The Data Management Plan Puzzle: Putting the Pieces Together

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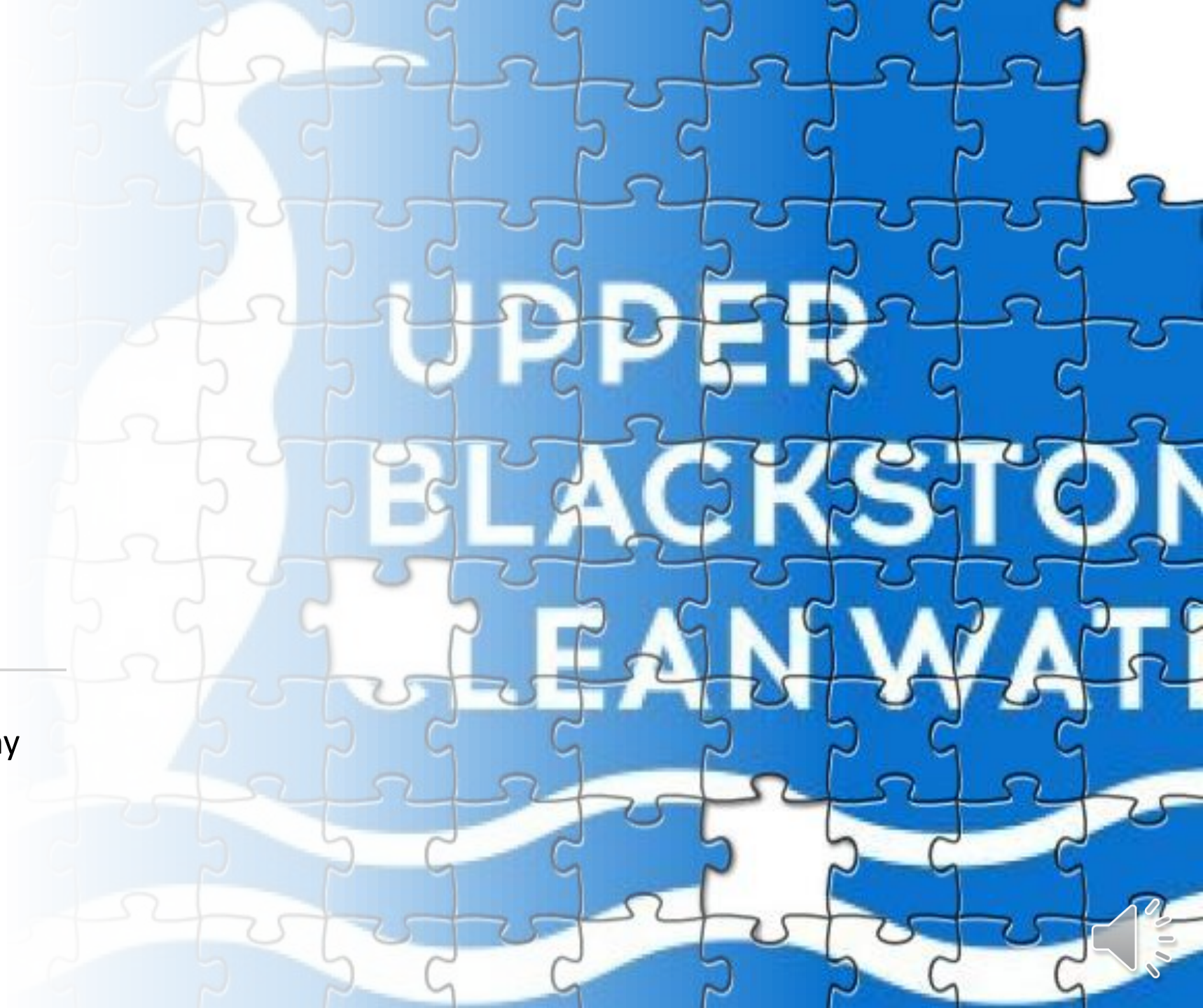
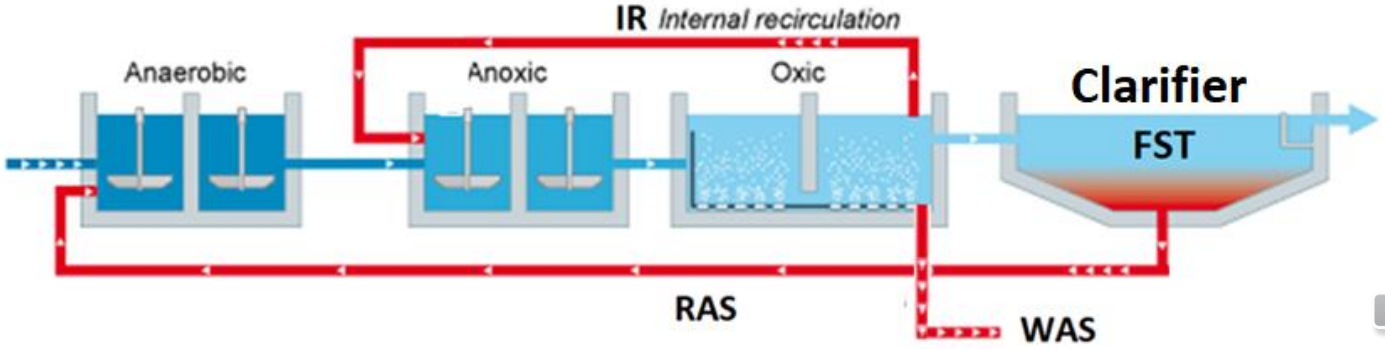


Upper Blackstone at a Glance

- Plant Information:
  - Influent characterization:
    - Avg Flow: 30 MGD
    - Avg CBOD: 154 mg/L
    - Avg TN: 28 mg-N/L
  - Process configuration
    - A2O
    - 4 trains
  - Regulation/Permit
    - Seasonal permit
    - TN: 5 mg-N/L
    - TP: 0.1 mg-P/L
      - Interim Limit: 0.45 mg-P/L (60 day rolling average)



Data

- Source
- Overload or Underload
- Categorize & Prioritize Data
- Visualize Data
- Application

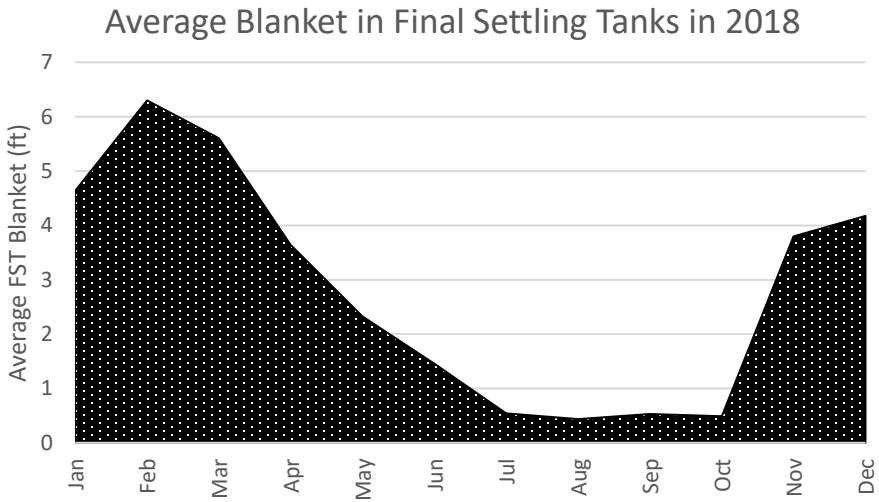
The Data Management Plan Puzzle

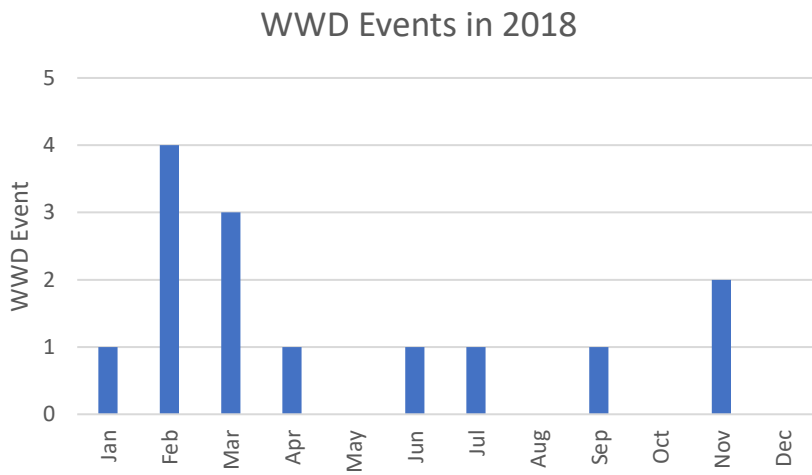
❖Goal

- ✓Troubleshoot
- ✓Optimize process
- ✓Discover & prevent the potential problem
- ✓Increase department efficiency
- ✓Reduce treatment cost

I. Optimization Example: High Blanket in Winter

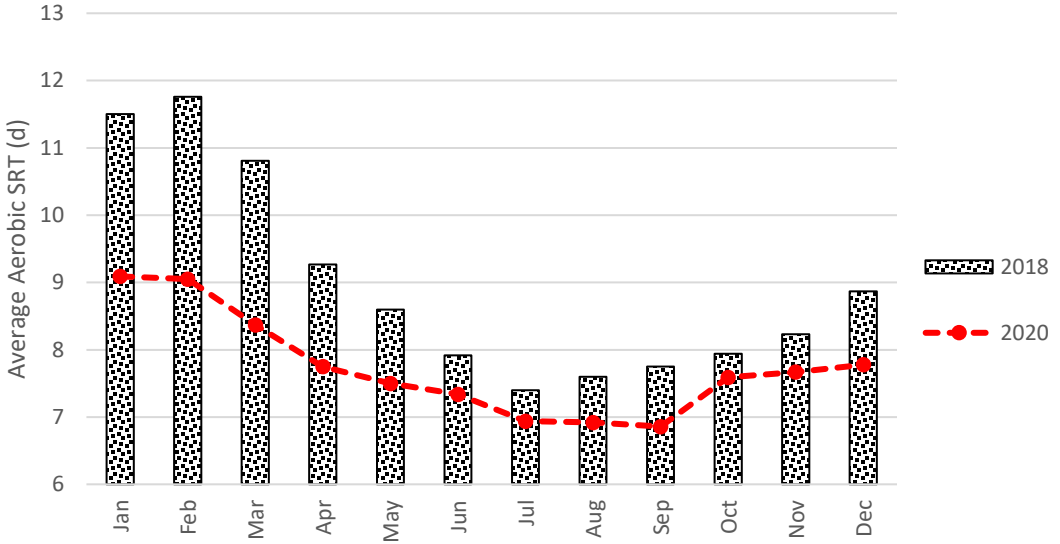
- High Blanket issue in Winter
- Difficulties to control the Solids at flows > 85 MGD
- Ending up with Wet Weather Discharge (WWD)

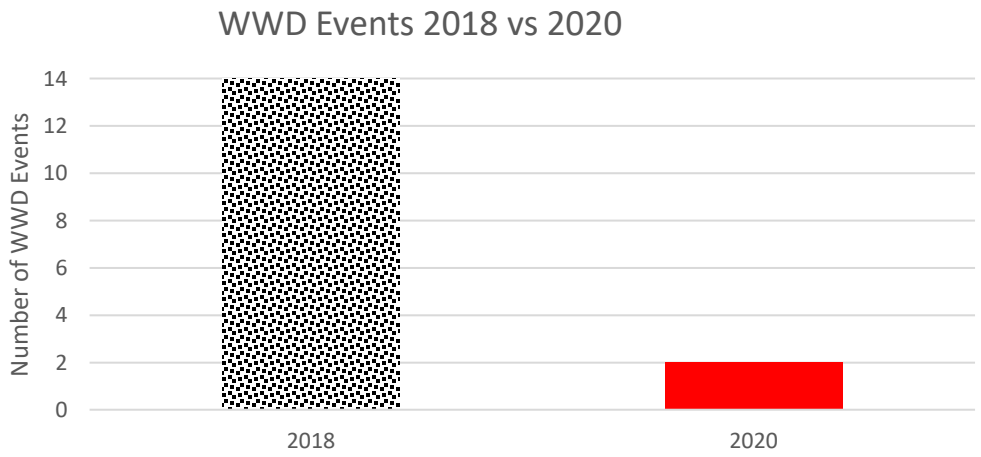


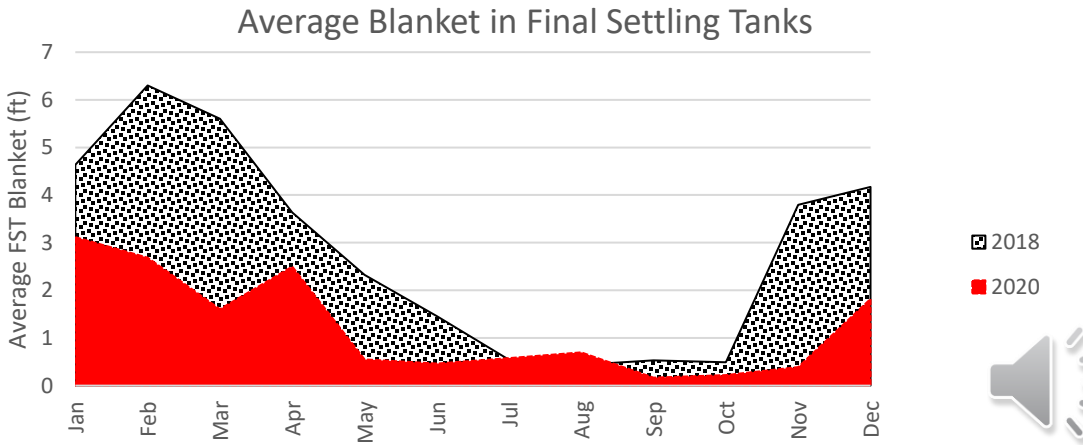


I. Optimization Example: High Blanket in Winter

- Approach:
  - Studied & analyzed the historical data, Lab, SCADA and related process parameters to model the system
  - Developed **5 steps solid adjustment strategy** to control the solid inventory
  - Bought new TSS probes
  - Calibrated our model with new collected data
- Results:
  - Reduced Aerobic SRT from 12 to 9 days
  - Solved the blanket issue in Winter
  - Significant reduction in WWD event
  - Reduced Chemical and Energy usage
  - Increased the process capacity without any major capital improvement.
  - Reduced the step-feed duration and improved the biology of our process

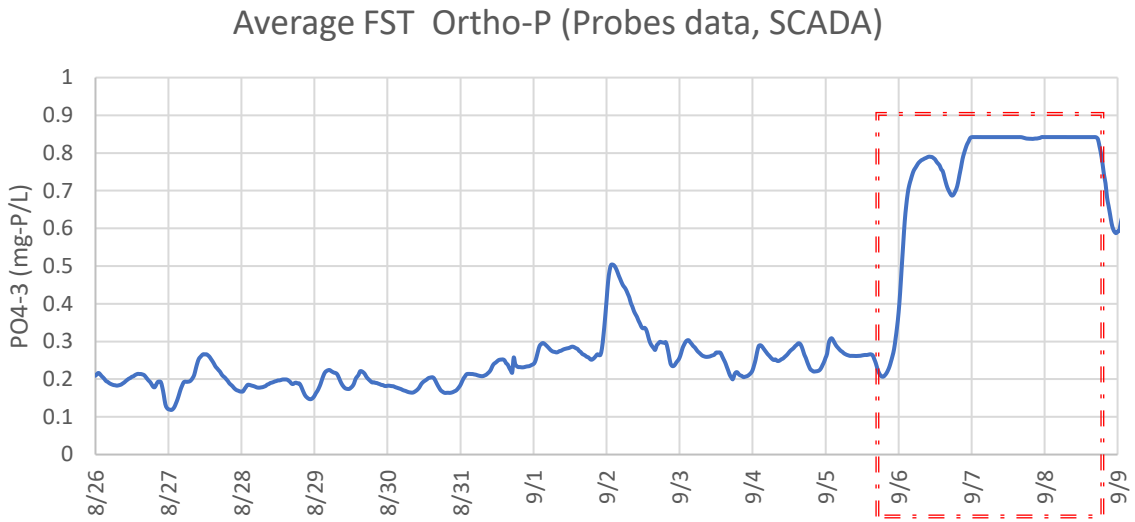


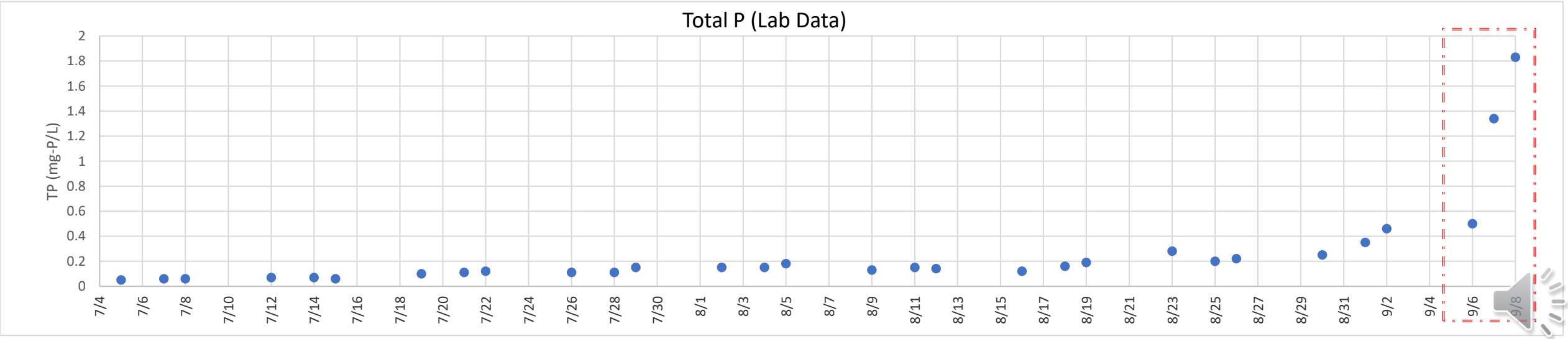




II. Troubleshooting Example: High Effluent Ortho P

- On Monday September 6th, Effluent Ortho-P increased significantly.
- TP Seasonal Permit: 0.45 mg-P/L
  (60 day rolling average)

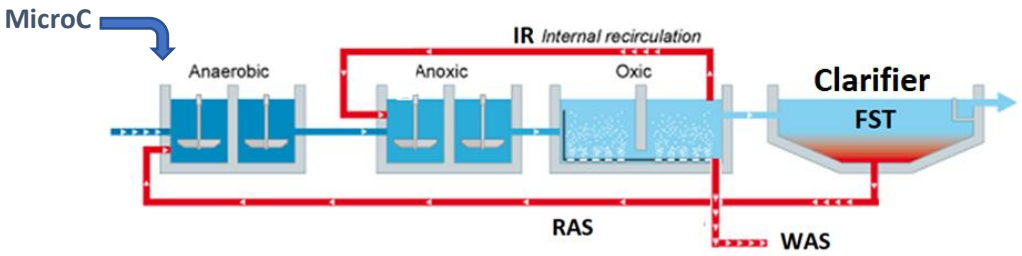


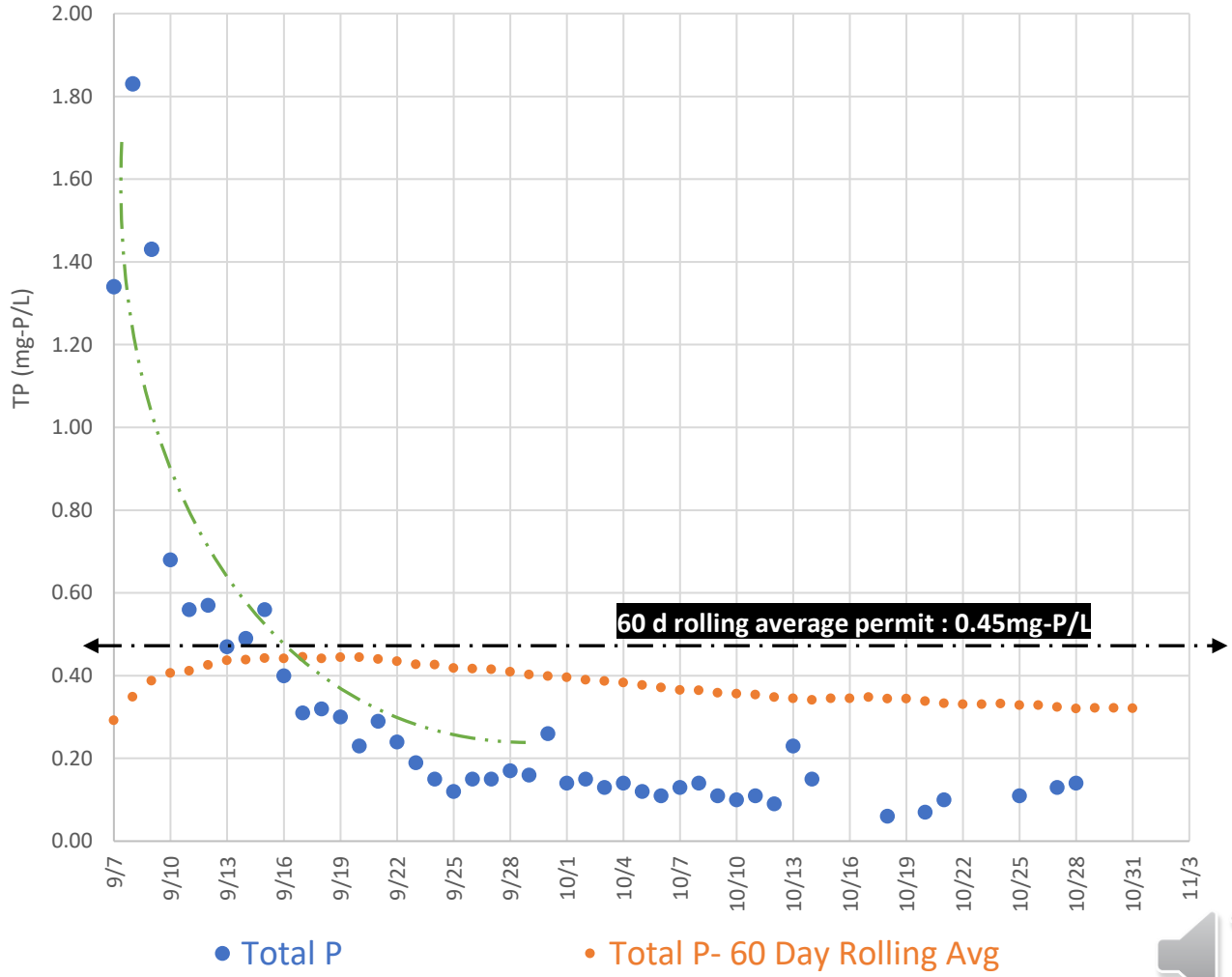


II. Troubleshooting Example: High Effluent Ortho P

- Approach:
  - Finding the reason
    - Data Analysis & Analytical Thinking
    - Historical Data
  - Dosing Supplemental Carbon to Anaerobic Zone

- Results:
  - Reduced the ortho-P
  - Maintained our permit – No Violation



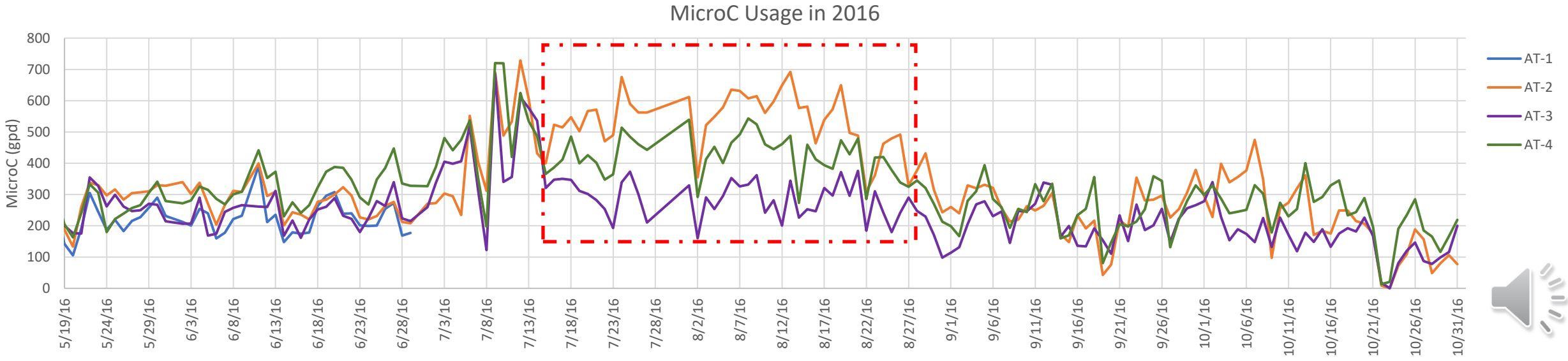


III. Uneven Supplemental Carbon Usage

- Uneven MicroC usage

- Similar NOx concentration

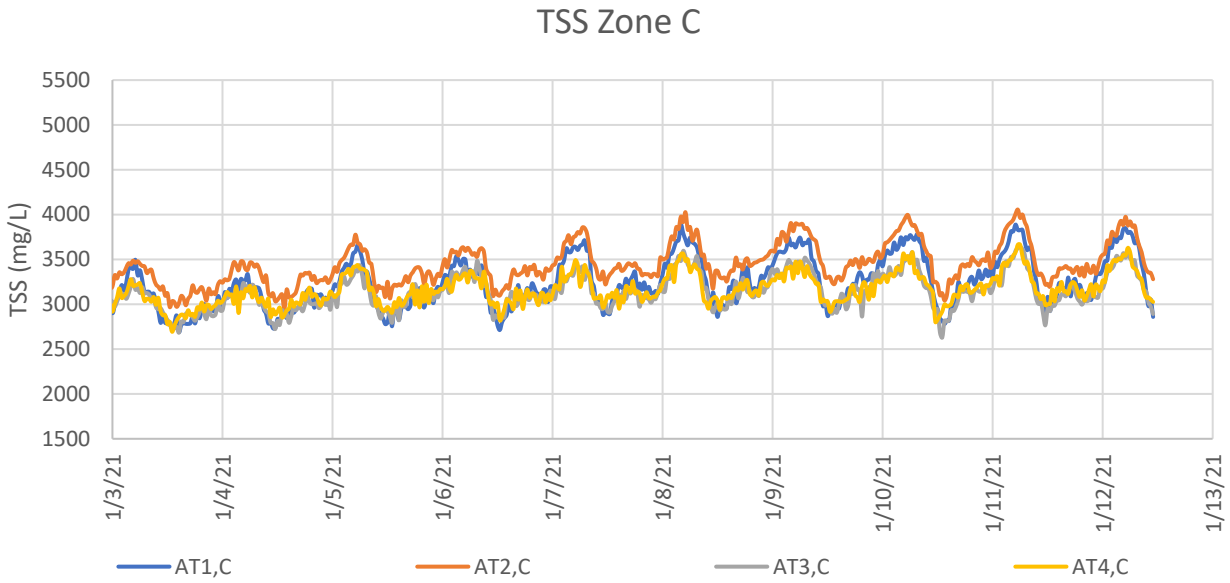
	MicroC Usage in 2016 (gpd)			
	AT-1	AT-2	AT-3	AT-4
May	134	173	154	156
June	224	273	237	324
July	Out of Service	485	363	452
August	Out of Service	509	269	406
September	Out of Service	248	211	249
October	Out of Service	213	159	239
Average	179	317	232	304

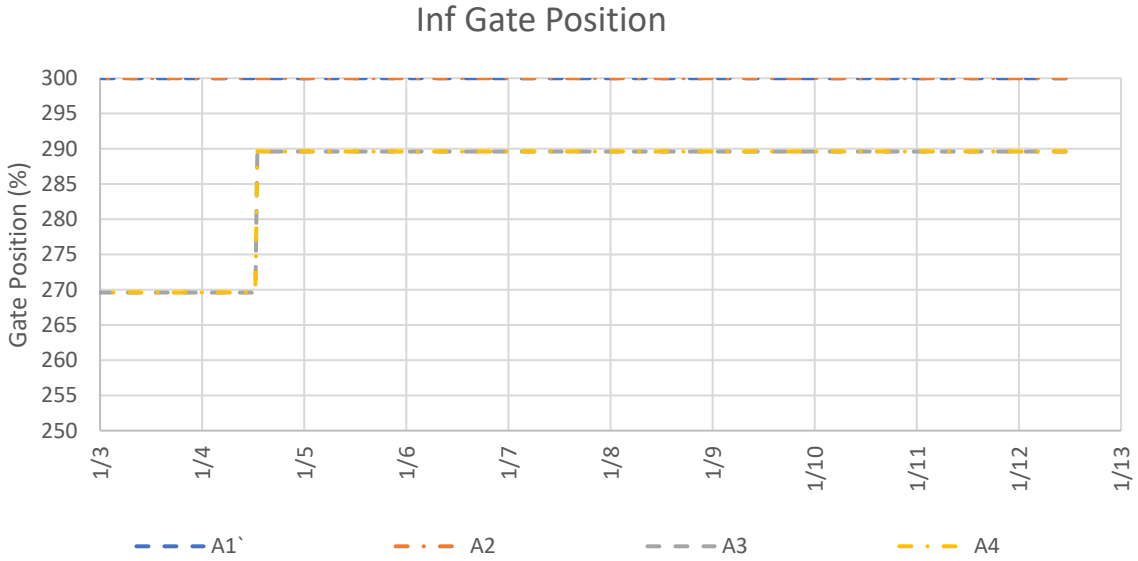


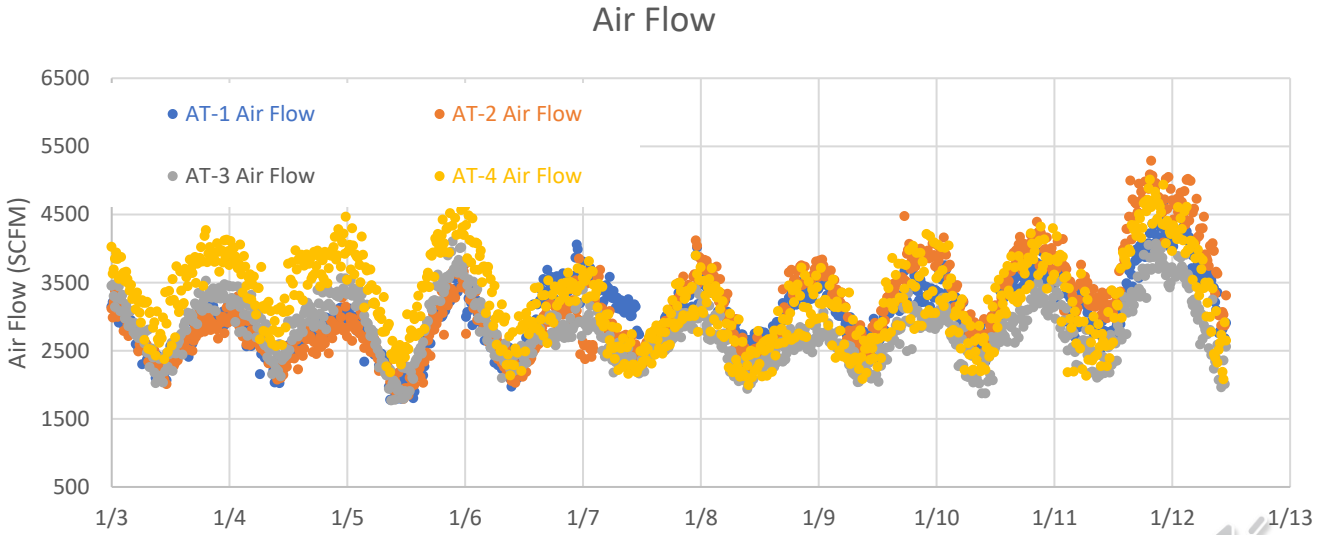

Aerobic
Anoxic
Anaerobic
BR#4
BR#3
BR#2
BR#1
PST#7
PST#6
PST#5
PST#4
PST# 3
PST#2
PST#1

- Approach:
  - Monitored the online PSTs and recorded their configurations.
  - Used TSS and airflow data to balance the load between the bioreactors

- Results:
  - Achieved better Process Control
  - Optimized chemical usage



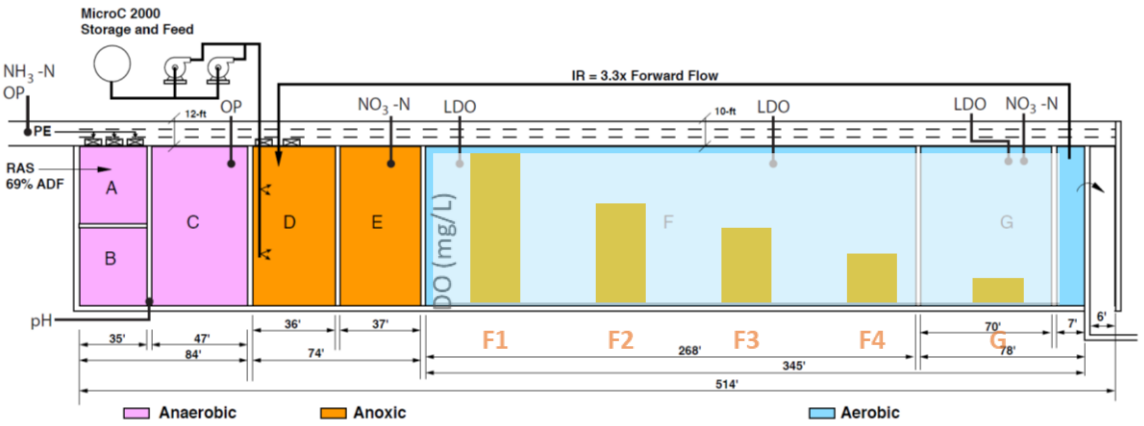


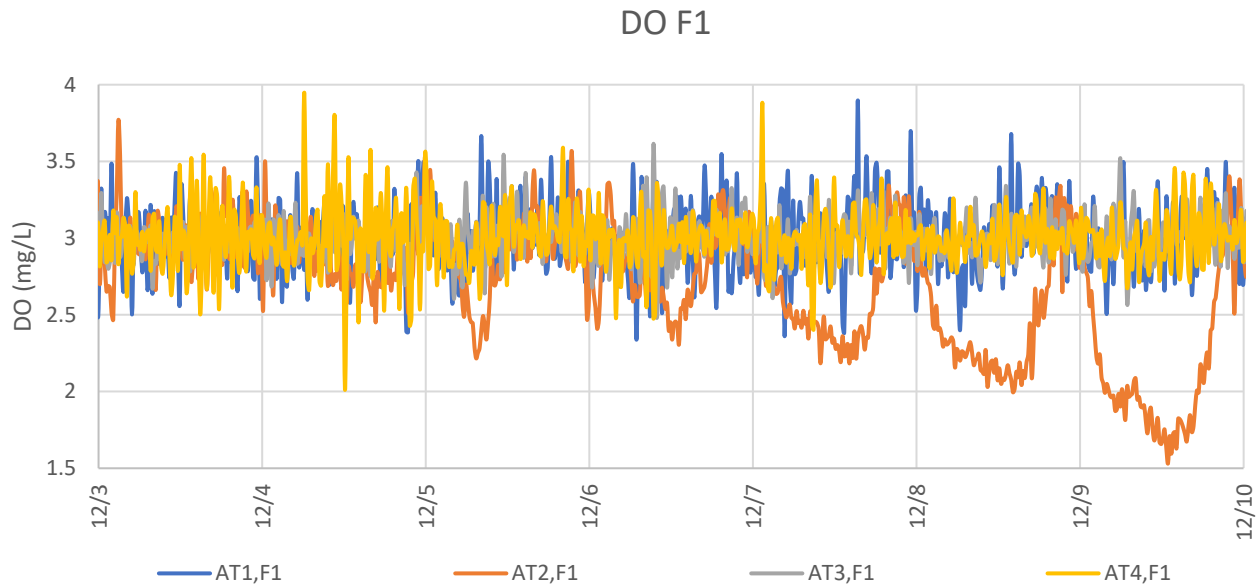


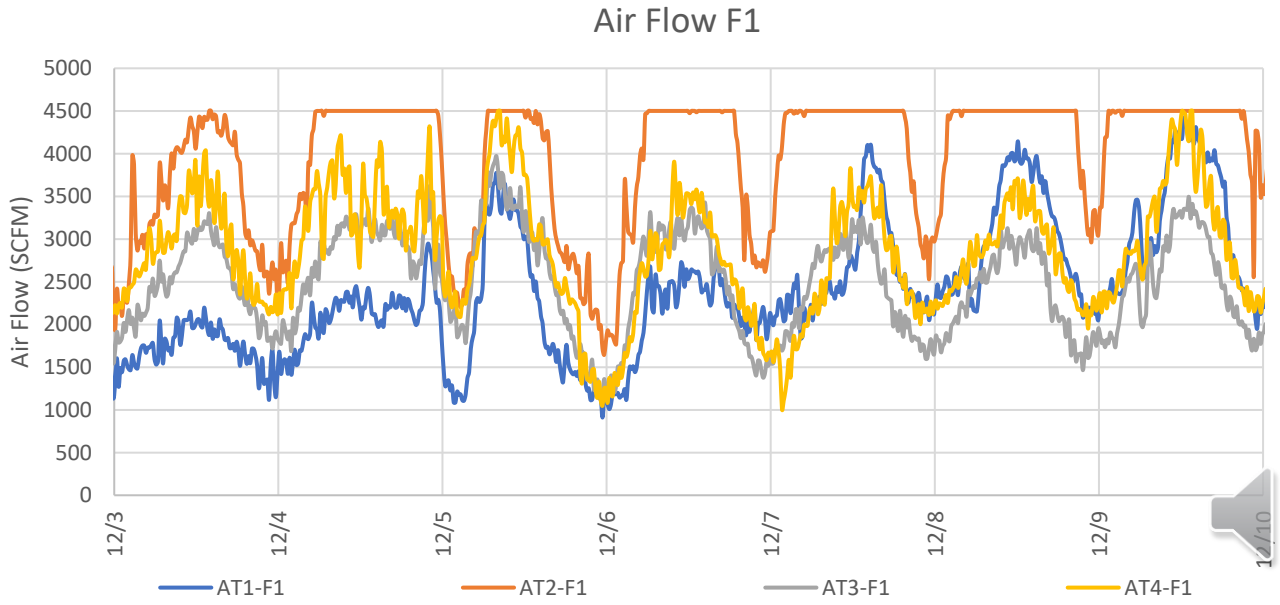
IV. Increase Department Efficiency

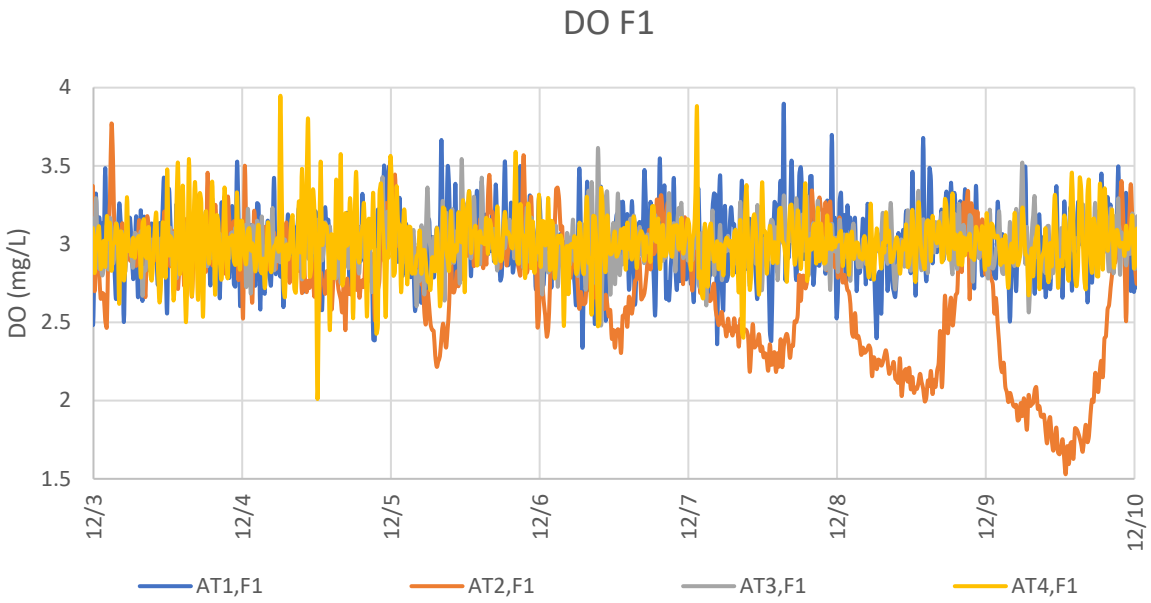
- Approach
  - 50-page report; 120+ graphs
  - Look for the changes in the last 30 days trend

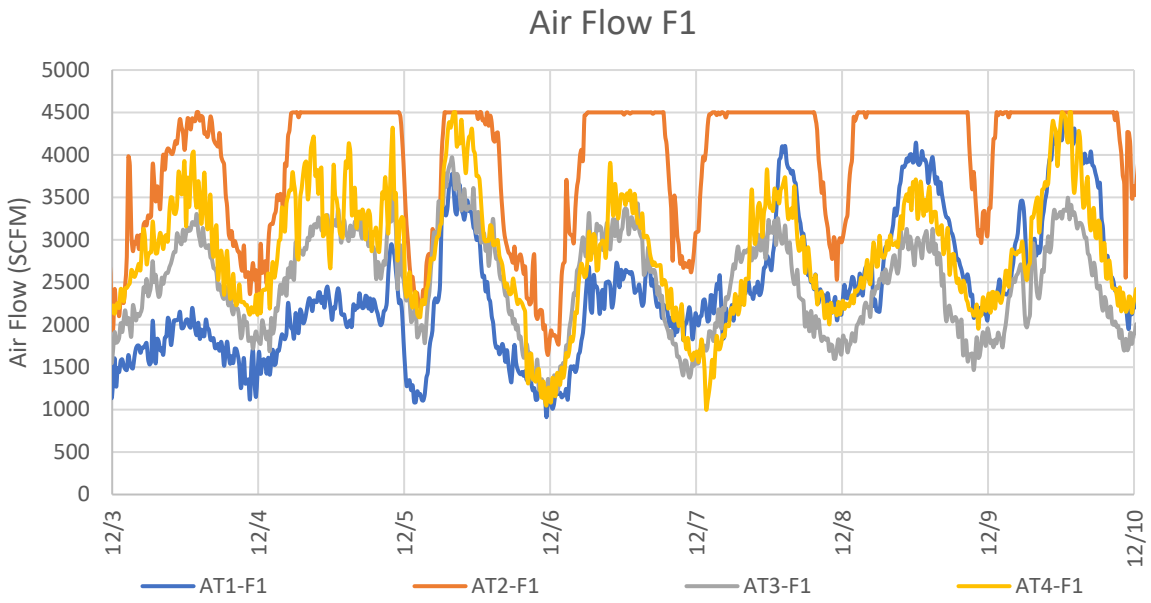
- Example
  - High air flow demand and low DO in Bioreactor2
  - Consequences
    - Poor BNR performance
    - Negative effect on AOB and PAO bacteria

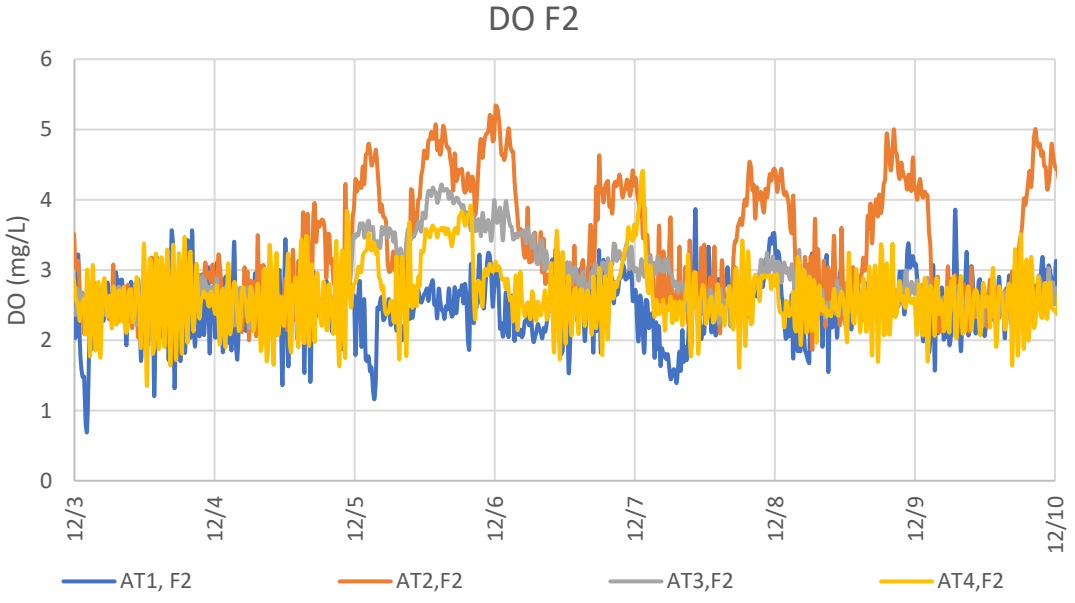


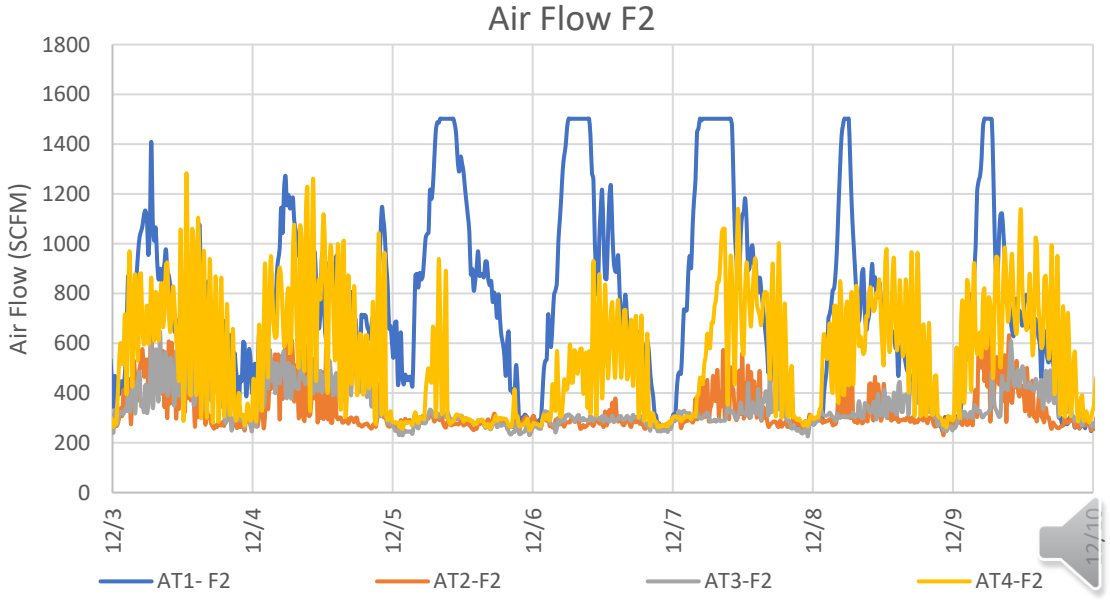


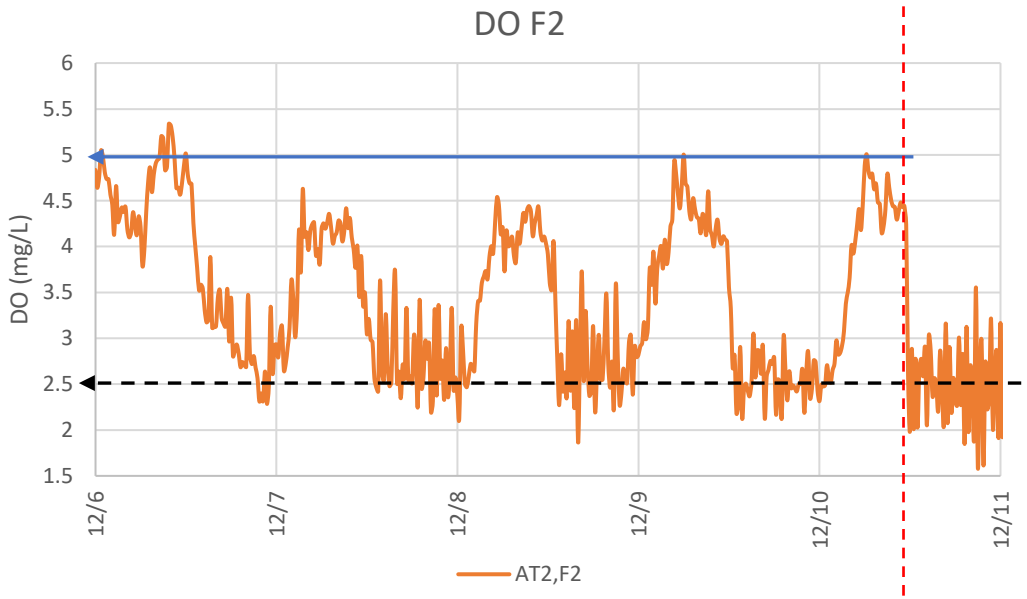



DO F1
DO (mg/L)
4
3.5
3
2.5
2
1.5
12/3
12/4
12/5
12/6
12/7
12/8
12/9
12/10
AT1,F1
AT2,F1
AT3,F1
AT4,F1

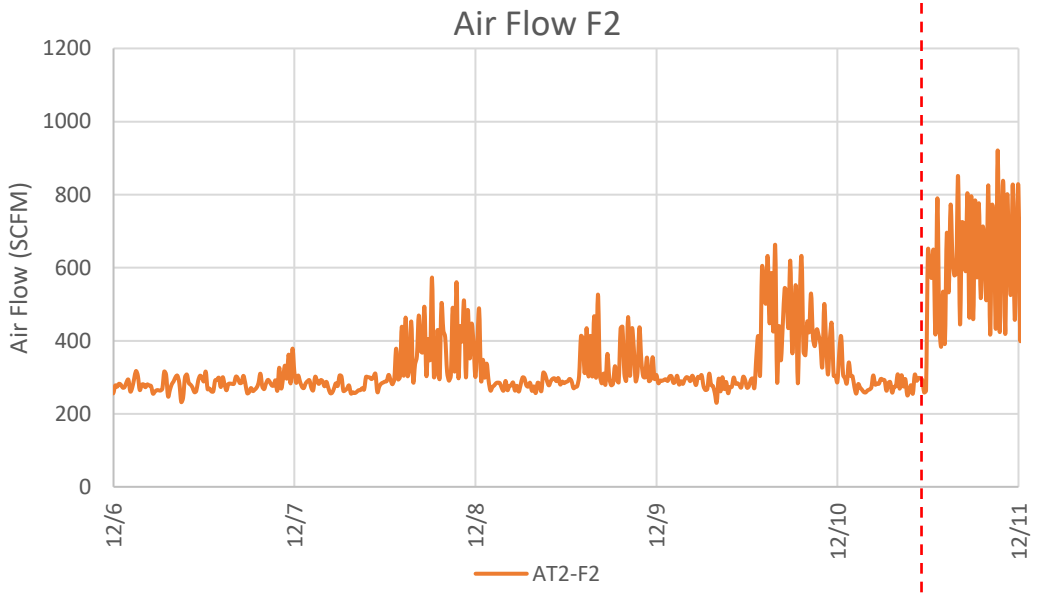

Air Flow F1
Air Flow (SCFM)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
12/3
12/4
12/5
12/6
12/7
12/8
12/9
12/10
AT1-F1
AT2-F1
AT3-F1
AT4-F1

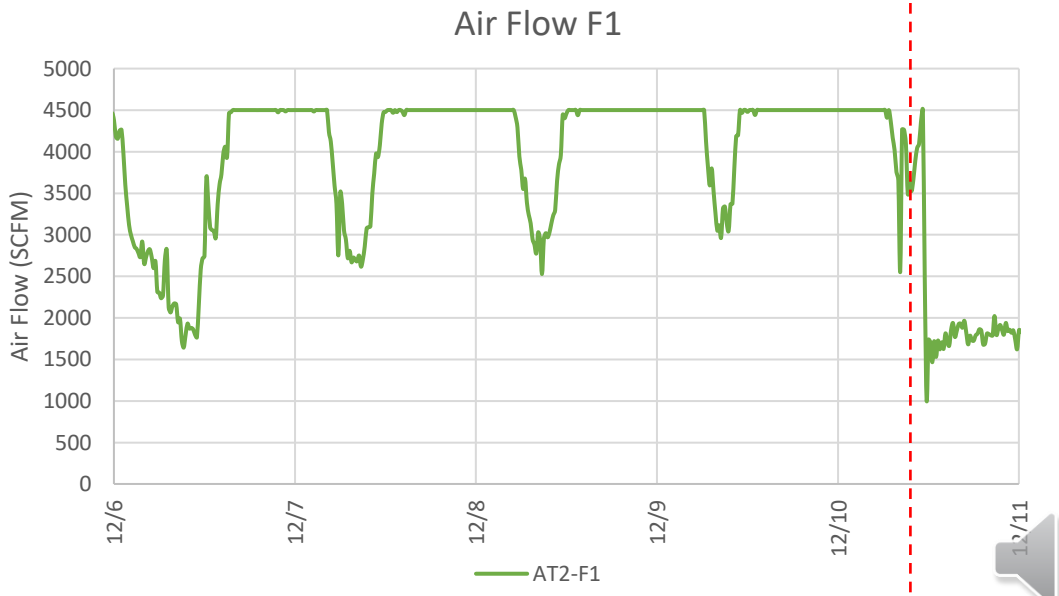

DO F2
DO (mg/L)
6
5
4
3
2
1
0
12/3
12/4
12/5
12/6
12/7
12/8
12/9
12/10
AT1, F2
AT2,F2
AT3,F2
AT4,F2

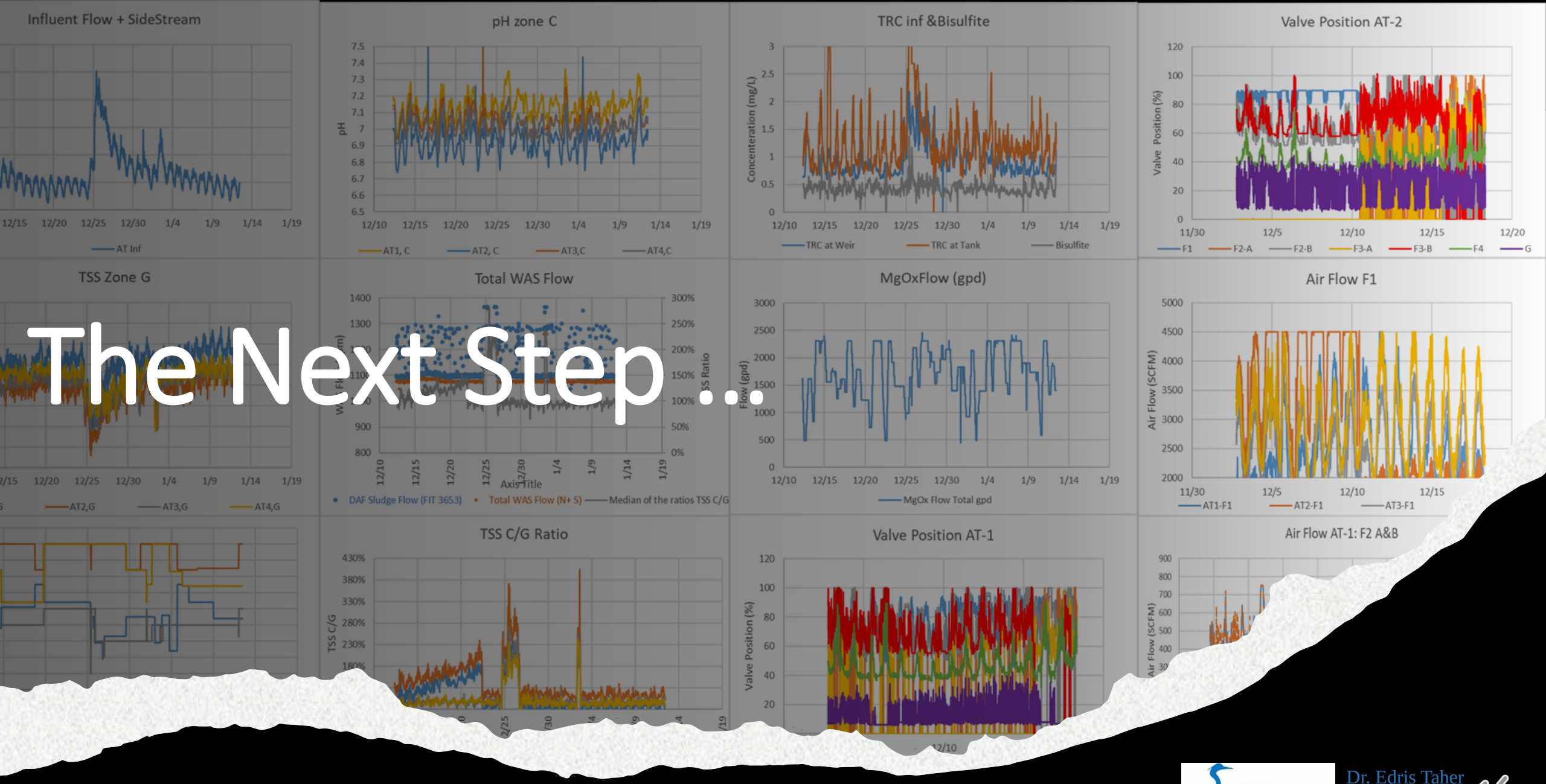

Air Flow F2
Air Flow (SCFM)
1800
1600
1400
1200
1000
800
600
400
200
0
12/3
12/4
12/5
12/6
12/7
12/8
12/9
12/10
AT1- F2
AT2-F2
AT3-F2
AT4-F2


DO F2
DO (mg/L)
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
12/6
12/7
12/8
12/9
12/10
12/11
AT2,F2


DO F1
DO (mg/L)
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
12/6
12/7
12/8
12/9
12/10
12/11
AT2,F1


Air Flow F2
Air Flow (SCFM)
1200
1000
800
600
400
200
0
12/6
12/7
12/8
12/9
12/10
12/11
AT2-F2


Air Flow F1
Air Flow (SCFM)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
12/6
12/7
12/8
12/9
12/10
12/11
AT2-F1



The Next Step…

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