2016 Membrane Technology CONFERENCE & EXPOSITION

Evaluation of Scinor Membrane for Retrofit and Future Expansion at the SPMWD

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SPI

San Patricio Municipal Water District

Scinor

Acknowledgements

- John Grymes – SPMWD
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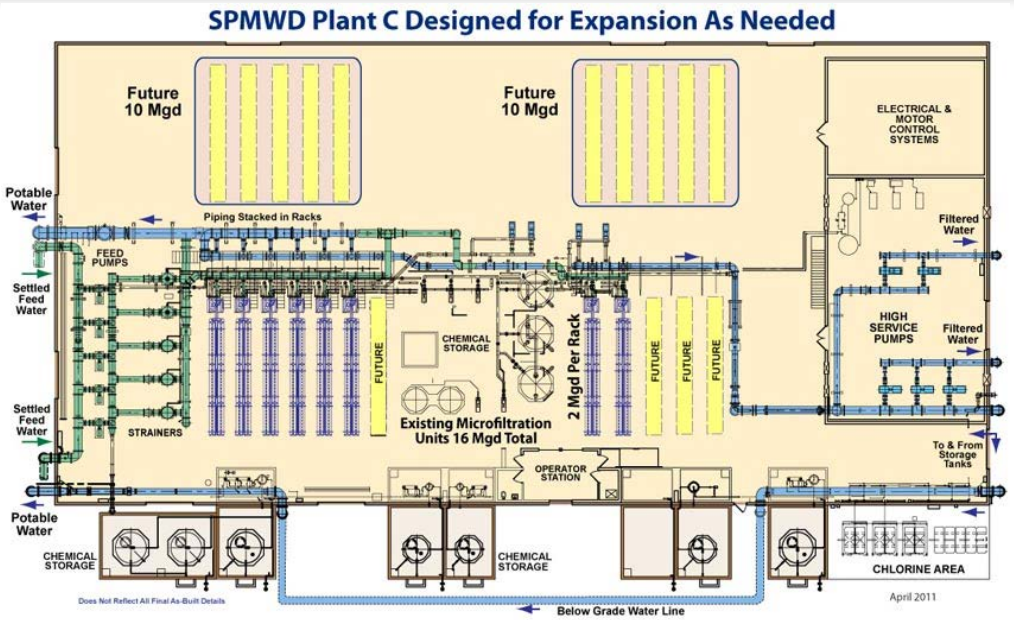
- Gabriela Handley – SPI
- Tom Poschmann – Scinor

Overview

- Background
- Project Objectives
- System Description
- Pilot Test Program
- Pilot Test Results
- Conclusions

Background:SPMWD Plant C

- SPMWD Plant C treatment:
  - Alum Coagulation Alum
  - Flocculation
  - Sedimentation
  - MF filtration using Pall membranes.
- Commissioned in January 2000 designed for 7.8 MGD and expanded to 11 MGD in 2006.
- CEB programming added in 2006.
- In 2010 the plant was re-rated at a higher flux from 53.4 gfd to 65 gfd. (16.4 mgd)
- The most recent expansion increased capacity to 19.4 mgd.

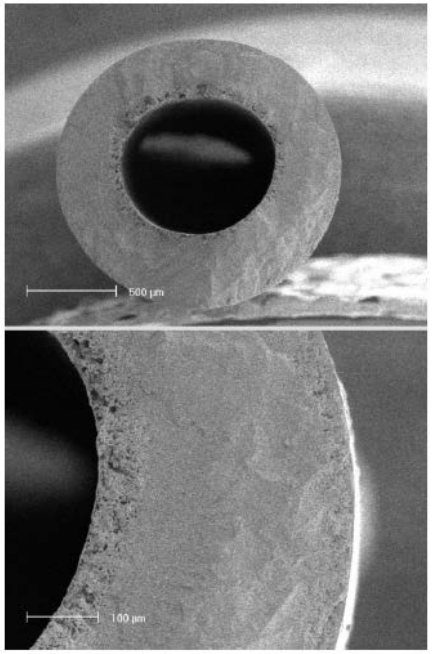


General Water Quality

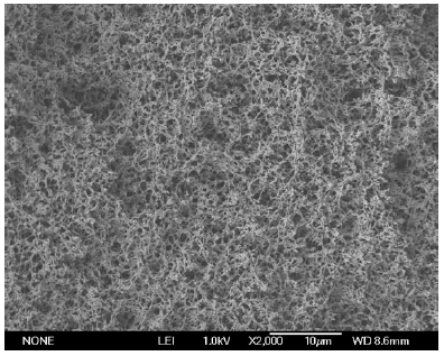
Parameter		Raw Water	
		Avg.	Range
Raw Water	Turbidity, Raw (NTU)*	30	28-32
	Total Suspended Solids (mg/L)	60	0-150
	Hardness (mg/L as CaCO3)	198	178-230
	Alkalinity(mg/L as CaCO3)	135	130-140
	Color (color units)	N/A	<1
	Temperature (°C)	23	14-30
	pH	8.1	7.8-8.5
	Total Organic Carbon (mg/L)	5.7	4.2-6.5
Settled Water	Alkalinity(mg/L as CaCO3)	135	130-140
	pH	7.4	7.2-7.8
	Turbidity, Settled**(NTU)	3	0.5-10
	Total Organic Carbon (mg/L)	3.4	2.5-4.0

Scinor Membrane Information

Parameter	Units	Value
Type of Membrane	-	UF
Membrane Model	-	SMT600-P50
Membrane Material	-	PVDF - TIPS
Fiber Length	mm	1950
Inside Diameter	mm	0.7
Outside Diameter	mm	1.3
Effective Surface Area	ft^2	538
Direction of Flow	--	Outside-in
Membrane Pore Size (nominal)	microns	0.01
Operational Characteristics		
Maximum Allowable TMP	psid	45
pH Range (Operating)	-	1 to 11
pH Range (Cleaning)	-	1 to 13
Integrity Test Pressure	psi	18
Log Removal Value (Giardia, Crypto)*	--	>5.5
Log Removal Value (MS2 bacteriophage)*	--	>4.0



SEM cross-section of TIPS UF hollow fiber)

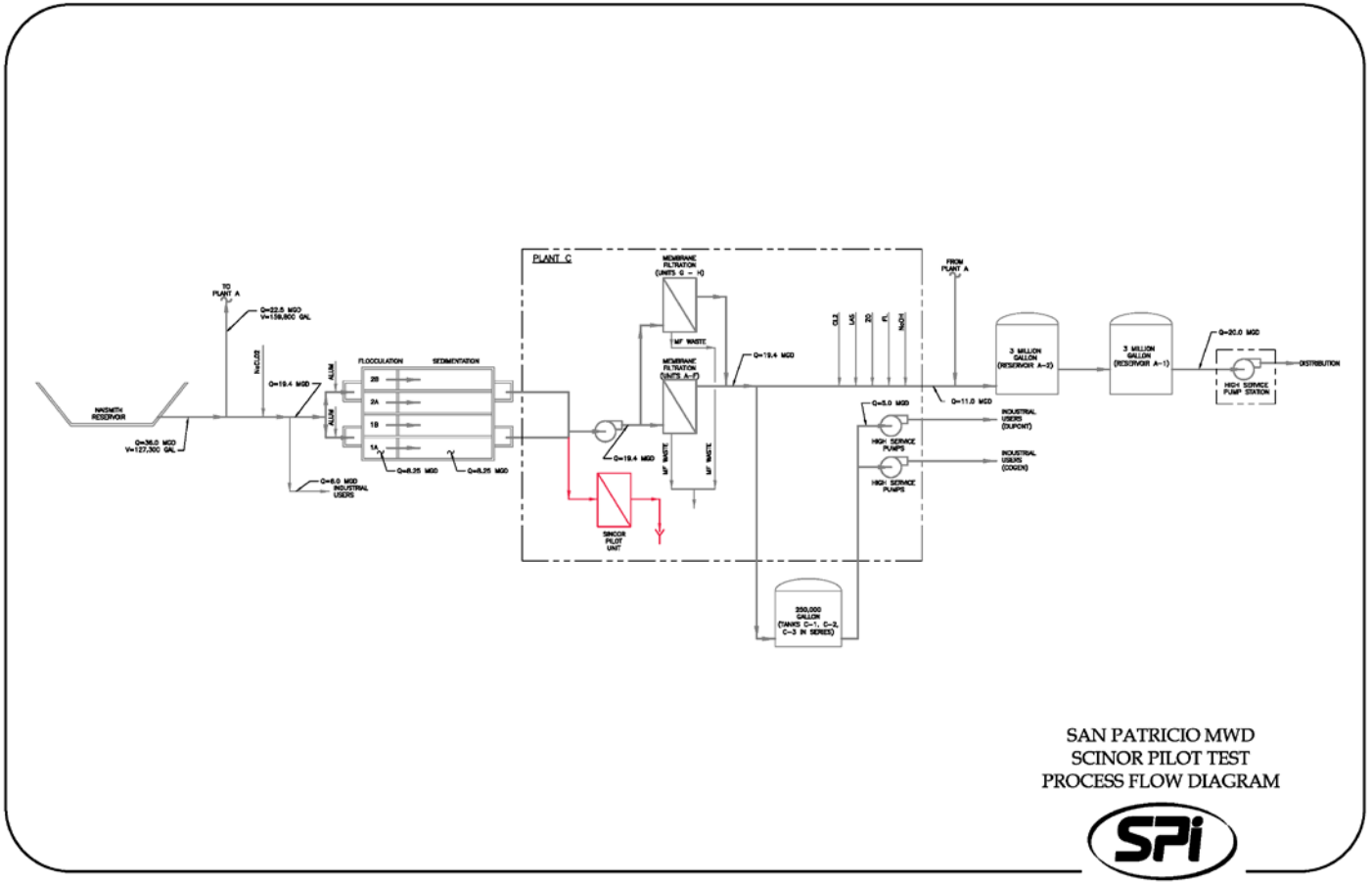


Project Objectives

- Evaluate the system operation at various operating fluxes between 50 and 65 gfd and select the optimal flux;
- Demonstrate the membrane system performance for the selected flux during evaluation period;
- Demonstrate stable and reliable performance for backwashing and CEB at selected flux;
- Demonstrate stable and reliable performance for 30 day CIP interval when operated at the selected flux (temperature compensated).
- Obtain TCEQ approval as an alternative membrane for replacement or future installation.

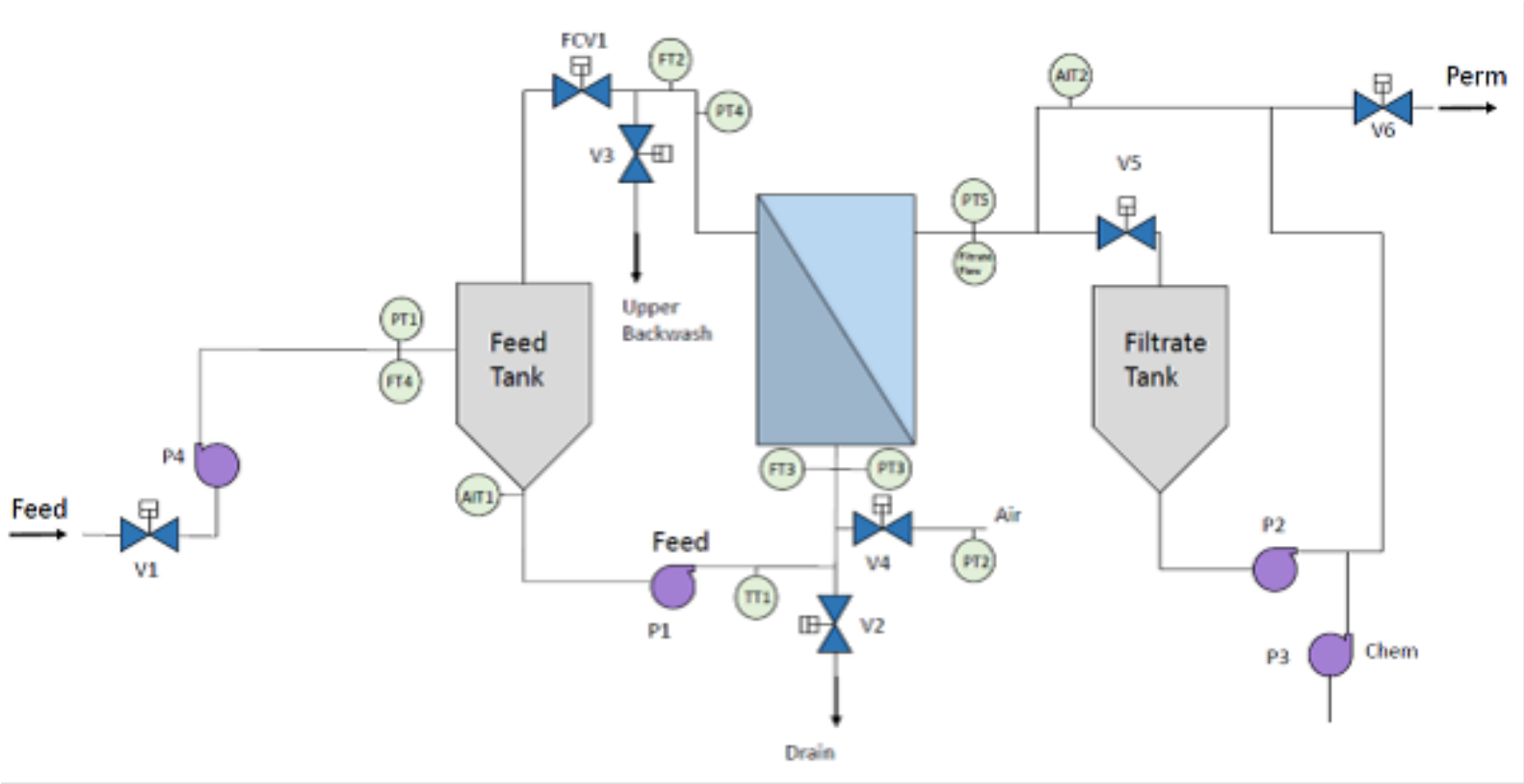
System Description

- Installation Schematic



System Description

- Pilot Unit Schematic



Pilot Unit Description

- Existing Pall Pilot owned by SPMWD
- Supplied in 2000
- Scinor Membranes Dimensionally Identical
- Reprogrammed for (CEB Sequence) by SPMWD Staff
- Monitored by SCADA
- Maintenance issues
  - Air Flow
  - Hypochlorite Metering Pump
  - Hypochlorite Solution Degradation

Pilot Test Program

- Phase 1

Schedule		
Week #	**Operating Conditions**	**Unit Flow Rate (gpm)**
0	CIP + Clean Water Test	
1	Flux at 50 gfd	18.7 gpm*
2	Flux at 55 gfd	20.6 gpm*
3	Flux at 60 gfd	22.4 gpm*
4	Flux at 65 gfd	24.3 gpm*

Backwash Regime				
Step	**Description**	**Duration**	**Flowrate**	**Chlorine Dose**
1	Aeration / Backwash	30 Sec	3 SCFM/module 8 gpm	0
2	Backwash	20 Sec	15 gpm/module	0
Frequency of Backwash: after each 475 gallons of filtrate				

CEB Regime				
Step	**Description**	**Duration**	**Flowrate**	**Chemicals**
1	Aeration / Backwash	30 Sec	3 SCFM/module 7.5 gpm	
2	Backwash	60 Sec	15 gpm/module	250 mg/L NaOCl
3	Soak	30 min		
4	Aeration / Backwash	30 Sec	3 SCFM/module 7.5 gpm	
5	Backwash	60 Sec	15 gpm/module	
Frequency of CEB: once a day				

Pilot Test Program

- Phase 1

CIP Regime				
Step	**Description**	**Duration**	**Flowrate**	**Chemicals**
1	Circulation with Chemical	60 min	9.8 gpm/module	1,000 mg/L NaOCl +500 mg/L NaOH -followed by - 0.5 % Citric Acid
2	Aeration	60 Sec	3 SCFM/module	
3	Soak	60 Min		
4	Drain	60 Sec		
5	Forward Flush	5 Min	9.8 gpm/module	
6	Drain	60 Sec		

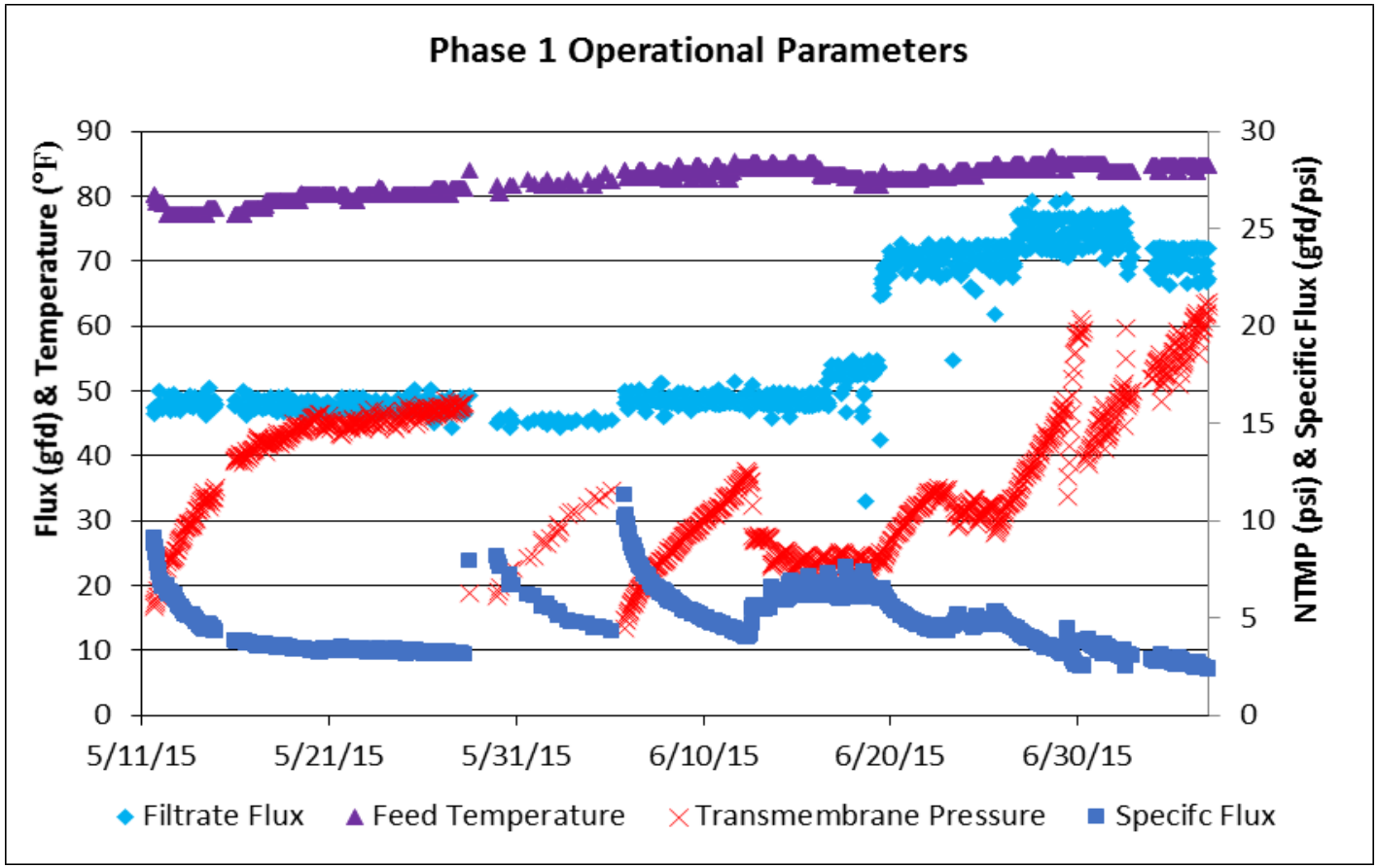
Frequency of CIP: every 30 days

Pilot Test Program

- Phase 2 & Phase 3
  - Phases 2 & 3 were designed to demonstrate the performance of the Scinor module at the selected flux rate during phase 1.
  - CIP's were performed:
    1. Beginning of testing (before phase 1)
    2. At the end of phase 1
    3. At the end of phase 2
    4. At the end of phase 3

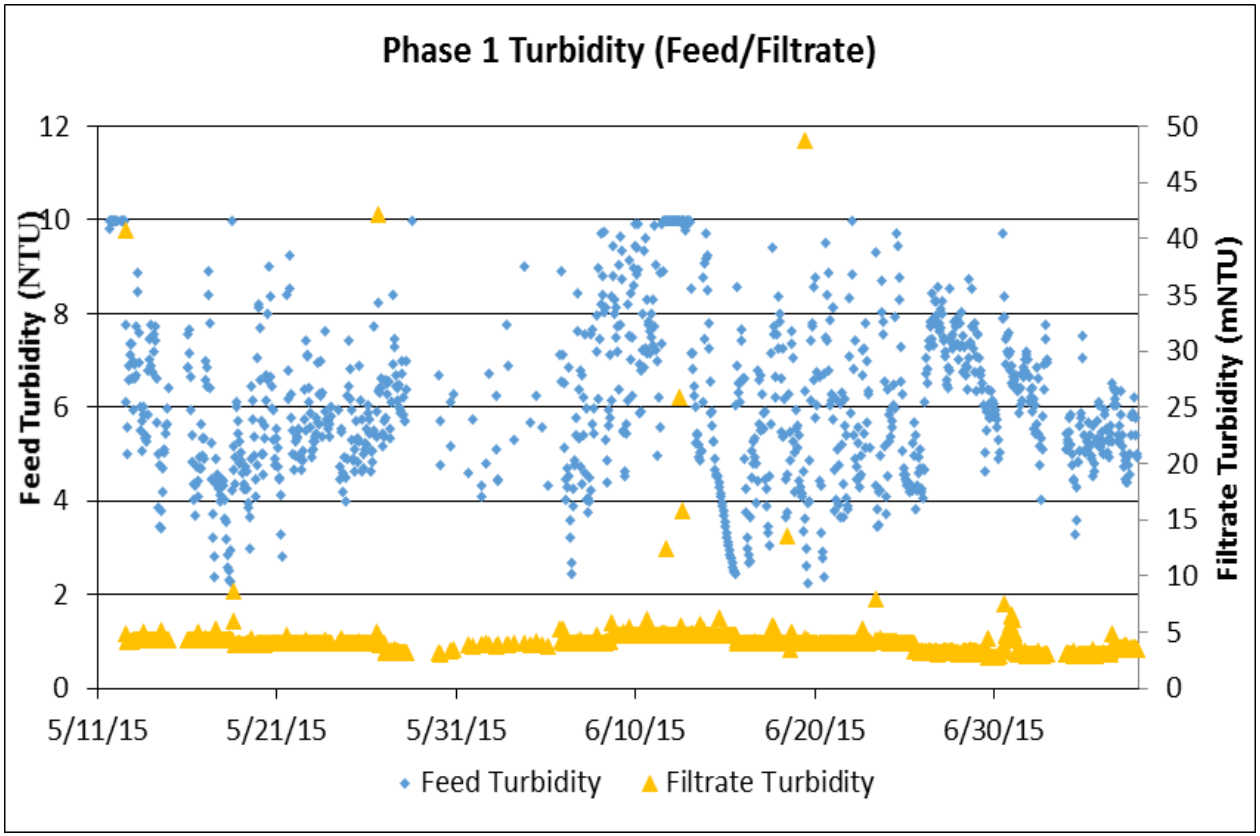
Pilot Test Results

- Phase 1 Performance



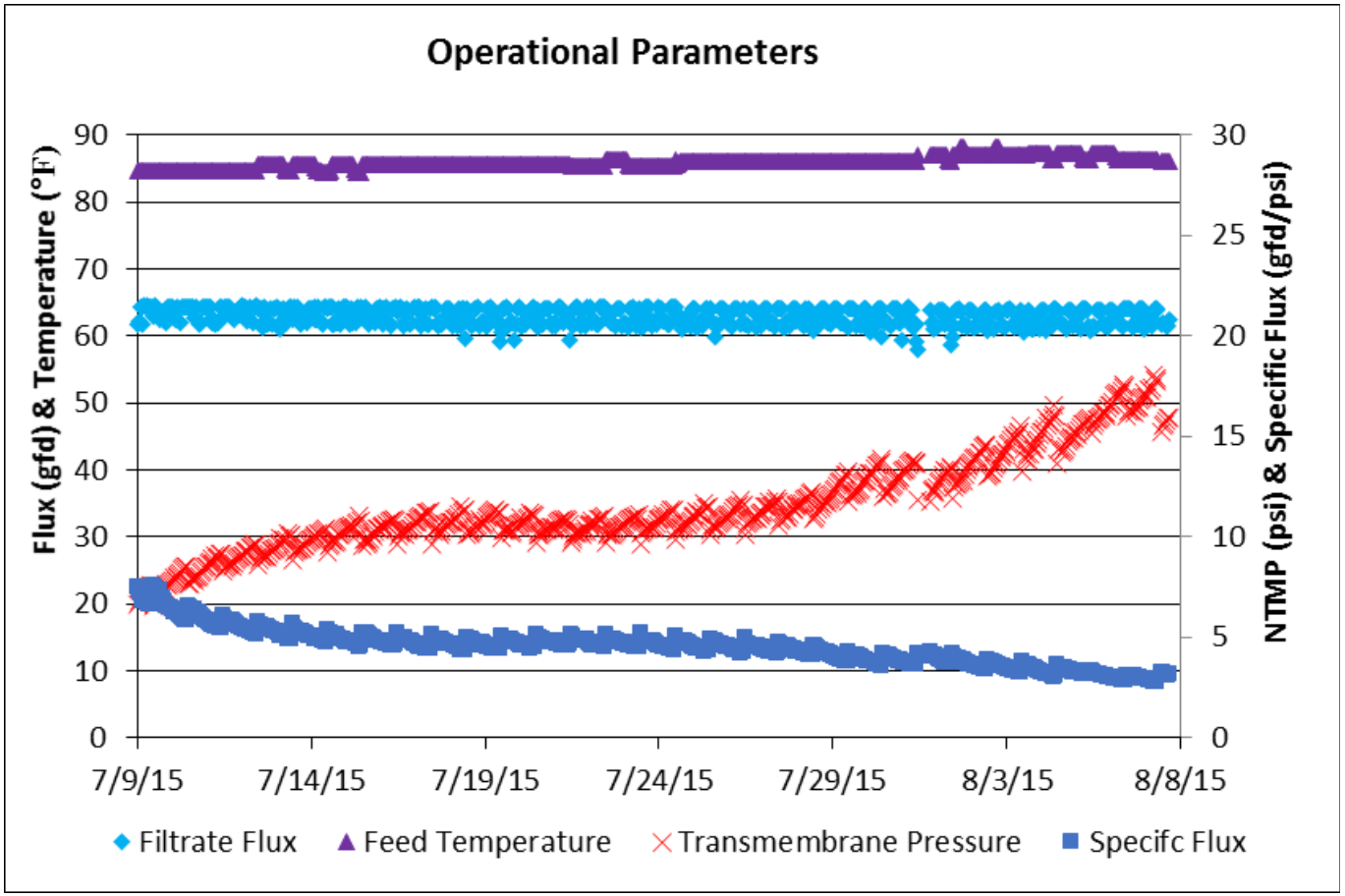
Pilot Test Results

- Phase 1 Turbidity



Pilot Test Results

- Phase 1 Supplemental Data



Pilot Test Results

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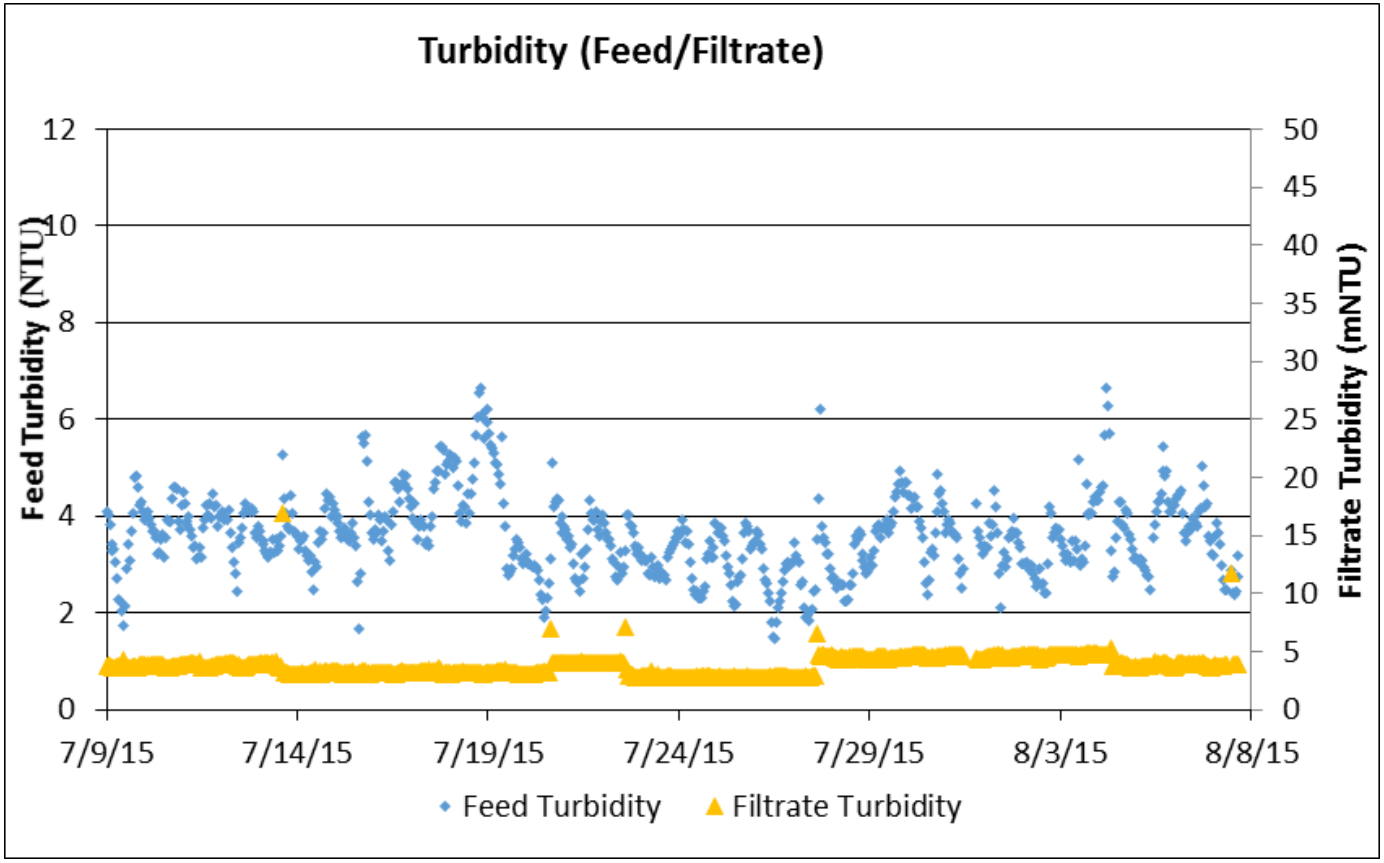
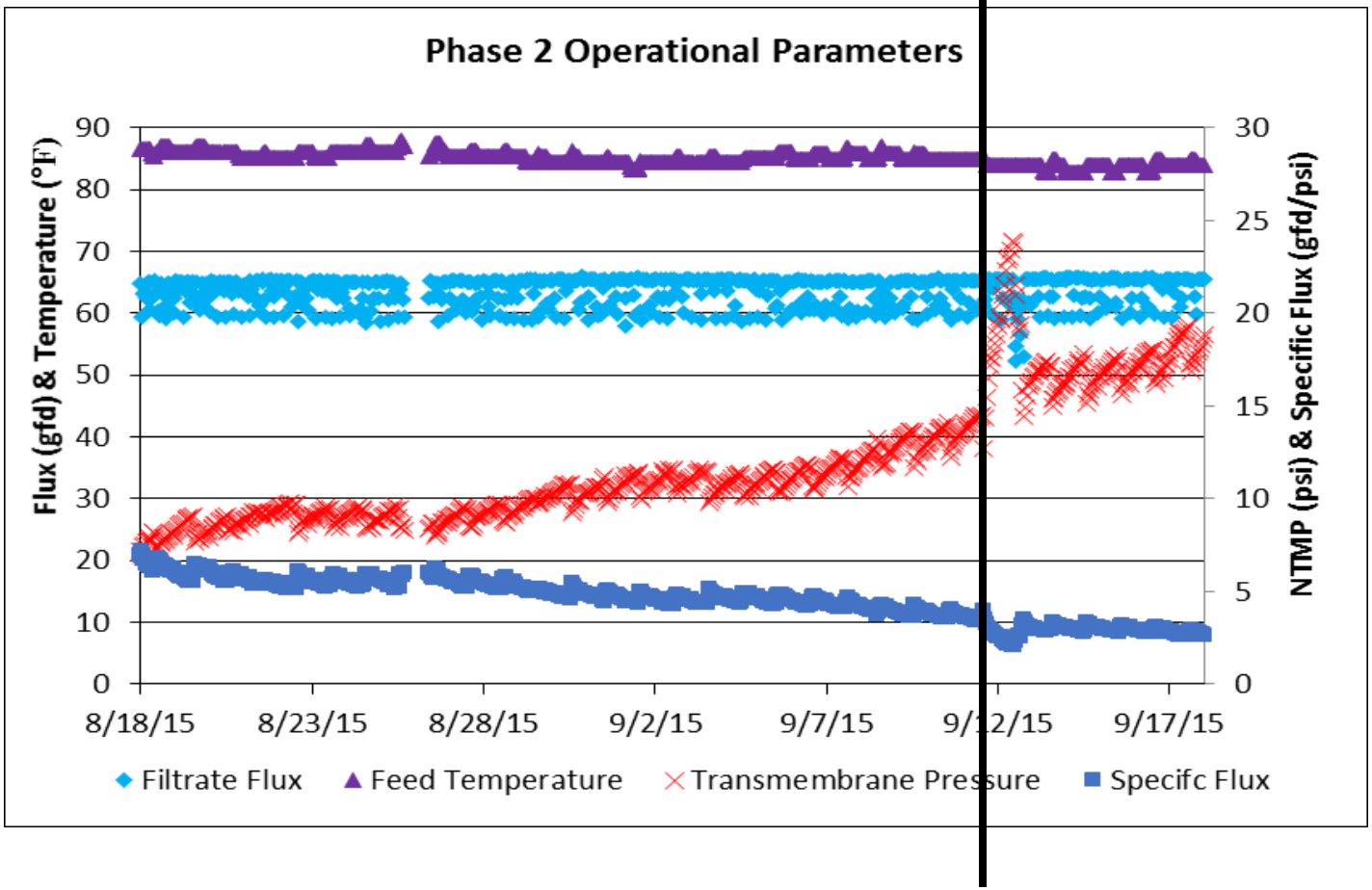


Pilot Test Results

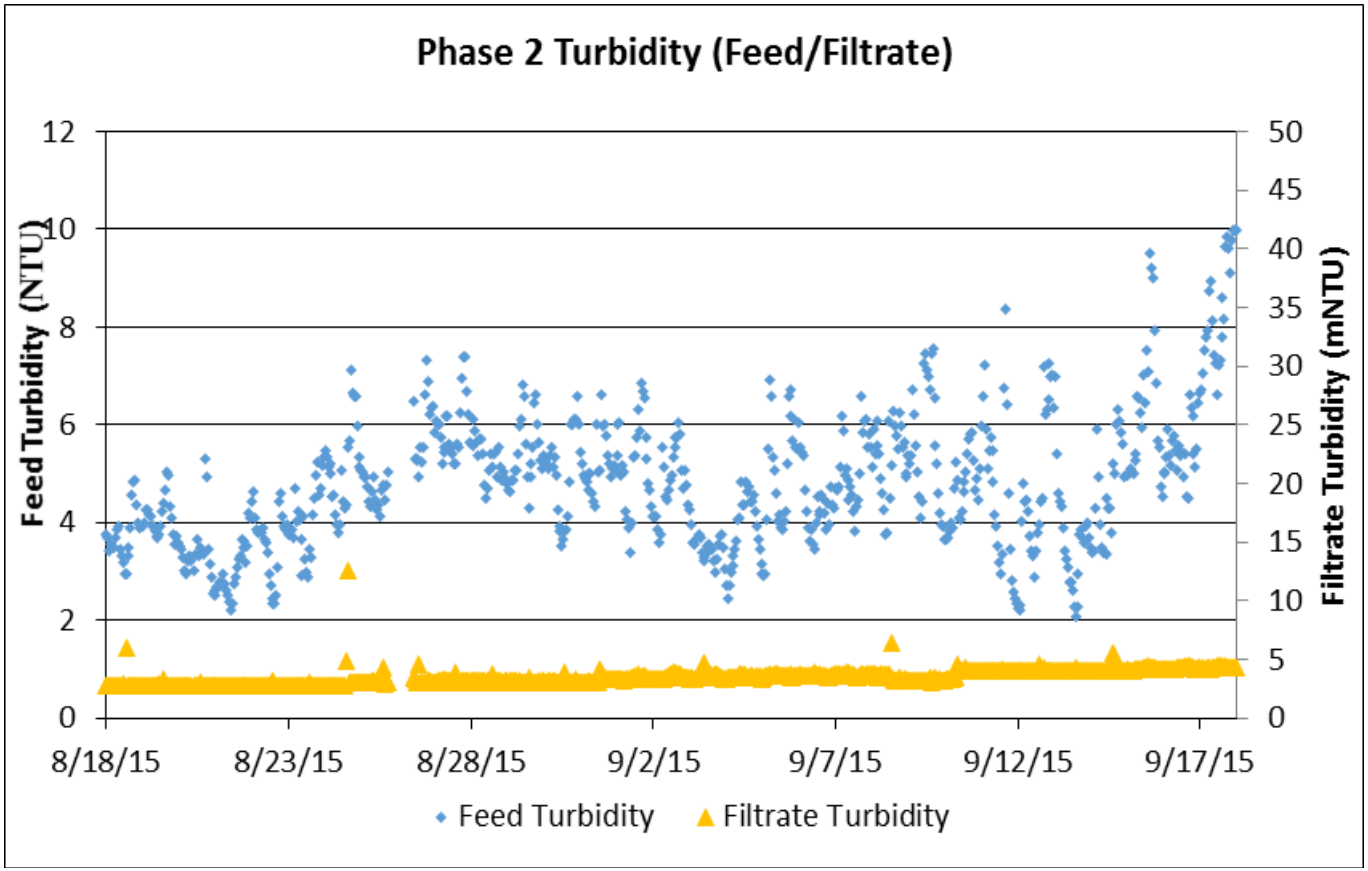
- Phase 2 Performance



Air Scour Isolation Valve Closed

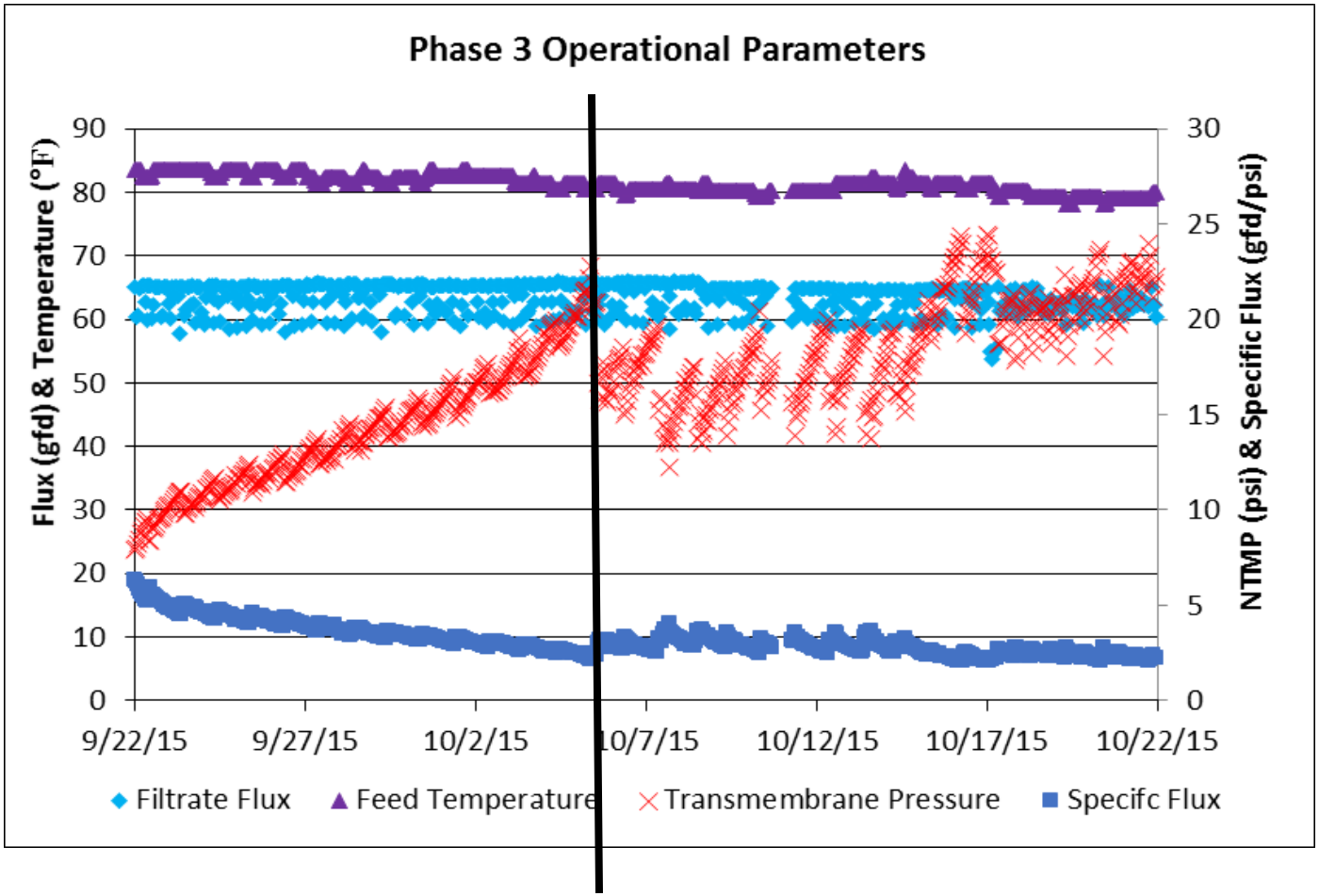
Pilot Test Results

- Phase 2 Turbidity



Pilot Test Results

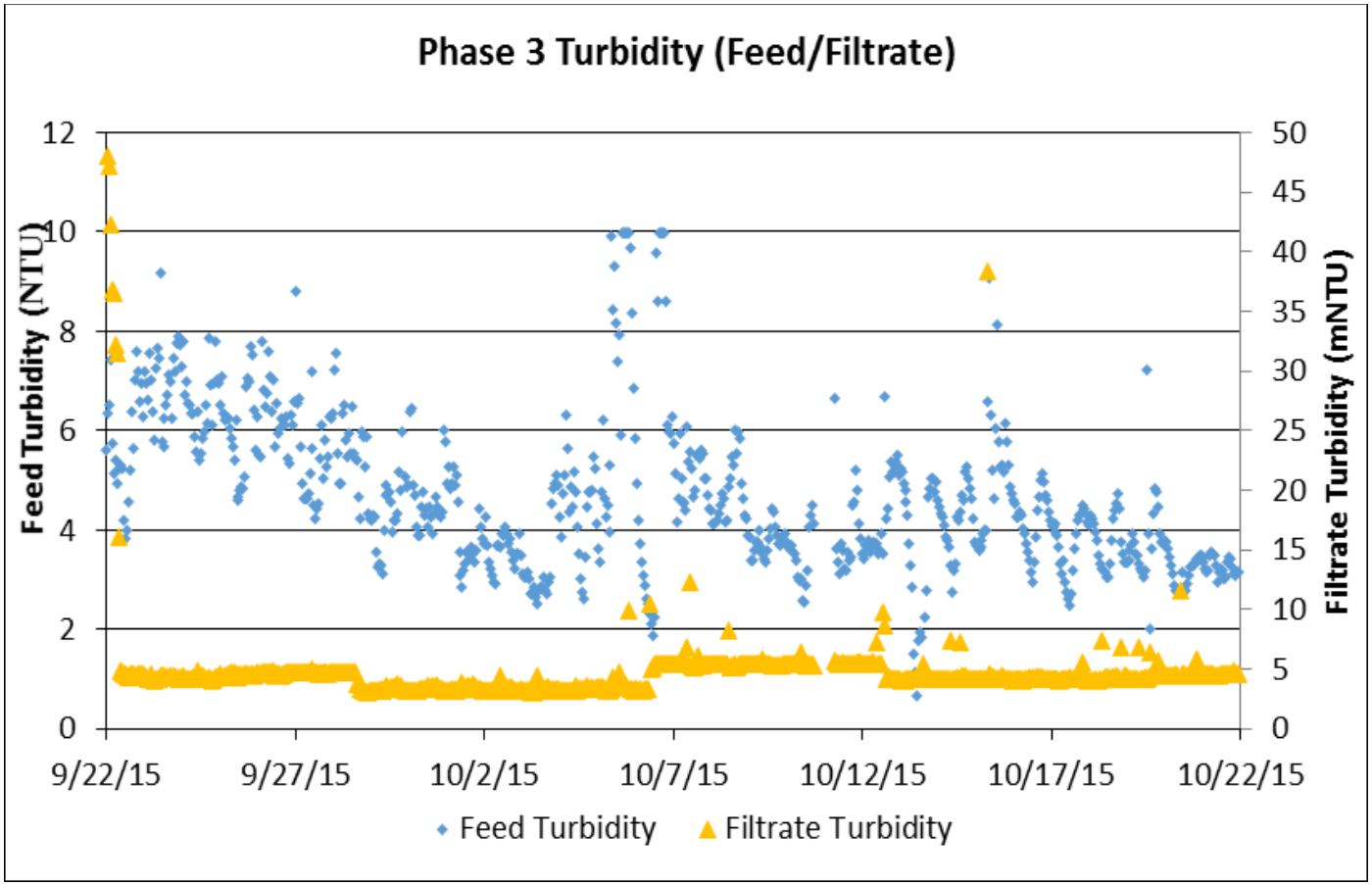
- Phase 3 Performance



Hypochlorite Replaced

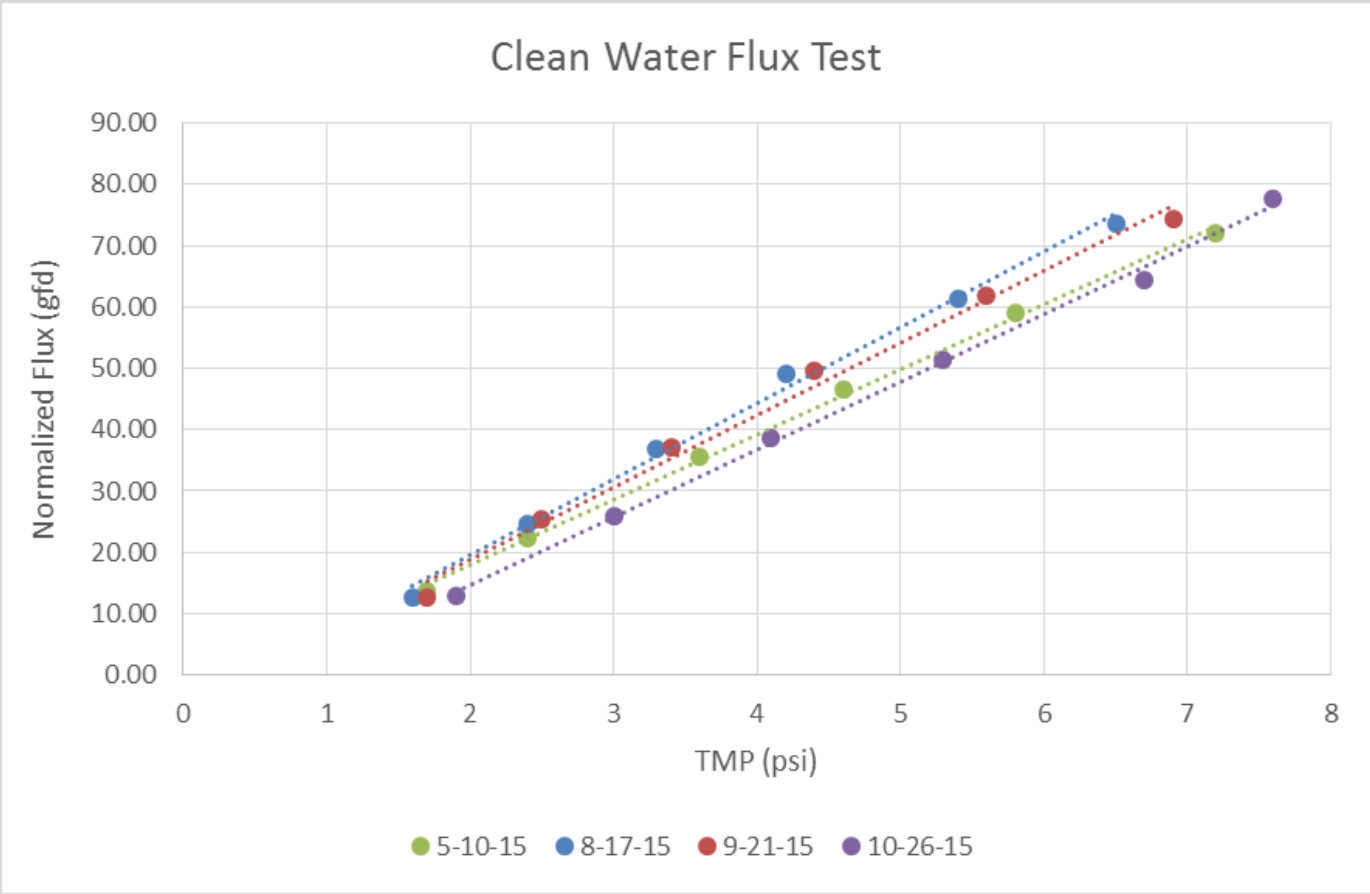
Pilot Test Results

- Phase 3 Turbidity



Pilot Test Results

- Clean Water Flux Tests



Pilot Test Results

- Membrane Integrity Test Results

Date	Start Pressure (psi)	End Pressure (psi)	Duration (min)	Result (psi/min)	LRV
5/29/2015	18.7	18.5	5	0.04	4.7
6/1/2015	18.5	18.2	5	0.06	4.27
6/2/2015	17.9	17.9	5	0	>5.5
6/3/2015	18.4	18.3	5	0.02	4.66
6/4/2015	17.9	17.5	5	0.08	4.05
6/5/2015	18.7	18.7	5	0	>5.5
6/12/2015	18	18	5	0	>5.5
8/17/2015	22.9	22.7	5	0.04	4.9
8/24/2015	20.5	20.4	5	0.02	4.92
8/31/2015	21.2	21.1	5	0.02	4.45
9/8/2015	20.1	19.9	5	0.04	4.77
9/14/2015	19.5	19.4	5	0.02	4.58
9/21/2015	18.9	18.7	5	0.04	4.48
9/28/2015	20.2	20.1	5	0.02	4.79
10/5/2015	19.5	19.2	5	0.06	4.12
10/12/2015	18.9	18.8	5	0.02	4.56
10/19/2015	20	19.9	5	0.02	4.55
10/22/2015	20.8	20.4	5	0.08	4.00

Conclusions

- Testing performed at the SPMWD indicated that the Scinor SMT600-P50 UF membrane is capable of maintaining a temperature corrected flux of 65 gfd, without loss of filtrate quality or excessive fouling.
- For this water, operational performance is comparable to existing membranes in service.
- The District is satisfied that the Scinor UF module achieved its piloting objectives and is in the process of submitting a complete pilot report to the TCEQ for approval for replacement or future expansion.

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SAN PATRICIO MUNICIPAL WATER DISTRICT

Scinor

Questions?

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