FISH OPERATIONS PLAN IMPLEMENTATION REPORT

August 2018

Submitted by the U.S. Army Corps of Engineers
Northwestern Division
Portland, OR.

Introduction

The U.S. Army Corps of Engineers (Corps) is submitting this report in accordance with the 2018 Summer Fish Operations Plan[1] (2018 Summer FOP). The 2018 Summer FOP describes operations during the summer fish migration season, generally June 16 through August 31, 2018. To the extent Corps project operations are not specified in the 2018 Summer FOP, the FCRPS operations will be consistent with the 2014 NOAA Fisheries Supplemental Biological Opinion (2014 Supplemental BiOp), the U.S. Fish and Wildlife Service 2000 and 2006 Biological Opinions, and/or other operative documents, including the 2018 Water Management Plan (WMP), WMP seasonal updates, and the 2018 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2018 Summer FOP during the month of August 2018. 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, i.e. the specified spill level or percent spill identified in the 2018 Summer FOP, or the spill cap;[2]
- 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 2018 Summer FOP, section 4.1);
- actual spill: the hourly flow over the spillway; and,
- the resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream.[3]

This report also provides information on issues and unanticipated or emergency situations that

[1] The 2018 Summer FOP was posted to the TMT website on June 1, 2018 (http://pweb.crohms.org/tmt/documents/fpp/2018/final/FPP18_AppE_Summer.pdf).
[2] The term "spill cap" means the maximum spill level at each project that is estimated to meet, but not exceed, the gas cap (the applicable state TDG water quality standard) in the tailrace and the downstream forebay. There are occasions when the spill cap is less than the 2018 Summer FOP spill level, and in these instances, the Corps operates to the spill cap.
[3] Averages reported are consistent with the current and applicable Oregon TDG standard modification (120% tailwater) and Washington TDG criteria adjustments (120% tailwater/115% forebay). The Oregon TDG standard modification and the Washington TDG criteria adjustments have different methodologies for calculating TDG. When the standards vary or conflict, the Corps applies the more stringent standard. See 2018 Summer FOP section 2.1.

arose during implementation of the 2018 Summer FOP in August 2018.

Data Reporting

I. For each project providing fish passage operations, this report contains a graph displaying the performance of the summer fish passage spill program for the month of August, with hourly spill, target spill, generation, and total flows. The monthly graphs begin on August 1 and end on August 31 and reflect the following operations for the lower Snake River and the lower Columbia River projects:

- The dark tan line represents the average hourly total river flow through the project in thousand cubic feet per second (kcfs).
- The dotted blue line represents the average hourly generation flow through the powerhouse each hour in kcfs.
- The dotted pink line represents the actual average hourly spill level through the spillway in kcfs.
- The thin green line represents the hourly target spill.
- The thick green line represents the 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 (2018 Summer FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the August 2018 Average Percent TDG Values Table (Table 3) . The numbers in red indicate the project exceeded the %TDG cap - i.e. 115% (forebay of the next downstream dam) or 120% (tailwater) for each project. For the lower Columbia projects, tailwater TDG values are presented by displaying the highest value %TDG (i.e., controlling limit, labelled “comb” for combined).

General Implementation Remarks

For all projects that spill for fish passage, the actual spill may vary from the target spill due to various conditions as described below. When actual spill levels are below or above the level specified in the 2018 Summer FOP, the dotted pink line will be below or above the thick green line in the figures.[4] When actual spill varied from target spill levels during periods of voluntary spill, the change in spill level is described below in the August 2018 Spill Variance Table (Table 1).[5] The Spill Variance Table includes average hourly data. When spill varies from target spill for a portion of an hour, resulting in the average hourly data varying from target spill, it is characterized as a variance for a full hour. There are instances when the hourly target spill levels

[4] The actual thickness of the adjusted spill level (thick green line) is not representative of the spill cap range; if the actual spill level is slightly outside the adjusted spill level, it should not be construed to indicate a spill variance or involuntary spill.

[5] 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.

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 target spill to the extent practicable. Other routine activities that changed spill levels and had been coordinated with regional partners are identified in the monthly Pre-Coordinated Operations Table (Table 2).

"Low flow" operations at the lower Columbia and Snake projects are triggered when inflow is insufficient to provide both minimum generation and the target spill levels. 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 2018 Summer FOP for Bonneville and The Dalles dams,[6] which may range up to ±3 kcfs) as compared to a target spill. A number of factors influence actual spill, including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (e.g. a higher forebay results in a greater level of spill since more water can pass under the spill gate).

Occurrences requiring an adjustment in operations and/or regional coordination are described in greater detail in the "Operational Adjustments" section below.

August Operations

The month of August was characterized by near average flows for the lower Snake River and below average flows for the lower Columbia River. Air temperatures were average to well above average during August along with very low precipitation across the Columbia Basin. The August 2018 observed precipitation was 52% of average on the Snake River above Ice Harbor and 41% of average on the Columbia River above The Dalles.[7] The NOAA Northwest River Forecast Center indicated that the August 2018 adjusted runoff for the Snake River at Lower Granite was 96% of the 30-year average (1981-2010) with a volume of 1.2 MAF (Million acre-feet).[8] The August 2018 adjusted runoff for the Columbia River at The Dalles was 78% of the 30-year average (1981-2010) with a volume of 6.0 MAF.

During the August 2018 reporting period, the planned 2018 Summer FOP spill operations were carried out as follows:

[6] As specified in the 2018 Summer FOP, Section 3.
[7] Retrieved September 4, 2018: https://www.nwrfc noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[8] Retrieved September 4, 2018: https://www.nwrfc noaa.gov/runoff/runoff_summary.php

- Lower Granite Dam – The hourly target spill level was 18 kcfs, 24 hours per day.
- Little Goose Dam – The hourly target spill level was 30% of the total flow, 24 hours per day. Spill transitioned to a fixed rate of 7 to 11 kcfs; depending on the previous day's average project outflow:
  - total flow > 32 kcfs : target spill 30% of total flow
  - total flow 28 – 32 kcfs : target spill 11 kcfs
  - total flow 24 – 28 kcfs : target spill 9 kcfs
  - total flow < 24 kcfs : target spill 7 kcfs
- Lower Monumental Dam – The hourly target spill level was 17 kcfs, 24 hours per day.
- Ice Harbor Dam – The hourly target spill level was 45 kcfs during the daytime and the spill cap during the nighttime.
- McNary – The hourly target spill level was 50% of the total flow, 24 hours per day.
- John Day Dam – The hourly target spill level was 30% of the total flow, 24 hours per day.
- The Dalles Dam – The hourly target spill level was the 40% of the total flow, 24 hours per day.
- Bonneville Dam – The hourly target spill level was alternating two-day treatments of 95 kcfs, 24 hours per day vs. 85 kcfs during the day and 121 kcfs during the nighttime.

Operational Adjustments

No operational adjustments to report during this period.

Table 1: Spill Variance Table – August 2018 (8/1 to 8/31)

Project	Parameter	Date	Time[9]	Hours	Type	Reason
Lower Granite	Reduced Spill	8/24/18	0800 - 1500[10]	7	Maintenance	Hourly spill was 0.4 to 4.9 kcfs less than the adjusted spill target due to the Digital Governor upgrade of Unit 6. The duration of this maintenance operation exceeded the length of time contemplated for pre-coordinated operations in the 2018 Summer FOP, Section 4.5 and 2018 FPP Appendix A.
Little Goose	Additional Spill	8/4/18	0300-0500	3	Human Error	Hourly spill remained at 11 kcfs (greater than the target spill of 30% of total flow) due to a delay in changing to the appropriate target.
McNary	Additional Spill	8/11/18	2000	1	Program Error	Hourly spill increased to 52% of total flow (greater than the spill target of 50% ± 1% range) because the spill control software program malfunctioned. Daily average spill was 50% of the total flow.
John Day	Reduced Spill	8/25/18	0700	1	Human Error	Hourly spill decreased to 28% of total flow (less than the spill target of 30% ± 1% range) due to a miscalculation. Daily average spill was 30% of the total flow.

Table 2: Pre-Coordinated Operations – August 2018 (8/1 to 8/31)

Project	Parameter	Date	Time[9]	Hours	Type	Reason
Lower Granite	Additional Spill	8/13/18 8/14/18 8/15/18 8/16/18	0700-1800 0700-1700 0700-1800 0700-1800	12 11 12 12	Maintenance	Hourly spill increased while generation went to speed no load (5 kcfs) due to units taken offline in order to perform doble testing. Regionally coordinated via the 2018 FPP Appendix A, page A-2.
Lower Granite	Reduced Spill	8/22/18	0900 1000	2	Maintenance	Hourly spill was 1 kcfs less than the adjusted spill target due to the Digital Governor upgrade of Unit 6. Regionally coordinated via the 2018 Summer FOP, Section 4.5 and 2018 FPP Appendix A.
Lower Granite	Additional Spill	8/25/18 – 8/26/18	2300-1300	15	Maintenance	Hourly spill increased up to 26 kcfs (greater than target spill of 18 kcfs) due to a cessation of generation in order to bring a transmission line back into service.
Little Goose	Reduced Spill	8/4/18	2100	1	Navigation	Hourly spill decreased to 26% of total flow (less than spill target of 30% ± 1% range). The volume of water needed to empty the navigation lock reduces the spill percentage. The spill rate did not change from the previous hour (9 kcfs). Daily average spill was 30% of the total flow. Regionally coordinated via 2018 Summer FOP, Section 4.3.2.
Little Goose	Reduced Spill	8/4/18	0700 – 1200 1700 – 2000 2200 – 2400	12	Operational limitation	Hourly spill decreased to 27% and 28% of total flow (less than the spill target of 30% ± 1% range) due to physical limits of gate settings and spill pattern. Daily average spill was 30% of total flow. Regionally coordinated via 2018 Summer FOP, Section 3 and 4.3.3, and 2018 FPP, table LGS-10.

[9] Spill variances and pre-coordinated operations are reported using hourly average data. If hourly average spill varies from the target, it is reported as one hour even if it occurred for less than one hour.
[10] The spill rate at 1000 hrs met the 2018 Summer FOP adjusted spill level.

Project	Parameter	Date	Time[9]	Hours	Type	Reason
Little Goose	Additional Spill	8/4/18	0600, 1300 - 1600	5	Operational limitation	Hourly spill increased up to 34% of total flow (greater than the spill target of 30% +/-1%) due to physical limits of gate settings and spill pattern. Daily average spill was 30% of total flow. Regionally coordinated via 2018 Summer FOP, Section 3 and 4.3.3, and 2018 FPP, table LGS-10.
Little Goose	Additional Spill	8/6/18 8/7/18 8/8/18 8/9/18	0600-1700 0600-1700 0600-1600 0600-2000	12 12 11 15	Maintenance	Hourly spill increased while generation went to speed no load (5 kcfs) due to units taken offline in order to perform doble testing. Regionally coordinated via the 2018 FPP Appendix A, page A-2.
Little Goose	Reduced Spill	8/10/18	0500	1	Navigation	Hourly spill decreased to 28% (below 30% ± 1% range). The volume of water needed to empty the navigation lock reduces the spill percentage. The spill rate was consistent with the next hour (7 kcfs). Daily average spill was 30% of the total flow. Regionally coordinated via 2018 Summer FOP, Section 4.3.2.
Little Goose	Additional Spill	8/7/18 8/8/18 8/9/18	2000-2300 0000-0500 1700-2300 0000-0500	4 13 6	Maintenance	Hourly spill increased to 16 kcfs (greater than the spill target of 11 kcfs) due to a constraint on generation capacity because doble testing occurred during the day. Regionally coordinated via the 2018 FPP Appendix A, page A-2.
Lower Monumental	Reduced Spill	8/2/18	1800	1	Navigation	Hourly spill was reduced to less than target spill (17 kcfs ± 2 kcfs) for safe navigation. Regionally coordinated via the 2018 FOP, Sections 4.1 and 4.6.
John Day	Additional Spill	8/8/18	2300	1	Transmission Stability	Hourly spill increased to 32% of total flow (greater than the spill target of 30% ± 1% range) in order to provide contingency reserves. Daily average spill was 30% of total flow. Regionally coordinated via 2018 Summer FOP, Sections 4.1 and 4.4.
The Dalles	Reduced Spill	8/5/18	2100	1	Transmission Stability	Hourly spill decreased to 37% of total flow (less than 40% ± 1% range) in order to provide contingency reserves. Daily average spill was 40% of total flow. Regionally coordinated via 2018 Summer FOP, Sections 4.1 and 4.4.

Table 3: August 2018 Average Percent TDG Values (8/1/ to 8/31)

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 %:	115	120	115	120	115	120	115	120	115	120	115	120	115	120	115	120
Method:	WA	WA	WA	WA	WA	WA	WA	WA	WA	Comb	WA	Comb	WA	Comb	WA	Comb
8/1/2018	103	116	112	114	112	117	115	114	110	116	109	114	108	113	109	117
8/2/2018	103	116	112	114	111	116	115	114	110	115	109	114	107	112	107	115
8/3/2018	103	116	112	114	109	116	114	113	108	114	107	113	106	111	105	116
8/4/2018	103	116	110	112	109	116	112	113	106	114	105	113	106	112	105	116
8/5/2018	102	116	110	110	108	116	111	113	106	114	105	113	109	113	107	117
8/6/2018	102	115	109	115	108	116	110	113	107	115	105	113	109	115	110	116
8/7/2018	102	115	108	115	109	116	111	114	108	115	106	113	109	114	111	117
8/8/2018	102	115	109	114	109	116	113	113	110	115	107	113	109	115	112	117
8/9/2018	103	112	109	115	109	115	114	114	110	115	107	115	109	114	112	117
8/10/2018	103	112	111	114	109	115	114	114	110	116	107	115	108	114	111	116
8/11/2018	103	111	112	110	110	115	114	113	109	115	107	114	106	112	108	117
8/12/2018	103	111	111	110	110	115	112	113	107	113	106	114	106	112	106	117
8/13/2018	103	116	109	109	109	113	111	112	107	114	108	114	110	114	106	115
8/14/2018	103	116	109	109	109	115	111	113	106	115	108	115	110	115	109	116
8/15/2018	103	116	109	109	107	115	110	114	107	116	107	114	110	115	112	118
8/16/2018	103	115	107	109	108	114	111	113	107	115	107	114	111	114	112	117
8/17/2018	101	113	106	109	108	112	111	112	107	114	106	114	106	113	109	117
8/18/2018	101	110	107	109	108	112	110	110	107	114	104	112	105	111	105	114
8/19/2018	101	110	108	109	108	111	110	110	107	115	106	113	109	112	106	114
8/20/2018	101	108	108	108	108	110	111	108	107	114	107	114	109	114	107	117
8/21/2018	101	109	108	108	109	112	111	109	106	114	107	114	109	114	107	117
8/22/2018	103	111	109	109	108	113	110	111	107	116	107	114	110	115	111	117
8/23/2018	102	110	109	109	107	114	110	112	106	115	107	114	110	114	111	117
8/24/2018	101	109	107	109	107	111	108	109	104	114	105	113	106	112	108	117
8/25/2018	100	109	106	109	107	113	107	112	104	115	103	113	104	111	104	117
8/26/2018	101	115	105	108	107	114	107	113	103	115	103	114	105	111	104	116
8/27/2018	101	110	105	108	107	114	107	112	101	114	102	113	105	111	105	117
8/28/2018	100	109	104	109	106	111	107	110	102	114	102	112	108	111	107	116
8/29/2018	100	113	105	109	106	116	107	113	103	114	103	114	109	114	110	117
8/30/2018	100	113	105	109	106	115	107	113	103	114	102	114	108	113	110	118
8/31/2018	98	112	104	109	105	115	107	113	103	114	102	115	105	111	107	118

Figure 1

Lower Granite Dam - Hourly Spill and Flow

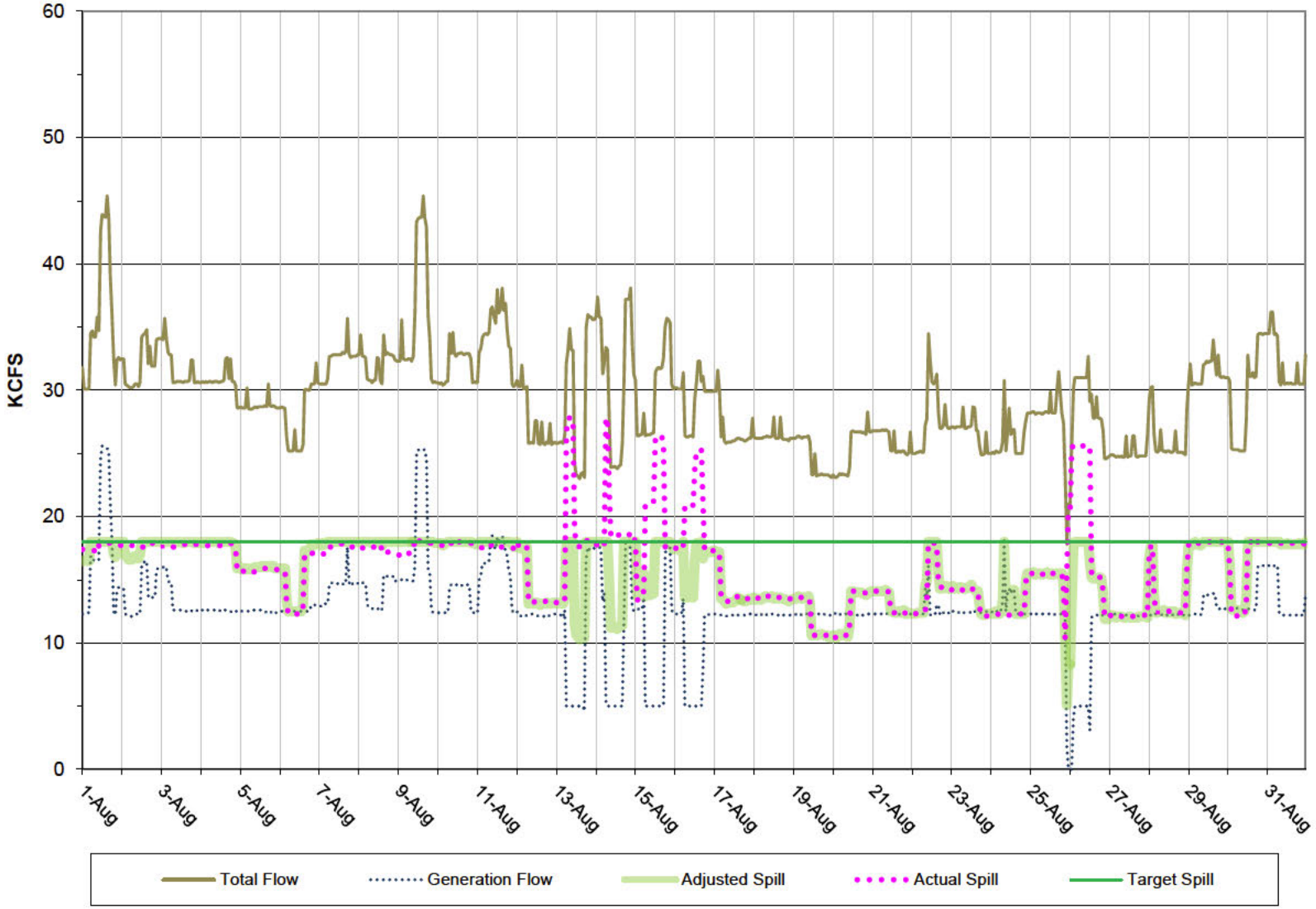


Figure 2

Little Goose Dam - Hourly Spill and Flow

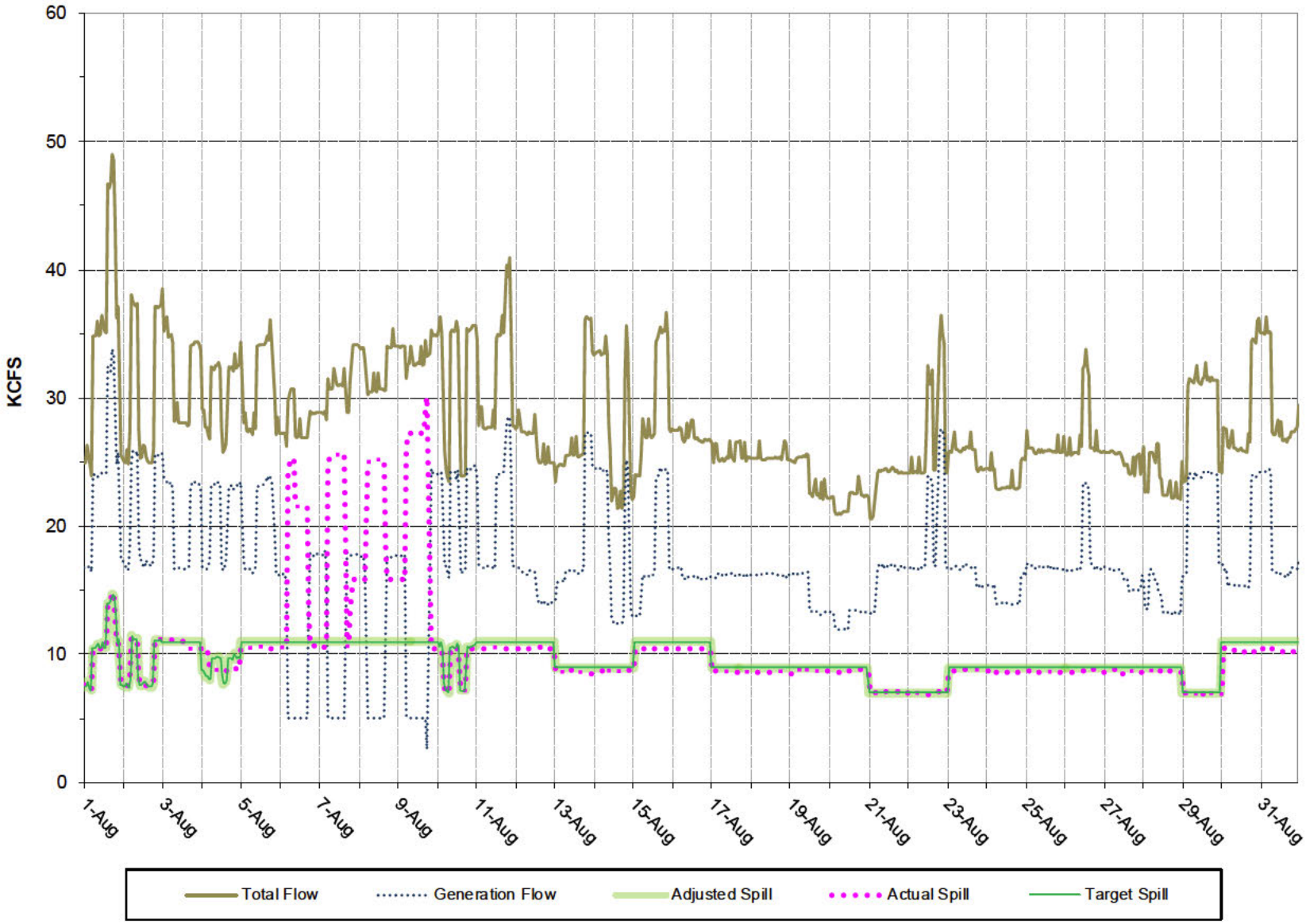


Figure 3

Lower Monumental Dam - Hourly Spill and Flow

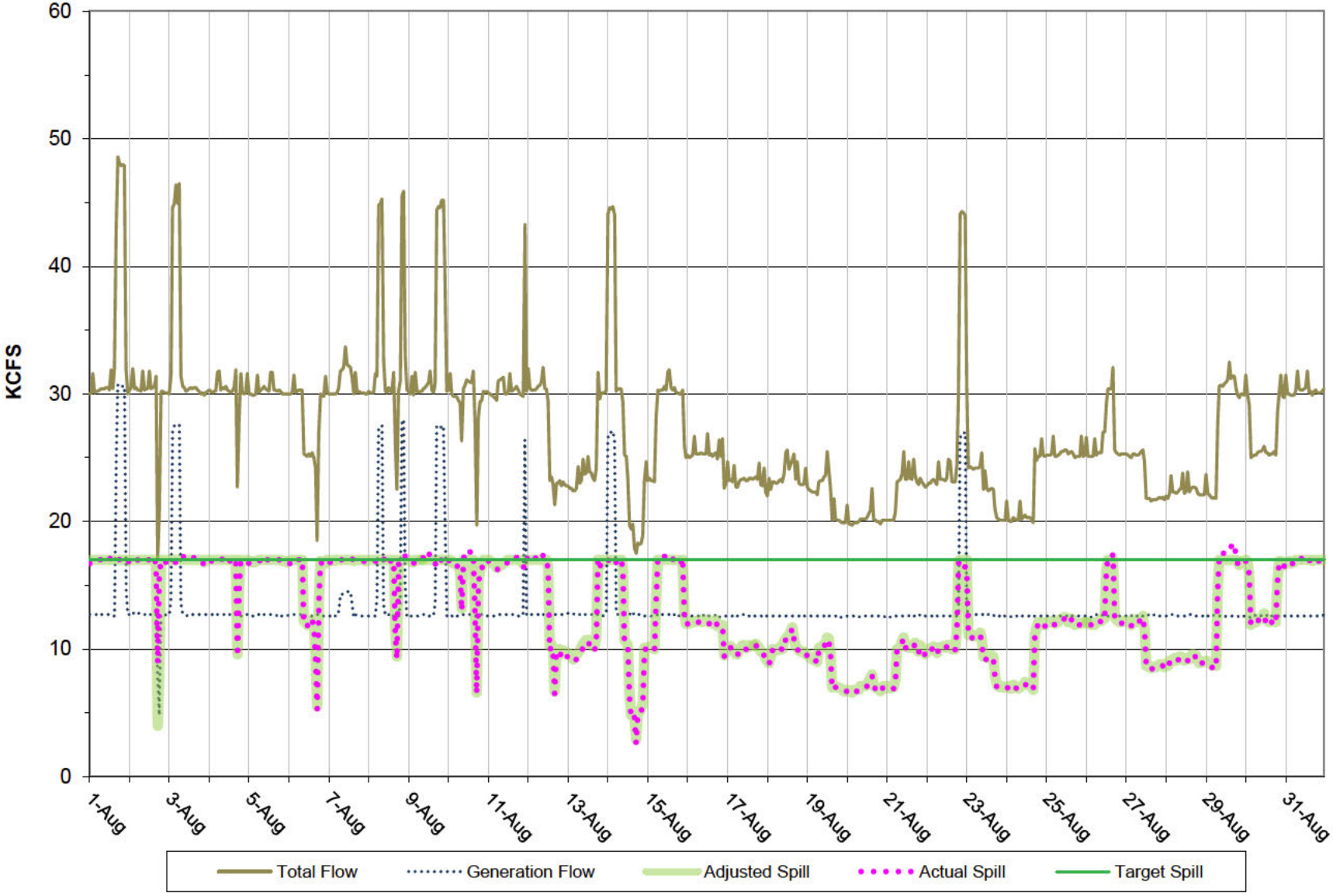


Figure 4

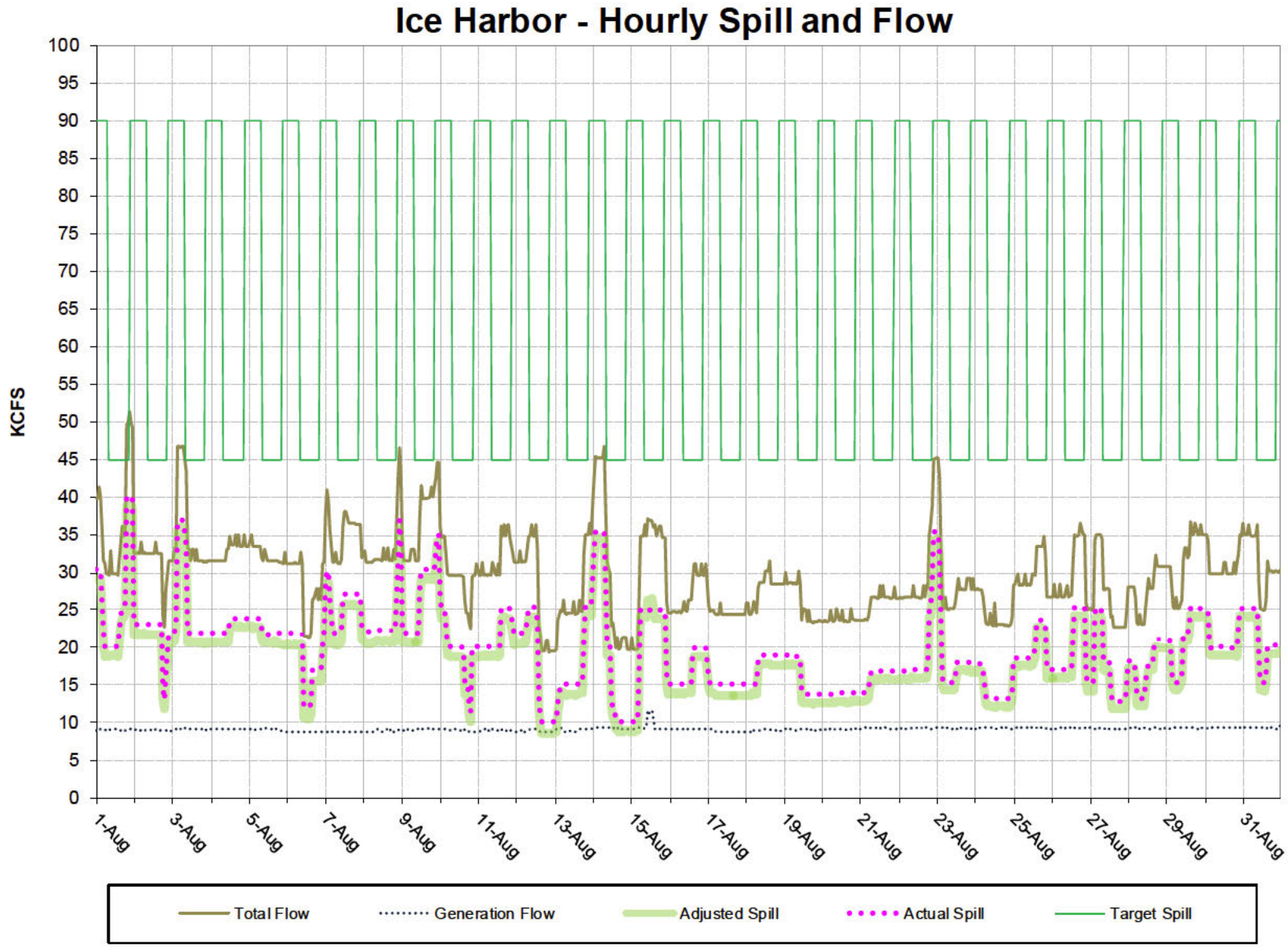

Ice Harbor - Hourly Spill and Flow
KCFS
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted Spill
Actual Spill
Target Spill

Figure 5

McNary Dam - Hourly Spill and Flow

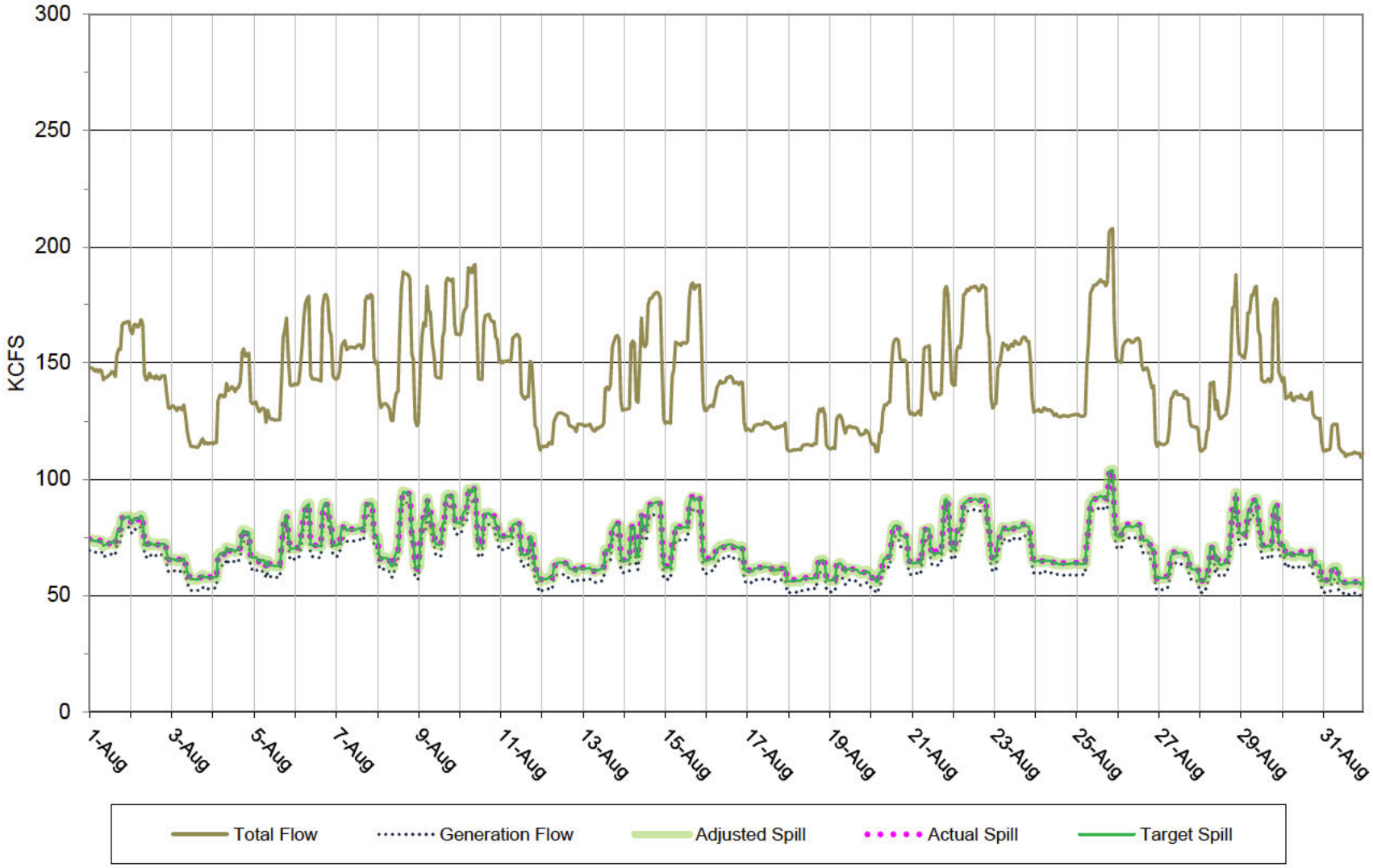


Figure 6

John Day Dam - Hourly Spill and Flow

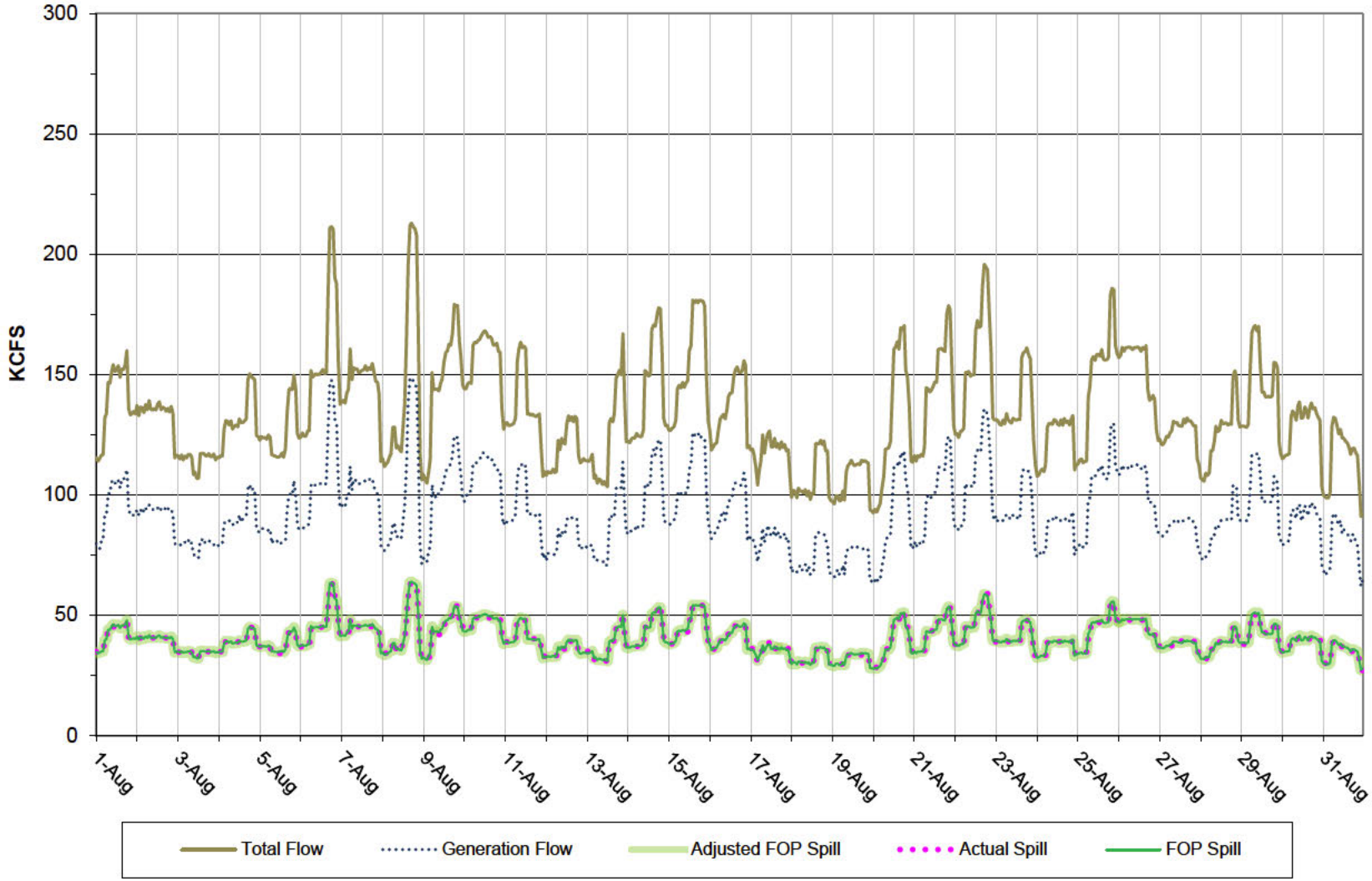


Figure 7

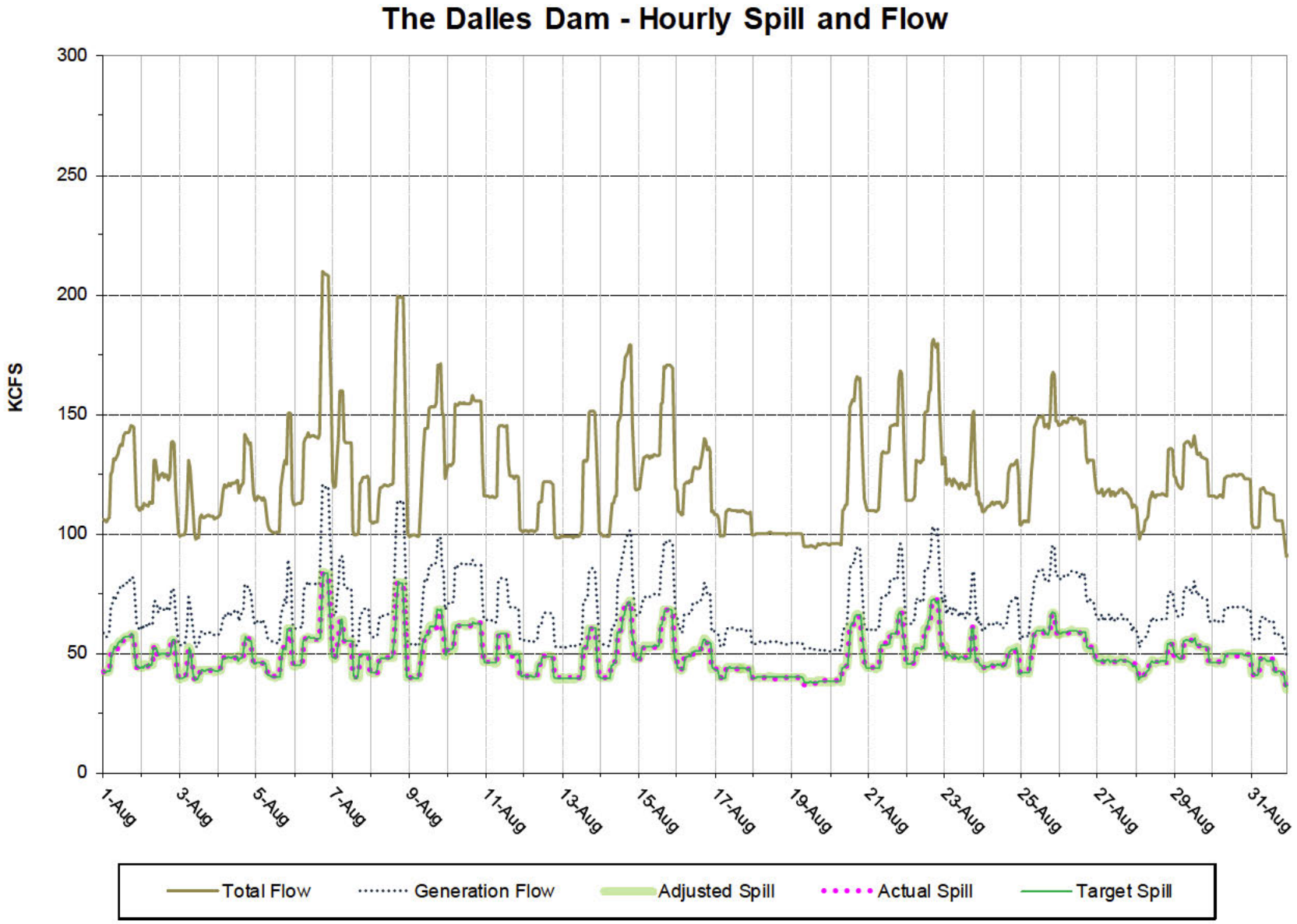
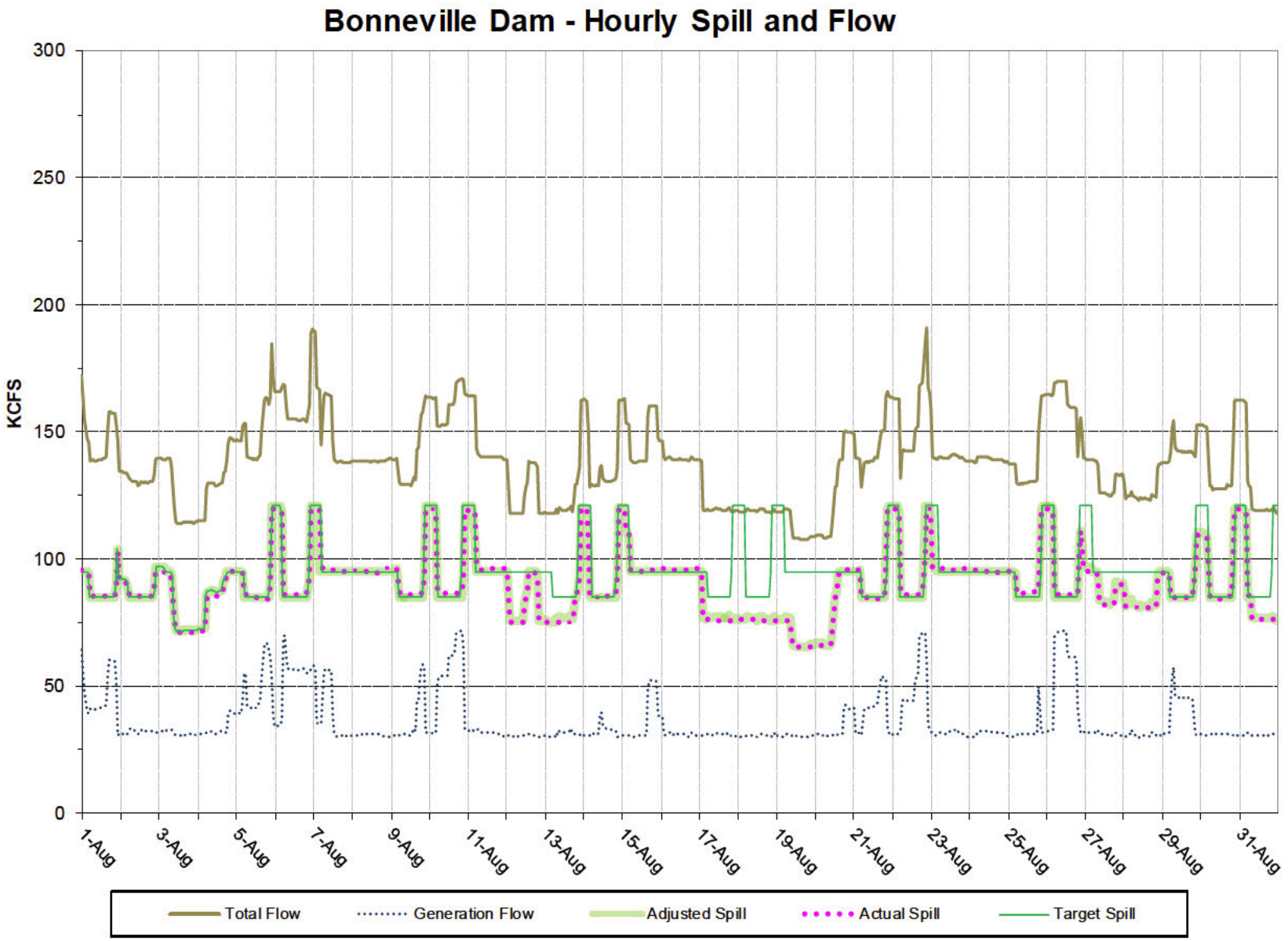

The Dalles Dam - Hourly Spill and Flow
KCFS
300
250
200
150
100
50
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted Spill
Actual Spill
Target Spill

Figure 8


Bonneville Dam - Hourly Spill and Flow
KCFS
300
250
200
150
100
50
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted Spill
Actual Spill
Target Spill