FISH OPERATIONS PLAN IMPLEMENTATION REPORT

May 2019

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 2019 Fish Operations Plan[1] (2019 FOP). The 2019 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2019 spring and summer fish migration seasons, generally April 3 through August 31. The 2019 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 2019 NOAA Fisheries Columbia River System Biological Opinion (2019 BiOp)[2], the 2018 Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions), the 2019-2021 Spill Operation Agreement (Agreement), the Corps' requirements under the Endangered Species Act (ESA), and is the subject of ongoing consultation and 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 2019 BiOp and other guiding operative documents, including the 2019 Water Management Plan (WMP), seasonal WMP updates, and the 2019 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2019 FOP during the month of May 2019. 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 2019 FOP, section 4.1);
- actual spill: the hourly flow over the spillway; and,
- resultant 12-hour average TDG for the tailwater at each project.

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[1] The 2019 FOP was posted to the Technical Management Team (TMT) website on April 1, 2019 (http://pweb.crohms.org/tmt/documents/fpp/2019/).

[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.

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2019 FOP in May 2019.

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.
- 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 (2019 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the May 2019 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 120% (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 May 2019 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

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

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 2019 FOP for Bonneville and The Dalles dams,[4] 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.

May Operations

The month of May was characterized by above average flows for the lower Snake River and average flows for the lower Columbia River with above average air temperatures and varied precipitation in the Columbia Basin. Observed precipitation in May was 105% of average on the Snake River above Ice Harbor and 83% of average on the Columbia River above The Dalles[5]. The NOAA Northwest River Forecast Center runoff summary for May indicated that the adjusted runoff for the Snake River at Lower Granite was 118% of the 30-year average (1981-2010) with a volume of 8.1 MAF (Million acre-feet). The adjusted runoff for the Columbia River at The Dalles was 100% of the 30-year average (1981-2010) with a volume of 25.3 MAF.[6]

The 2019 spring fish passage spill operation at the Corps' eight lower Snake and lower Columbia River projects differs from previous years' operations as a result of the Agreement signed in December 2018. Spring spill operations occur April 3–June 20 at the four lower Snake River

[4] As specified in the 2019 FOP section 3.
[5] Retrieved 1 May 2019: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[6] Retrieved 1 May 2019: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php?date=05/01/2019

projects, and April 10–June 15 at the four lower Columbia River projects. Target spill levels for April 2019 at each project are defined in Table 1.

Table 1: Summary of 2019 spring target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	GAS CAP SPILL (at least 16 hours per day)[1, 2, 3, 5]	PERFORMANCE STANDARD SPILL (up to 8 hours per day)[2, 4, 5]
Lower Granite	120% Gas Cap	20 kcfs
Little Goose	120% Gas Cap	30%
Lower Monumental	120% Gas Cap (uniform spill pattern)	30 kcfs
Ice Harbor	120% Gas Cap	30%
McNary	120% Gas Cap	48%
John Day	120% Gas Cap	32%
The Dalles	120% Gas Cap[6]	40%
Bonneville	120% Gas Cap[7]	100 kcfs

1. Uncertainty remains about how the system will respond to these new operations, therefore existing adaptive management processes will be employed to help address any unintended consequences that may arise in-season as a result of implementing these proposed spill operations.
2. Spill may be temporarily reduced at any project if necessary to ensure navigation safety or transmission reliability.
3. 120% Gas Cap spill is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state laws/water quality standards.
4. The 8 hours of Performance Standard spill can occur in up to two blocks per calendar day, an AM block and a PM block. An AM block is defined as beginning in the AM (but may end in the PM) and a PM block is defined as beginning in the PM (but may end in the AM). Only Little Goose would be set to at least 4 hours in the AM (beginning near dawn and not to exceed 5 hours in the AM) and no more than 4 hours in the PM (generally near dusk) to help with adult passage issues. All other projects could spill up to 5 hours of performance standard spill either in the AM or PM time period with the remaining hours occurring in the alternate time period (not to exceed 8 hours in a day).
5. No ponding above current Snake River MOP/John Day MIP assumptions (to provide a 1 ft. useable range and a 1.5 ft. useable range, respectively).
6. Spill to the 120 % Gas Cap restricted to spillbays 1-8 (within the spillwall) when river flows is ≤ 350 kcfs).
7. Spill to the 120% Gas Cap, not to exceed 150 kcfs.

In its implementation of the 2019 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 in the tailrace (see Table 4).[7] 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). For the month of May 2019, conditions constraining the spill cap at Bonneville and The Dalles dams did not occur (see Table 1 fn 6,7).

[7] See 2019 FOP section 2.2

Operational Adjustments

1. Little Goose

Beginning on May 21, the Corps adjusted the hours of the 30% Performance Standard spill operation at Little Goose Dam to address upstream passage delay of adult spring Chinook at the project.

From May 21 through May 24, the Corps and BPA implemented the 30% spill operation for 5 hours in the morning (0600-1100) and 3 hours in the afternoon (1600-1900), per a recommendation from Idaho received on May 20 and consensus (no objections) from TMT on May 22.

From May 25 through May 28, the Corps and BPA implemented a modified 30% spill operation for 6 hours in the morning (0600-1200) and 2 hours in the afternoon (1700-1900). This operation was coordinated with TMT at the meeting on May 24 and regional sovereigns either supported or did not object.

Starting on May 29 and continuing into June[8], the Corps and BPA implemented a modified 30% spill operation for 8 consecutive hours in the morning (0400-1200). This operation was requested by FPAC on May 28 and coordinated with TMT at the meeting on May 29. Regional sovereigns either supported or did not object to this operation.

2. Lower Monumental

The uniform spill pattern continued to be applied to performance standard spill during May 2019 (see April 2019 FOP Implementation Report for details).

3. The Dalles

3.a. The spill cap as a percentage of total project outflow on an hourly basis continued during May 2019 (see April 2019 FOP Implementation Report for details).

3.b. Beginning May 10, the Corps began a combined spill operation at The Dalles and John Day Dams with two primary objectives: meet, but not exceed, 120% TDG in The Dalles tailrace while maintaining at least 40% spill at The Dalles Dam[9] for the benefit of juvenile fish passage. If necessary to achieve both of these objectives, the John Day Dam spill cap would be reduced below the estimated spill cap to meet, but not exceed, 120% TDG in the tailrace at John Day Dam. The Dalles tailrace gauge represents a mix of powerhouse and spillway TDG. The TDG associated with the powerhouse flow is at the same percentage as the upstream forebay TDG. The Dalles forebay TDG is a result of TDG generated upstream at John Day Dam and environmental conditions (e.g., wind speed, barometric pressure and water temperature). This combined spill approach at The Dalles and John Day Dams was coordinated with TMT at the May 10 TMT meeting. Regional sovereigns either supported or did not object to this operation.

[8] Operational adjustments that occur in June will be included in the June FOP Implementation Report.
[9] The Dalles spill cap remains a percentage of total project outflow on an hourly basis rather than a fixed daily level (kcfs).

3.c. On May 15, an error was discovered in the reported air pressure data at The Dalles tailwater gauge (TDDO). A 1.01 multiplier was being applied to the data transmitted from the gauge. This error caused an approximately one percent increase in the calculated percent saturation metrics at TDDO and resulted in 12-hr average TDG exceedances that were not previously reported. Therefore, spill caps for The Dalles spill may have been greater than they would have otherwise been. The error applies to data back to June 2015. The multiplier is no longer being applied and erroneous data has been corrected for 2015 through 2019. TMT members were made aware of this issue via email on May 16 and at the May 22 TMT meeting.

4. Bonneville

Beginning May 17, the Bonneville tailwater telemetered water quality sensor was removed to prevent damage during the forecasted high flows. In past years, total flow between 450 and 500 kcfs damaged the gauge. Access to the gauge is limited above a tailwater stage of 28.0 feet, which correlates with a flow of approximately 400 kcfs. The forecast on May 16 indicated flows in excess of 420 kcfs the week of May 20, with flows exceeding 380 kcfs on May 18. The Corps and USGS agreed that the real-time instrument should be replaced on May 17 while the gauge was still accessible. When the 10-day flow forecast predicted flows less than 380 kcfs, the USGS replaced the telemetered sensor (May 21). Although real-time data were not available for daily spill review, recorded data are available in the database from May 17 through May 22. TMT members were made aware of this issue via email on May 17 and at the May 22 TMT meeting.

Table 2: Spill Variance Table – May 2019 (5/1 to 5/31)

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
Ice Harbor	Additional Spill	5/30/19	1200	1	Human Error	Hourly spill increased to 95 kcfs (above adjusted spill of 89 kcfs) due to delay in shifting flow to generation when Unit 2 was returned to service.
John Day	Additional Spill	5/20/19	0700-1600	10	Maintenance	Hourly spill increased to 180 kcfs (above adjusted spill of 168 kcfs). Units 9-12 were taken out of service for unscheduled maintenance to replace the master power panel.
The Dalles	Reduced Spill	5/9/19	0900	1	Emergency	Hourly spill decreased to 90 kcfs (below adjusted spill of 96 kcfs) due to an emergency recovery of commercial barge from the spillway.

[10] Data collected for reporting spill variances are reported as hourly averages. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented as an hour. The hourly average data is reported at the end of the hour (i.e., hour ending).

Table 3: Pre-Coordinated Operations – May 2019 (5/1 to 5/31)

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
Lower Granite	Additional Spill	5/19/19	1000-1200	3	Maintenance	Hourly spill increased to 60 kcfs (above the adjusted spill of 51 kcfs) while performing VBS screen inspection. Regionally coordinated via 2019 FPP, page LWG-14.
Little Goose	Additional Spill	5/14/19	1000-1200	3	Maintenance	Hourly spill increased to 62 and 70 kcfs (above the adjusted spill of 54 kcfs) while removing debris from trash racks which necessitated a generation flow decrease. Regionally coordinated via 2019 FPP, page LGS-29.
Little Goose	Additional Spill	5/15/19	1000-1600	7	Maintenance	Hourly spill increased to 62 (above the adjusted spill of 54 kcfs) while removing debris from trash racks which necessitated a generation flow decrease. Regionally coordinated via 2019 FPP, page LGS-29.
Little Goose	Modified Performance Standard Hours	5/25/19 5/26/19 5/27/19 5/28/19	1200 1200 1200 1200	1 1 1 1	Adaptive Management	Extended the AM block of performance standard spill by 1 hour and shortened the PM block by 1 hour. Regionally coordinated at the 5/24/19 TMT meeting.
Little Goose	Modified Performance Standard Hours	5/29/19 5/30/19 5/31/19	1000-1200 1000-1200 1000-1200	3 3 3	Adaptive Management	Extended the AM block of performance standard spill by 3 hours and removed the 3-hour PM block. Regionally coordinated at the 5/28/19 TMT meeting.
Lower Monumental	Reduced Spill	5/1/19 5/2/19 5/3/19 5/4/19 5/5/19 5/6/19 5/7/19 5/8/19 5/9/19 5/10/19 5/11/19 5/12/19 5/13/19 5/14/19 5/15/19 5/17/19 5/19/19 5/21/19 5/23/19 5/25/19 5/27/19 5/29/19 5/31/19	1700-1800 1700-1900 1700-1800 1700-1900 1800-1900 1700-1900 1800-1900 1700-1800 1700-1900 1700-1800 1800-1900 1800-1900 1800-1900 1900 1800-1900 1800 1800 1900-2000 1800-2000 1800-1900 1800-1900 1800-1900 1800	2 3 2 3 2 3 2 2 3 2 2 2 2 1 2 1 1 2 3 2 2 2 1	Navigation	Hourly spill reduced below target spill for safe navigation. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
Lower Monumental	Additional Spill	5/17/19	0800-1200	5	Research Related	Hourly spill increased to 55 kcfs (above adjusted spill of 40 kcfs). Units 2 and 3 were taken out of service to change head gate cylinders as part of a Fish Guidance Efficiency research study. Regionally coordinated via 2019 FPP, Appendix A, page A-13.
Lower Monumental	Additional Spill	5/20/19	1000-1500	6	Maintenance	Hourly spill increased to 48 and 55 kcfs (above adjusted spill of 41 kcfs) while removing debris from trash racks which necessitated a generation flow decrease. Regionally coordinated via 2019 FPP, page LMN-28.
The Dalles	Additional Spill	5/20/19	1900	1	Transmission Reliability	Hourly spill increased to 42% (above adjusted spill of 40% ± 1%) due to providing balancing reserves. 24-hr average was 40.2%. Regionally coordinated via 2019 FPP, Appendix E, Section 4.1.

Table 4: May 2019 Average Percent TDG Values Table (5/1 to 5/31)

Date	FIXED MONITORING STATIONS															
	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
	Lower Granite FB	Lower Granite TW	Little Goose FB	Little Goose TW	Lower Monumental FB	Lower Monumental TW	Ice Harbor FB	Ice Harbor TW	McNary FB	McNary TW	John Day FB	John Day TW	The Dalles FB	The Dalles TW	Bonneville FB	Bonneville TW
Gas Cap %:	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**
5/1/2019	106	120	115	**121**	121	119	118	119	113	120	112	120	117	**121**	120	120
5/2/2019	105	120	114	120	120	119	117	119	112	119	112	120	115	119	116	119
5/3/2019	105	120	114	120	120	120	117	119	112	119	113	120	116	120	113	119
5/4/2019	106	120	116	120	122	120	119	**121**	113	119	114	120	119	**123**	116	120
5/5/2019	107	120	117	120	122	120	119	120	115	118	114	120	119	**122**	117	120
5/6/2019	106	120	117	120	121	120	119	120	115	119	115	120	120	**122**	119	120
5/7/2019	105	119	117	120	122	120	119	120	115	119	117	119	119	**122**	118	120
5/8/2019	105	120	117	120	121	120	118	**121**	115	120	118	120	119	**121**	117	120
5/9/2019	104	120	116	120	122	120	118	**122**	115	119	118	120	121	**123**	119	120
5/10/2019	105	120	117	120	122	120	118	120	115	119	118	120	122	**123**	120	120
5/11/2019	105	120	118	120	122	120	119	120	116	119	120	119	121	**123**	121	120
5/12/2019	106	120	117	120	122	**121**	119	120	116	119	119	119	118	**121**	118	120
5/13/2019	105	120	116	120	121	120	118	120	115	119	117	119	117	120	115	120
5/14/2019	105	120	115	120	120	**121**	117	120	113	119	116	119	117	120	116	120
5/15/2019	105	120	115	**121**	121	**121**	118	**122**	113	119	115	120	118	**122**	118	**121**
5/16/2019	106	120	115	120	123	**121**	119	**124**	115	120	115	120	118	**121**	121	**121**
5/17/2019	105	120	114	120	121	**121**	118	**122**	114	120	113	119	114	119	116	119
5/18/2019	104	**123**	112	**125**	121	**124**	117	**129**	113	120	113	**121**	117	**122**	117	**121**
5/19/2019	106	**121**	115	**122**	126	**121**	119	**125**	117	120	112	**121**	116	**121**	120	**121**
5/20/2019	106	120	116	120	123	**121**	120	**121**	117	120	111	**122**	114	119	117	120
5/21/2019	105	120	115	120	121	120	119	**121**	115	120	114	120	117	**121**	118	120
5/22/2019	104	119	114	119	120	119	117	120	114	120	114	120	116	**121**	117	120
5/23/2019	104	119	114	120	121	120	118	120	116	120	115	120	118	**122**	117	120
5/24/2019	105	120	114	120	122	119	118	120	115	120	114	119	116	120	115	119
5/25/2019	105	120	113	120	120	120	117	120	113	120	112	119	116	120	114	119
5/26/2019	105	120	116	120	121	119	118	120	112	120	112	119	117	**121**	117	120
5/27/2019	105	120	116	120	121	120	118	120	114	120	112	119	117	120	117	119
5/28/2019	105	120	115	120	122	120	119	120	114	120	111	119	115	120	114	119
5/29/2019	105	120	116	120	122	120	119	120	114	120	114	120	116	120	114	120
5/30/2019	106	120	115	120	122	120	119	120	116	120	115	119	117	**121**	116	120
5/31/2019	106	120	116	120	121	**122**	119	**121**	115	120	116	119	118	**122**	118	**121**
Exceedances:		**2**		**4**		**9**		**11**		**0**		**3**		**20**		**5**

Figure 1

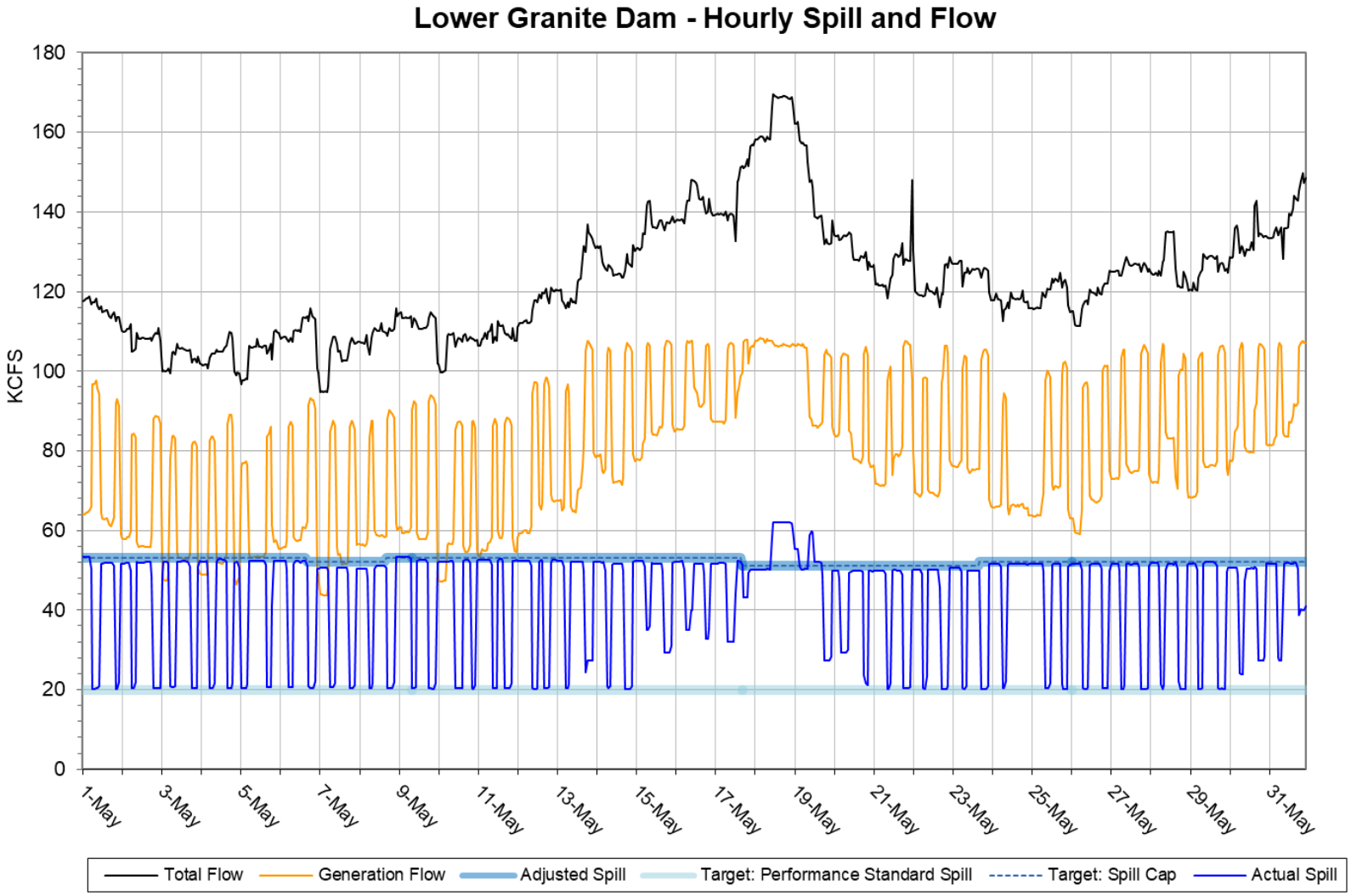

Lower Granite Dam - Hourly Spill and Flow
KCFS
180
160
140
120
100
80
60
40
20
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 2

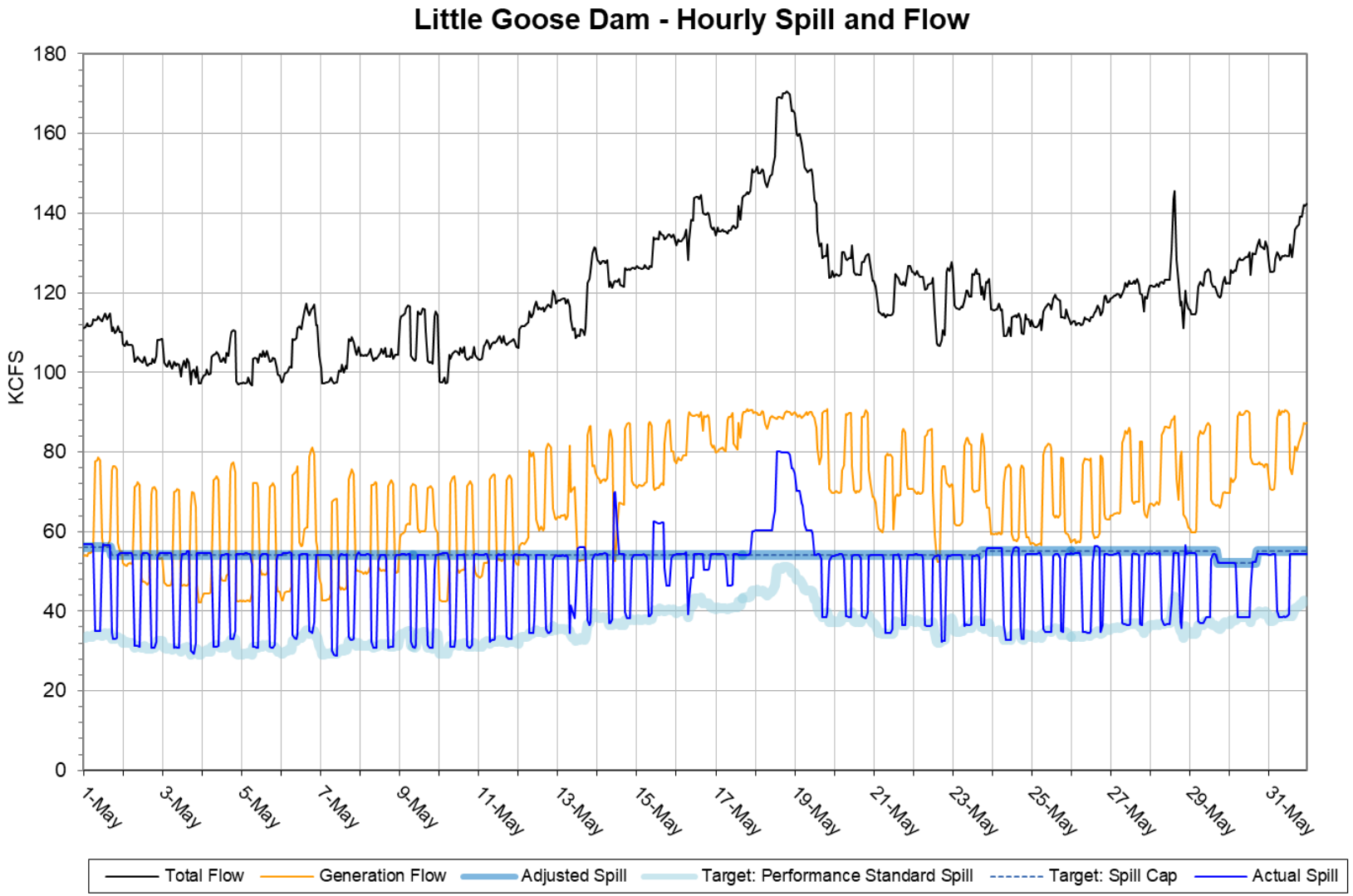

Little Goose Dam - Hourly Spill and Flow
KCFS
180
160
140
120
100
80
60
40
20
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 3

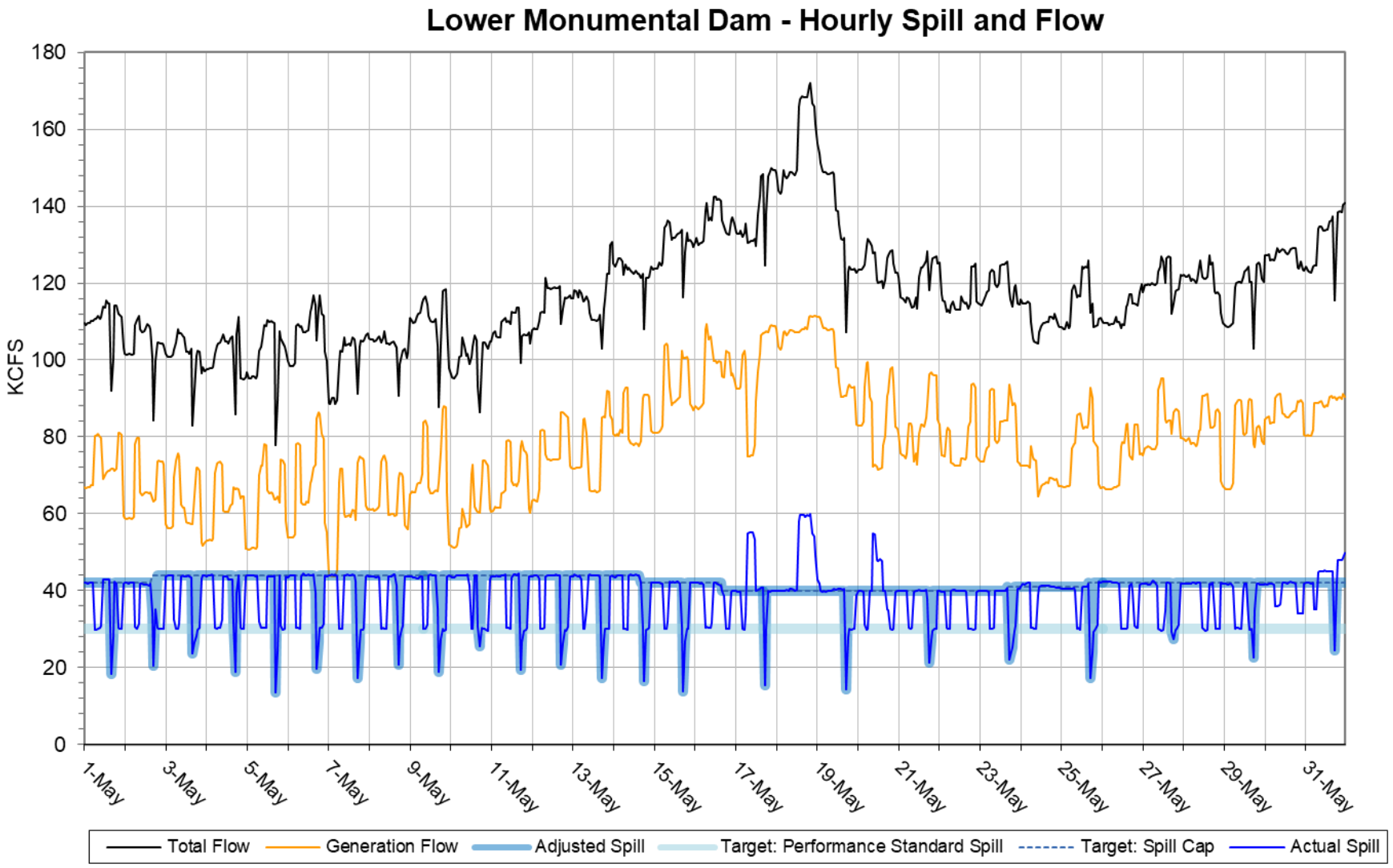

Lower Monumental Dam - Hourly Spill and Flow
KCFS
180
160
140
120
100
80
60
40
20
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 4

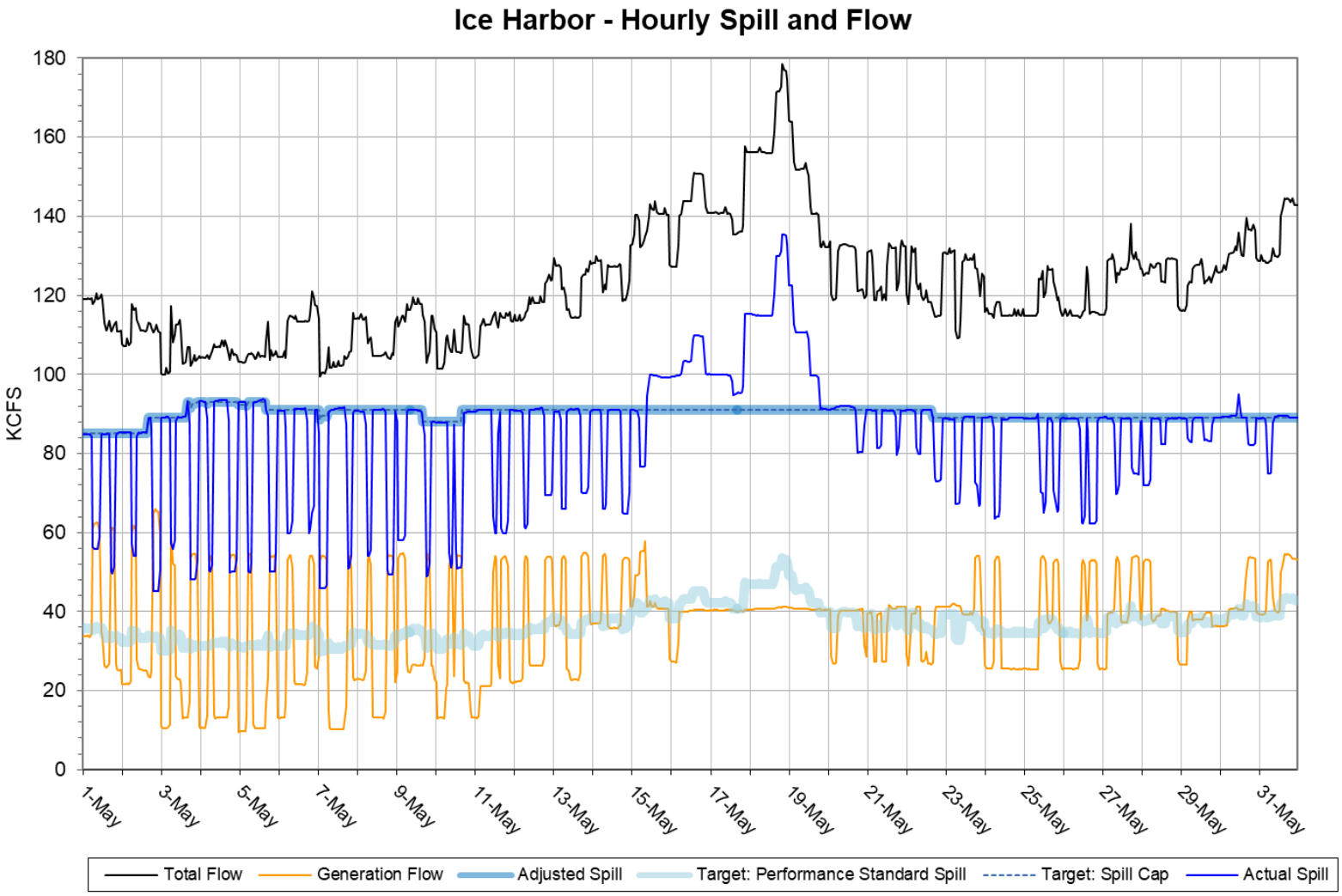

Ice Harbor - Hourly Spill and Flow
KCFS
180
160
140
120
100
80
60
40
20
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 5

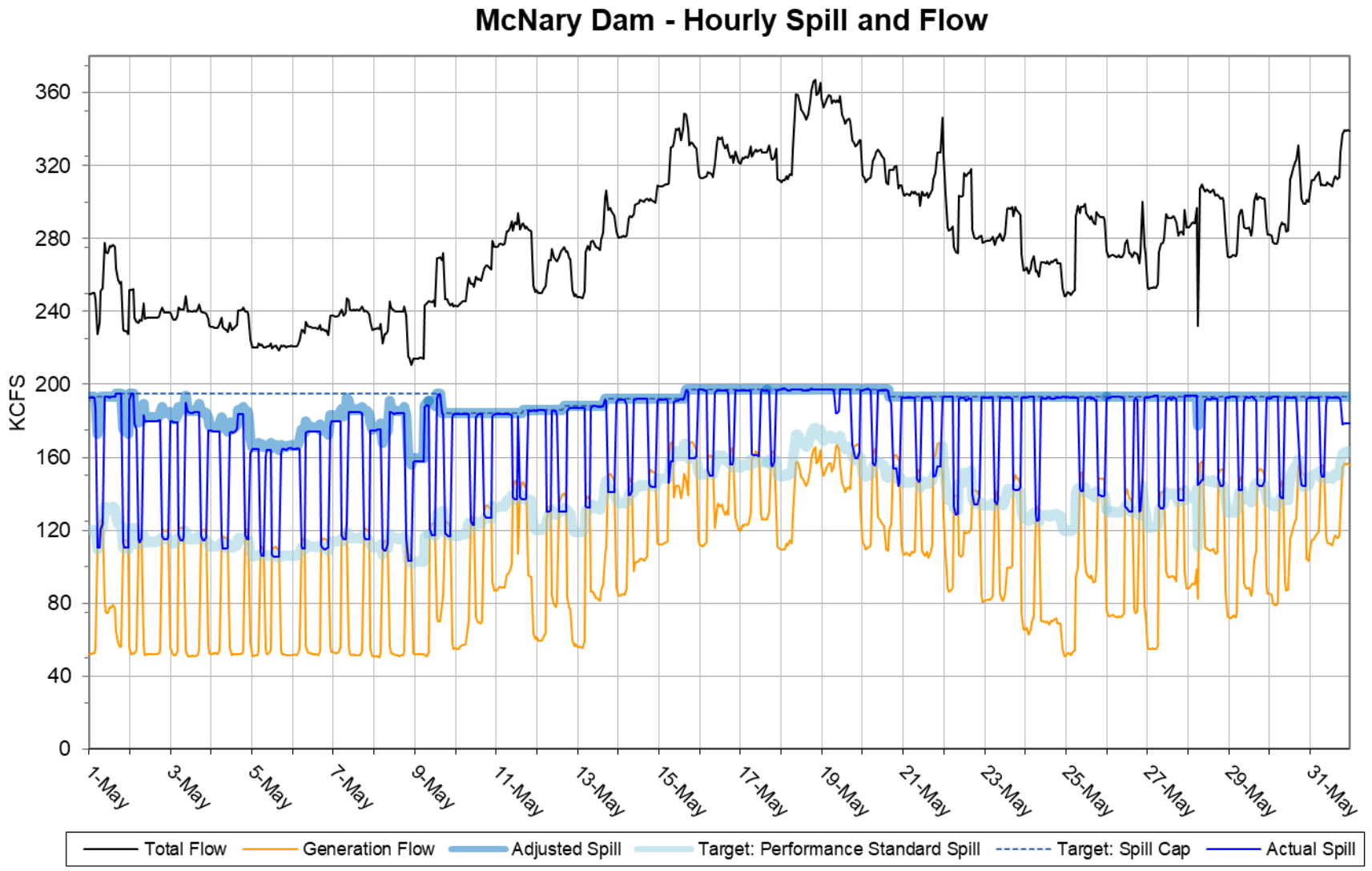

McNary Dam - Hourly Spill and Flow
KCFS
360
320
280
240
200
160
120
80
40
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 6

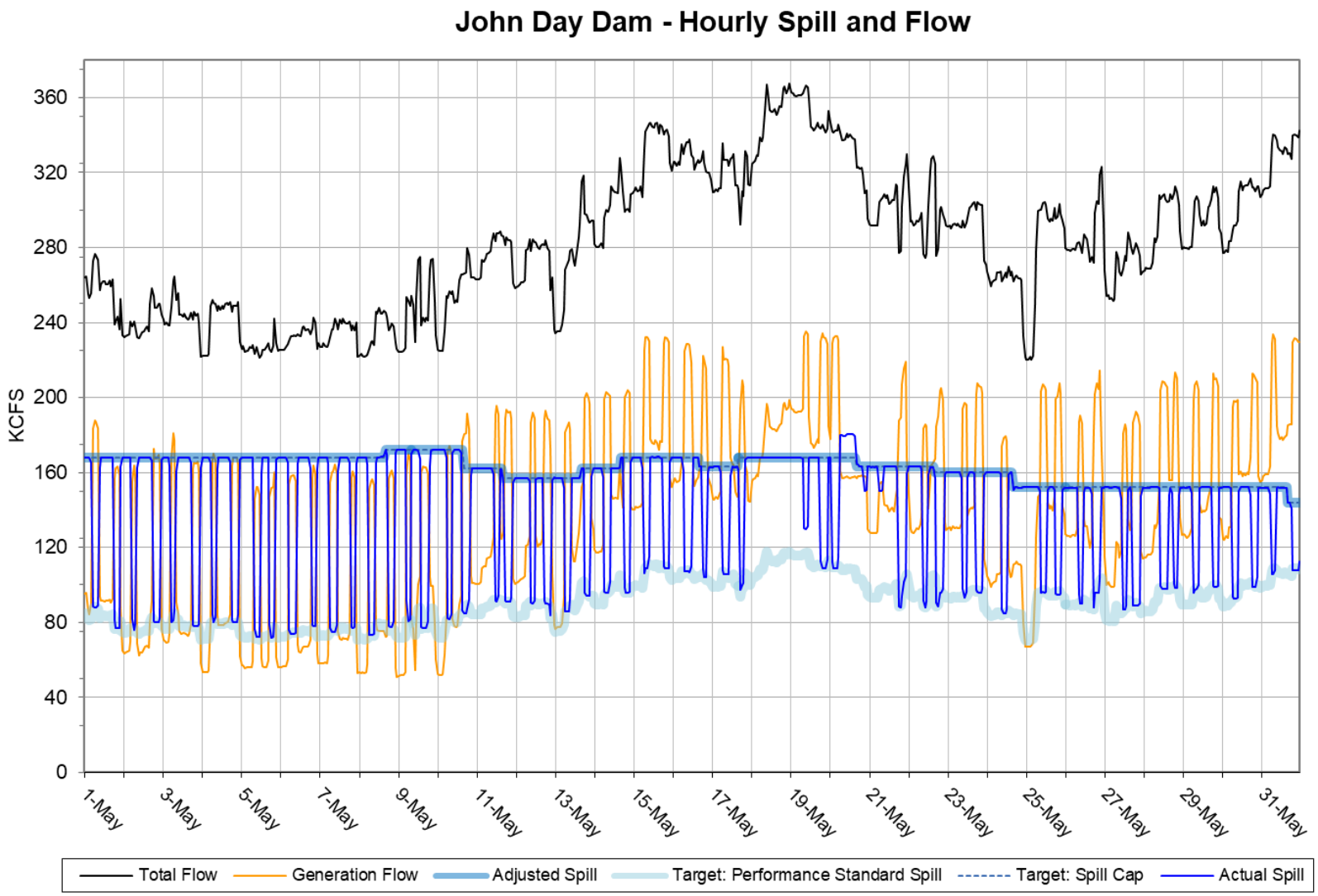

John Day Dam - Hourly Spill and Flow
KCFS
360
320
280
240
200
160
120
80
40
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 7

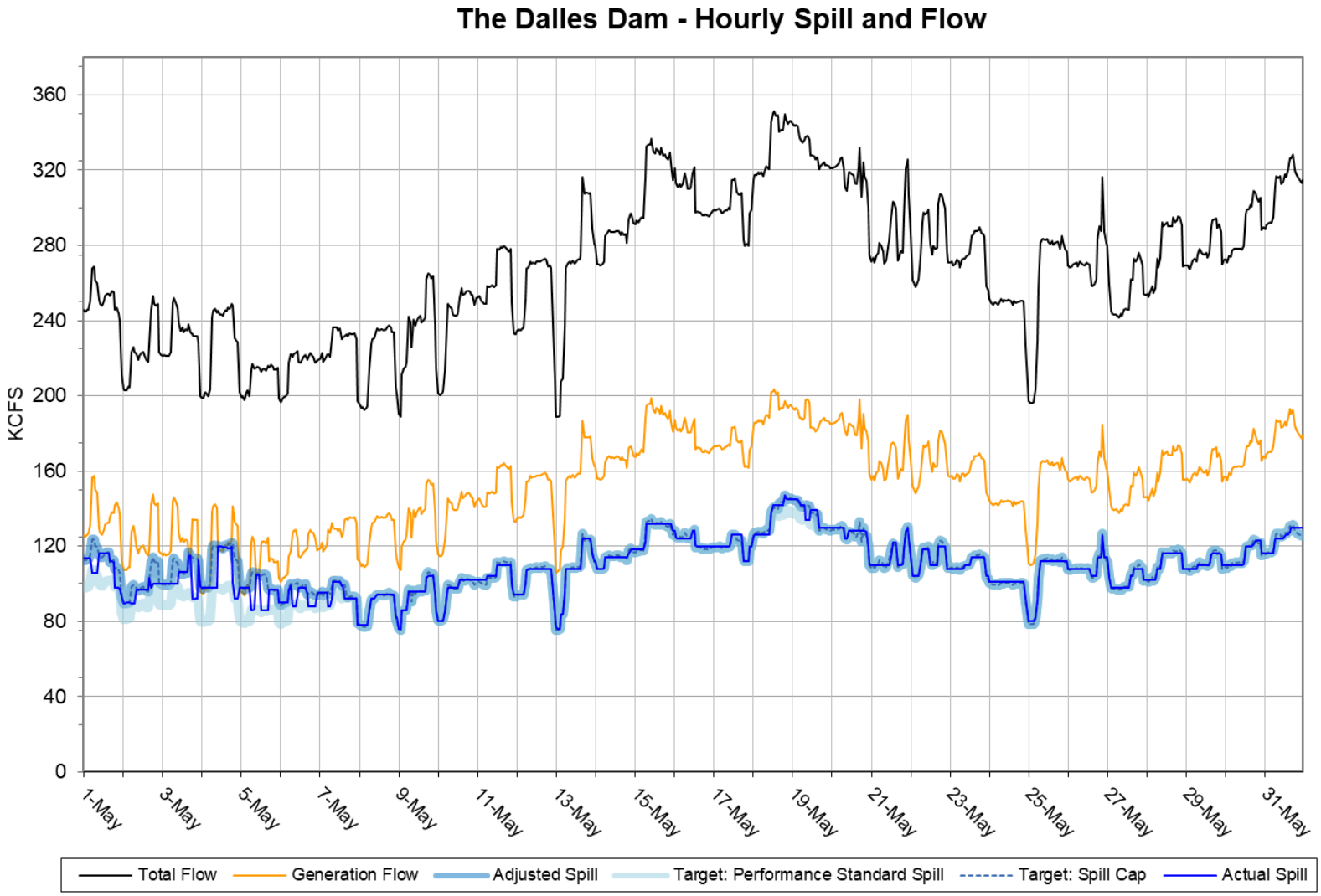
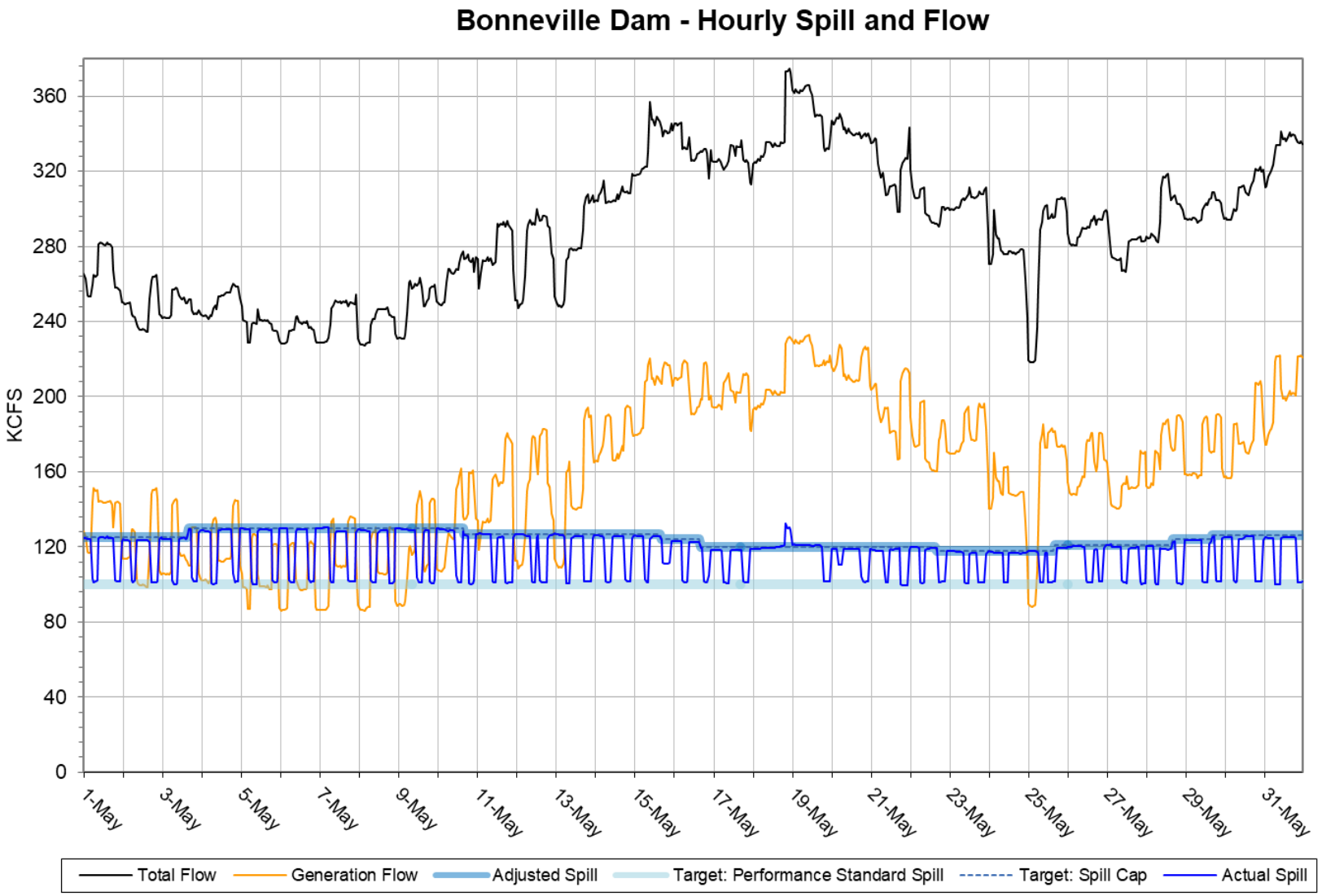

The Dalles Dam - Hourly Spill and Flow
KCFS
360
320
280
240
200
160
120
80
40
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill

Figure 8


Bonneville Dam - Hourly Spill and Flow
KCFS
360
320
280
240
200
160
120
80
40
0
1-May
3-May
5-May
7-May
9-May
11-May
13-May
15-May
17-May
19-May
21-May
23-May
25-May
27-May
29-May
31-May
Total Flow
Generation Flow
Adjusted Spill
Target: Performance Standard Spill
Target: Spill Cap
Actual Spill