FISH OPERATIONS PLAN IMPLEMENTATION REPORT

August 2016

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 2016 Fish Operations Plan (2016 FOP) posted to the Technical Management Team (TMT) website on February 29, 2016. The 2016 FOP describes the Corps' project operations for fish passage at its Federal Columbia River Power System (FCRPS) dams during the spring and summer fish migration season, generally April through August. To the extent Corps project operations are not specified in the 2016 FOP, the FCRPS operations will be consistent with the 2014 NOAA Fisheries Supplemental Biological Opinion (2014 Supplemental BiOp), the USFWS 2000 and 2006 BiOps, and/or other operative documents, including the 2016 Water Management Plan (WMP), WMP seasonal updates, and the 2016 Fish Passage Plan (FPP).

The Corps' August 2016 lower Snake and Columbia River project and fish passage operations are contained in this report. In particular, information in this report includes the following:

- Hourly flow through the powerhouse at each dam;
- Hourly flow over the spillway compared to the spill target for that hour; and
- Daily average Total Dissolved Gas (TDG) levels (percent of saturation) in the tailwater at each project, and in the subsequent downstream project's forebay.[1]

This report also provides information on presented issues and unanticipated or emergency situations that arose during implementation of the 2016 FOP in August 2016.

Data Reporting

I. For each project providing fish passage operations, this report contains one graph per operational month (August) displaying the performance of the fish passage spill program, with hourly spill, FOP spill, generation, and total flows. The monthly graphs begin on August 1 and end on August 31 for the following lower Snake River and lower Columbia River projects: Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville.

[1] 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.

Operations represented on the monthly graphs start at 0100 hours on August 1 for the lower Snake River and the lower Columbia River projects as follows:

- 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 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 FOP spill level as defined in the 2016 FOP.
- The thick green line represents the adjusted FOP spill. This is the hourly maximum 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 the following conditions:

    - spill percentage or flow rate specified in the 2016 FOP;
    - spill caps as set daily for TDG management;
    - test spill levels for fish passage research;
    - minimum generation for power system needs;
    - minimum spill at Bonneville (50 kcfs) dam; and
    - minimum spill at John Day is 25 percent of project outflow.

II. The average daily %TDG for the 12 highest hours for all projects is shown in the August 2016 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 (controlling limit), and the lower value is displayed with a strikethrough.

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 spill levels briefly deviate below or above the level specified in the 2016 FOP, the dotted pink line will be below or above the heavy green line in the figures.[2] Actual deviations from the target operation during voluntary spill hours are described below in the August 2016 Spill Variance Table (Table 1).[3] The Spill Variance Table includes average hourly data; therefore, while spill may vary from target FOP spill for only a portion of an hour, the Spill Variance Table characterizes the variance as a full hour. There are instances when the hourly FOP 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

[2] The actual thickness of the heavy green line (Adjusted FOP Spill) is not intended to represent the full allowable tolerance; and if the dotted pink line is slightly outside it should not be construed to indicate a spill variance or involuntary spill.

[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, and passing debris.

stops to most closely approximate the 2016 FOP level of spill while also avoiding exceeding the %TDG spill cap to the extent practicable.

"Low flow" operations at the lower Columbia and Snake projects are triggered when inflow is insufficient to provide both minimum generation and the specified 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. During low flow periods at Little Goose Dam, the overall project spill percentage appears to be reduced because the calculations do not account for the volume of water released during navigational lockages; however, the actual spill volume remains constant. When this occurs, it is recorded in the monthly Pre-Coordinated Operations Table (Table 2)[4] denoted as "Navigation" type.

Actual spill levels at Corps projects with set flow targets may vary up to ±2 kcfs within the hour (except as otherwise noted in the 2016 FOP for Bonneville and The Dalles dams[5], which may range up to ±3 kcfs) as compared to those specified in the 2016 FOP and the RCC spill priority list (defining the project %TDG spill caps). 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).

The 2016 FOP describes project "Operations during Rapid Load Changes" (p. 6). For reporting purposes, when hourly spill levels were not met as a result of load swing hours and other related within-hour load variability issues, the notation "Transmission Stability" will be used in the Spill Variance Table. "Transmission Stability" occurs because projects must be available to respond to within-hour load variability to satisfy North American Electric Reliability Corporation (NERC) reserve requirements ("on response") or other NERC mandatory reliability regulatory requirements. In addition to within-hour load variability, projects on response must be responsive to within hour changes resulting from intermittent generation (such as wind generation). During periods of rapidly changing loads and intermittent generation, projects on response may have significant changes in turbine discharge within the hour while spill quantity remains the same within the hour. Under normal conditions, within-hour load changes primarily occur immediately preceding and following the peak load hours; however, within-hour changes in intermittent generation can occur at any hour of the day. Occasionally, several hours after peak load hours, the project may be decreasing total outflow and generation faster than the

[4] Other routine activities that change spill levels and have been coordinated with regional partners will be identified in Table 2.

[5] As specified in the 2016 FOP (p. 14), this applies when the spill level is below 40% of total flow at The Dalles Dam.

corresponding spill decreases causing the percent spill to be slightly higher. Due to the high variability of within-hour load, reporting actual spill percentages that vary by more than the ±1 percent within hour requirement (or other ranges specified in the 2016 FOP) may occur with greater frequency with "Transmission Stability" hours than other hours.

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 below average flows for the lower Snake River and lower Columbia River. The NOAA Northwest River Forecast Center's Runoff Processor indicated that the August 2016 adjusted volume runoff on the lower Snake River was below the 30 year average (1981-2010): 0.92 MAF (Million Acre Feet) or 74% of average as measured at Lower Granite Dam. For the lower Columbia, the Runoff Processor indicated the August 2016 adjusted volume runoff was also below the 30 year average (1981-2010): 5.7 MAF or 75% of average as measured at The Dalles. The monthly precipitation summary for August was well below average at 12% on the Snake River above Ice Harbor Dam and well below average on the Columbia River above The Dalles Dam at 31%.

During the August 2016 reporting period, the planned 2016 FOP spill operations were carried out as follows:

- Lower Granite Dam - The hourly target spill level was 18 kcfs, 24 hours/day.
- Little Goose Dam - The hourly target spill level was a fixed rate of 7-11 kcfs, depending on the previous day's average project outflow: outflow 28-32 kcfs = spill 11 kcfs; outflow 24-27.9 kcfs = spill 9 kcfs; outflow less than or equal to 23.9 kcfs = spill 7 kcfs.
- Lower Monumental Dam - The hourly target spill level was 17 kcfs, 24 hours/day.
- Ice Harbor Dam - The hourly target spill level was 45 kcfs during the day and the %TDG cap during the night. Nighttime spill hours are 1800–0500.
- McNary Dam - The hourly target spill level was 50% of total project outflow, 24 hours/day.
- John Day Dam - The hourly target spill level was 30% of total project outflow, 24 hours/day.
- The Dalles Dam - The hourly target spill level was 40% of total project outflow, 24 hours/day.
- Bonneville Dam - The hourly target spill level of 95 kcfs, 24 hours/day, continues in order to minimize erosion of the Bradford Branch-B fish ladder. See Operational Adjustments section and the July 2016 FOP Implementation Report for additional discussion of this operation.

Table 1: Spill Variance Table – August 2016 (8/1 to 8/31)

Project	Parameter	Date	Time[6]	Hours	Type	Reason
Lower Granite	Reduced Spill	8/11/16 – 8/12/16	1900 - 1800	24	Human Error	Generation ranged from 14.0 to 14.4 kcfs, outside of FOP minimum generation range (11.6-13.2 kcfs) due to use of incorrect unit priority implemented following a full powerhouse outage.
Ice Harbor	Reduced Spill	8/25/16	1800-2000	3	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.[7]
Ice Harbor	Reduced Spill	8/26/16	0200-1000	9	Human Error	Generation ranged from 10.1 to 10.2 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/26/16	1200-1400	3	Human Error	Generation ranged from 10.1 to 10.2 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/26/16	1600	1	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/27/16	0300-0400	2	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/27/16	0600	1	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/27/16	0900 - 1800	10	Human Error	Generation ranged from 10.1 to 10.2 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/27/16	2000	1	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/27/16-8/28/16	2300-0400	6	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/28/16	0600	1	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/28/16	0900-1000	2	Human Error	Generation ranged from 10.1 to 10.2 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/28/16	1200-1500	4	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/28/16	1700-1800	2	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/29/16	0200	1	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/29/16	0400-0500	2	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/29/16	0700-0800	2	Human Error	Generation was 10.1 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.

[6] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.
[7] Corrective action has been taken to avoid future miscommunication between the duty scheduler and the project operator.

Project	Parameter	Date	Time[6]	Hours	Type	Reason
Ice Harbor	Reduced Spill	8/29/16	1000	1	Human Error	Generation was 10.2 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to incorrect use of minimum generation range.
Ice Harbor	Reduced Spill	8/31/16	1200	1	Program Error	Generation was 10.8 kcfs, outside of FOP minimum generation range (8.2-10.0 kcfs) due to a malfunction of the program that manages generation.
John Day	Additional Spill	8/2/16	1300	1	Program Error	Hourly spill increased to 32% (above 30% ±1%) due to using a backup computer while installing new computer software.

Table 2: Pre-Coordinated Operations – August 2016 (8/1 to 8/31)

Project	Date[6]	Type	Description of Event	Regional Coordination
Lower Granite	Partial day from August 8 through August 11	Maintenance	Spill increased due to units taken offline in order to perform doble testing.	2016 FPP, LWG, section 4.3.5 and Appendix A sections 1.4.
Lower Granite	August 23	Maintenance	Spill remained the same while generation increased in order to perform pre-shutdown testing for annual maintenance of unit 5.	2016 FPP, LWG, section 4.3.2 and 2016 FOP, page 7.
Lower Granite	August 25	Maintenance	Spill remained the same while generation increased in order to perform post-shutdown testing for annual maintenance of unit 6.	2016 FPP, LWG, section 4.3.2 and 2016 FOP, page 7.
Lower Granite	August 29	Maintenance	Spill increased to 8-9 kcfs while generation increased in order to perform pre-shutdown testing for annual maintenance of unit 5.	2016 FPP, LWG, section 4.3.2 and 2016 FOP, page 7.
Little Goose	Partial day from August 15 and August 18	Maintenance	Spill increased due to units taken offline in order to perform doble testing.	2016 FPP, LGS, section 4.3.5 and Appendix A sections 1.4.
Lower Monumental	Partial day from August 1 through August 5	Maintenance	Spill increased due to units taken offline in order to perform doble testing.	2016 FPP, LMN, section 4.3.5 and Appendix A sections 1.4 and 7.1.7.
Lower Monumental	Every other day from August 1 through August 15	Navigation	Spill was reduced for safe passage of fish barges crossing project tailwater.	2016 FOP, pages 2, 4 and 7
Ice Harbor	August 25	Maintenance	Spill remained the same while generation increased in order to perform post-shutdown testing for annual maintenance of unit 1.	2016 FPP, IHR, section 4.3.2 and 2016 FOP, page 7
Ice Harbor	August 29	Maintenance	Spill remained the same while generation increased in order to perform post-shutdown testing for annual maintenance of unit 3.	2016 FPP, IHR, section 4.3.2 and 2016 FOP, page 7
Bonneville	August 1-August 31	Operational Limitations	Spill was switched to a constant 95 kcfs starting on July 5 in order to minimize erosion of the Bradford Branch-B fish ladder.	The modified spill treatment schedule was coordinated with the region via FPOM memo of coordination (MOC) 16BON47.

Table 3: August 2016 Average Percent TDG Values Table (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	OR	WA	WA	OR	WA	WA	OR	WA	WA	OR	WA
8/1/2016	104	110	108	109	107	116	113	111	109	117	~~117~~	106	114	~~114~~	107	113	~~113~~	104	117	~~117~~
8/2/2016	103	110	108	109	107	117	113	109	108	~~115~~	117	106	~~113~~	114	107	~~112~~	113	104	117	~~117~~
8/3/2016	103	111	107	109	106	117	111	109	105	~~114~~	114	104	113	~~113~~	105	~~111~~	111	105	~~116~~	117
8/4/2016	102	111	107	110	106	118	110	109	106	~~116~~	116	105	113	~~113~~	109	114	~~114~~	107	114	~~114~~
8/5/2016	103	112	107	110	106	116	111	110	106	116	~~116~~	105	~~113~~	113	109	~~114~~	114	109	~~117~~	117
8/6/2016	103	112	106	109	106	114	111	110	107	~~115~~	116	104	~~113~~	113	107	~~112~~	113	109	~~117~~	117
8/7/2016	102	111	105	109	106	112	110	110	107	~~114~~	114	104	~~112~~	113	104	~~111~~	111	106	~~117~~	117
8/8/2016	102	114	105	109	106	111	109	110	107	115	~~115~~	103	113	~~113~~	105	111	~~111~~	104	117	~~117~~
8/9/2016	102	114	105	109	105	111	108	109	105	~~115~~	115	103	~~113~~	113	105	111	~~111~~	104	~~116~~	117
8/10/2016	102	114	105	109	104	112	108	109	104	115	~~115~~	102	114	~~114~~	104	111	~~111~~	105	115	~~115~~
8/11/2016	102	114	105	109	104	112	107	110	105	116	~~115~~	103	114	~~114~~	106	113	~~113~~	107	117	~~117~~
8/12/2016	101	112	105	109	104	112	106	110	106	116	~~116~~	104	~~113~~	114	108	114	~~114~~	110	117	~~117~~
8/13/2016	101	109	105	109	105	111	106	109	107	116	~~116~~	105	114	~~114~~	108	114	~~114~~	112	117	~~117~~
8/14/2016	101	109	106	109	106	111	106	108	108	~~115~~	115	105	~~113~~	114	108	~~113~~	113	112	~~115~~	117
8/15/2016	101	108	106	113	106	109	108	107	108	~~114~~	114	105	~~112~~	113	107	~~111~~	112	109	114	~~114~~
8/16/2016	101	111	106	111	106	113	108	111	109	115	~~115~~	106	113	~~113~~	106	~~111~~	111	106	114	~~114~~
8/17/2016	103	111	107	110	106	114	109	112	109	~~115~~	116	107	~~114~~	114	106	112	~~112~~	104	114	~~114~~
8/18/2016	102	109	108	115	106	110	109	108	109	116	~~116~~	108	~~115~~	115	108	113	~~113~~	105	~~114~~	114
8/19/2016	102	111	108	113	107	113	109	112	109	117	~~117~~	109	~~115~~	116	110	~~115~~	115	107	117	~~117~~
8/20/2016	102	110	107	110	107	112	109	110	109	117	~~117~~	109	~~115~~	115	111	115	~~115~~	111	117	~~117~~
8/21/2016	103	109	107	110	107	110	109	107	109	~~114~~	116	109	~~114~~	115	111	~~113~~	115	111	~~116~~	117
8/22/2016	102	108	106	108	107	109	109	107	106	114	~~114~~	108	~~113~~	114	109	~~111~~	112	109	~~116~~	116
8/23/2016	102	105	106	109	107	109	108	108	104	114	~~114~~	106	~~113~~	113	106	111	~~111~~	105	~~114~~	116
8/24/2016	101	105	106	109	106	109	107	108	104	~~114~~	114	106	113	~~113~~	108	112	~~112~~	106	114	~~114~~
8/25/2016	102	105	106	109	106	108	107	107	103	113	~~113~~	107	114	~~114~~	109	113	~~113~~	110	~~114~~	114
8/26/2016	102	106	107	109	106	108	107	107	104	115	~~114~~	107	~~114~~	114	110	~~114~~	114	111	114	~~114~~
8/27/2016	102	107	107	109	106	109	106	107	104	~~113~~	114	107	~~113~~	114	110	~~113~~	114	111	~~113~~	114
8/28/2016	101	106	106	108	106	110	106	108	103	113	~~113~~	105	~~112~~	112	108	111	~~111~~	109	113	~~113~~
8/29/2016	100	106	105	108	106	110	106	108	104	114	~~114~~	105	114	~~114~~	108	112	~~112~~	107	116	~~116~~
8/30/2016	101	106	105	108	105	108	106	107	104	~~113~~	114	105	~~113~~	114	108	~~112~~	112	106	~~115~~	116
8/31/2016	101	105	105	109	105	108	106	106	103	113	~~113~~	104	112	~~112~~	105	~~111~~	111	105	~~113~~	113

Figure 1

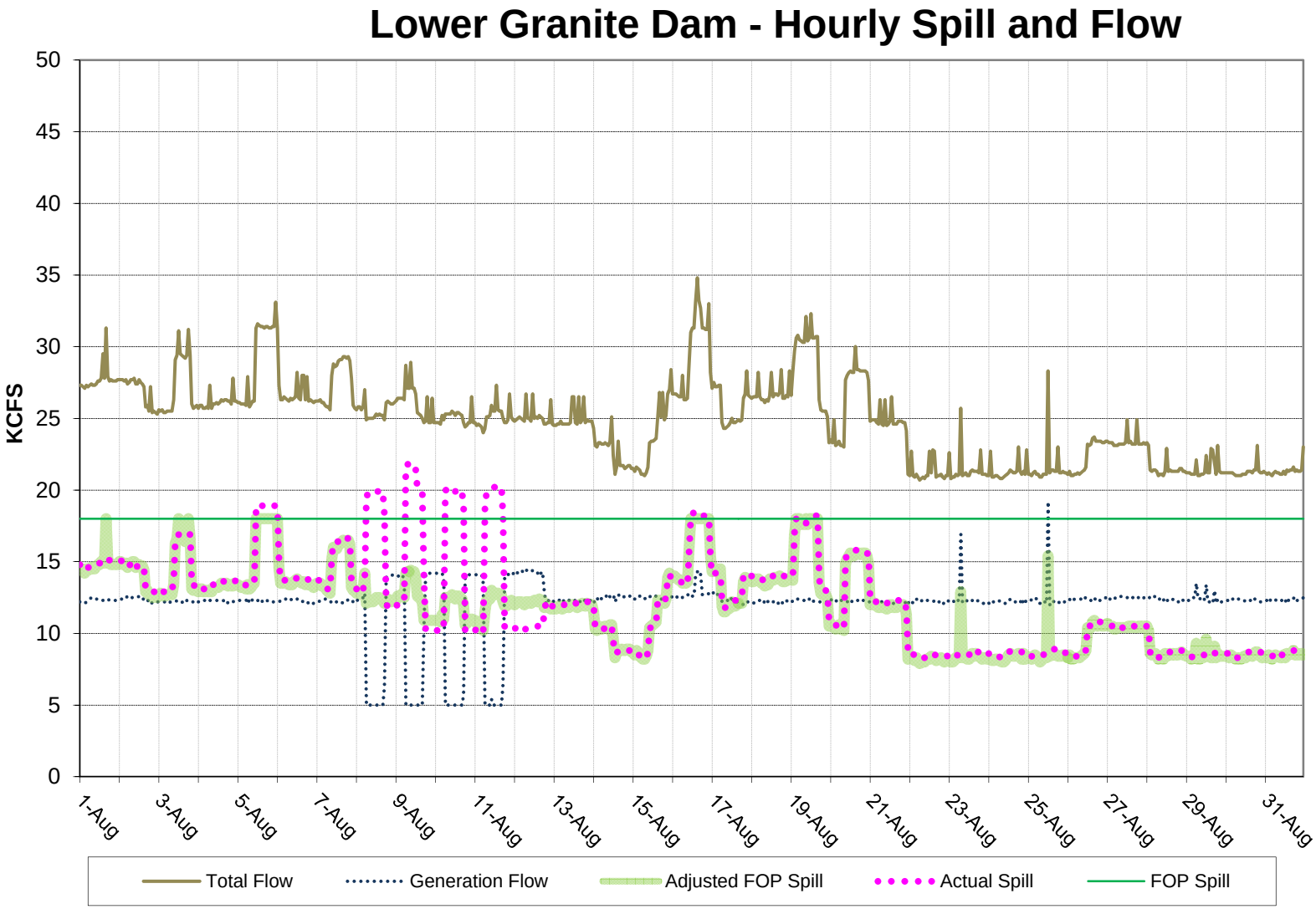

Lower Granite Dam - Hourly Spill and Flow
KCFS
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 2

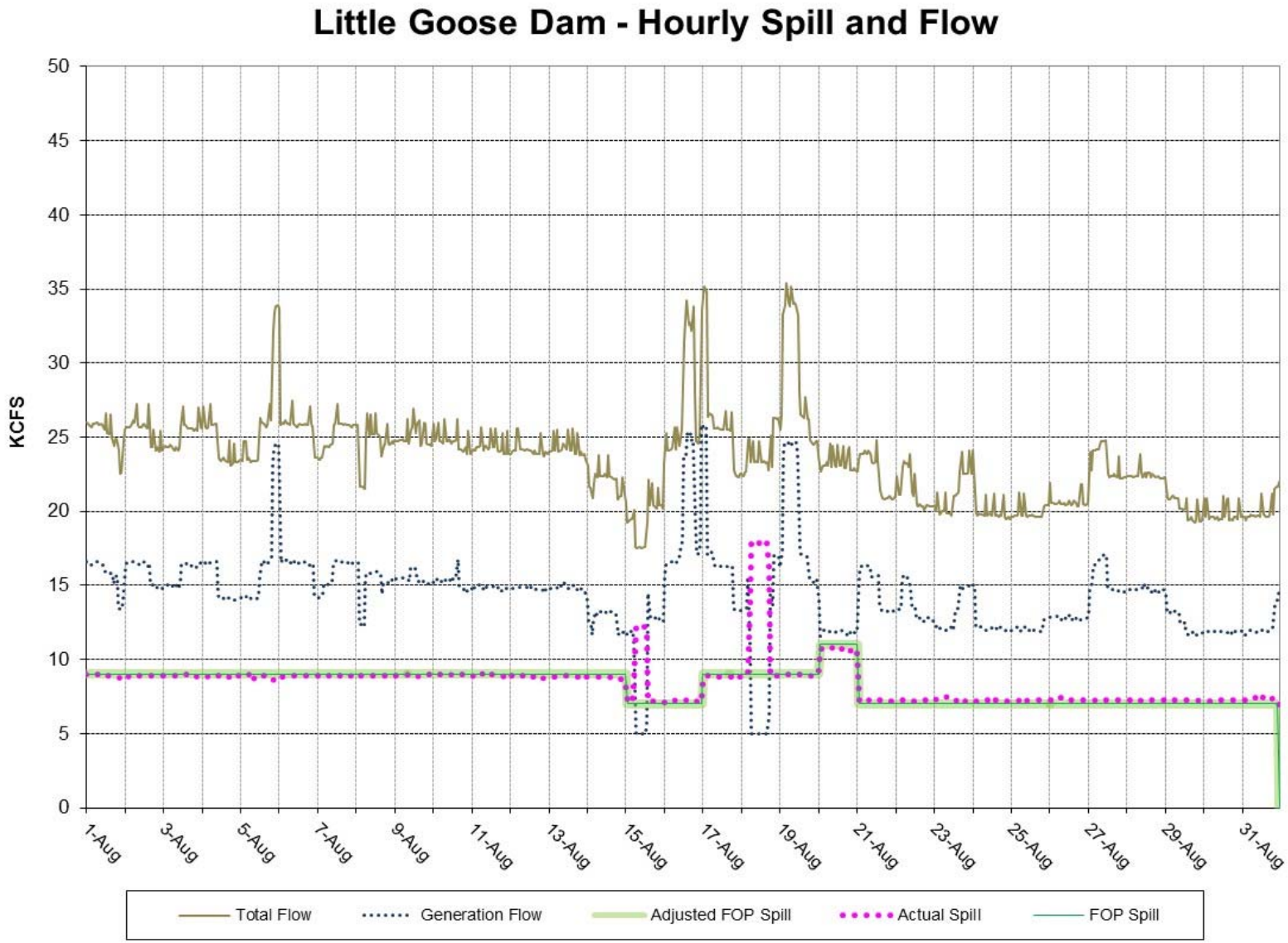

Little Goose Dam - Hourly Spill and Flow
KCFS
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 3

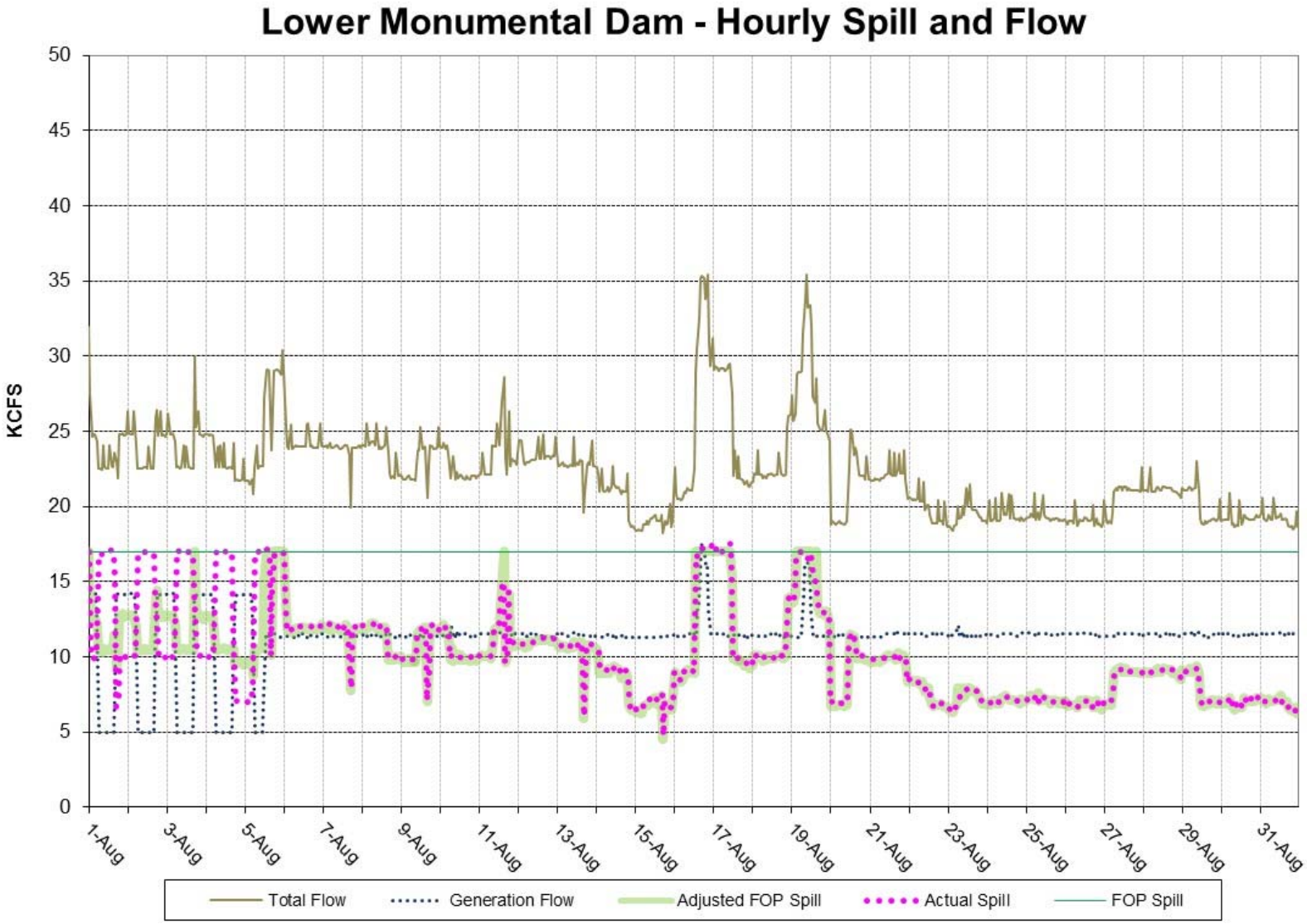

Lower Monumental Dam - Hourly Spill and Flow
KCFS
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 4

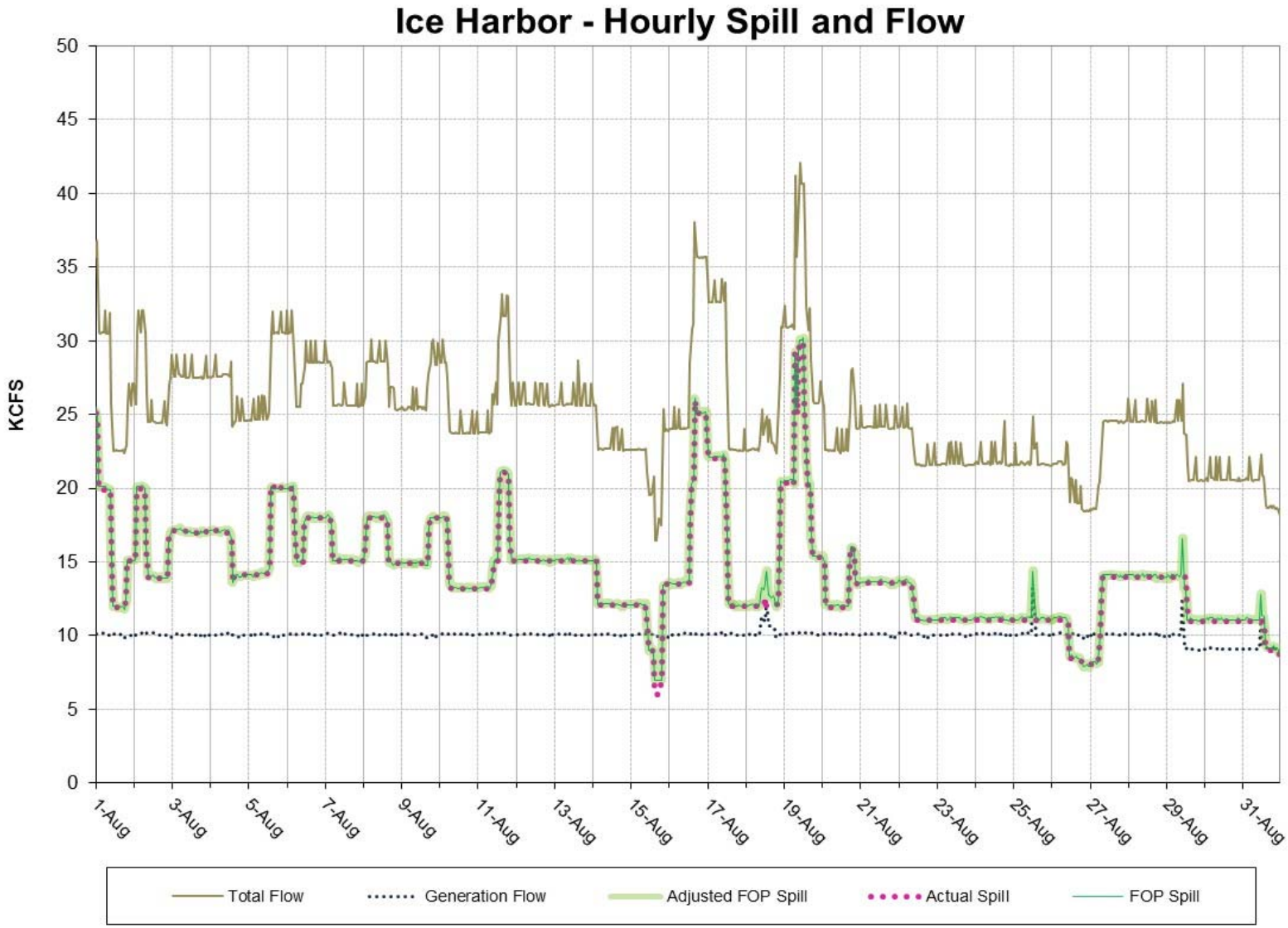

Ice Harbor - Hourly Spill and Flow
KCFS
50
45
40
35
30
25
20
15
10
5
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 5

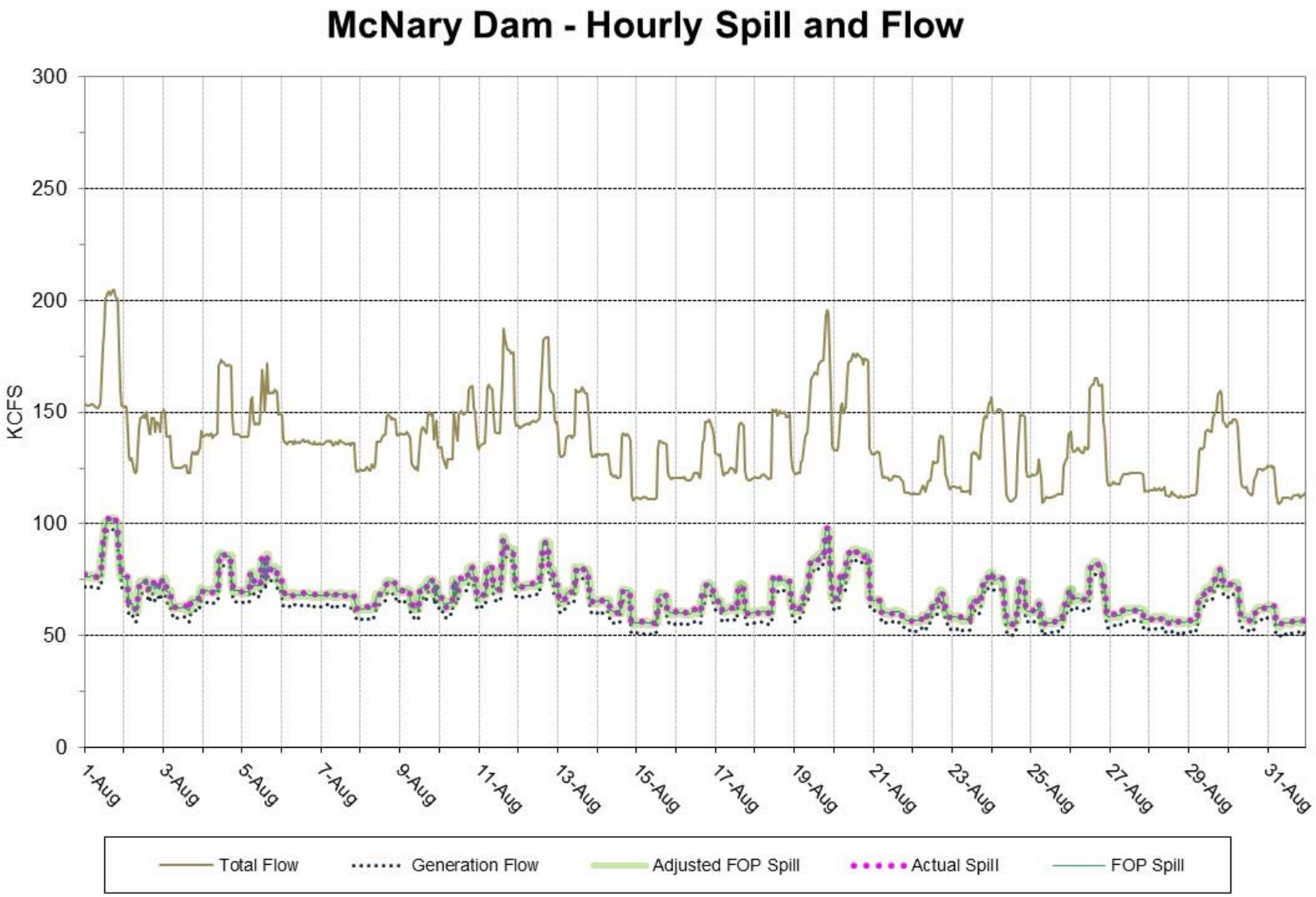

McNary Dam - Hourly Spill and Flow
KCFS
300
250
200
150
100
50
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 6

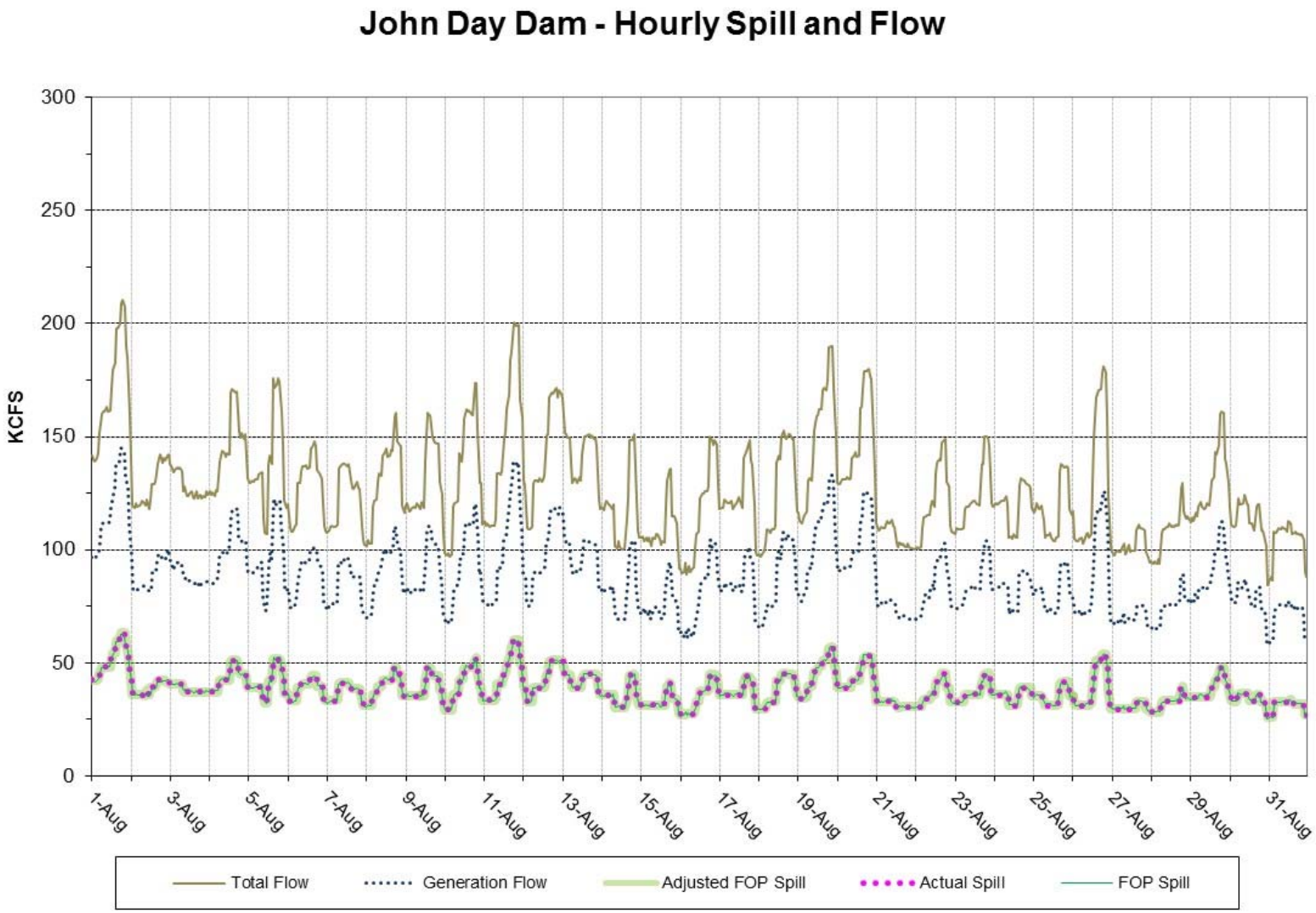

John Day Dam - Hourly Spill and Flow
KCFS
300
250
200
150
100
50
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 7

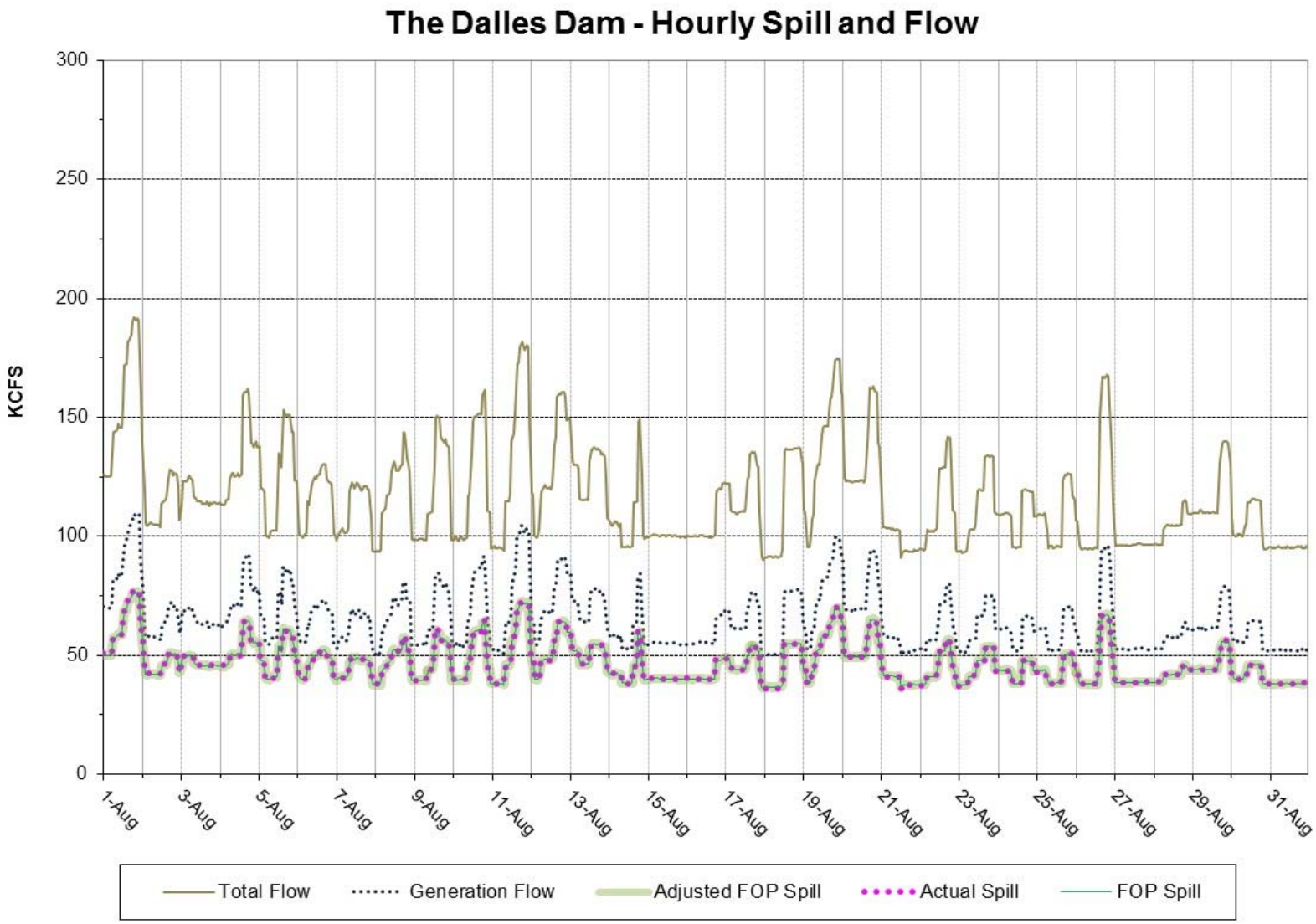
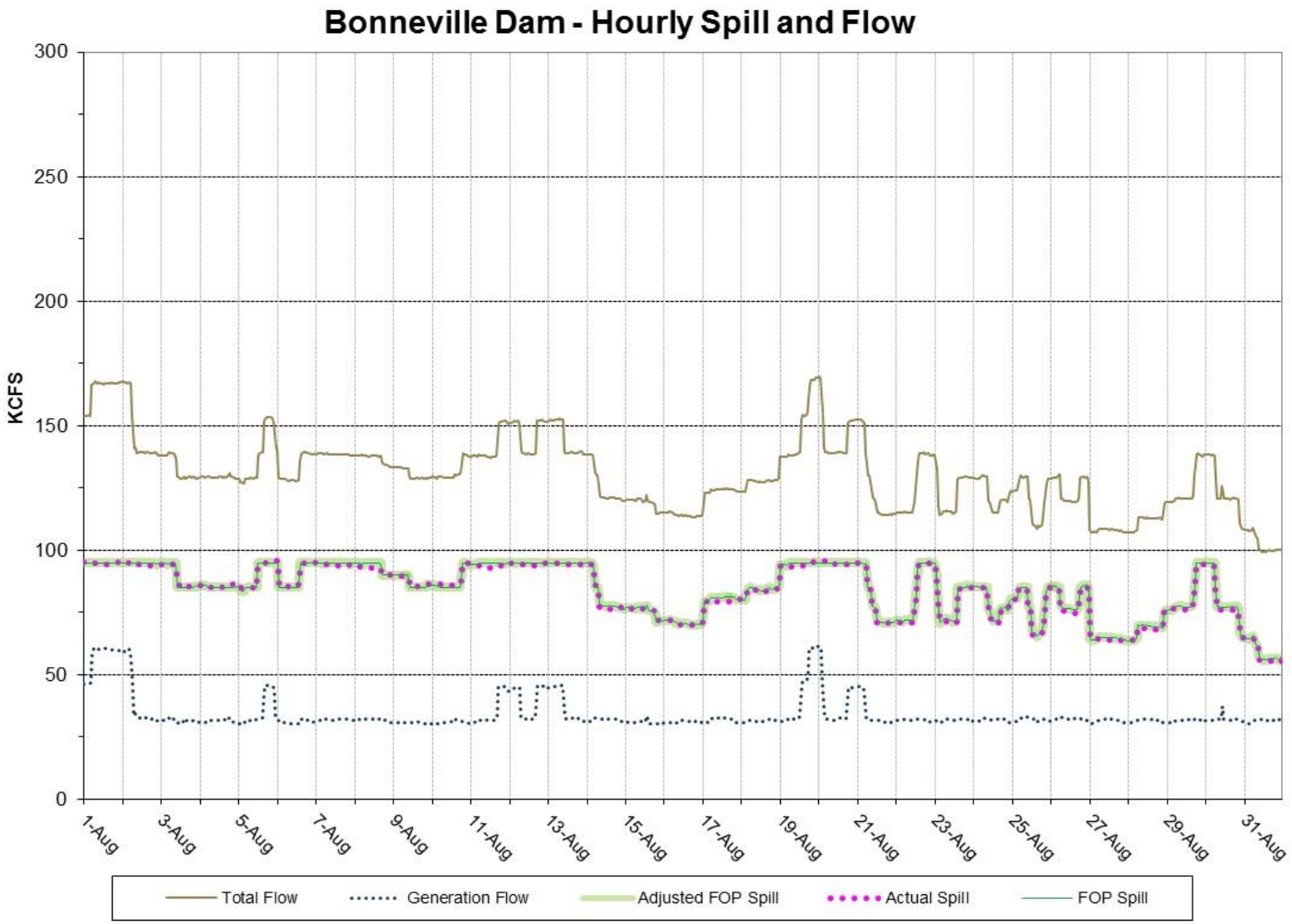

The Dalles Dam - Hourly Spill and Flow
KCFS
300
250
200
150
100
50
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

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 FOP Spill
Actual Spill
FOP Spill