



Bull Shoals Flow Monitoring Analysis

December 10, 2025

Purpose:

- Compare flow rates during dry and wet weather
- Pinpoint areas experiencing excessive infiltration and inflow (I&I)

Available Data	Info Extracted from Data	Available Data
SCADA	• PS runtime peaking factors • Used to compare which PS ran excessively during rain events	All
Rain Gauge	• Total rainfall (in) and rainfall intensity (mm/hr) • Used to evaluate rain events and dry weather periods	06/25/2025 to 10/1/2025
Flow Monitoring	• PS flow peaking factors • Find MGD/in-D-mi values to find which areas have excessive flow	06/25/2025 to 10/1/2025
Lake Levels	• Lake level driven infiltration	05/2025 to 09/2025
Treatment plant inflows	• Inflow vs rainfall evaluation provides infiltration indication	2023 to 2025

Summary

Monitoring Observations:

- Comprehensive 3--month dataset
- 2 Significant rainfall events were recorded
 - Both intensities consistent with 1-year storm event
 - Both events provide sufficient magnitude to evaluate the system's performance under notable rainfall conditions
- Flow meter responses were generally satisfactory for both rain events

Sewer Screening Observations:

- Preliminary sewer screening showed limited I/I observations in trunk lines connecting the southwest, east, and central areas of the system to the treatment plant that are not large contributors to capacity issues

Monitoring Analysis:

- Three methods to evaluate I/I and capacity conducted:
 - Flow Peaking factors
 - Gal/Day/in-D-mi
 - Runtime Peaking Factors

Findings:

- FM 4, 6A, 6B, and 16C show the greatest peaking factors
- FM 6A, 6B, and 16C show the most excessive flow rates
- PS 5A, 7, 14, 16, and 17 show longest pump runtimes

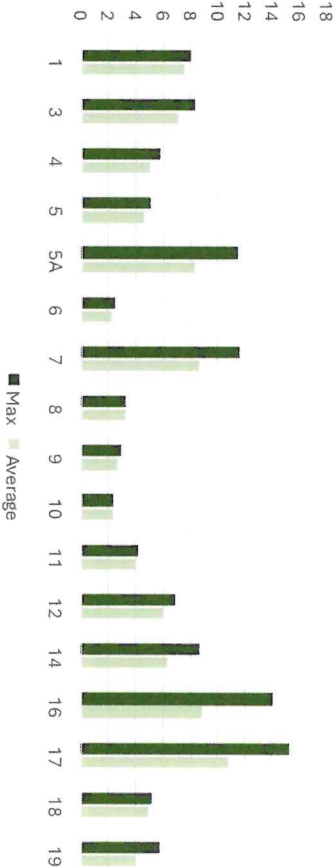
Notable Rain Events

Start Date/Time	Duration (hr)	Total Rain (in)	Peak Intensity (in/hr)
6/28/25 12:50	4.67	1.31	1.27
9/23/25 9:45	9.58	2.34	1.26

Monitoring Analysis Summary

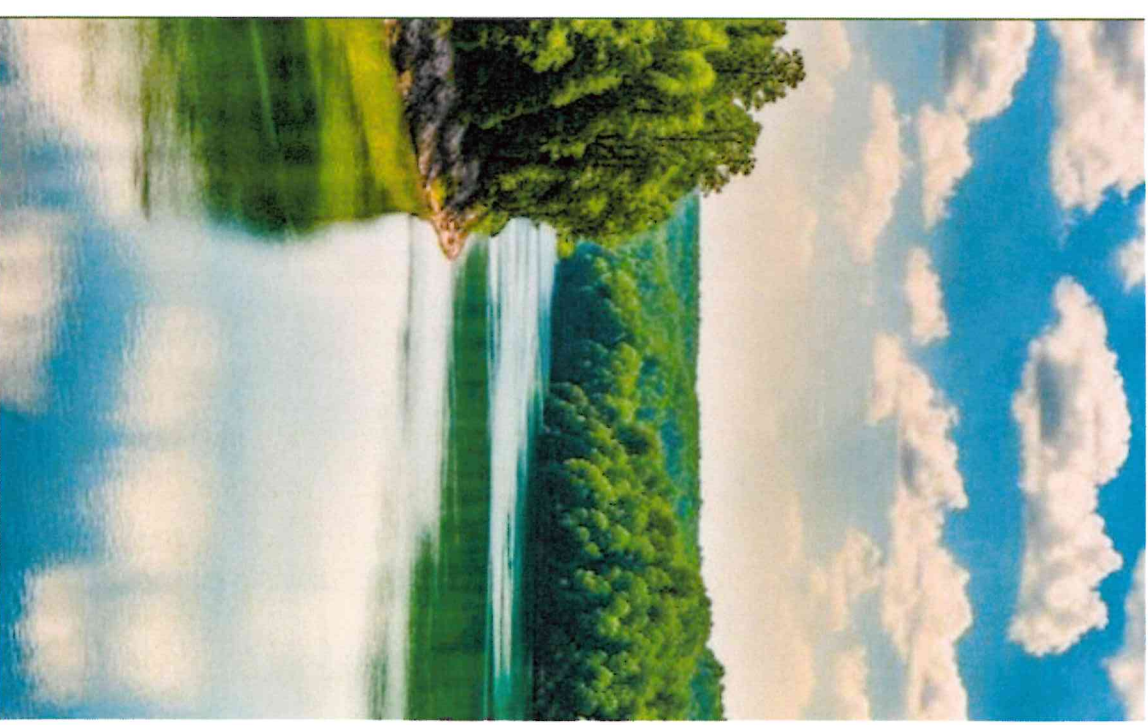
Flow Monitor	Max Flow/Level Peaking Factor	I/I Gal/Day/in-D-mi
FM 4	8.38	812
FM 6A	8.48	6702
FM 6B	7.85	3648
FM 15	6.43	2607
FM 16A	4.76	3130
FM 16C	9.98	6073
LM 2	1.13	-
LM 15	1.34	-

Lift Station Runtime Peaking Factors



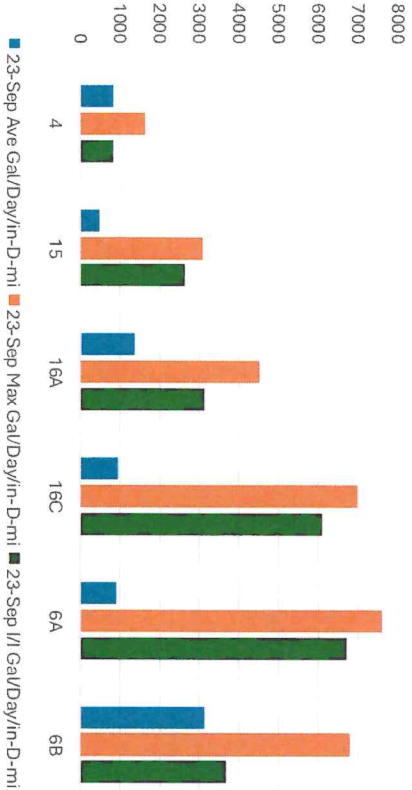
Recommendations:

- I/I Investigation
 - The data shows high peaking factors, indicating potential inflow concerns
 - May include investigating private property sources, system cross connections or storm water conveyance evaluation that is impacting the sanitary system.
 - Sewershed wide smoke testing
 - Dye testing (not applicable if no storm system)
 - CCTV inspection
 - Continue sewer screening
 - Preliminary sewer screening identified some deficiencies, but not enough data to make a measurable impact on the flow monitoring analysis

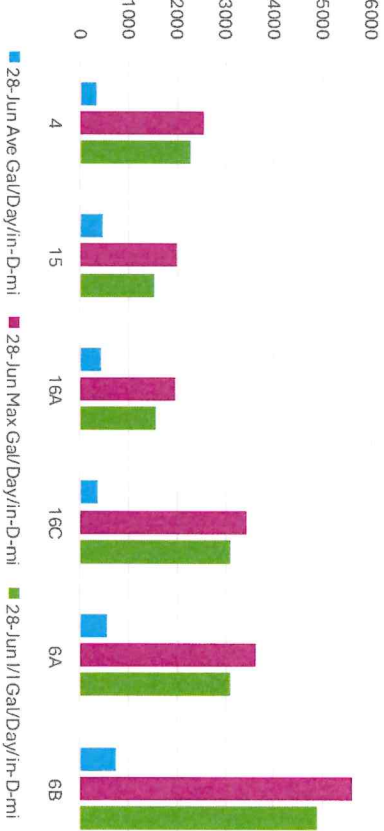


Flow Rate Analysis

Gal/Day/in-D-mi Comparison
23-Sep



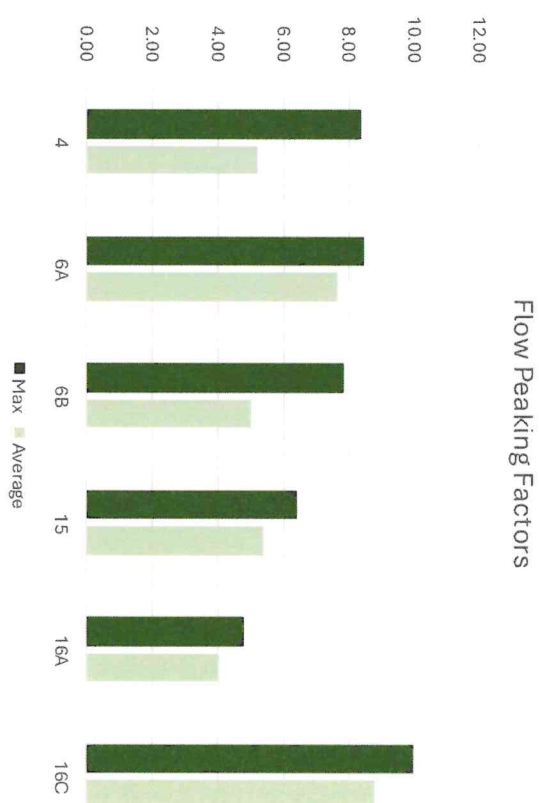
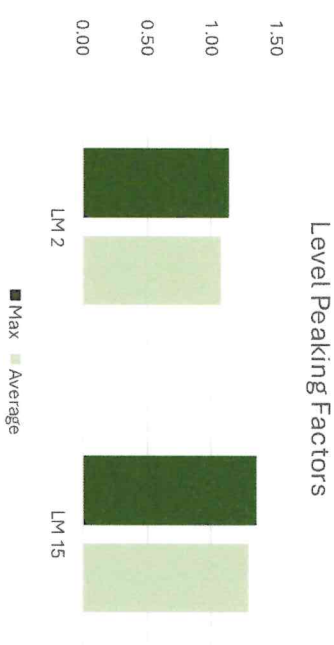
Gal/Day/in-D-mi Comparison
28-Jun



FM	23-Sep				28-Jun		
	Ave Gal/Day/in-D-mi	Max Gal/Day/in-D-mi	I/I Gal/Day/in-D-mi	Ave Gal/Day/in-D-mi	Max Gal/Day/in-D-mi	I/I Gal/Day/in-D-mi	
4	801	1613	812	306	2566	2260	
6A	896	7598	6702	529	3632	3103	
6B	3130	6778	3648	714	5601	4887	
15	480	3088	2607	456	1988	1532	
16A	1365	4496	3130	409	1948	1539	
16C	916	6989	6073	343	3425	3081	

Summary:
Data from FM 6A, 6B, and 16C show
the most excessive flow rates

Flow Monitoring Peaking Factor Analysis



FM	Peaking Factors		Max	Ave
	28-Jun	23-Sep		
4	8.38	2.01	8.38	5.20
6A	6.87	8.48	8.48	7.68
6B	7.85	2.17	7.85	5.01
15	4.36	6.43	6.43	5.40
16A	4.76	3.29	4.76	4.03
16C	9.98	7.63	9.98	8.81
LM 2	1.01	1.13	1.13	1.07
LM 15	1.34	1.23	1.34	1.29

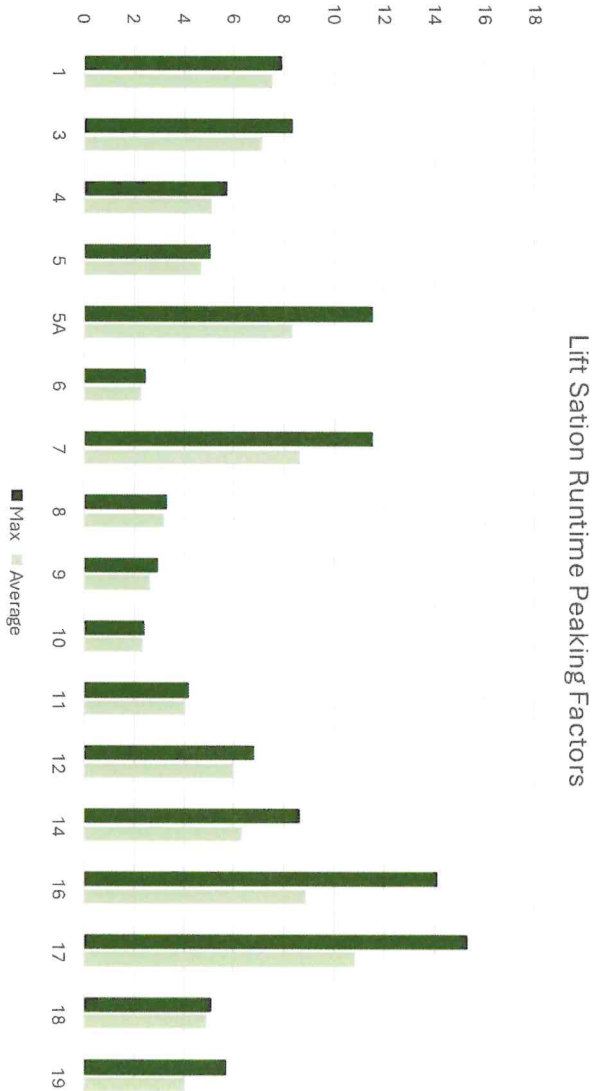
Summary:

Data from FM 4, 6A, 6B, and 16C show the greatest peaking factors

High Peak could indicate inflow

Pump Runtime Peaking Factor Analysis

Lift Station	Runtime Peaking Factors		MAX	AVG
	28-Jun	23-Sep		
1	7.21	7.93	7.93	7.57
3	5.85	8.37	8.37	7.11
4	4.43	5.73	5.73	5.08
5	4.31	5.01	5.01	4.66
5A	5.18	11.5	11.5	8.34
6	2.45	2.12	2.45	2.285
7	5.71	11.54	11.54	8.625
8	3.31	3.1	3.31	3.205
9	2.95	2.34	2.95	2.645
10	2.25	2.41	2.41	2.33
11	3.88	4.2	4.2	4.04
12	5.06	6.83	6.83	5.945
14	8.67	3.93	8.67	6.3
16	3.72	14.08	14.08	8.9
17	15.33	6.33	15.33	10.83
18	4.66	5.13	5.13	4.895
19	5.69	2.42	5.69	4.055



Summary:

Data from pumps 5A, 7, 14, 16, and 17 shows pump runtimes are much longer after rain event