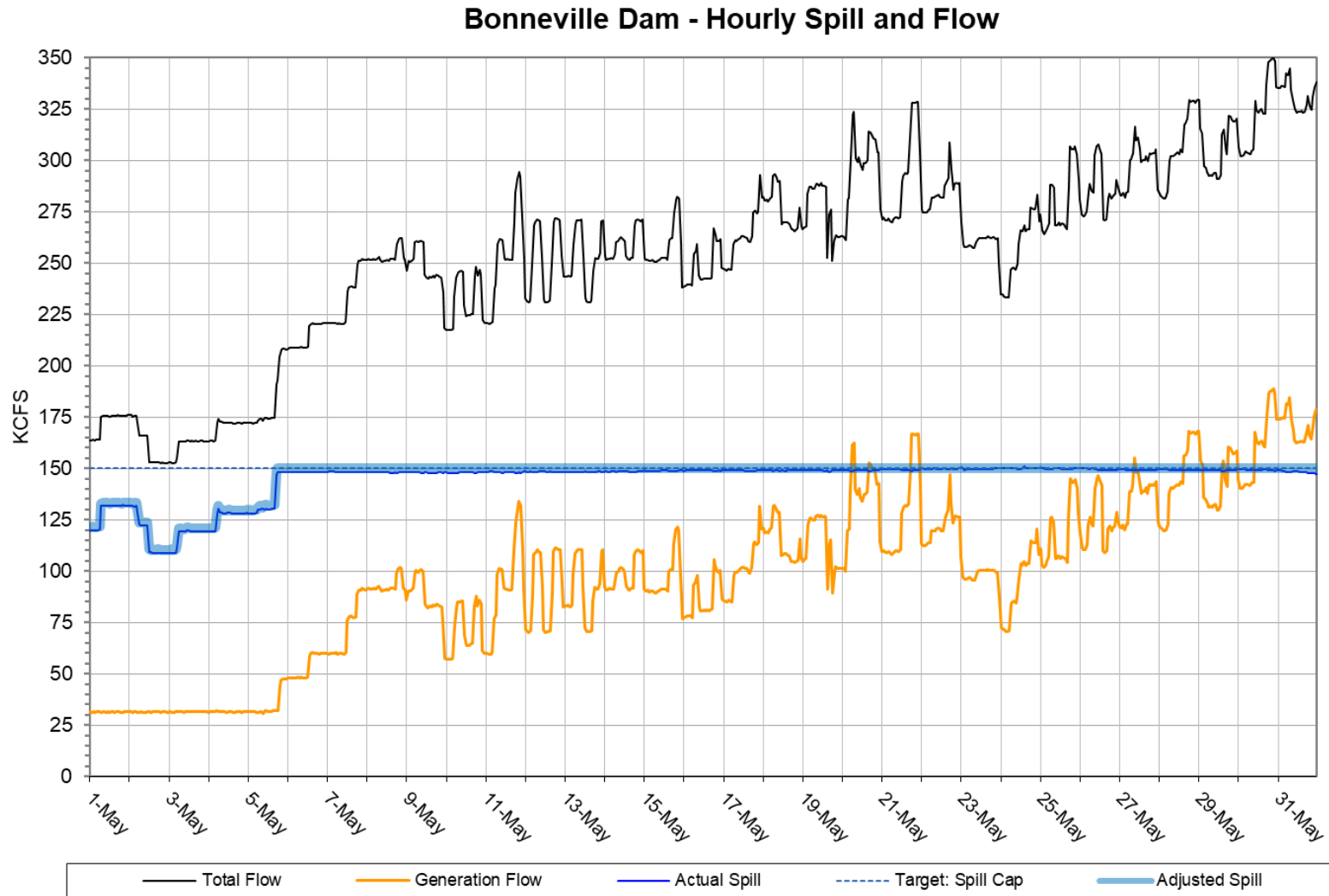
The Dalles Dam - Hourly Spill and Flow



<sup>21</sup> 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<sup>22</sup>



<sup>22</sup> 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.