weftec 18
the water quality event™

TECHNICAL SESSION

Developing Drought Immunity: The Hamby WRF Potable Water Reuse Project

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CITY OF ABILENE

eHT

Overview

- City of Abilene's Water Supplies
- City of Abilene's Response to Dwindling Water Supplies
- Background on Hamby Water Reclamation Facility
- Details of Planned Indirect Potable Reuse Project
- Hamby WRF Facility Data and Lessons Learned

City of Abilene's Water Supplies

Abilene's Water Utilities

- Abilene serves treated potable water to approximately 125,000 retail users and an additional 32,000 wholesale users.
    - Abilene has approximately 40,000 retail connections and connections with 14 wholesale water systems.
- Abilene supplies reclaimed water to 25 contracted reclaimed customers citywide and an additional 10 irrigators around the Hamby Water Reclamation Facility.
- Abilene diverts approximately 24,500 ac-ft/yr of surface water from its three surface water sources (about 22 MGD) and delivers 23,700 ac-ft/yr to its retail and wholesale customers (about 21 MGD)
- Abilene's retail customers use about 86% (about 18 MGD) of the total treated water that is produced from the water production system while its wholesale customers use about 14% (about 3 MGD)

City of Abilene
Water Production and Wastewater Reuse Schematic (Before January 2015)

Hubbard Creek Reservoir

Lake Fort Phantom Hill

Northeast WTP

Grimes WTP

Hamby WRF

Outfall 001 Freewater Creek

Outfall 002 Kirby Lake

Reuse Customers

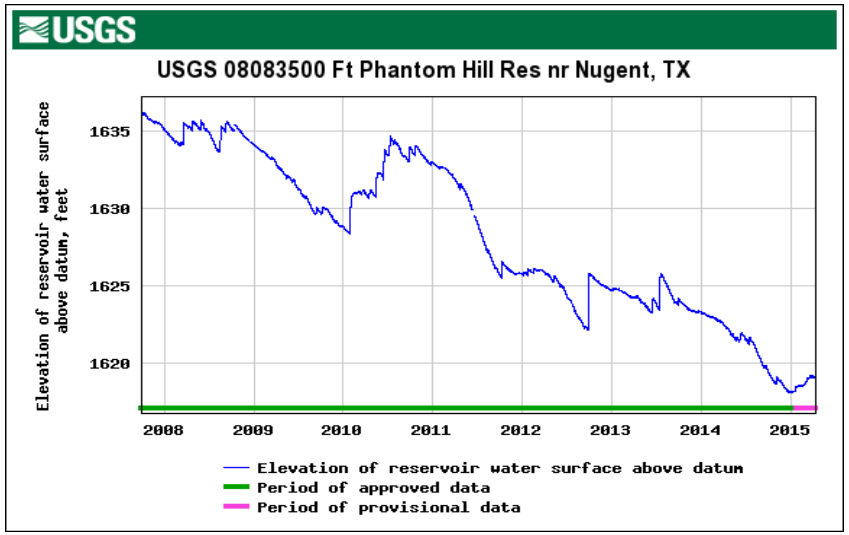
Hargesheimer WTP

Lake O.H. Ivie

Abilene's Water Sources

- The recent historic drought severely affected Abilene's raw water sources.

Abilene's Water Sources



Lake Fort Phantom Hill

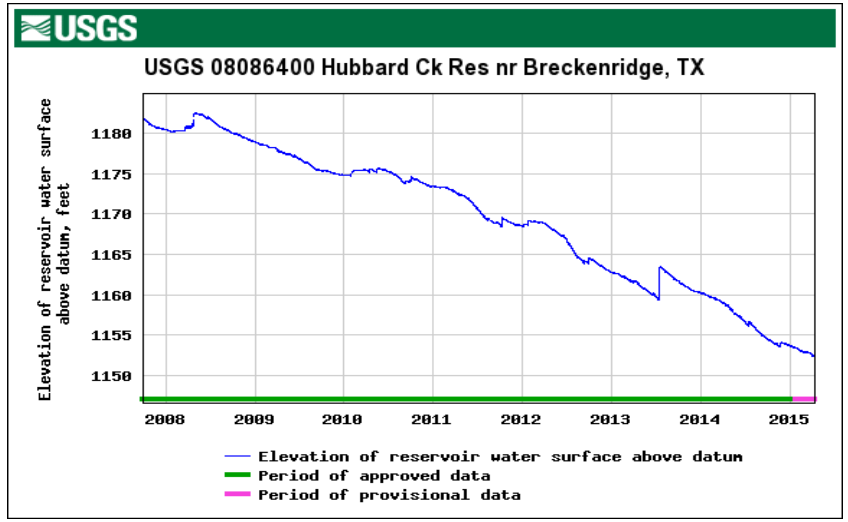
Full pool: 1,635.9 ft msl

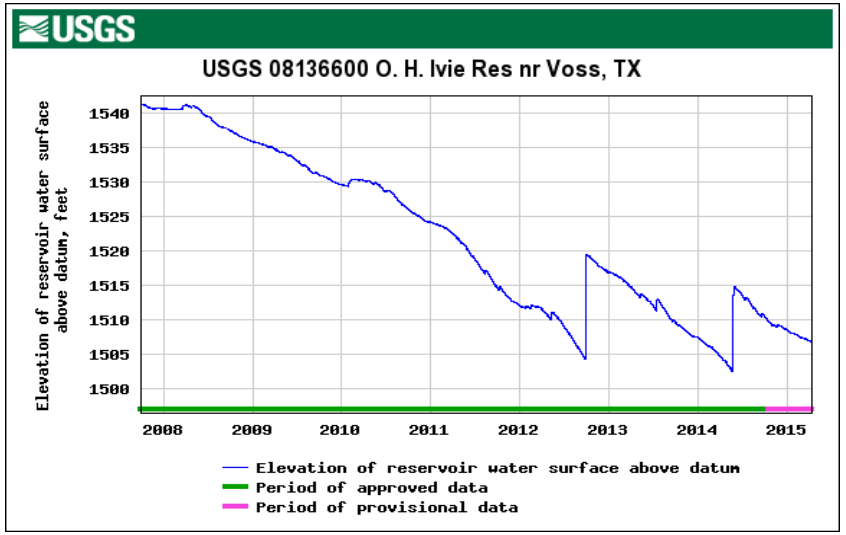
2015: - 16.85 ft

Hubbard Creek Lake

Full pool: 1,183.0 ft msl

2015: - 30.73 ft





Lake O.H. Ivie

Full pool: 1,1,551.5 ft msl

2015: - 44.81 ft

City of Abilene's Response to Dwindling Water Supplies

City of Abilene
Water Production and Wastewater Reuse Schematic (After January 2015)

Hubbard Creek Reservoir

Outfall 003
Lake Fort
Phantom Hill

Hamby
WRF

Outfall 001
Freewater
Creek

Outfall 002
Kirby Lake

Reuse
Customers

Northeast
WTP

Grimes
WTP

Hargesheimer
WTP

Lake O.H.
Ivie

Background on Hamby Water Reclamation Facility

Hamby WRF (Prior to IPR Project)

- The Hamby WRF was constructed in the 1950s and underwent some modifications over the years but represented a first generation activated sludge facility (1970s technology).

- Effluent from the Hamby WRF was usually suitable for discharge to Freewater Creek, and for irrigation reuse, but unsuited for indirect potable reuse.

Hamby WRF (Pre-2015)

Details of Planned Indirect Potable Reuse Project

Indirect Potable Reuse Project

- Constituents of concern in the Hamby WRF effluent, were it to be used for indirect potable reuse included:
  - Nitrogen/Phosphorus-algae growth leads to taste and odor
  - Salinity levels and other secondary parameters
  - DBPs - TTHMs, HAA5, Bromate, others?
  - Contaminants of Emerging Concern (CECs)

Indirect Potable Reuse Project

- The City undertook a study to evaluate treatment options to address needs to:
  - Meet current and future TPDES permits (CBOD5, TSS, ammonia, pH, DO), and to reduce phosphorus.
  - Preserve reuse water quality
  - Remove salinity and other constituents that didn't belong in a drinking water source.

WRF Improvements to Support IPR

- The City determined through its study that a viable treatment system to meet all treatment objectives would utilize:
  - Reverse Osmosis (RO) to reduce salinity and other secondary constituents.
  - Ozone followed by biologically active filters to break apart and remove CECs.
  - Biological Nutrient Removal (BNR) and Membrane Bioreactors (MBR) to meet current and future TPDES permits, to reduce phosphorus, and to provide filtration for Type I/II reuse supply.

Hamby Water Reclamation Facility (During Construction)

Pretreatment System

Influent from Buck Creek PS

Influent from Prison PS

Influent from EQ

New Fine Grit Removal

Fine Degritted Effluent to Fine Screens

New 2 mm Fine Screen System

Fine Screen Effluent to IFSS Structure

Onsite EQ Storage

Dewatered Grit to Dumpster

Dewatered Screenings to Dumpster

Flow Equalization System

Influent from Buck Creek PS

Influent from Prison PS

New PTU Structure

Overflow from PTU Structure to EQ Return PS

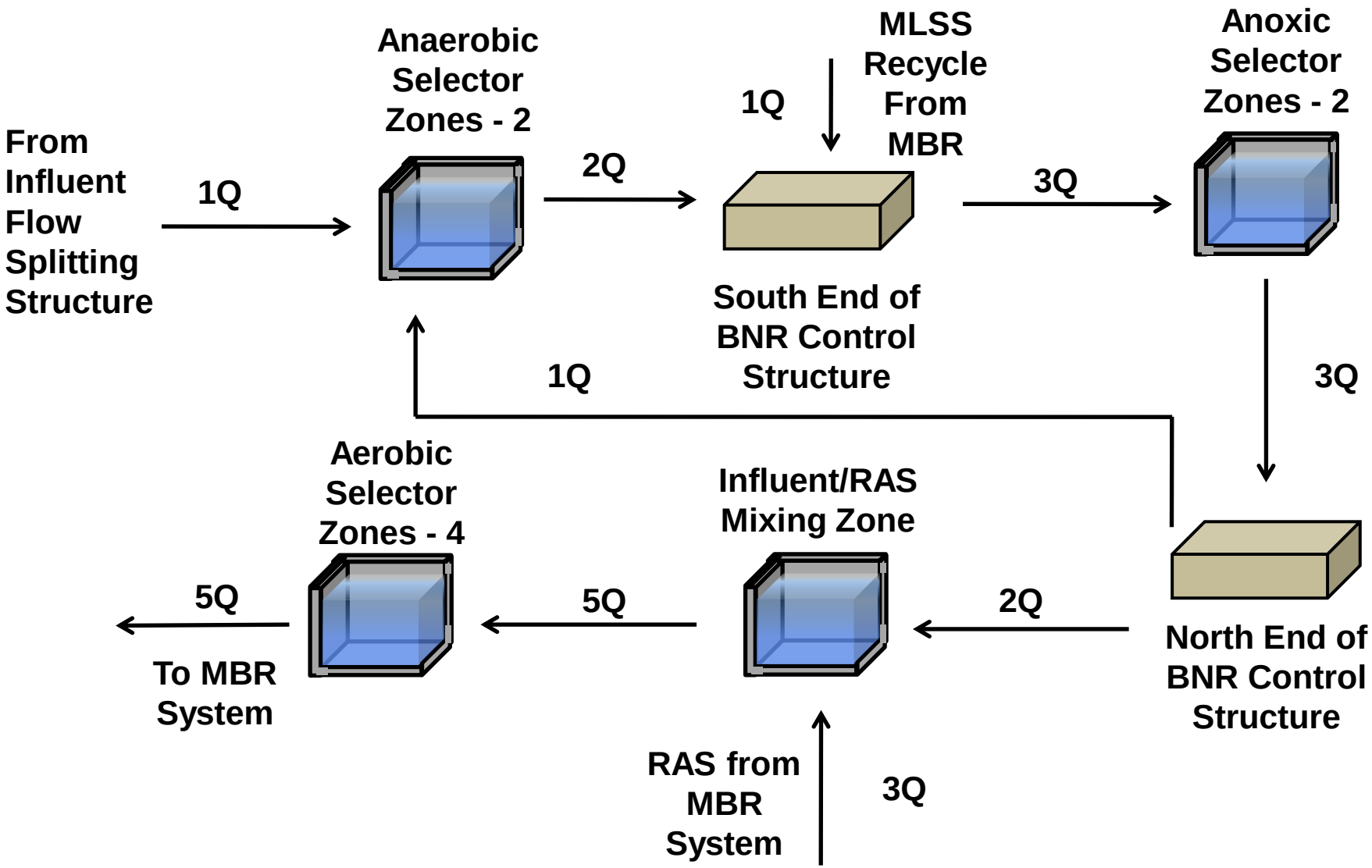
New EQ Return PS

EQ Return Flow Back to PTU Structure Influent Channel

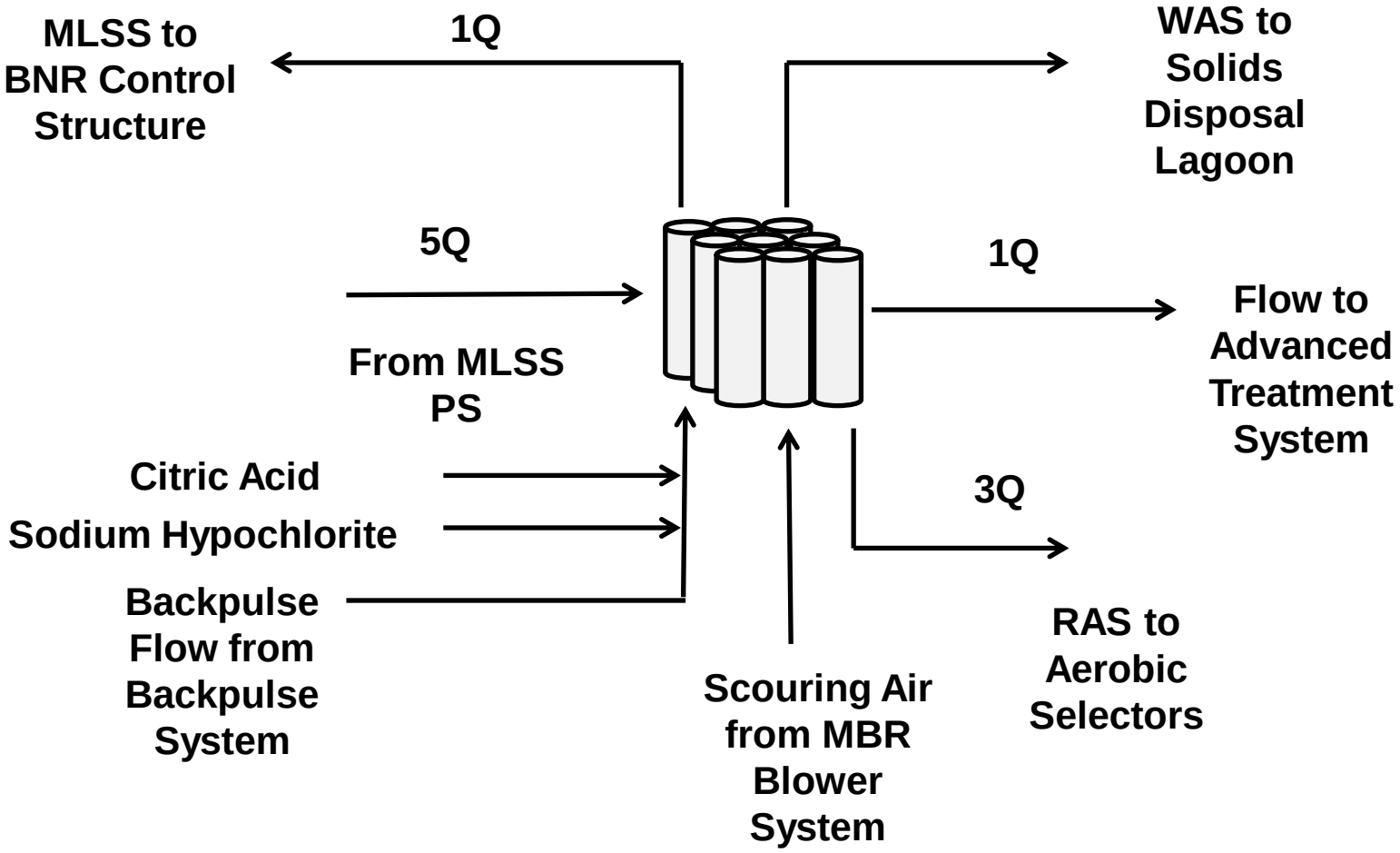
Overflow from EQ Return PS Wet Well to Earthen EQ Basin

Earthen EQ Basin

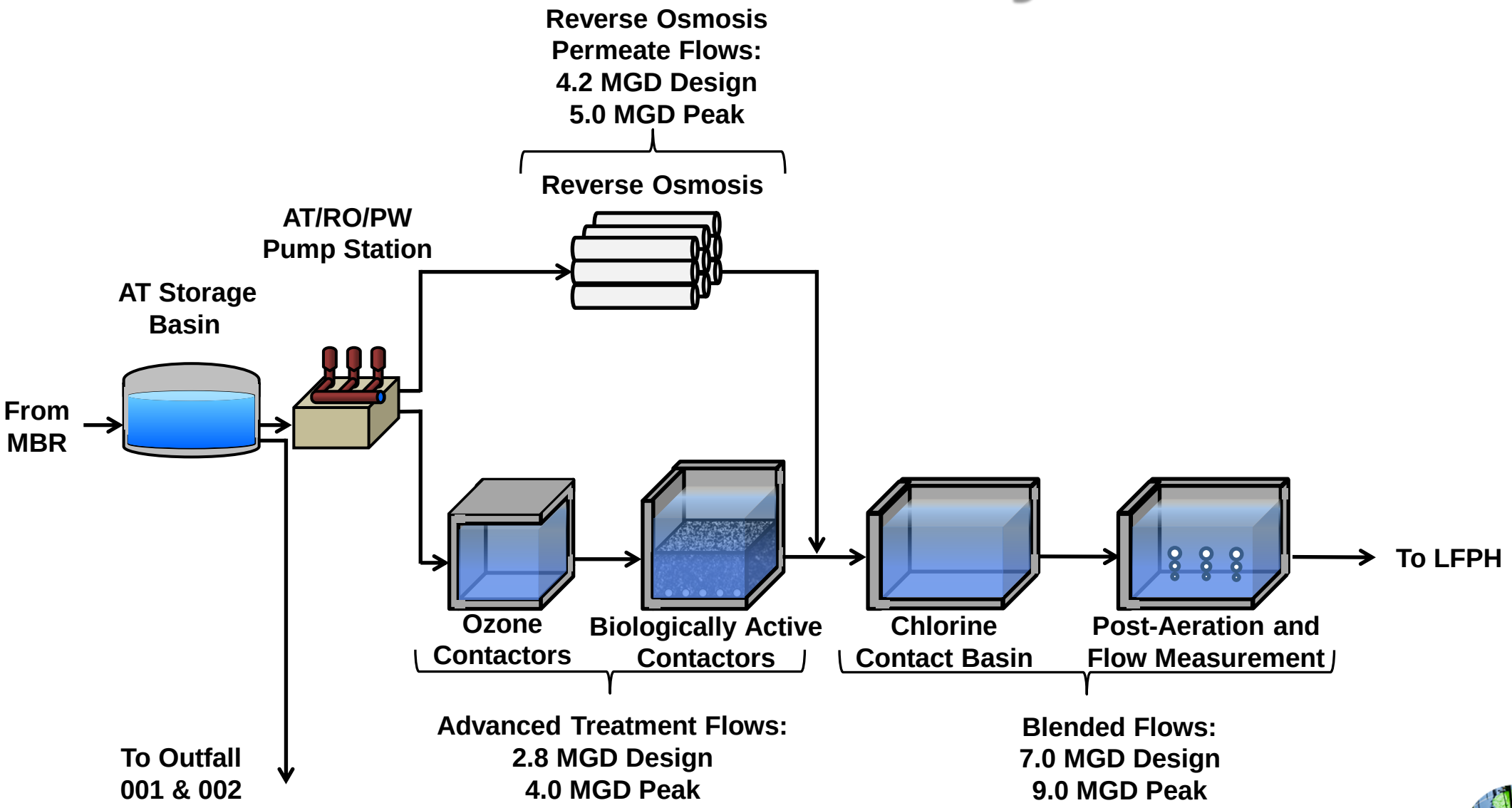
Biological Nutrient Removal System



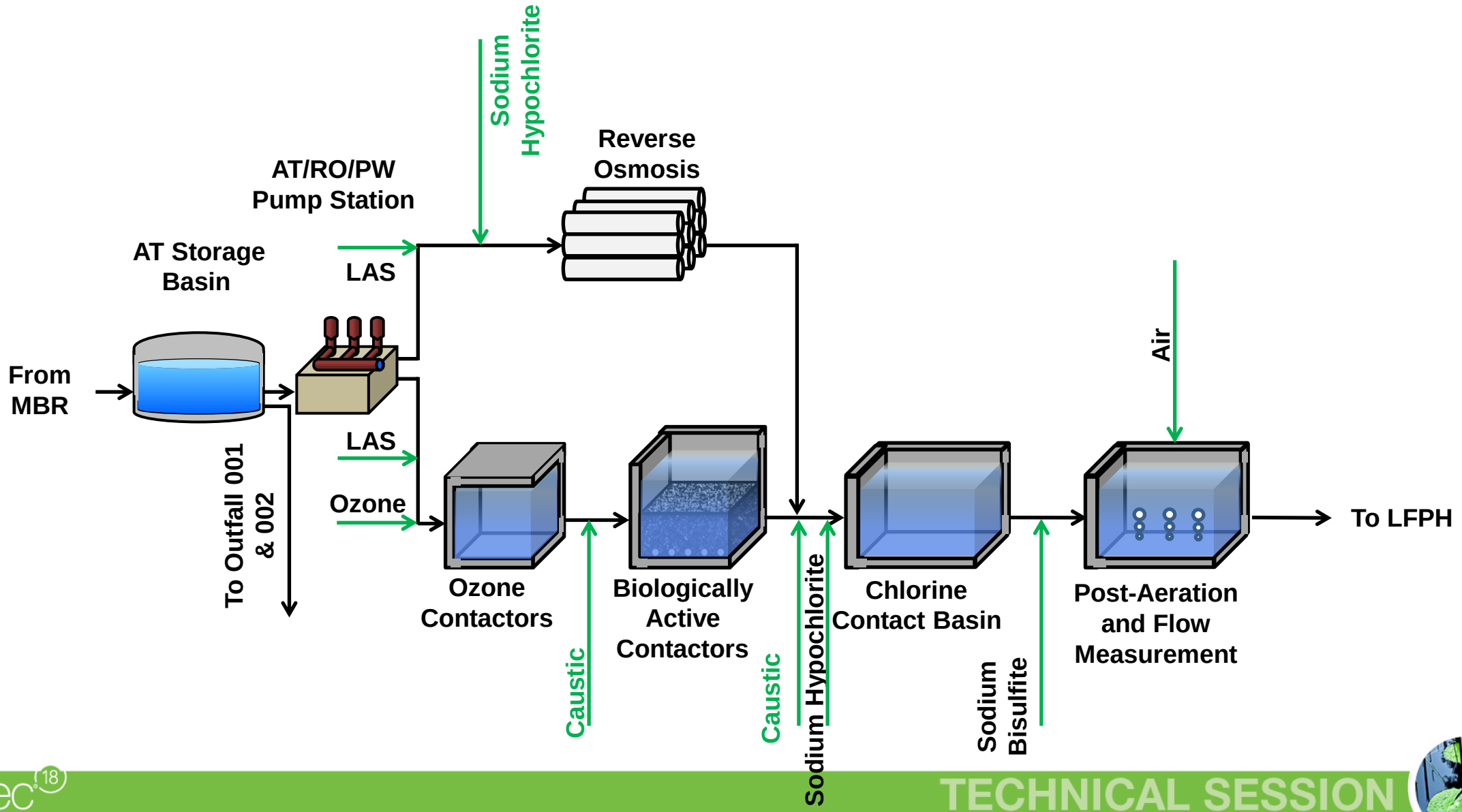
Membrane Bioreactor System



Advanced Treatment System



AT System - Chemical Feed Locations



Hamby WRF Facility Data and Lessons Learned

Average and Design WRF Influent Quality for the IPR Project

Parameter	Average Condition	Design Condition
BOD_5 (mg/L)	199	232.8
Total Suspended Solids (TSS) (mg/L)	190	226.1
Ammonia (mg/L as N)	22.0	24.0
Total Phosphorus (TP) (mg/L as P)	5.7	7.3
Volatile Suspended Solids (VSS): TSS	0.70	0.70
Ammonia: Total Kjeldahl Nitrogen (TKN)	0.69	0.69
Ortho-Phosphate: TP	0.5	0.5

Anticipated TPDES Permit Limits and Reuse Quality Standards

Parameter	Anticipated Outfall No. 001/002 TPDES Permit Limits	Anticipated Outfall 003 TPDES Permit Limits	Current Type I Reuse Quality Standards per Reclaimed Water Rules
5-day $CBOD_{5)}$, mg/L	April-Sept.: 7 Oct.-March: 10	5	5
TSS, mg/L	15	15	None
Ammonia-Nitrogen, (NH_3-N), mg/L	April-Sept.: 2 Oct.-March: 3	2	None
Total Phosphorus, mg/L	0.5	0.5	None
*Escherichia col*i (*E. coli*) CFU/100 mL	*E. coli:* 126	*E. coli*: 126	Fecal: 20 (30-day geo. mean) 75 (single grab max)
Turbidity, NTU	None	None	3

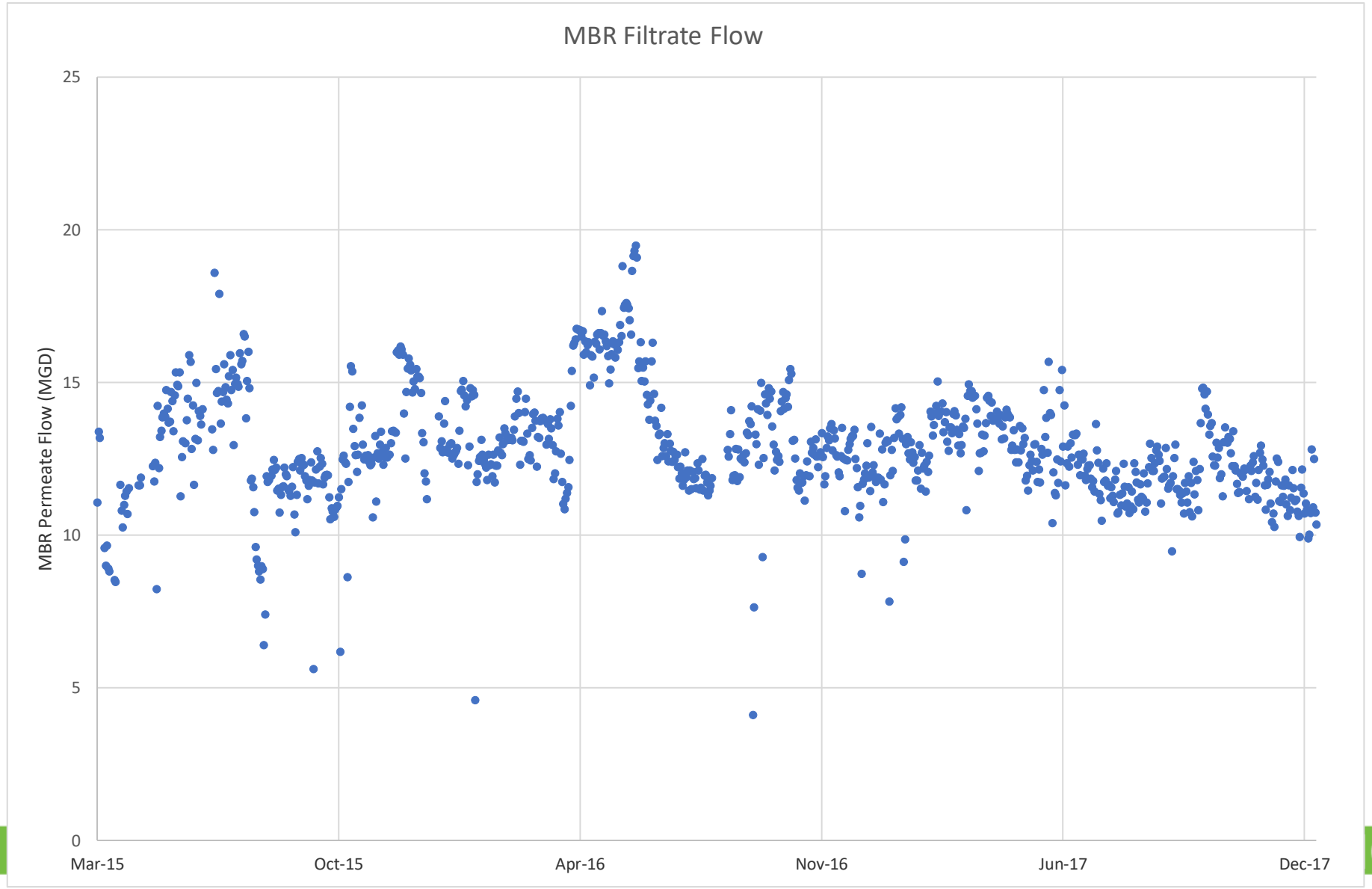
Treatment Goals for Advanced Treated Effluent Discharged Via Outfall No. 003

Parameter	Goal
Annual Average Flow Rate to Lake Fort Phantom Hill	7 MGD
Total Phosphorus	0.5 mg/L
TDS	375 mg/L
Chloride (as $Cl^{-)}$	100 mg/L
Sulfate (as SO_4^{2-})	95 mg/L
Pathogen Removal/Inactivation[b] *Cryptosporidium parvum* *Giardia lamblia* Viruses	 4-log 4-log 0.5-log
Contaminants of Emerging Concern (CECs)	50 - 90% Reduction

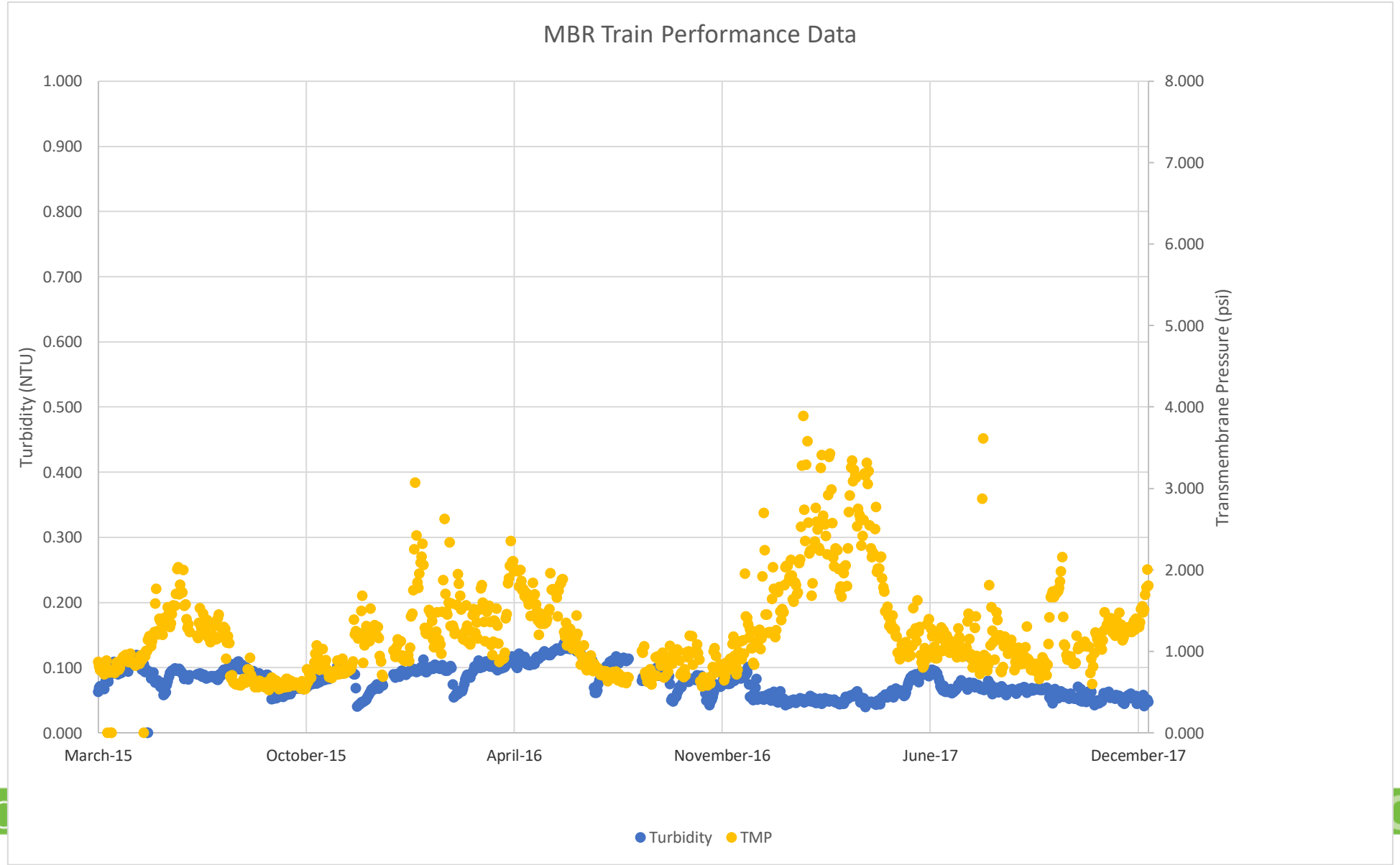
Comparison of Advanced Treated Effluent Treatment Goals and Actual Performance

Parameter	Goal	Actual Performance
Total Phosphorus	0.5 mg/L	0.03 mg/L
TDS	375 mg/L	325 mg/L
Chloride (as Cl^{-})	100 mg/L	80 mg/L
Sulfate (as SO_4^{2-})	95 mg/L	70 mg/L
Pathogen Removal/Inactivation[b]		
Cryptosporidium parvum	4-log	3.0-5.0-log
Giardia lamblia	4-log	3.3-5.4-log
Enterovirus	0.5-log+	7.1-8.1-log+
Norovirus (all three types)	0.5-log+	4.9-7.2-log+
Contaminants of Emerging Concern (CECs)	50 - 90% Reduction	80% Reduction

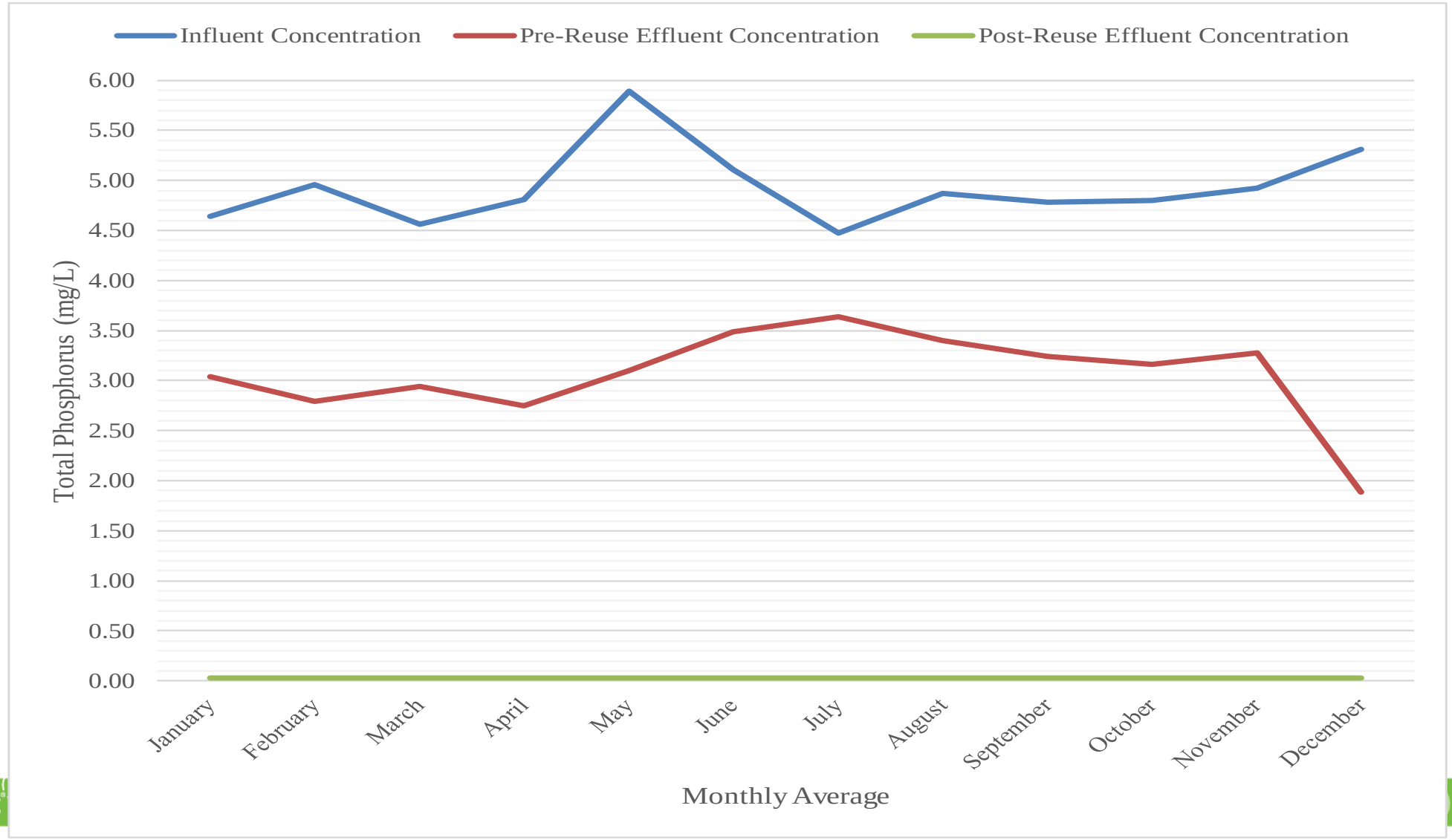
MBR Loading Since Reuse Project



Typical MBR Train Performance



Comparison of Historical and Reuse Performance on Total Phosphorus Reduction



For more information, please contact:

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