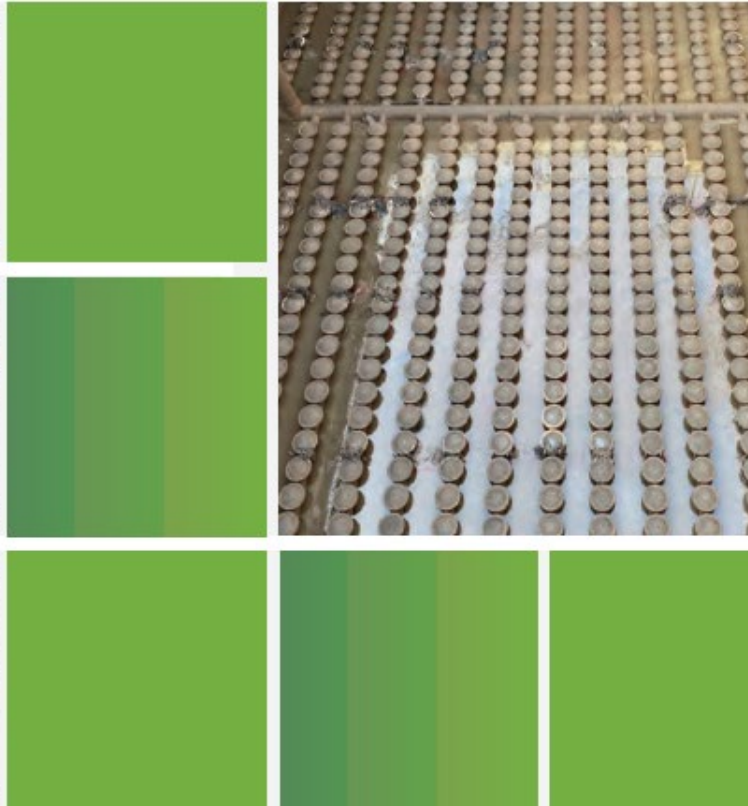


SAM WWTP Process Upset and Capacity Discussion

August 16, 2021



Agenda

- Introductions
- Process Capacity Results
- Process Improvement Recommendations
- Recent Loading Data
- Process Upsets and Response Summary
- Operating Recommendations

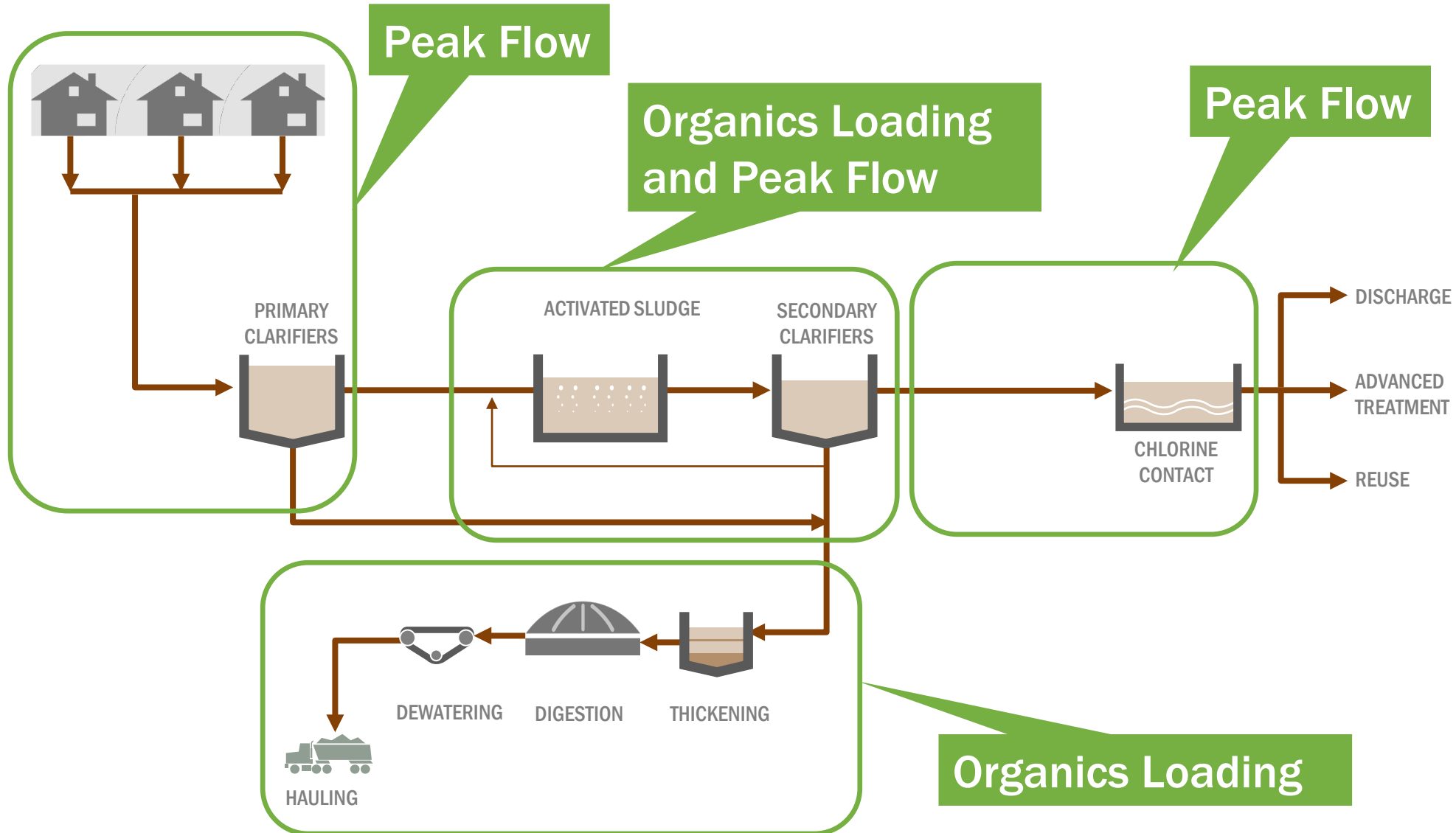
Issues at the WWTP

Month	Violation Type			Total Violations
	BOD	TSS	Others	
Oct-20	4	2	--	6
Nov-20	2	2	--	4
Dec-20	--	--	--	0
Jan-21	1	2	--	2
Feb-21	--	--	--	0
Mar-21	--	--	--	0
Apr-21	--	1	1	2
May-21	--	--	--	0
Jun-21	2	3	1	6
Jul-21	3	5	2	10
Aug-21 (so far)	0	0	0	0
Total	12	15	4	30



Process Capacity Results

What Really Limits Plant Capacity?



What Happens as Water Use Decreases?

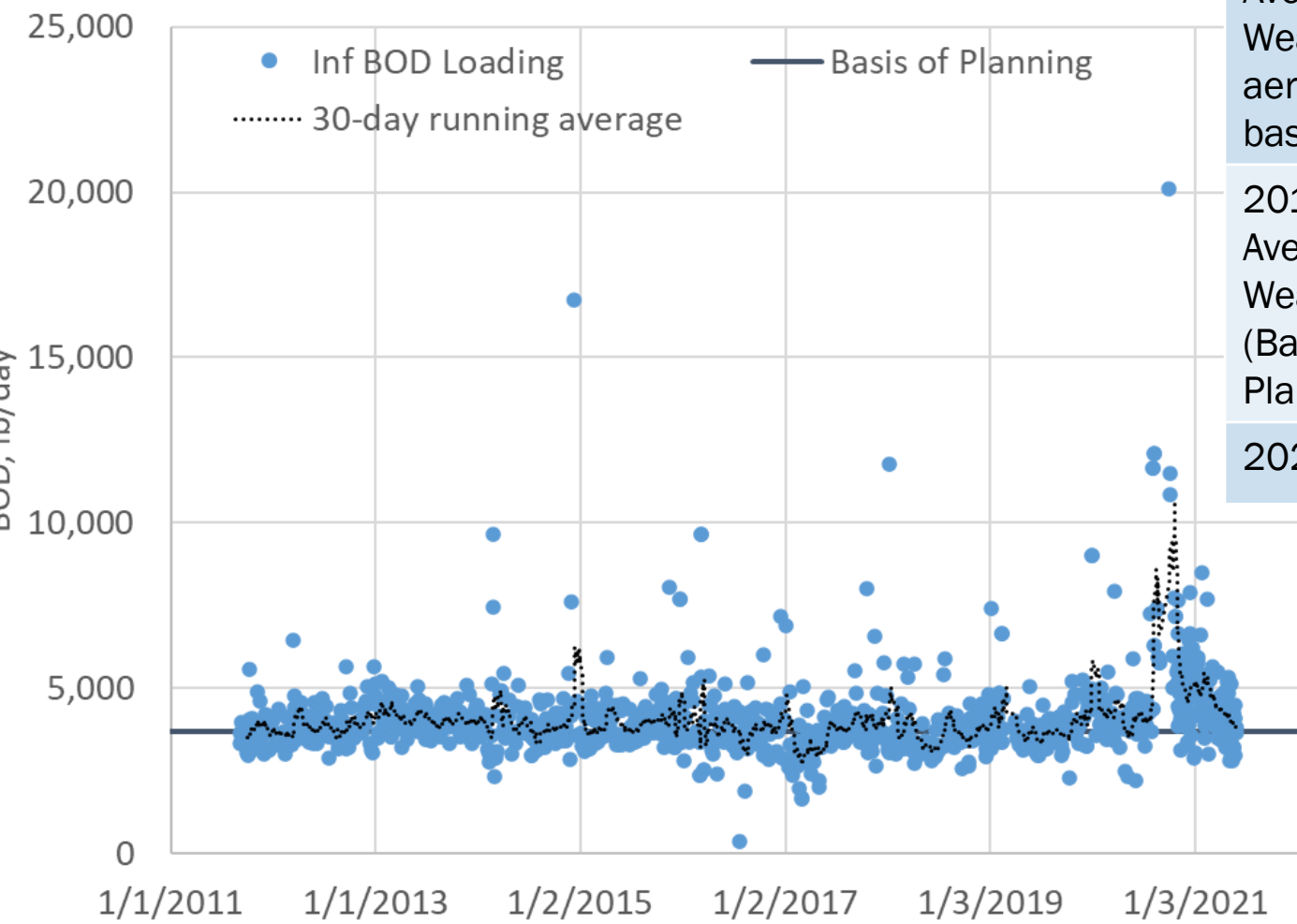
- With water conservation
 - Average flows decrease (people use less water)
 - Organic loadings don't change (same number of people produce same loading)
 - Together, that means concentrations go up
 - Peak flows may not decrease
- Other potential impacts
 - Septicity in collection system (potential changes in wastewater characteristics)

SAM BOD Loading

	Flow, mgd	Concentration, mg/L	Loading, lb/d
Design Average Dry Weather (3 aeration basins in service)	3.67	237	7,300
2018-2019 Average Dry Weather (Basis of Planning)	1.3	340	3,700
Percent of Design	35%		50%

Aeration Basin 3 is 40% of the original design volume (not including Aeration Basin 4).

SAM BOD Loading

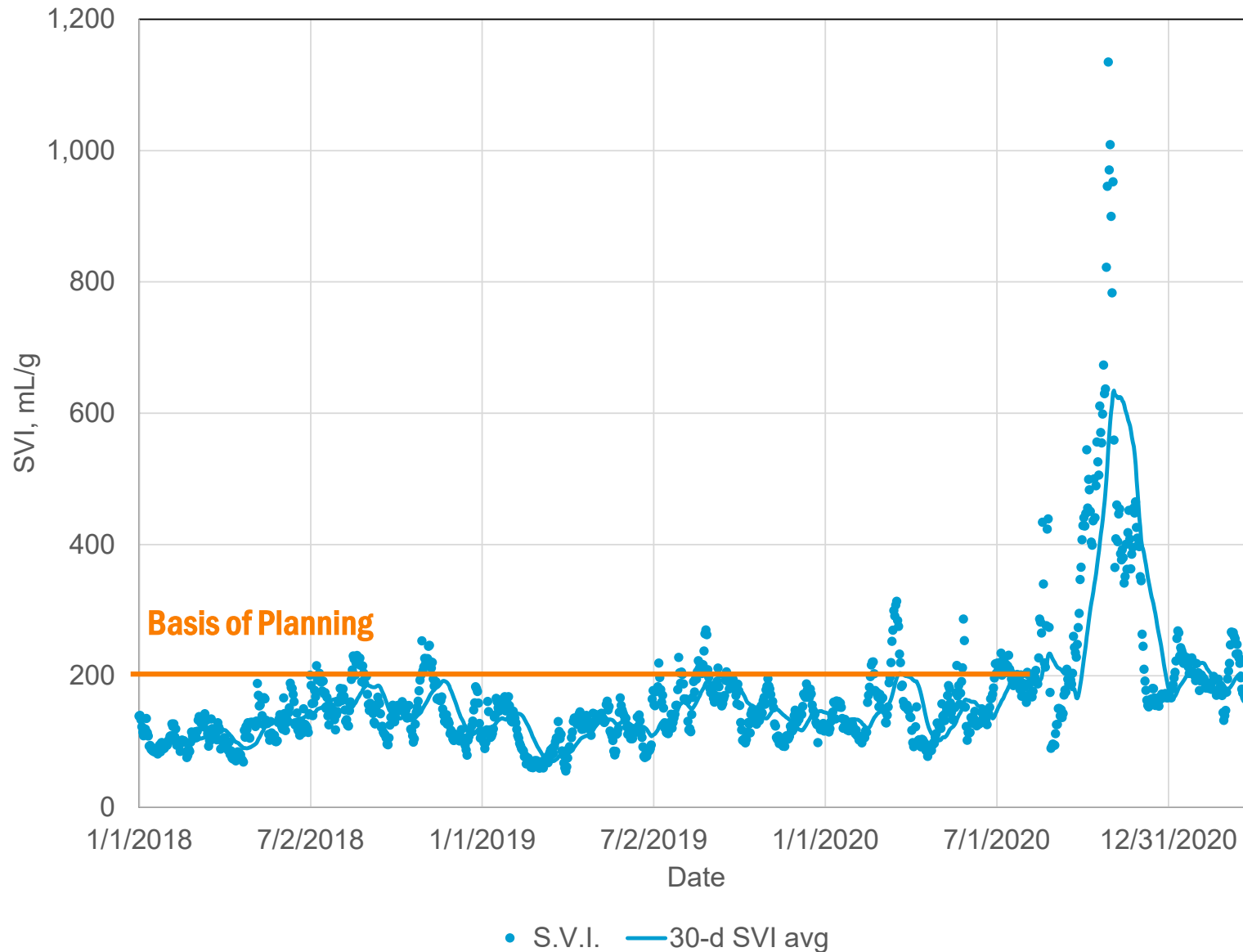


	Flow, mgd	Concentration, mg/L	Loading, lb/d
Design Average Dry Weather (3 aeration basins)	3.67	237	7,300
2018-2019 Average Dry Weather (Basis of Planning)	1.3	340	3,700
2021	1.4	380	4,300

Process Capacity Assumptions

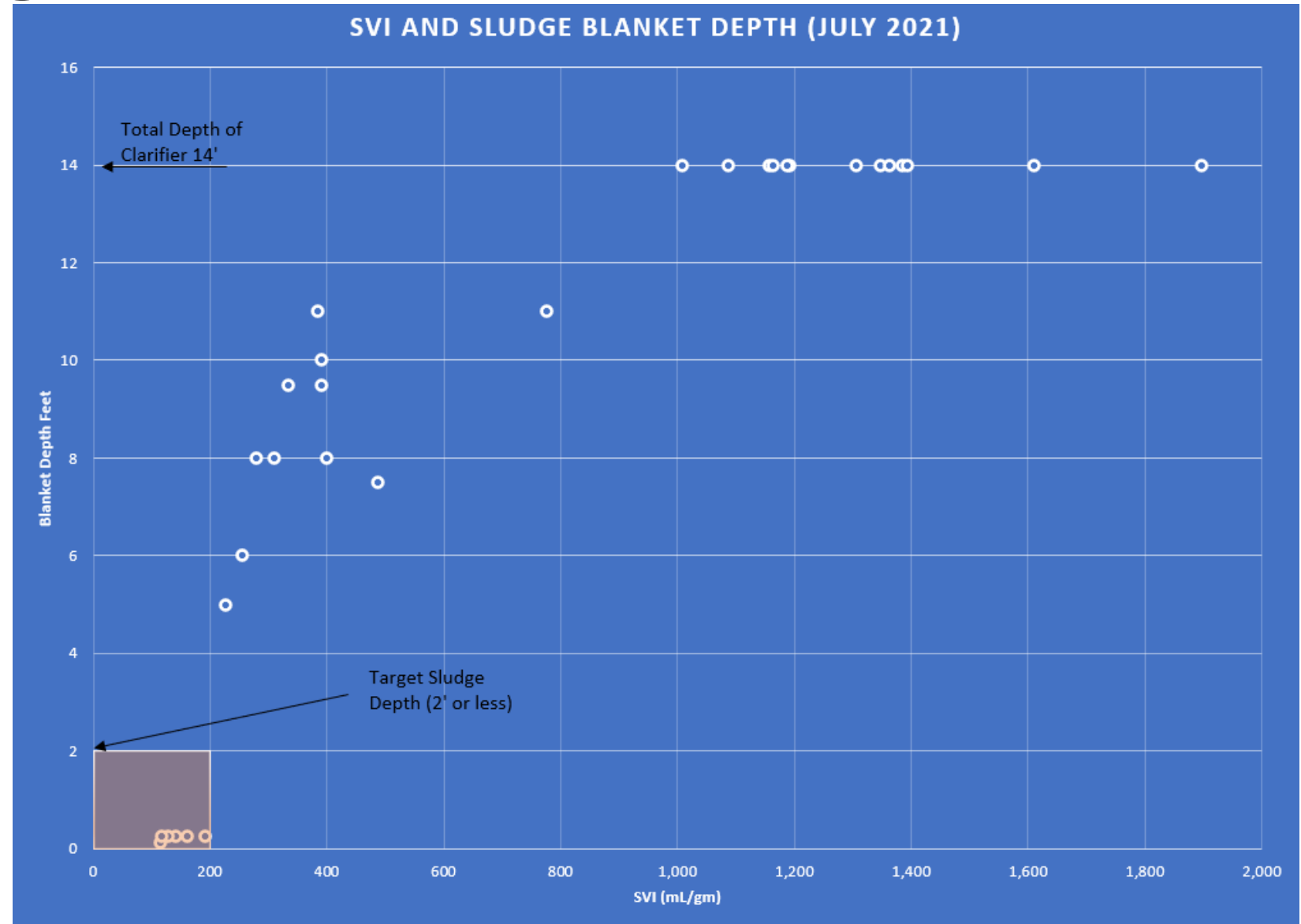
- 1 SST online during dry season, 2 SSTs online during wet season
- Peak hour flows are short in duration
- Capacity is rated assuming a peak day flow of 9 mgd (per design drawings)
 - Current peak day flow is closer to 6 mgd
- Design SVI of 200 mL/g (based on 90th percentile prior to Fall 2020 process upset)
- Based on typical flows/loads/wastewater concentrations from 2018-2020 (excluding the BOD spike period)
- Secondary system capacity is based on:
 - Maximum solids loading rate to secondary clarifiers
 - Blower aeration capacity
 - Diffuser aeration capacity

Process Capacity Assumptions – Sludge Volume Index (SVI)



Basis of planning is the 90th percentile SVI (excluding data from August 2021 onward)

What if SVI is Higher?

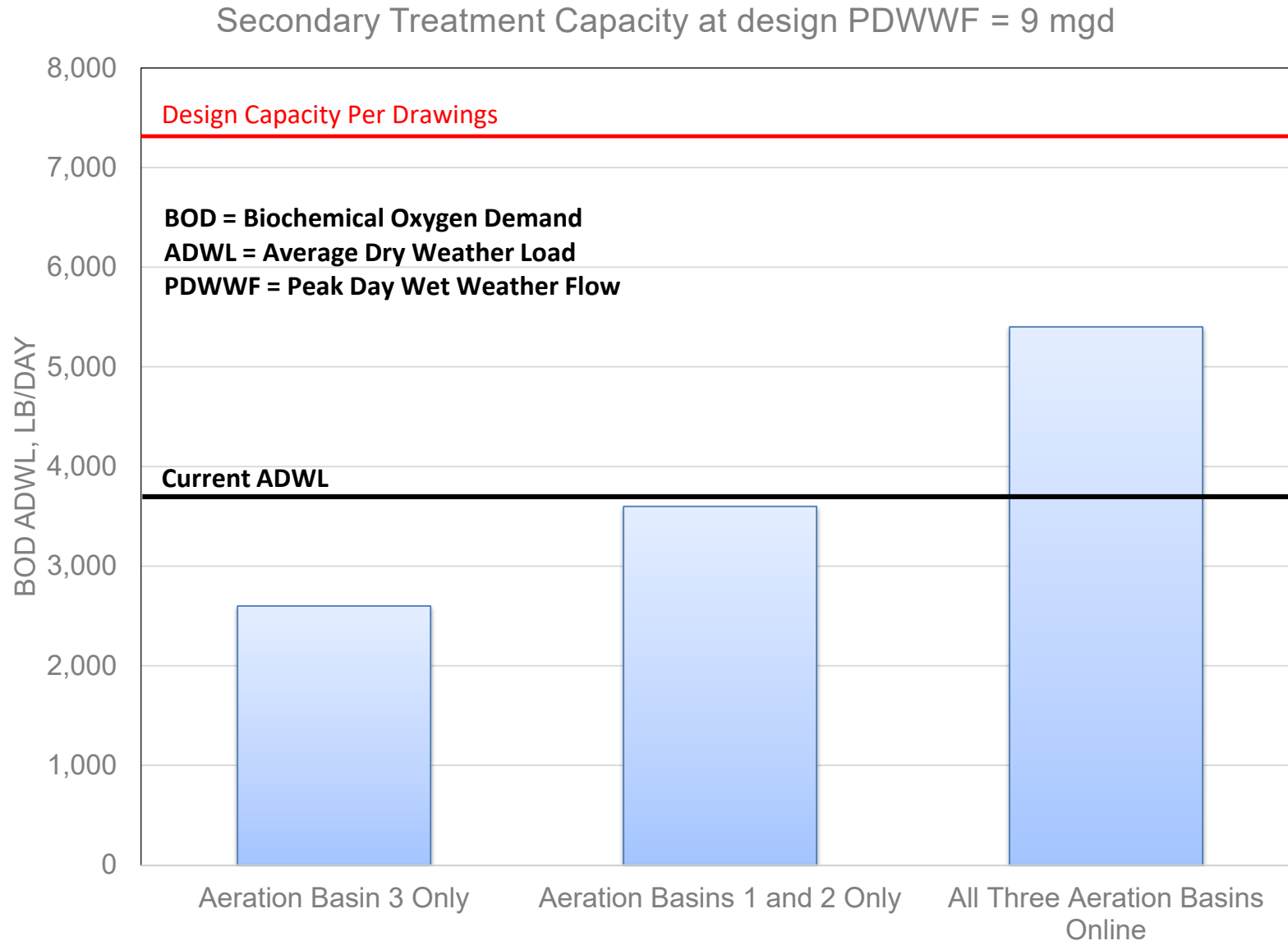


Process Capacity Evaluation

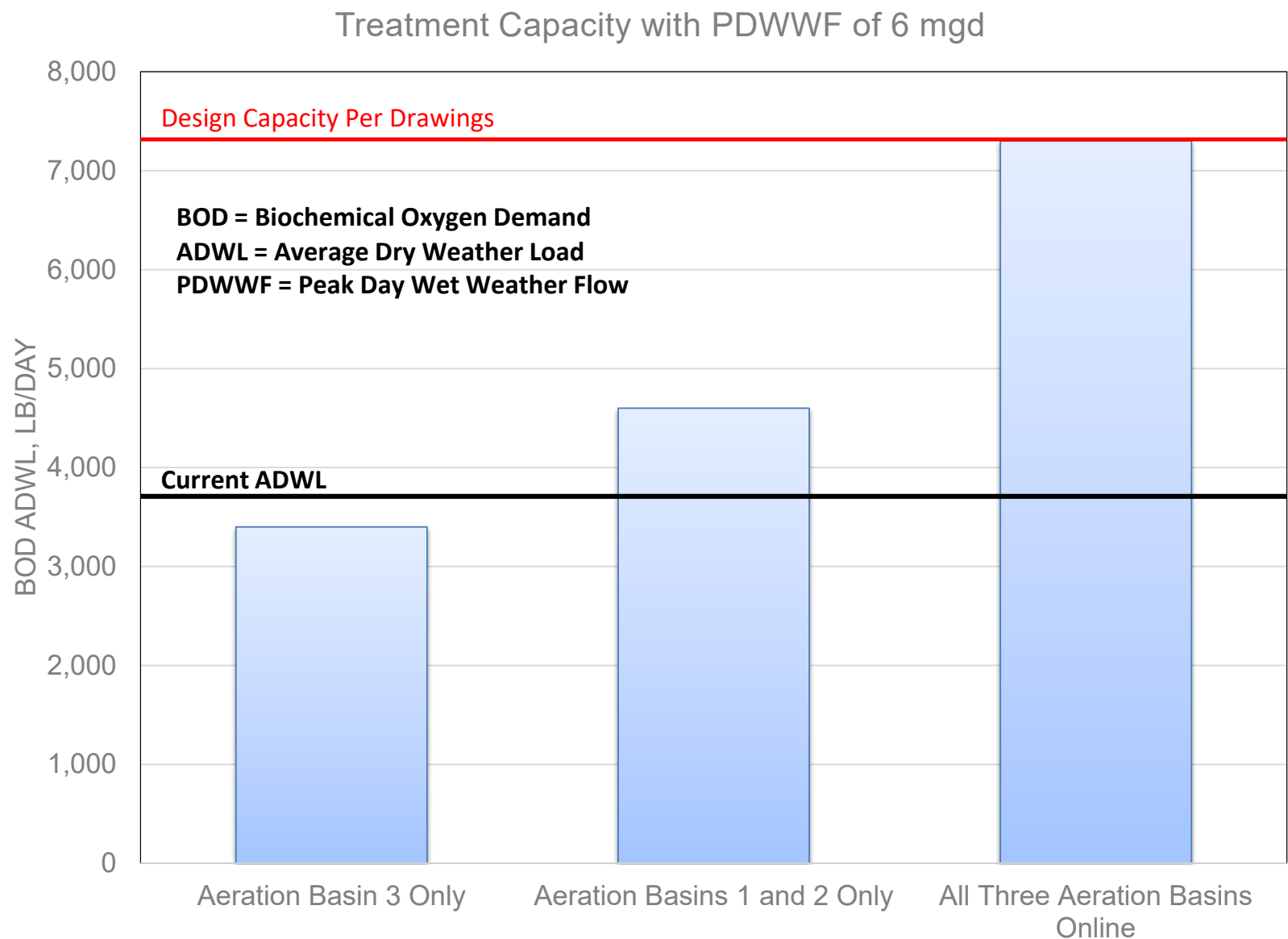
Secondary system capacity is based on:

- Maximum solids loading rate to secondary clarifiers (limiting factor)
- Blower aeration capacity (not limiting capacity)
- Diffuser aeration capacity (not limiting capacity)

Process Capacity Results (based on solids loading to clarifiers)

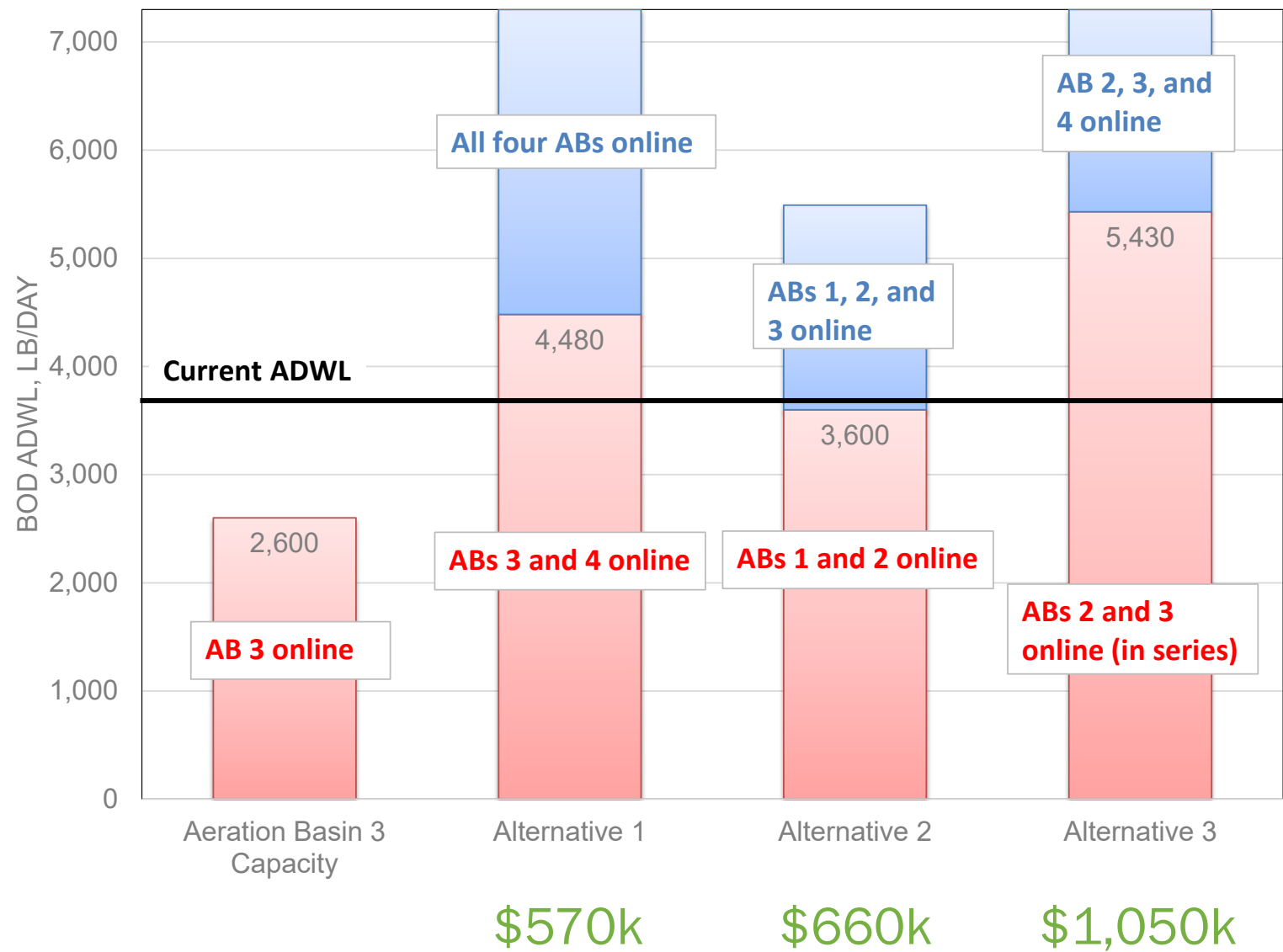


Process Capacity Results (based on solids loading to clarifiers)



Upgrades to Improve Process Capacity

Capacity Based on Current BOD Concentration of 340 mg/L





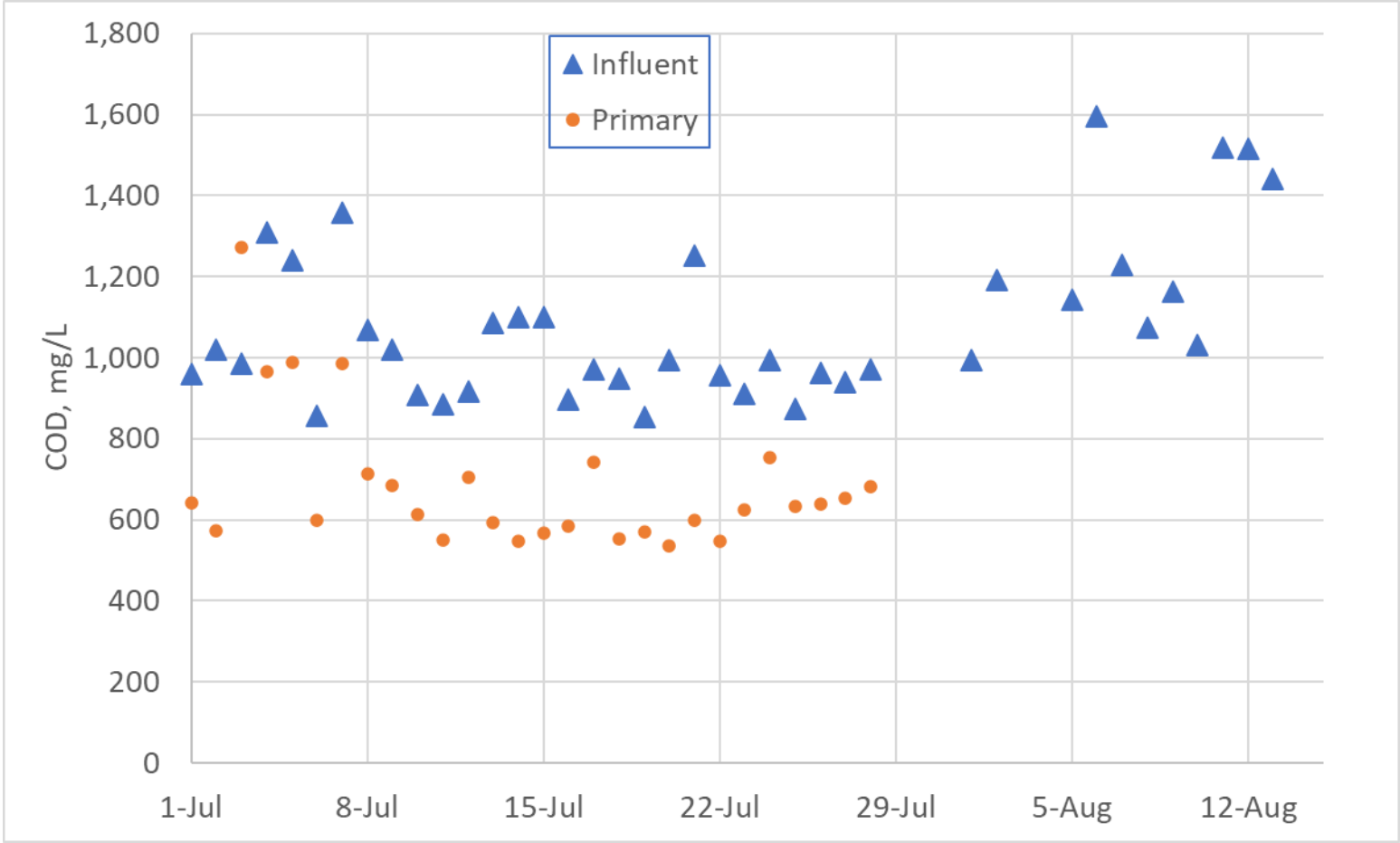
Process Improvement Recommendations

Process Upgrade Recommendations

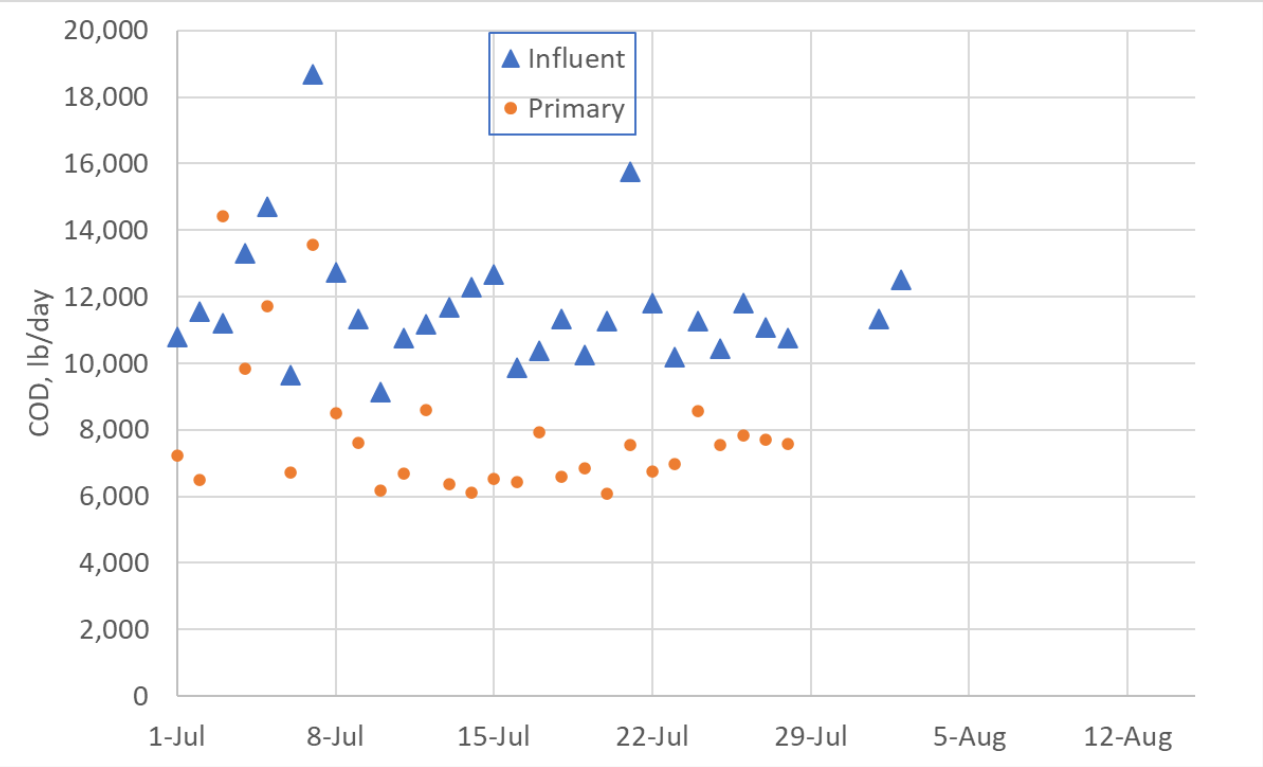
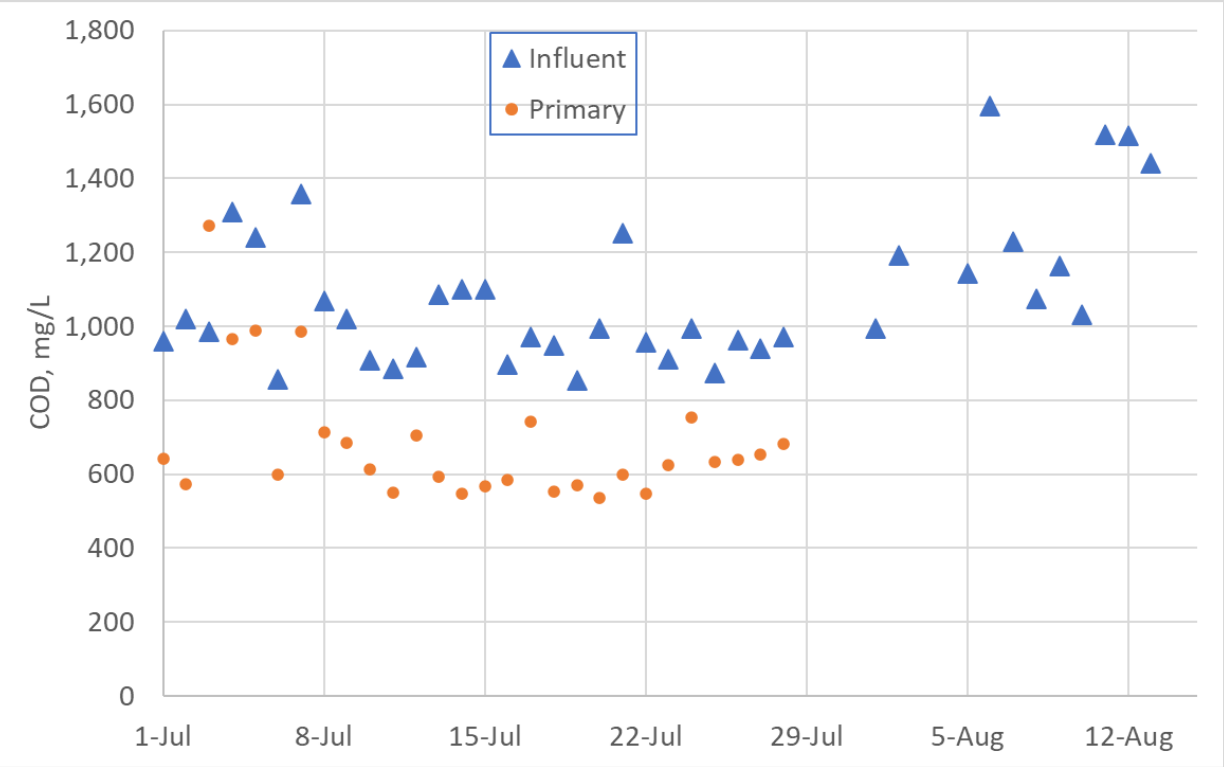
- Perform upgrades to provide additional basin volume to account for redundancy discrepancy. Alternative 1 (upgrading Basin 4 only) is recommended because it provides the lowest estimated cost and provides the most redundancy.
- Investigate the source of highly variable BOD loading entering the WWTP via a source control program. The peaking factor during the BOD spikes is significantly higher than typical.
 - If the recent higher BOD concentrations are used in the averaging calculation, the capacities will be lower than what is presented.

Recent Loading Data

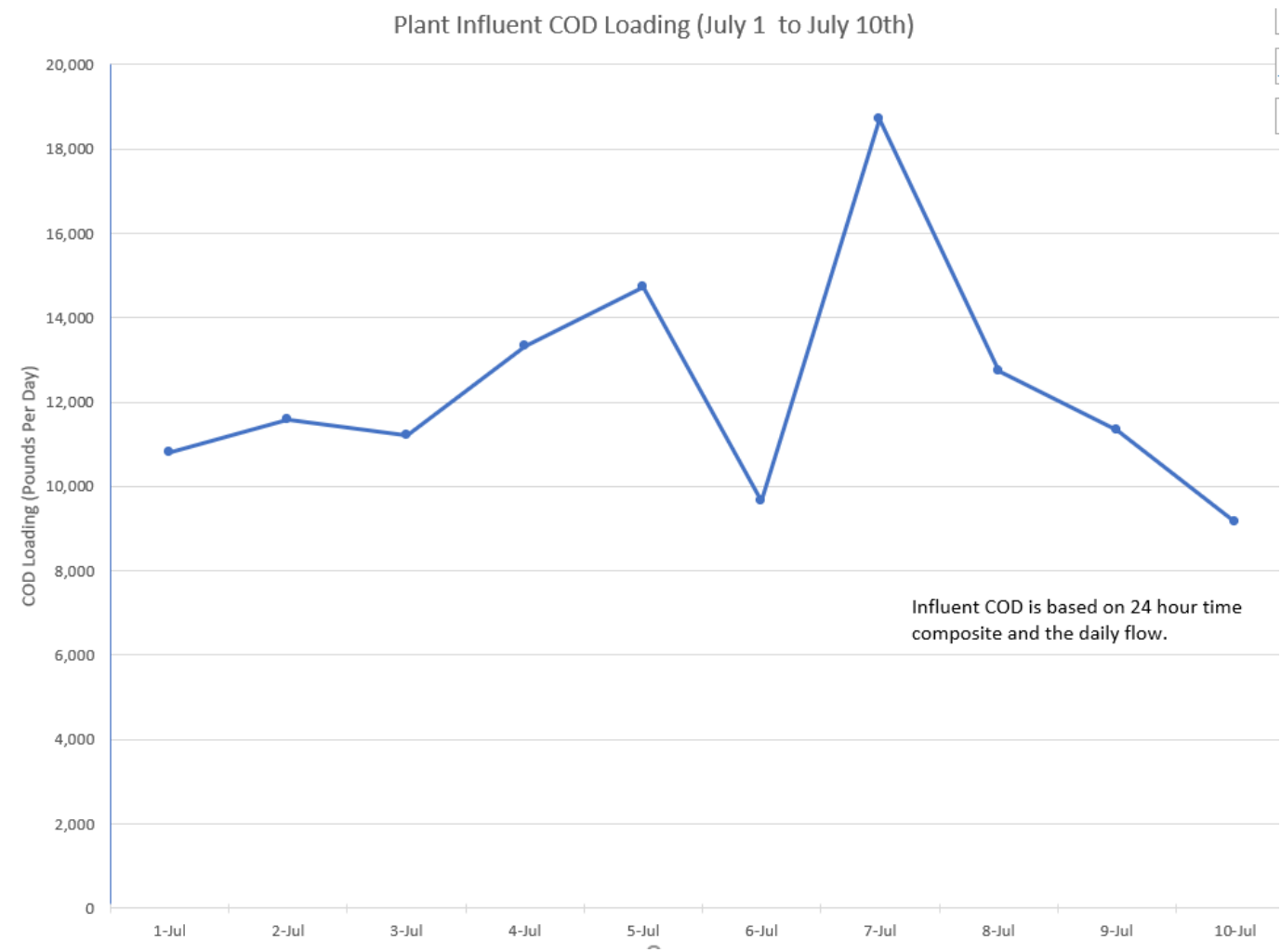
SAM Recent COD Data



SAM Recent COD Data



Elevated and Variable Plant Organic Loading in July



July 2021 – Variable Plant Loading Evaluation Princeton Pump Station (PPS) and Plant Influent Characteristics*

	Average Flow	Average BOD	Average BOD	Average COD	Average COD
Units:	mgd	mg/L	pounds/day	mg/L	pounds/day
Plant	1.38	375	4,213	988	11,198
PPS	0.10	550	453	1,250	1,026
% of Plant	7.4%	--	10.8%	--	9.2%
# Samples	31		14		14

Legend:

* Revised on 8/24/21

Samples collected as 24-hour, time weighted composite samplers.

BOD – Biochemical Oxygen Demand

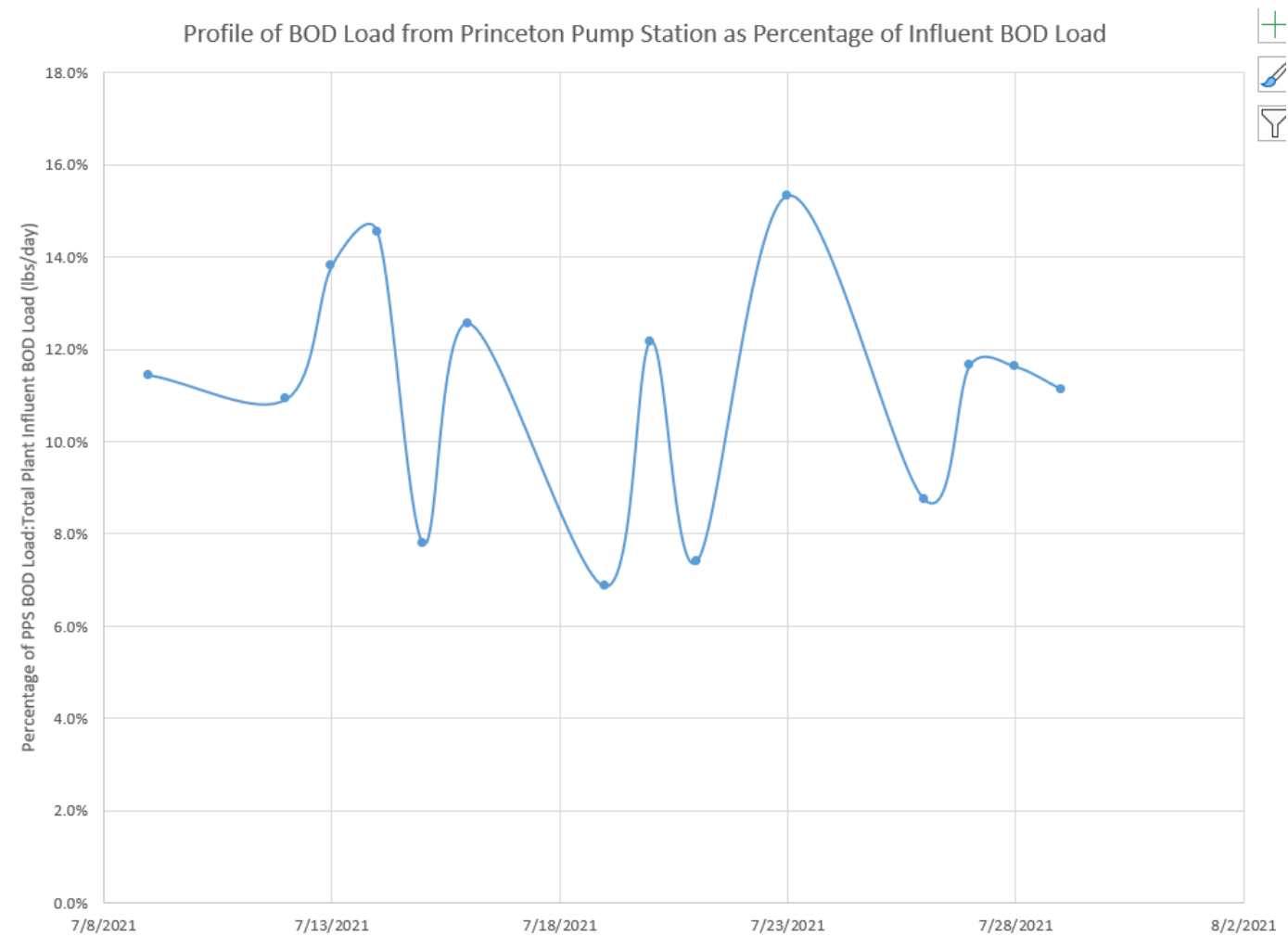
COD – Chemical Oxygen Demand

Mgd - million gallons per day

Mg/L - milligrams per liter

(--) Not calculated

Profile of BOD Load from Princeton Pump Station as Percentage of Influent BOD Load





Process Upset and Response Summary

Process Upset and Response Findings

- Filaments in activated sludge prevent sludge from settling
 - Septicity and SRMS were two common contributing factors to the types of filaments observed in June & July
- Plant sees high spikes in organic loading

Soluble readily-metabolizable substrates (SRMS) are substrates that are easy for the bacteria to biodegrade. Examples of SRMS are fatty acids, simple sugars, starches.

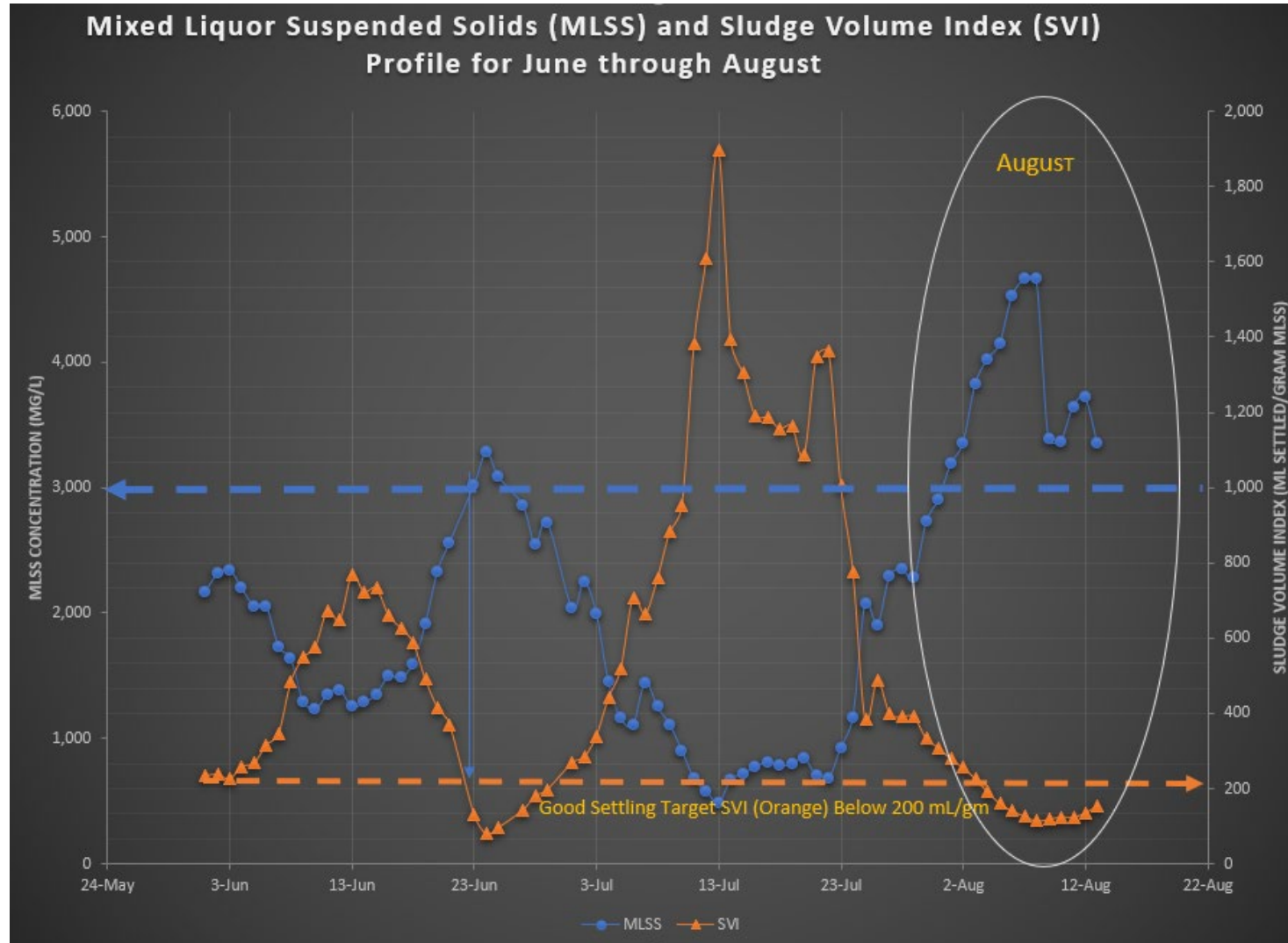
Operating Recommendations

- Upgrade systems to flow pace chemicals
- Use aeration basin inventory (SRT) to control MLSS targets
- Implement plans to replace WAS flow tubes
- Proceed with plans to clean out pump stations– resume regular program
- Evaluate provisions to provide permanent coagulant & polymer capability
- Purchase a jar testing apparatus with light table
- Continue testing for COD throughout plant, add other parameters.
 - Evaluate dedicated (PT) laboratory analyst to support operations
- Maintain spare bioaugmentation and ballast floc products onsite



BC Observation Summary

Aeration Basin and Settling Observation



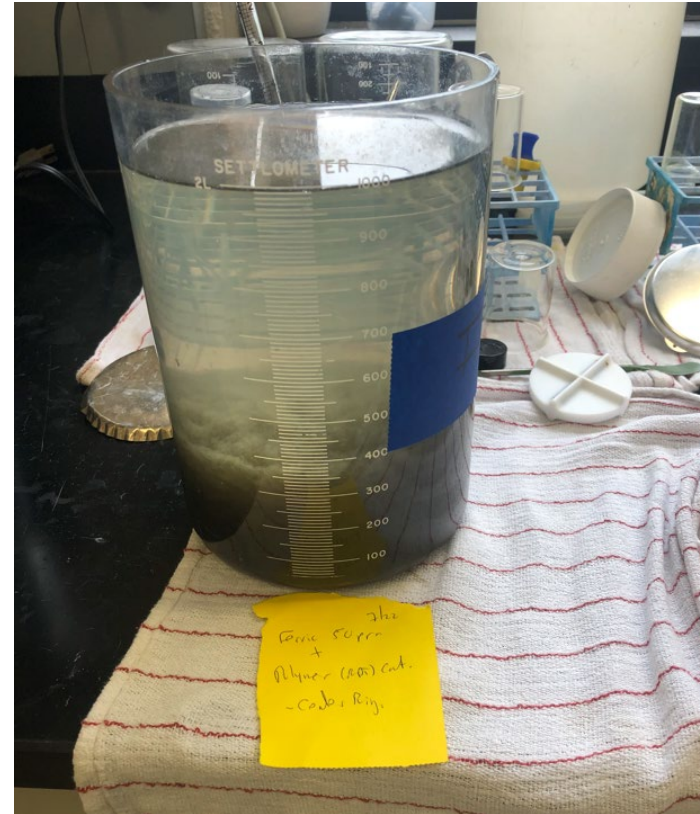
July 2021	Today (8/13)
MLSS Avg. 1,350 mg/L	MLSS Avg. 3,836 mg/L
Full Dispersed Sludge Blankets by July 7th (10 ft plus in 14 ft clarifier)	2 ft or less
2 Secondary Clarifiers	1 Secondary Clarifier
Increased Oxygen to 5.0 mg/L	4.5 mg/L
7/17 Biosupplement Increased	None
7/20 Ferric Salts & Polymer	Alum and Polymer
7/25 Floc Load Ballast	None Since
Sec. TSS Avg. 48 mg/L	Sec TSS TSS Avg. 11
7/31 Checked Calibration on WAS Meter and installed temporary device	Replacement Parts on Order

Rapid Response Measures

BioStar Incubator Grow Seed



On-site jar testing



- Polymer Jar Testing did not scale up well
- Ferric and polymer worked well
- Ferric shortage
- Now Using Alum and polymer



Microscopic Examination of the Sludge

Regular Microscopic Examinations Continued

Excerpt from June 15 EBS report

MLSS and RAS Filament Types & Causes	H ₂ S and/or septicity	Mature Biomass	Nutrient Deficiency	SRMS*	Low F:M	Low DO
1. <i>Type 021N</i>	X	X	Esp(N)	X		
2. <i>S. natans</i>			Esp (P)	X		X

Excerpt from July 19 EBS report

MLSS Filament Types & Causes	H ₂ S and/or septicity	Mature Biomass	Nutrient Deficiency	SRMS*	Low F:M	Low DO
1. <i>S. natans</i>			Esp(P)	X		X
2. <i>Actinomyces</i>		X		X		
3. <i>Type 1701</i>				X		X
4. <i>Thiothrix spp.</i>	X		Esp(N)	X		

**Soluble readily-metabolizable substrates (SRMS): substrates that are easy for the bacteria to biodegrade.*

Examples of SRMS are fatty acids, simple sugars, starches.

Septicity and SRMS were two common contributing factors to the types of filaments observed in June & July



Septicity Analysis

Collection System Evaluation

- Large Collection System and several pump stations = lots of time in the system
- FOG accumulation in pumping station
- High BOD samples in collection system have been observed

Septicity Monitoring

- ORP – oxidation reduction potential – measures septicity
- Rented portable probe to conduct monitoring
- High BOD samples in collection system have been observed



Most Recent Plant Upset (7/3/2021)

Second Upset

- Another plant upset started on 6/30/2021
 - Sludge settling problems
- Interim recommendations
 - Source evaluation program to understand what is coming into the plant
 - Add seed supplement daily same as last time
 - Add polymer to help settling – Use the new polymer that was jar testing
 - Build up solids in the system MLSS target = 3,000 mg/l once the event passes
 - Increase dissolved oxygen in the system

QUESTIONS?

