

# Preparing for Process Change: Lessons from Implementing/ Improving BNR Process

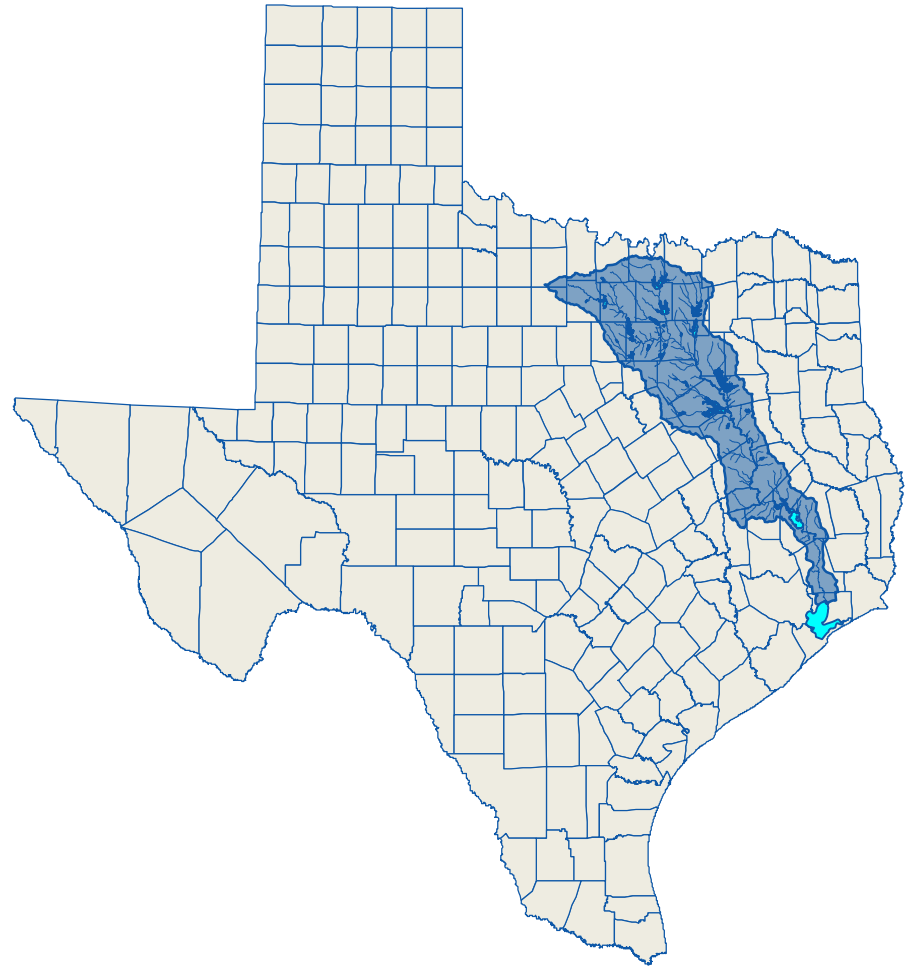
**John Bennett, TRA**

**Jeff Caffey, P.E., APAI**



# Trinity River Basin

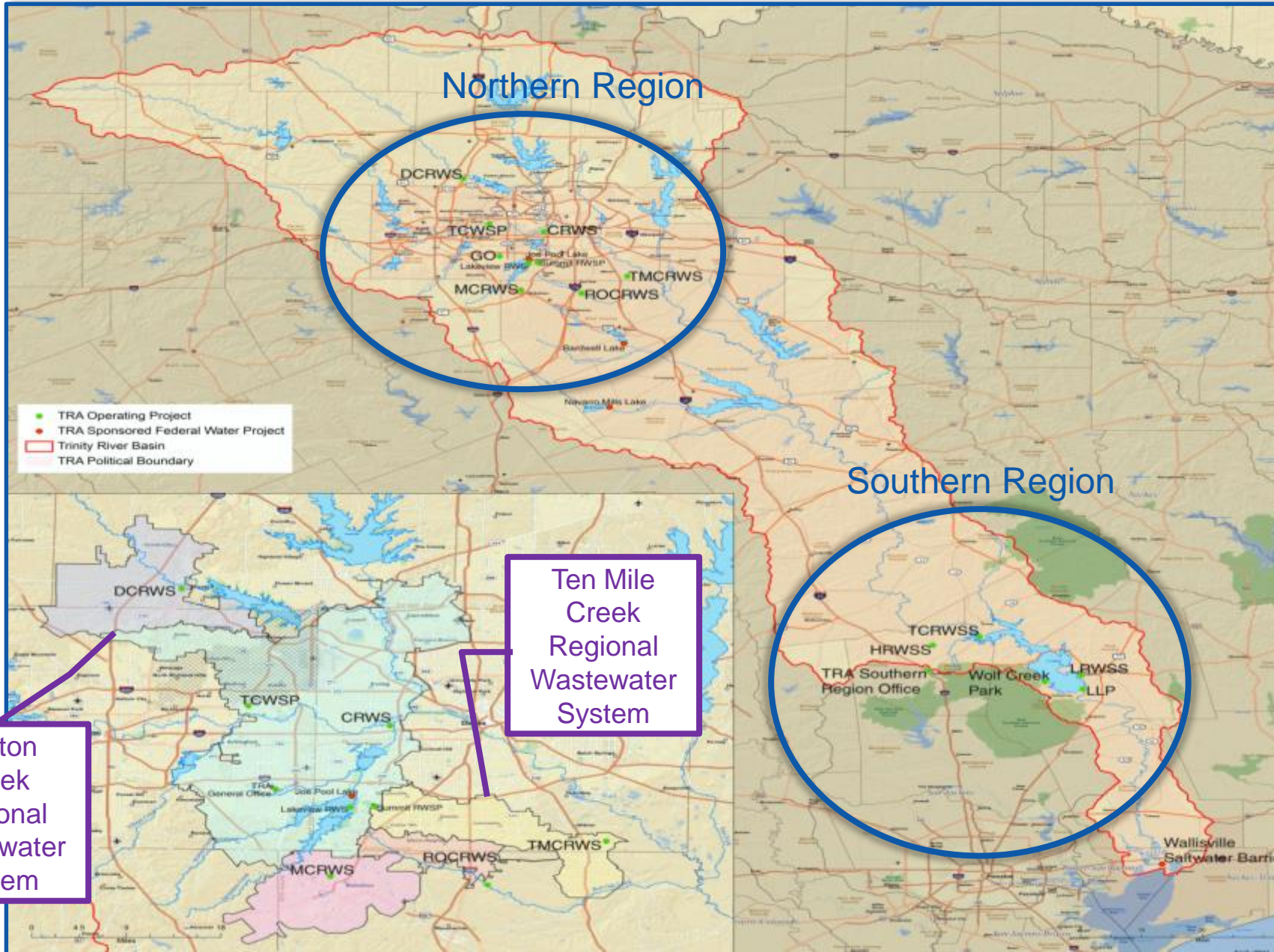
- Nearly 18,000 square miles
- Most developed large watershed in Texas with 32 water-supply reservoirs
- Water supply for approximately half of Texas' population.



- Established by Texas legislature in 1955
- Wholesale provider of water and wastewater treatment services
- Specialize in development and operation of multi-participant regional facilities
- Wholesale wastewater treatment provider to five TMCRRWS customer cities



# TRA's Basin-wide Facilities & Projects



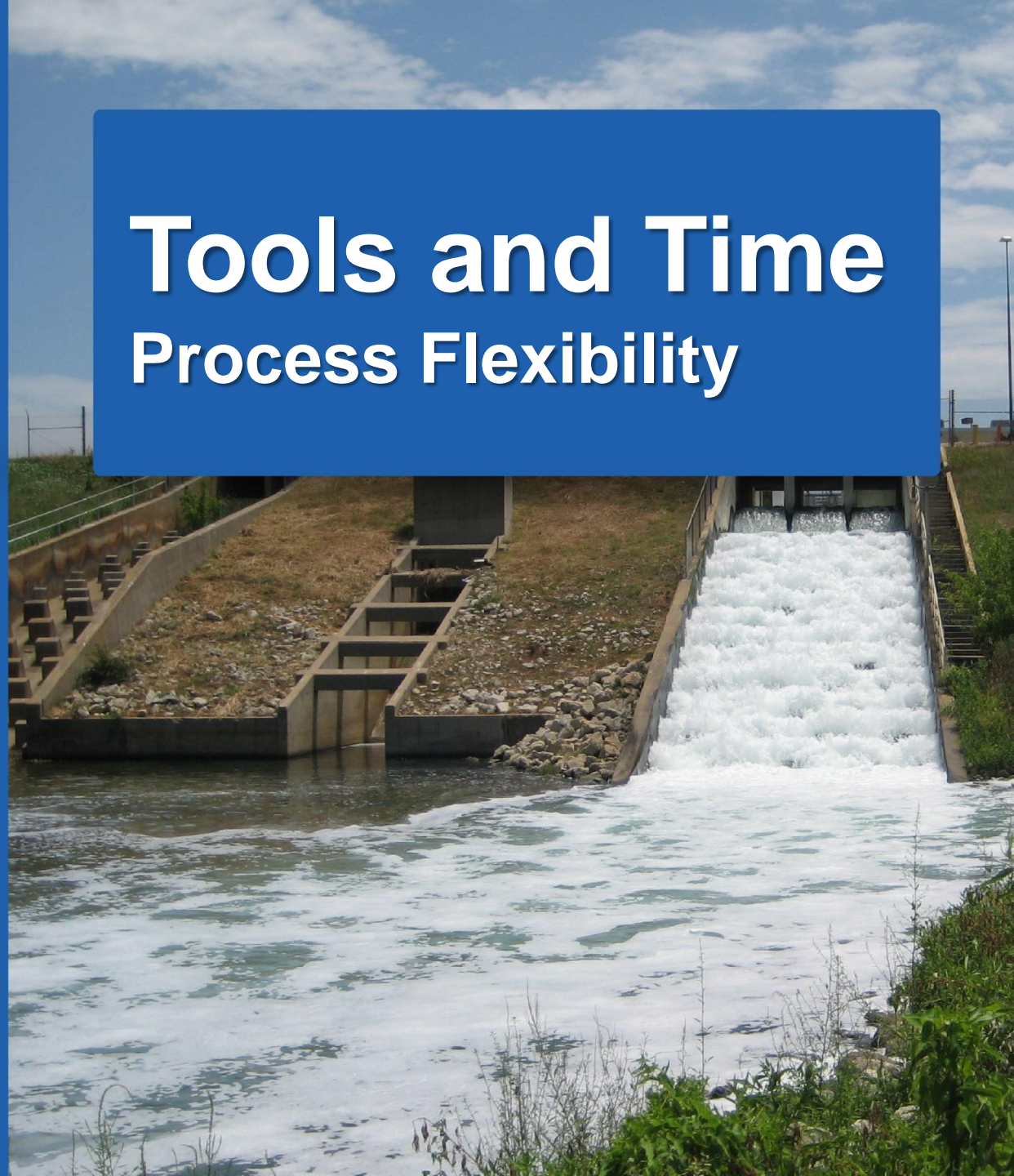


# AGENDA

1. Provide the tools needed and the time to learn.
2. How to prepare your staff
3. How do you prepare your facility
4. Lessons Learned from a Full Scale Study

# Tools and Time

## Process Flexibility

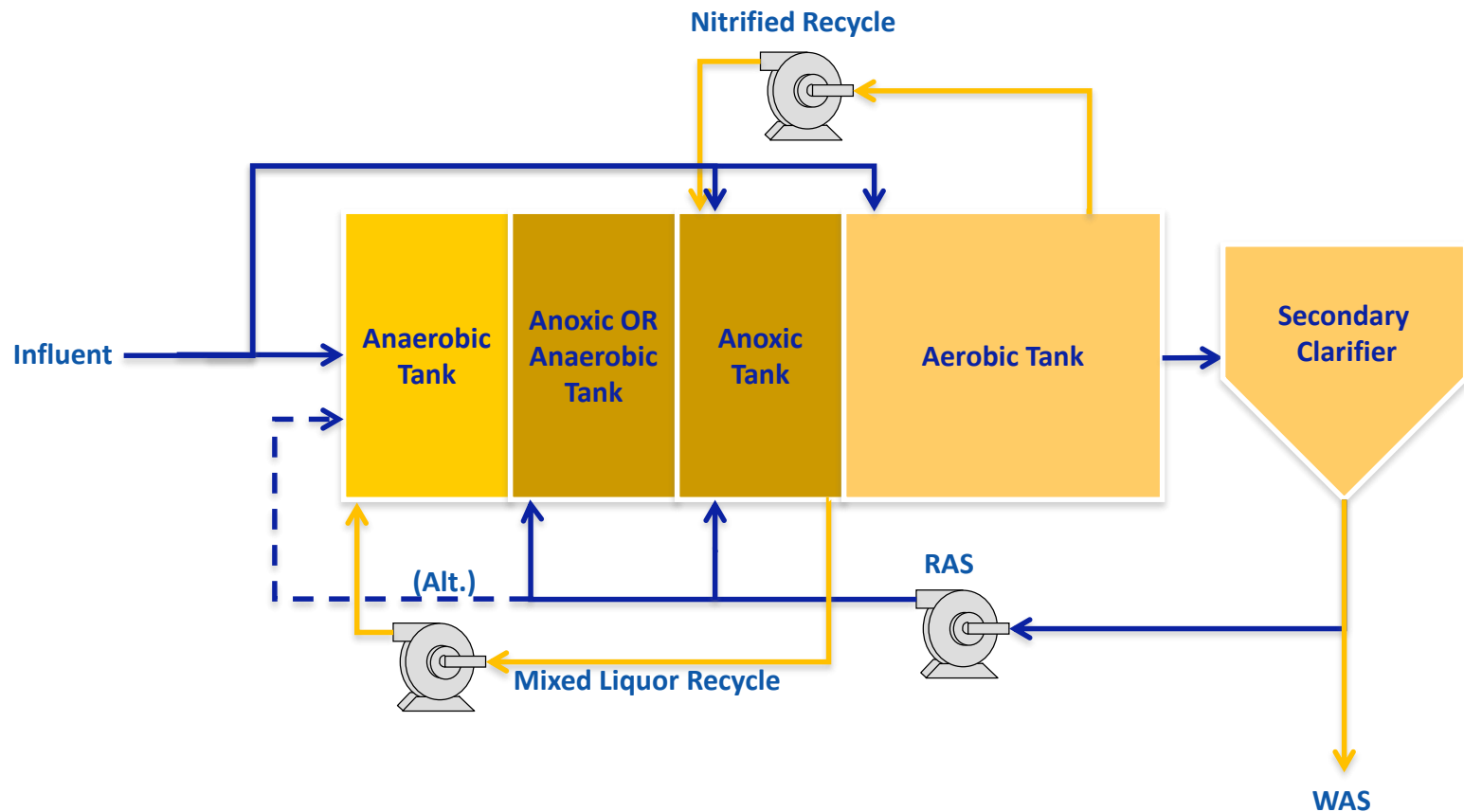


# DCRWS received three year notification for phosphorus

Parameter	Previous Interim Permit Outfall 001	Existing Outfall 002
	Daily Average mg/L	Daily Average mg/L
<b>CBOD</b>		
Jun to Nov	5	5
Dec to May	7	7
TSS	15	15
<b>Ammonia</b>		
Jun to Nov	1.4	1.9
Dec to May	3	3
Total Phosphorus	Not in Permit	0.5
EColi	126	126
DO	6 (min)	6 (min)
pH	6 (min)	6 (min)
FLOW	7 MGD AADF	11.5 MGD AADF

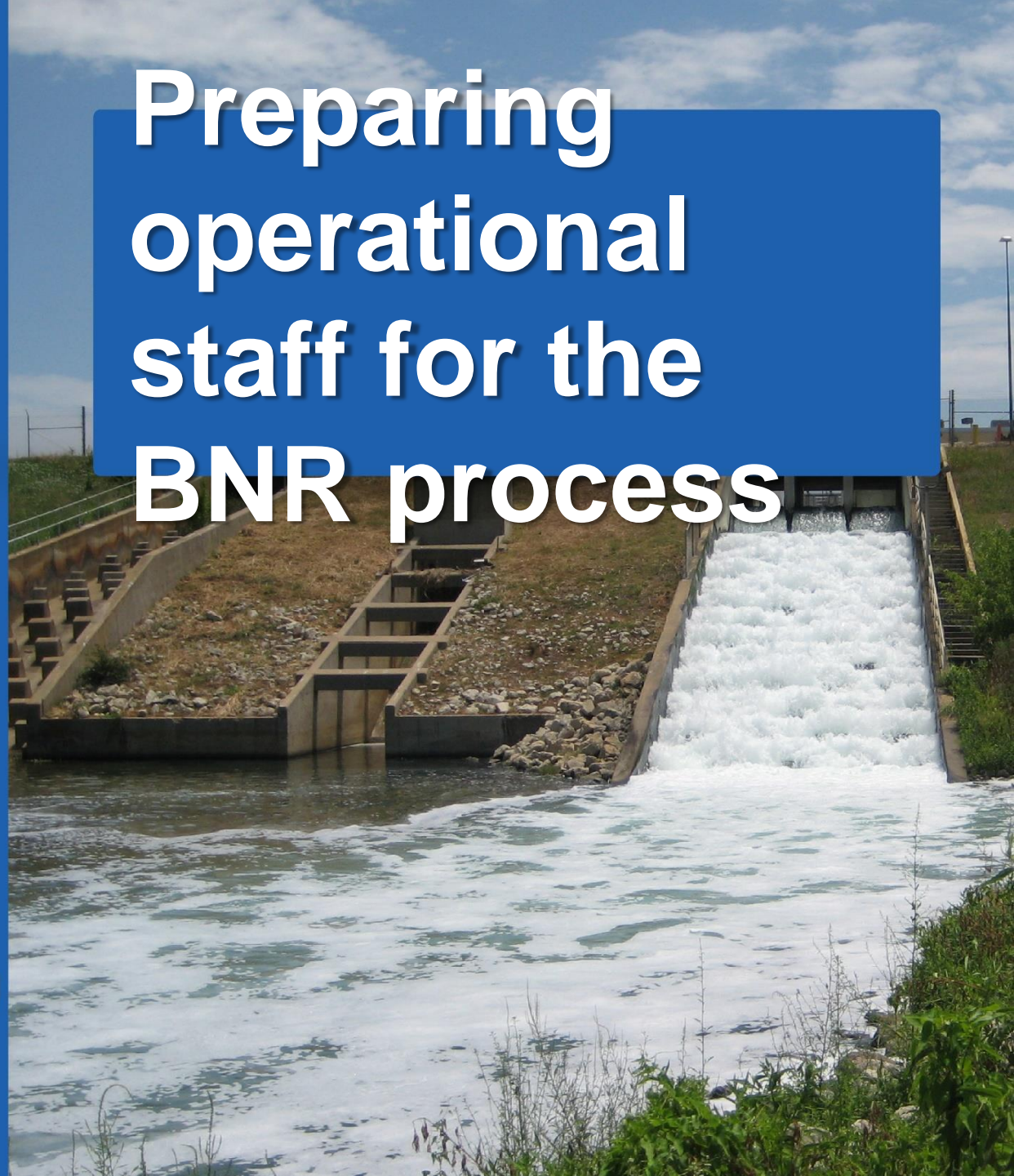
# Phosphorus Removal at Denton Creek

## University of Cape Town Process





# Preparing operational staff for the BNR process

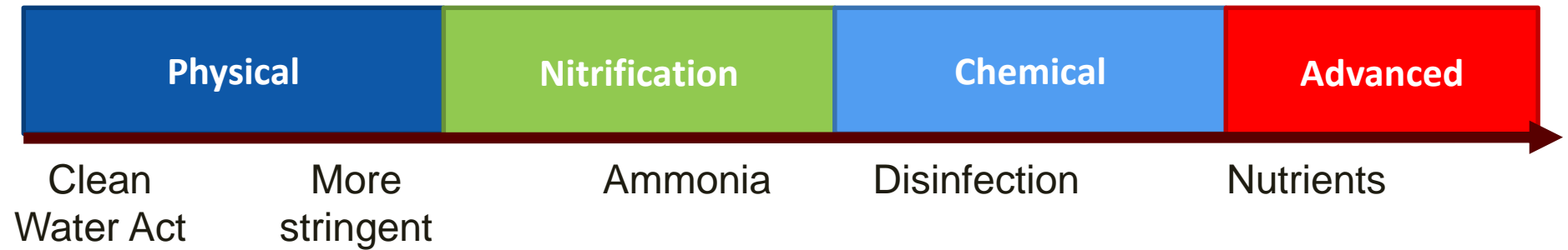


# Training

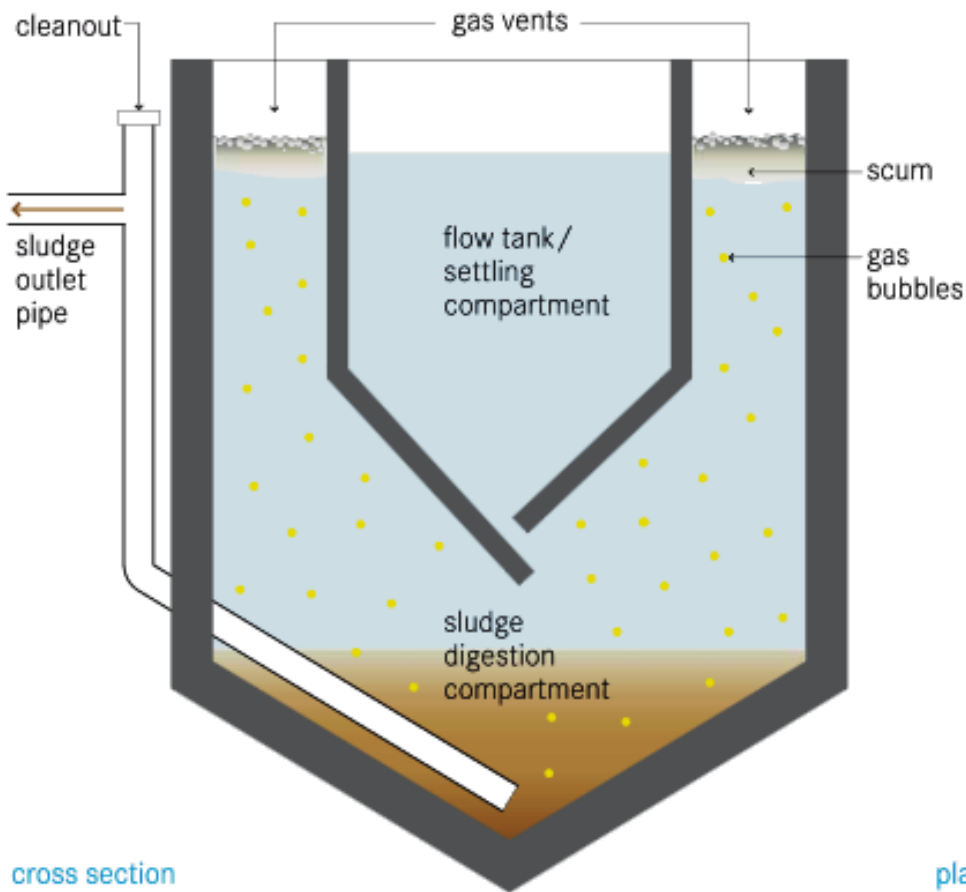
- What is the knowledge level of your staff
- What training is available
  - Resources for training
  - Methods of training



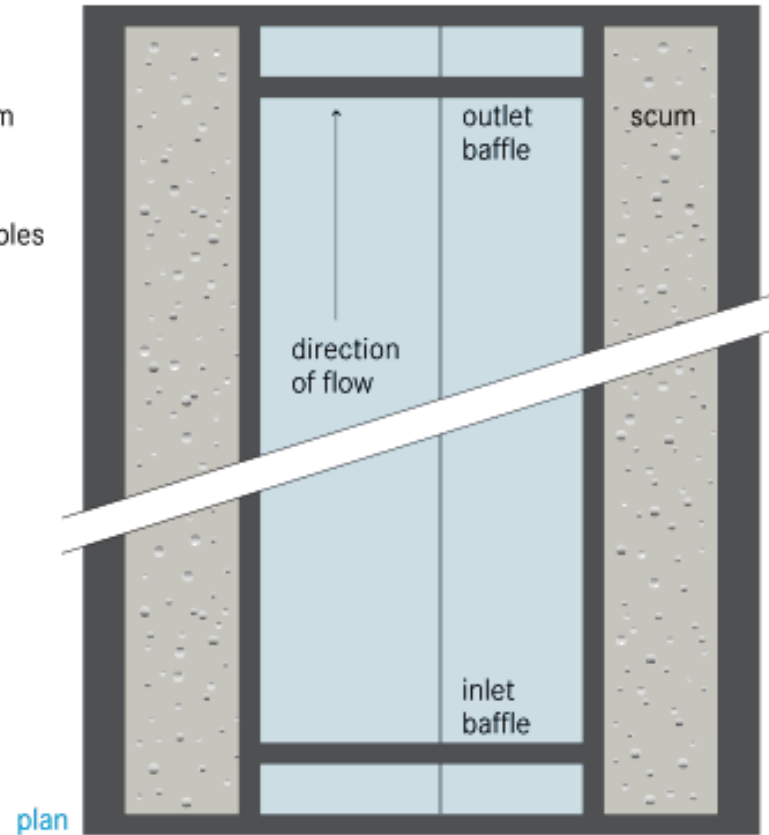
# Operators understand nitrification but not always phosphorus



# What training is available?



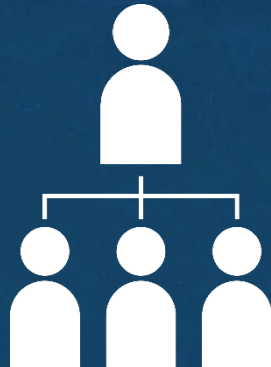
cross section



plan



# Keys to success for specialty training



## ON THE JOB STAFF TRAINING

- Knowledgeable teachers
- Passionate teachers
- Knowledge retention
- Motivated staff



## SPECIALIZED THIRD PARTY TRAINING

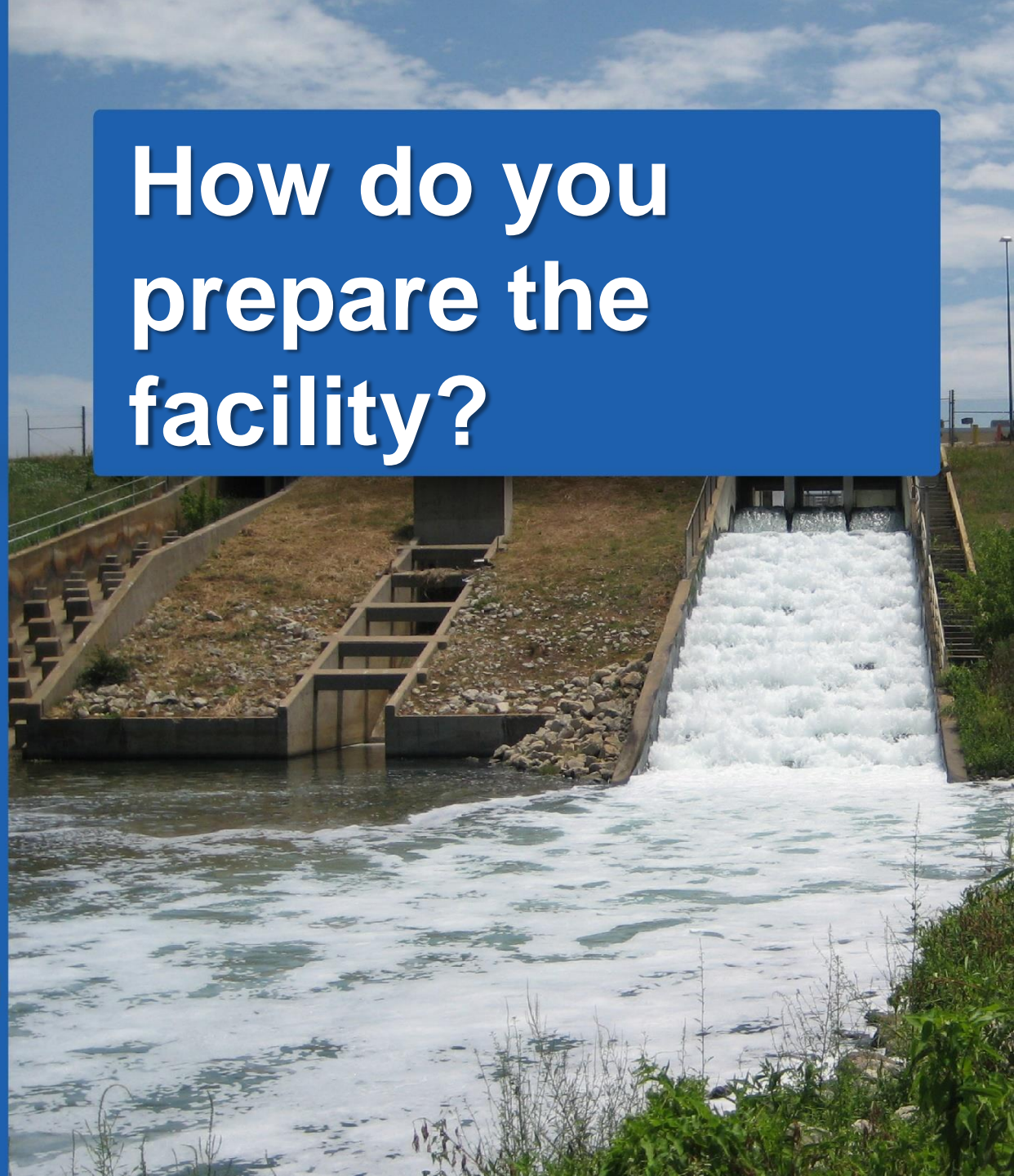
- Need to know your facility
- Know the audience and learning styles
- Possess actual expertise

# What are the necessary training topics?

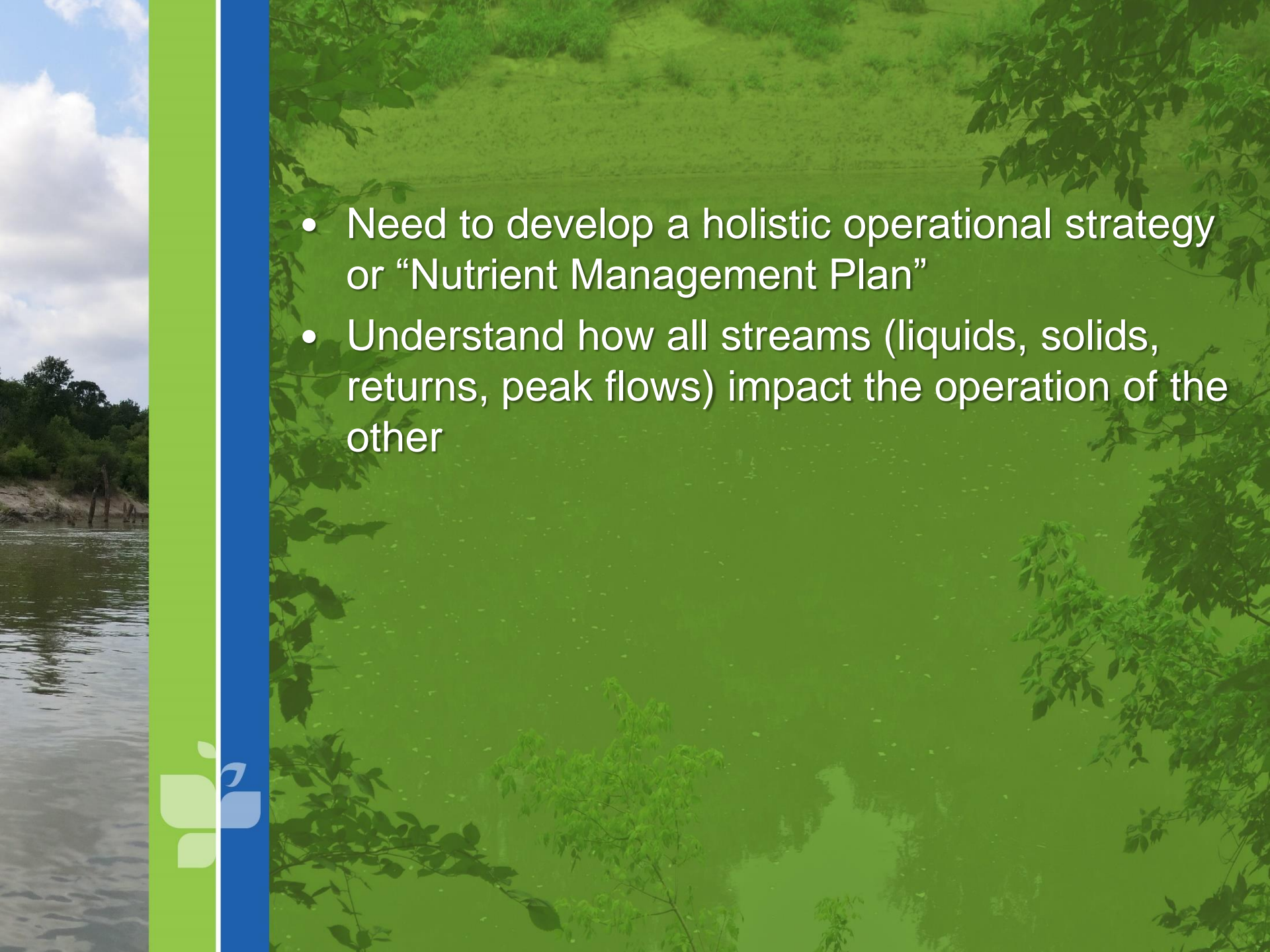
- Understanding ORP
- Understanding forms of phosphorus
- Theory behind the reactor designed
- Make process changes and test, full scale demonstration testing by staff
- Stress testing
- Time ahead of permit enforcement – need time to understand process (interim, transition times)



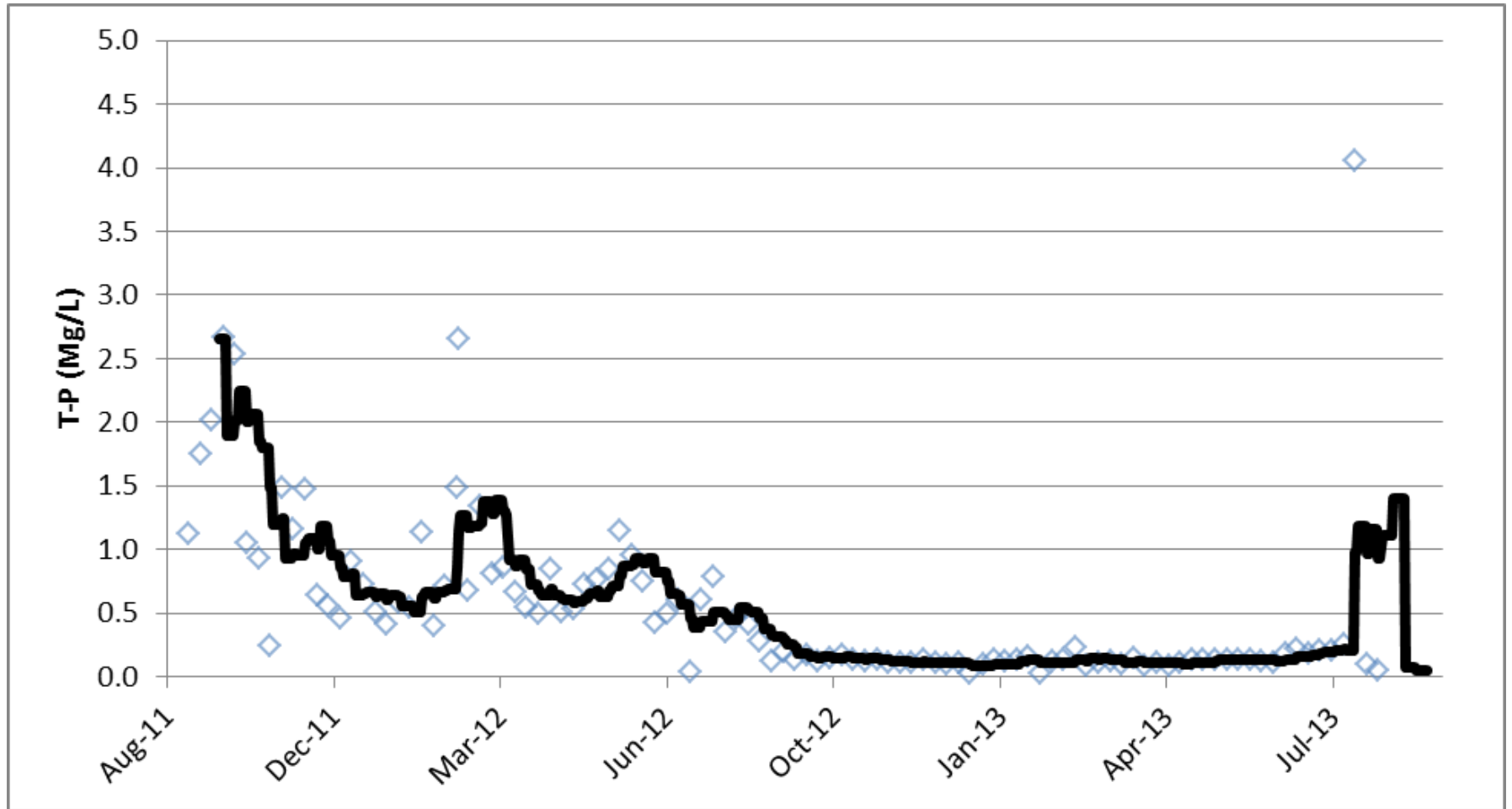
**How do you  
prepare the  
facility?**



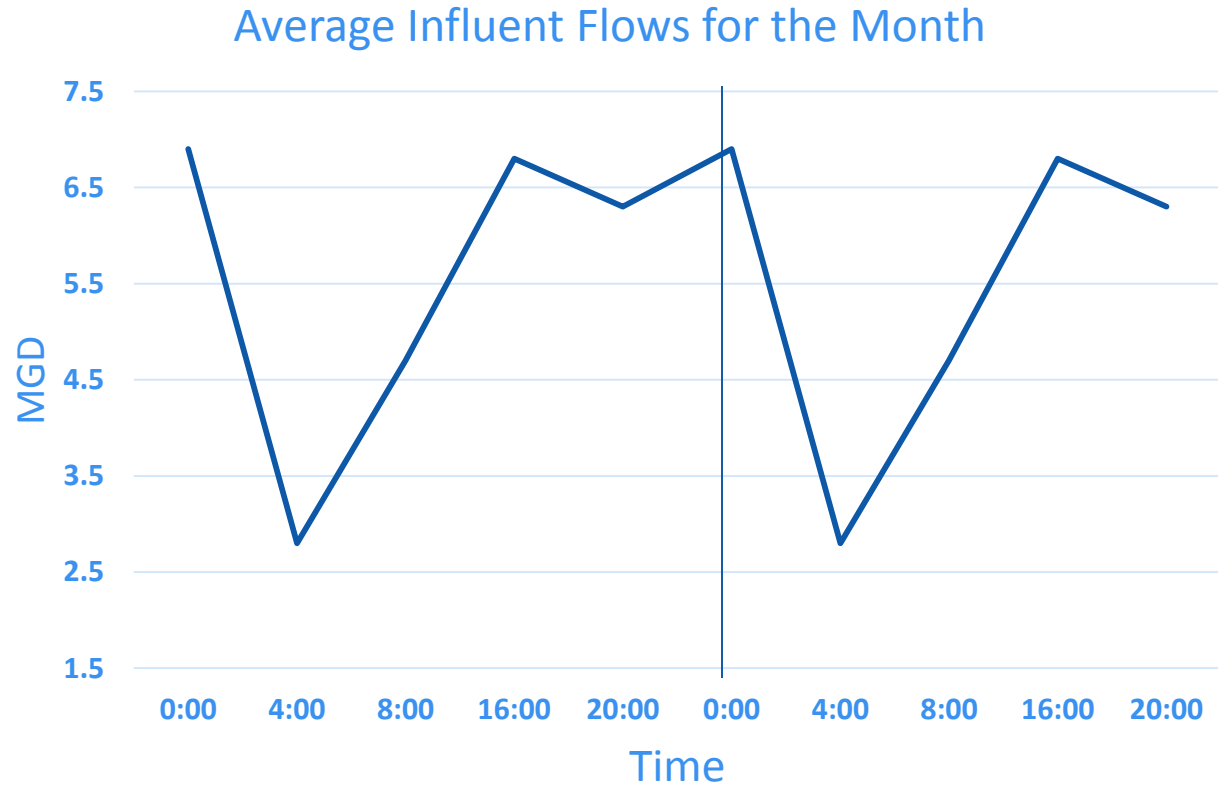


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- Need to develop a holistic operational strategy or “Nutrient Management Plan”
  - Understand how all streams (liquids, solids, returns, peak flows) impact the operation of the other

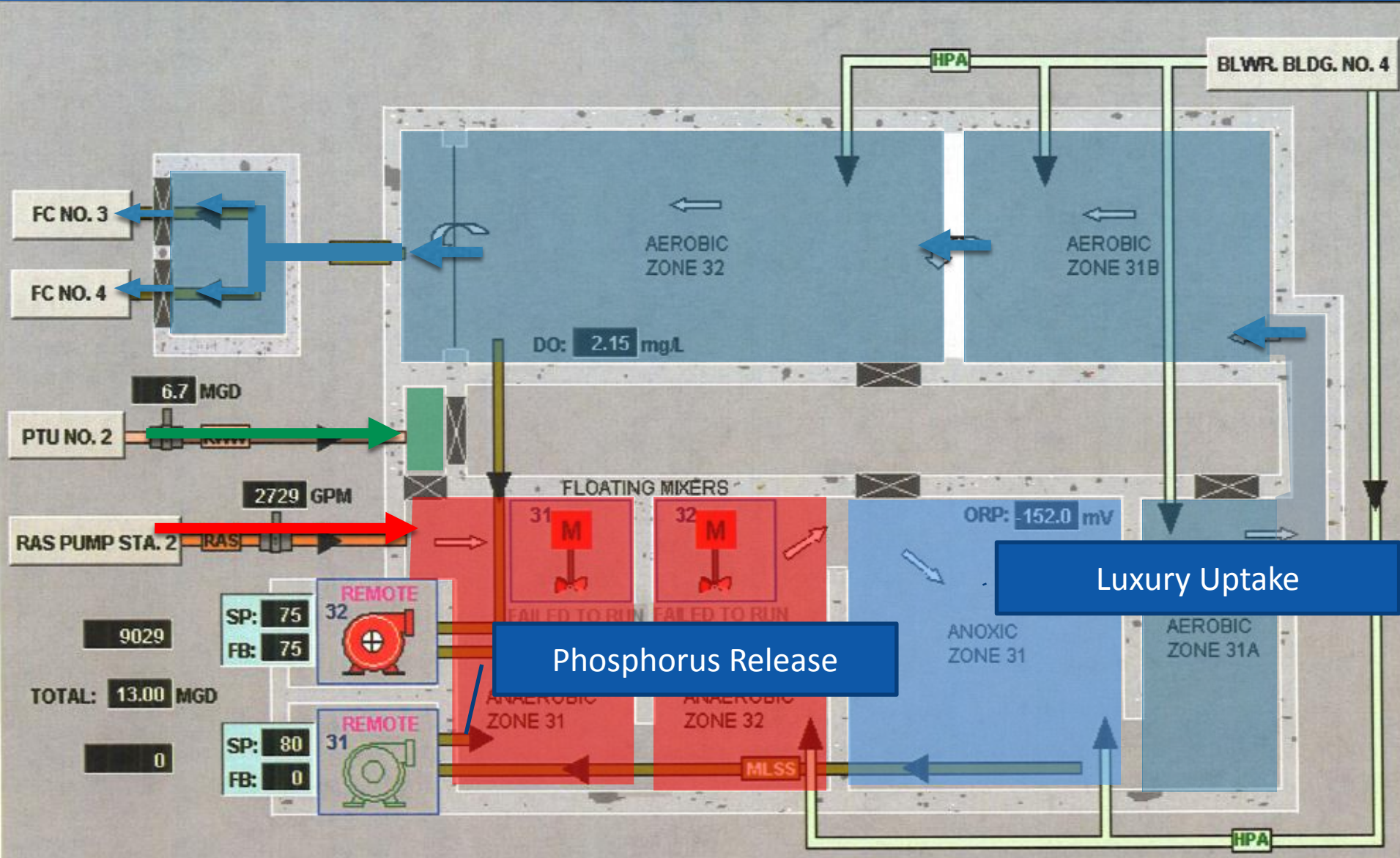
# We optimized P removal over time w/o chemical



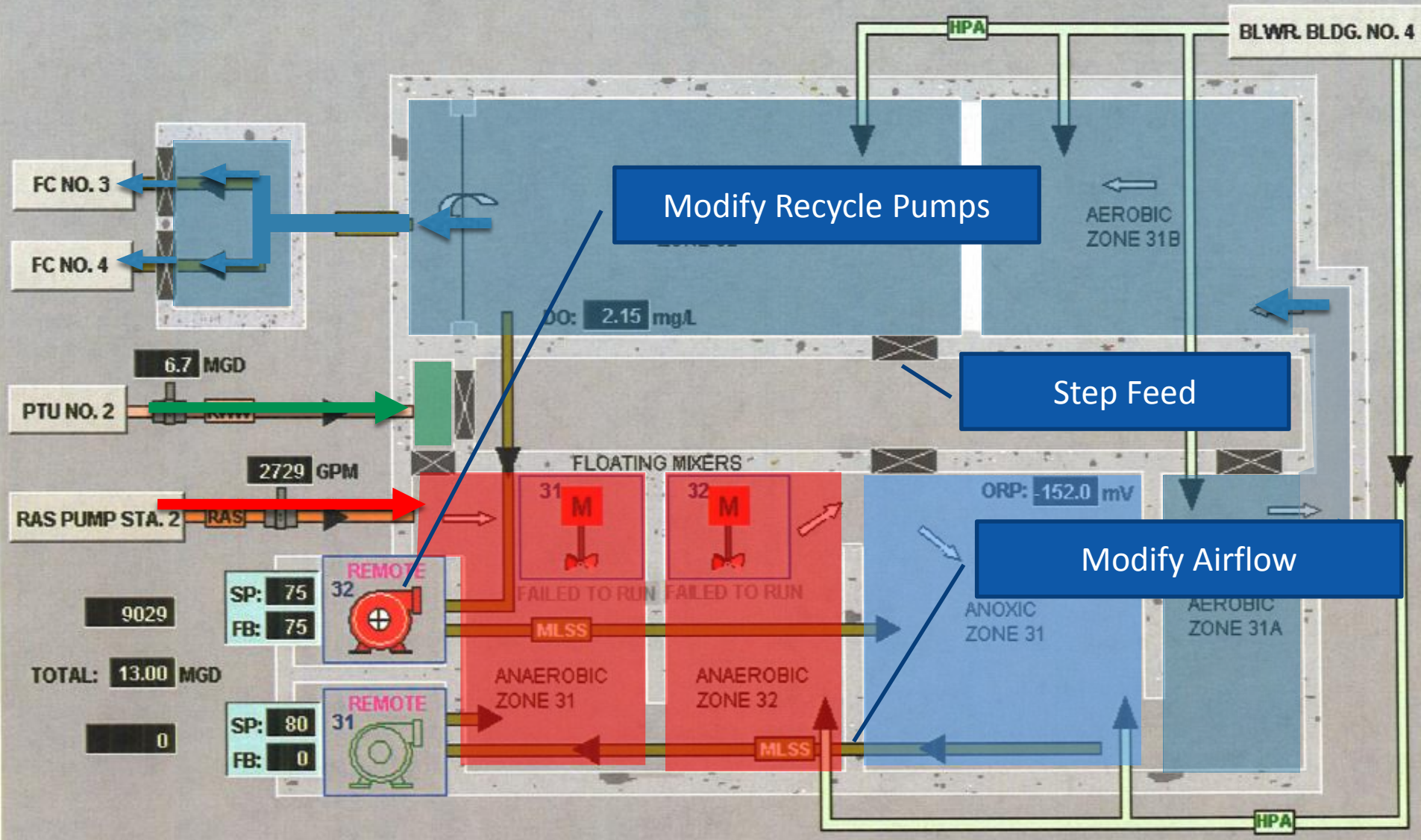
# Management of diurnal flows



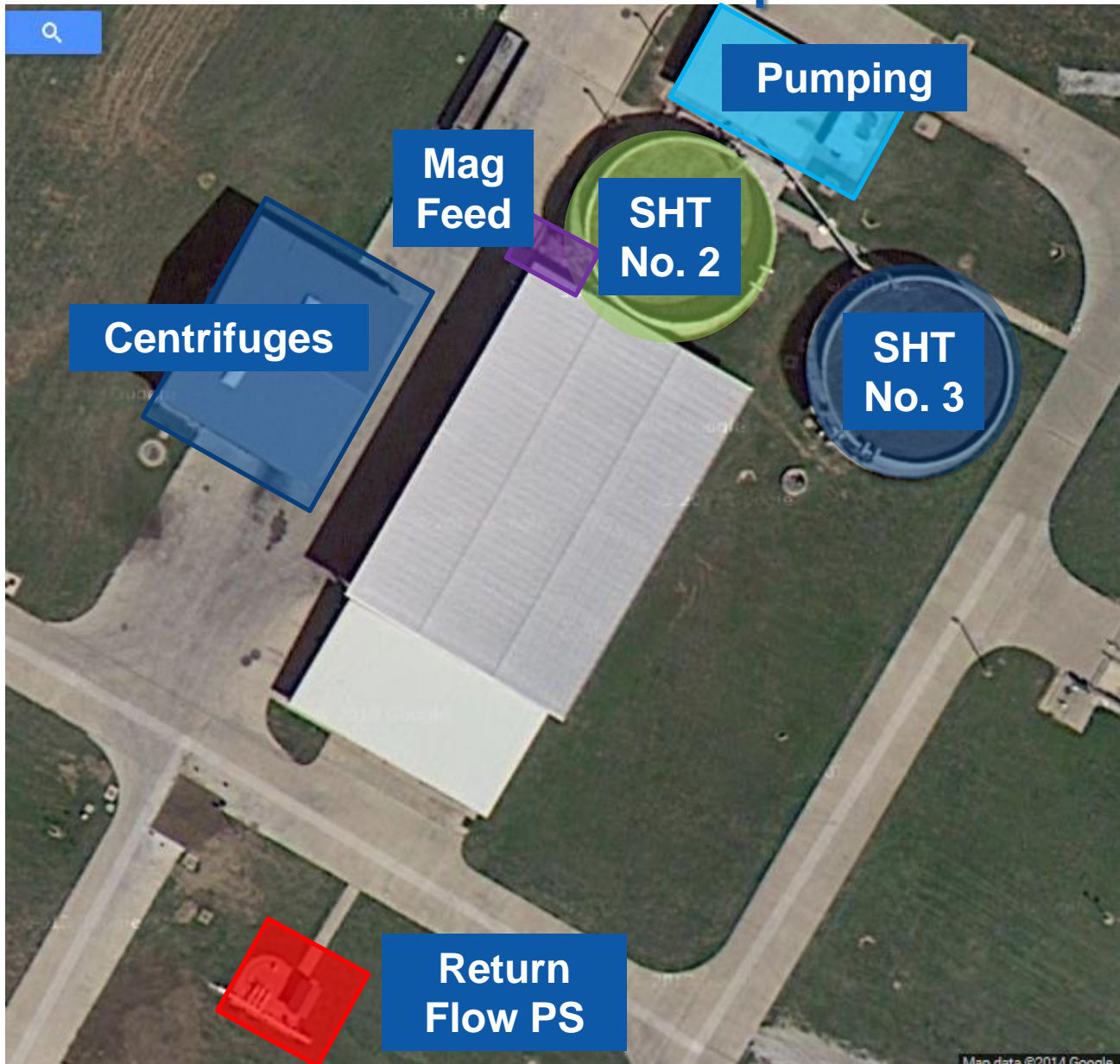
# Denton Creek achieves phosphorus removal through BPR



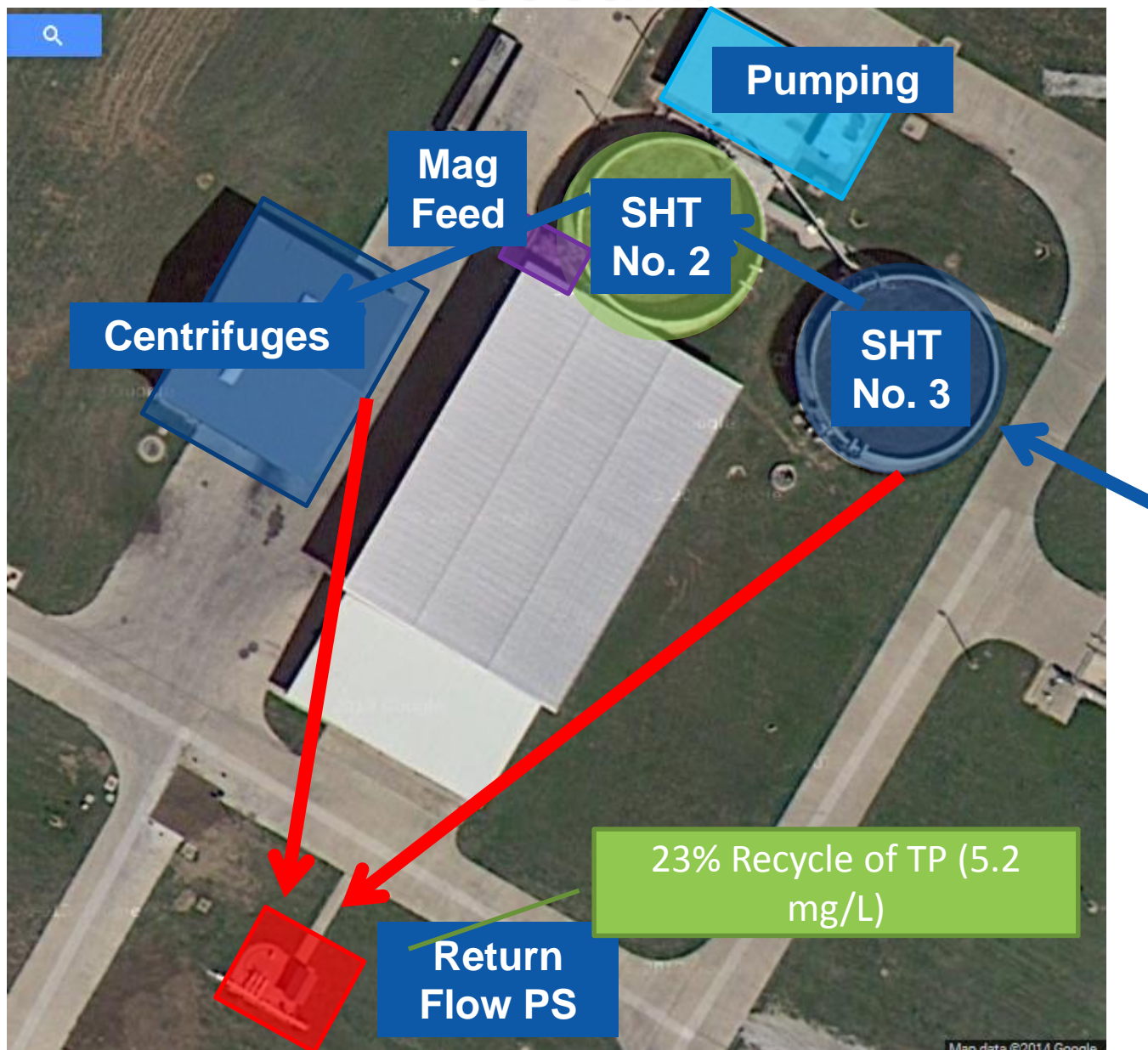
# Denton Creek can be controlled by modifying internal recycle



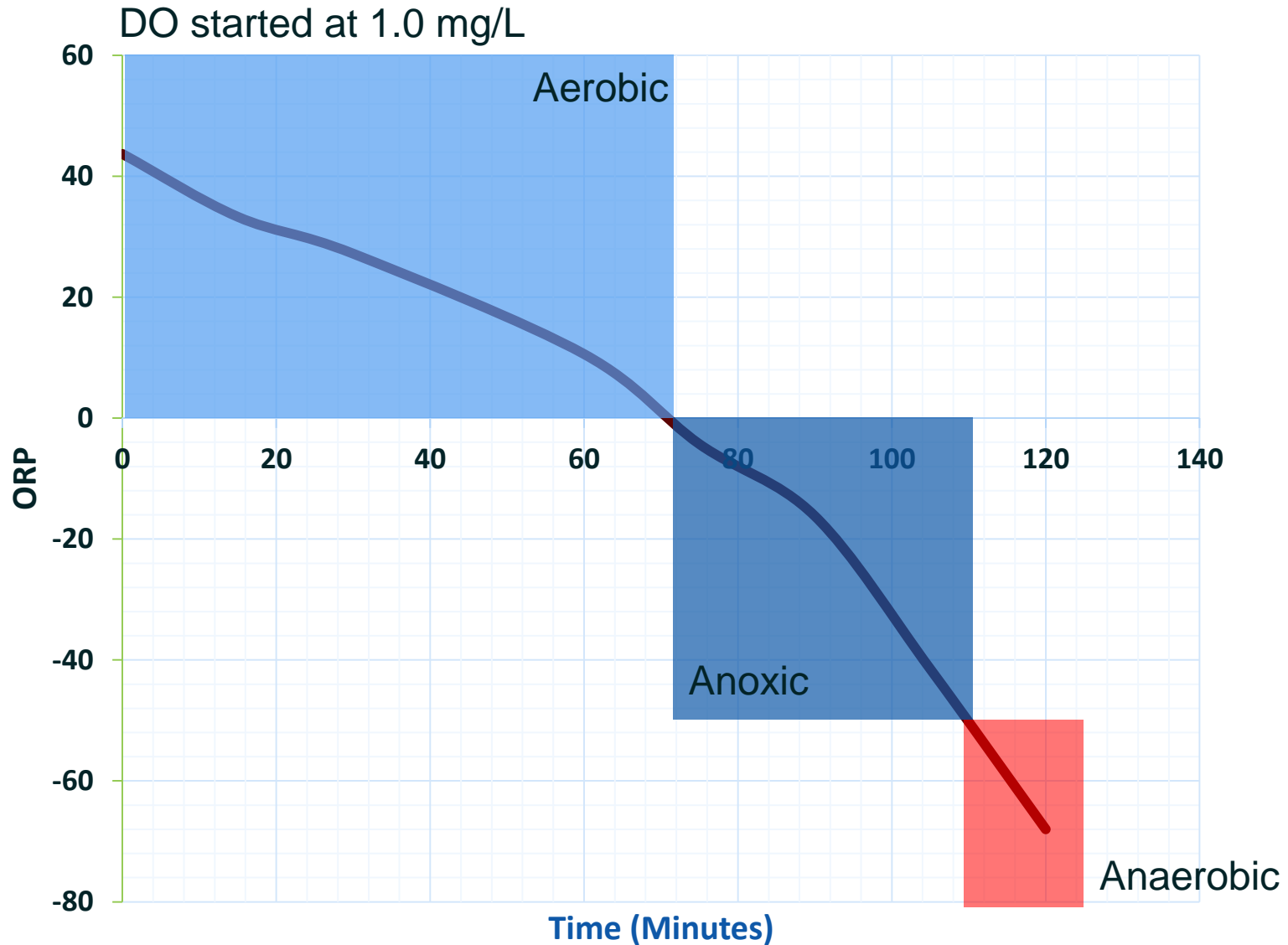
# Solids handling includes centrifuges and landfill disposal



# The concern is centrate recycle and decant

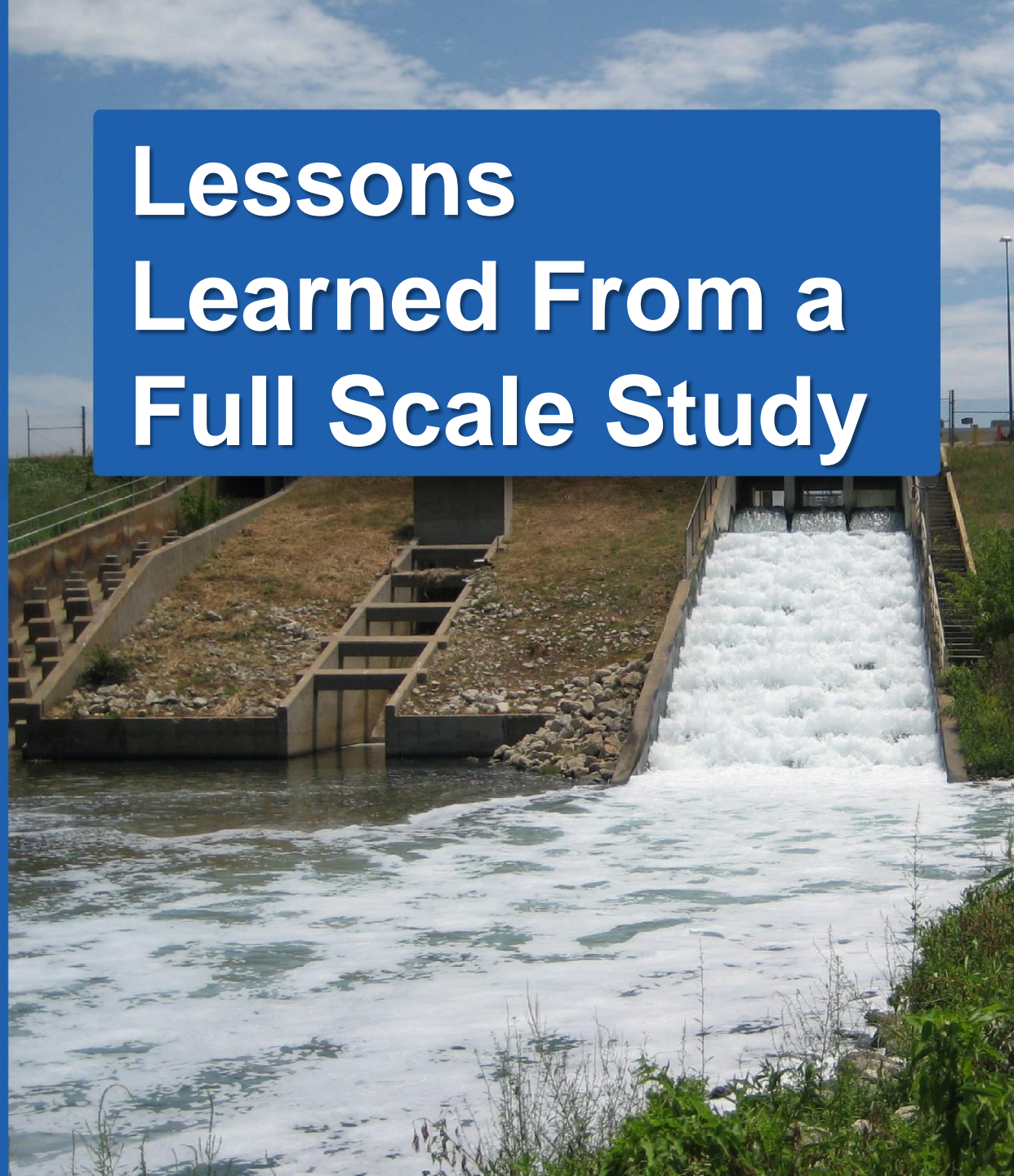


# SHT 2 becomes anaerobic in less than two hours





# Lessons Learned From a Full Scale Study



# Ten Mile Creek Demonstration Study Site Layout



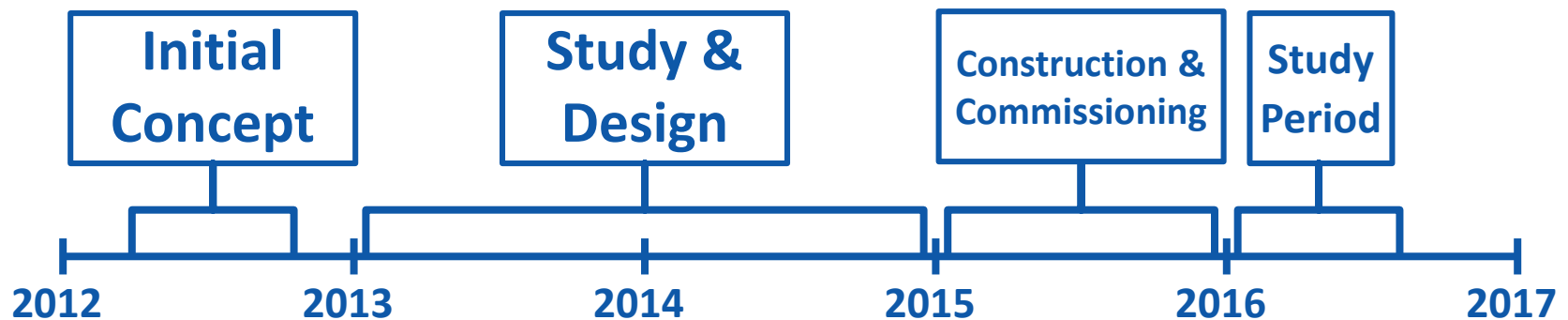
# TMC Mixed-Liquor Fermentation (MLF) Demonstration Background

- **Evaluate Potential of MLF**

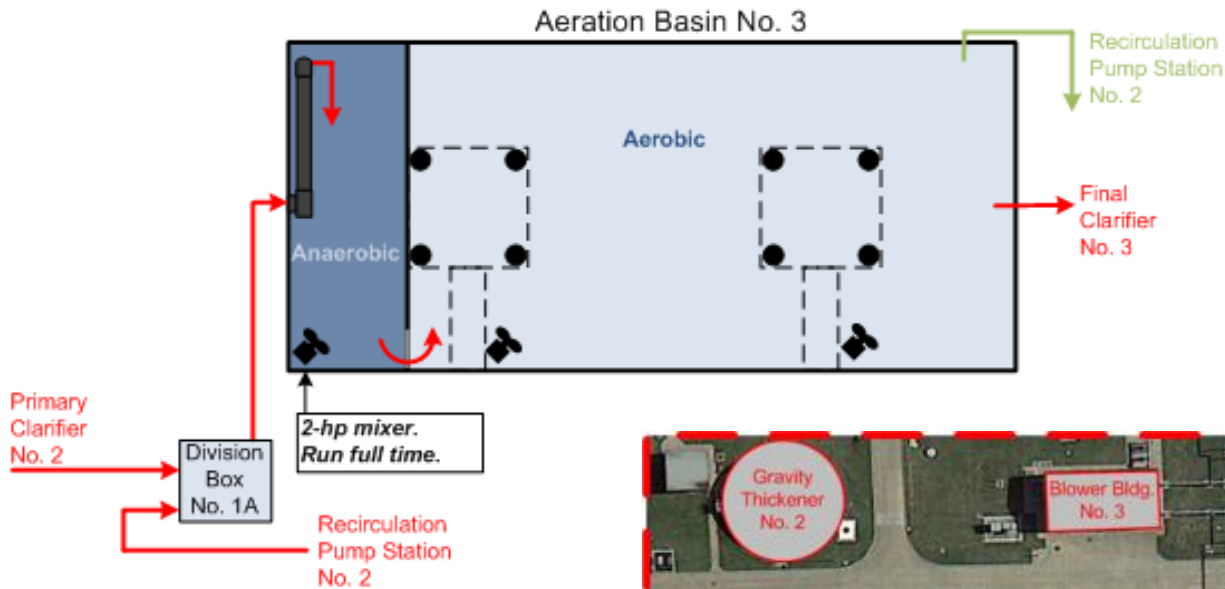
- More retrofit options
- Don't need primary sludge
- Stability
- Less influence of influent characteristics

- **Improve understanding of MLF**

- Operate in conventional mode vs the 2 MLF modes.
- Collect extra data to calibrate model
- Better understand process impacts of MLF



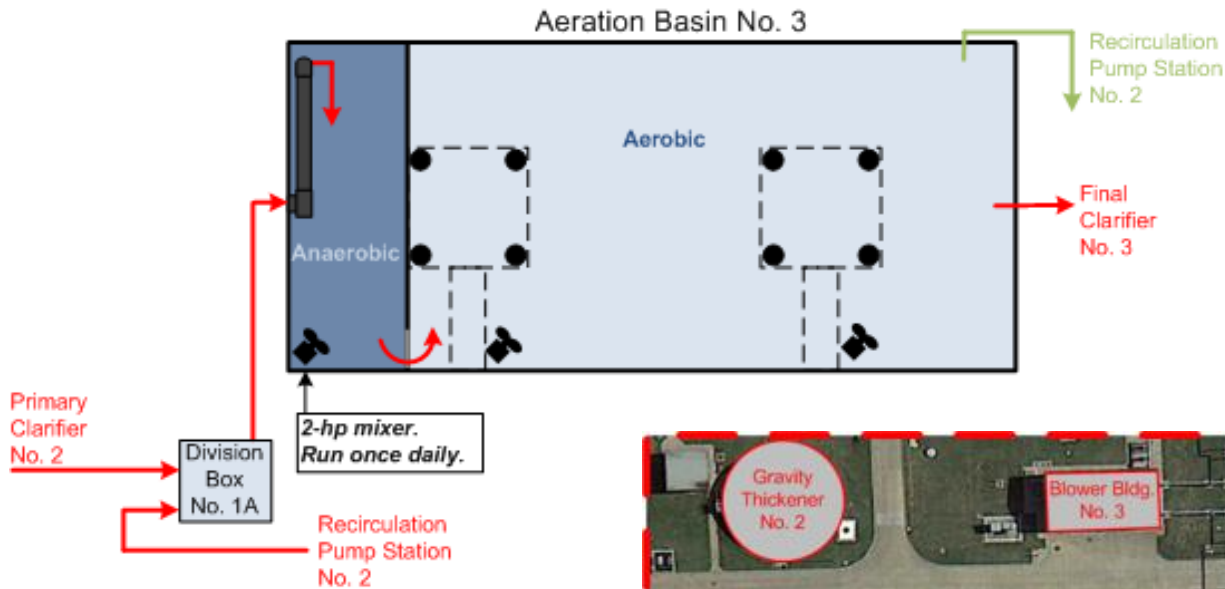
# Ten Mile Creek Demonstration Study Process Modifications



Operating Mode 1  
*Basic Biological P Removal*



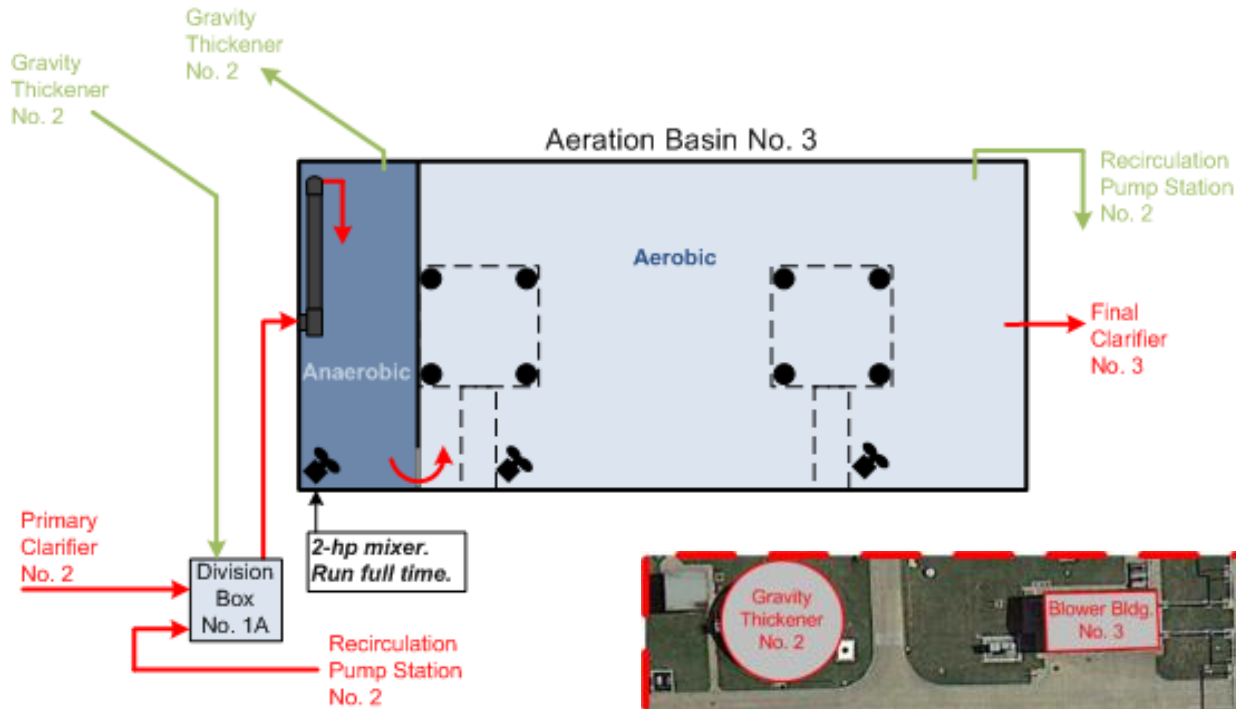
# Ten Mile Creek Demonstration Study Process Modifications



Operating Mode 2  
*BPR with In-Line MLF*



# Ten Mile Creek Demonstration Study Process Modifications



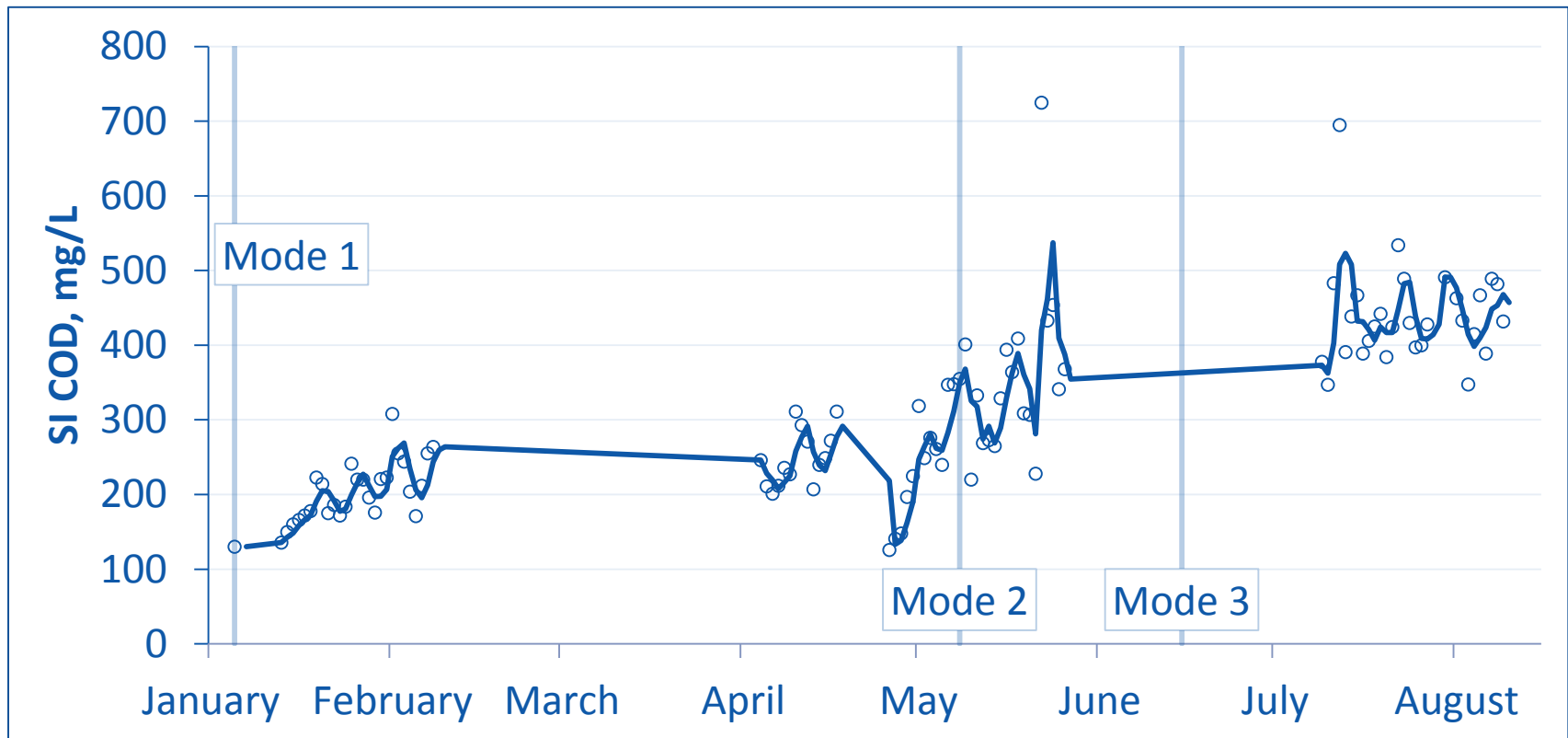
**Operating Mode 3**  
*BPR with Side-Stream MLF*



# Sample Analysis

Sample Point	Primary Effluent	Secondary Effluent	Anaerobic Zone Effluent	Aeration Basin Effluent	Mixed Anaerobic (Mode 2)	MLF Overflow (Mode 3)	MLF Underflow (Mode 3)	MLF Sludge Blanket (Mode 3)
	(1)	(2)	(3)	(4)	(5) †	(6)	(7)	(8)
Note	24-Hr Comp.	24-Hr Comp.	Settled Grab*	Settled Grab*	Settled Grab*	Settled Grab*	Settled Grab*	Settled Grab*
TSS	Daily	Daily		Daily	Daily	Weekly	Daily	Daily
VSS	Daily			2/week	2/week		2/week	
Depth								Daily
BOD	Daily	Weekly						
COD	Daily	Daily	Weekly		Weekly	Weekly	Weekly	
ffCOD	Weekly	Weekly	Weekly		Weekly	Weekly	Weekly	
TKN	Weekly							
NH <sub>3</sub> -N	Daily	Daily	Weekly		Weekly	Weekly	Weekly	
NO <sub>3</sub> -N		Daily						
TP	Weekly	Weekly						
OP	Daily	Daily	Daily		Weekly	Weekly	Weekly	
VFA ‡	Weekly		Weekly		Weekly	Weekly	Weekly	
SVI				Daily				
DO	Weekly			Online		Weekly		
pH	Daily	Daily	Daily	Daily	Daily			Daily
ORP			Weekly		Weekly		Weekly	
Alk	Daily	Weekly						

# Influent Concentrations Data Gives a Summary of the Study



- Influent Concentrations (Load) Increasing Throughout Study
- Several Wet Weather interruptions
- Partial Primary Clarifier Diversion Commenced in Mid April

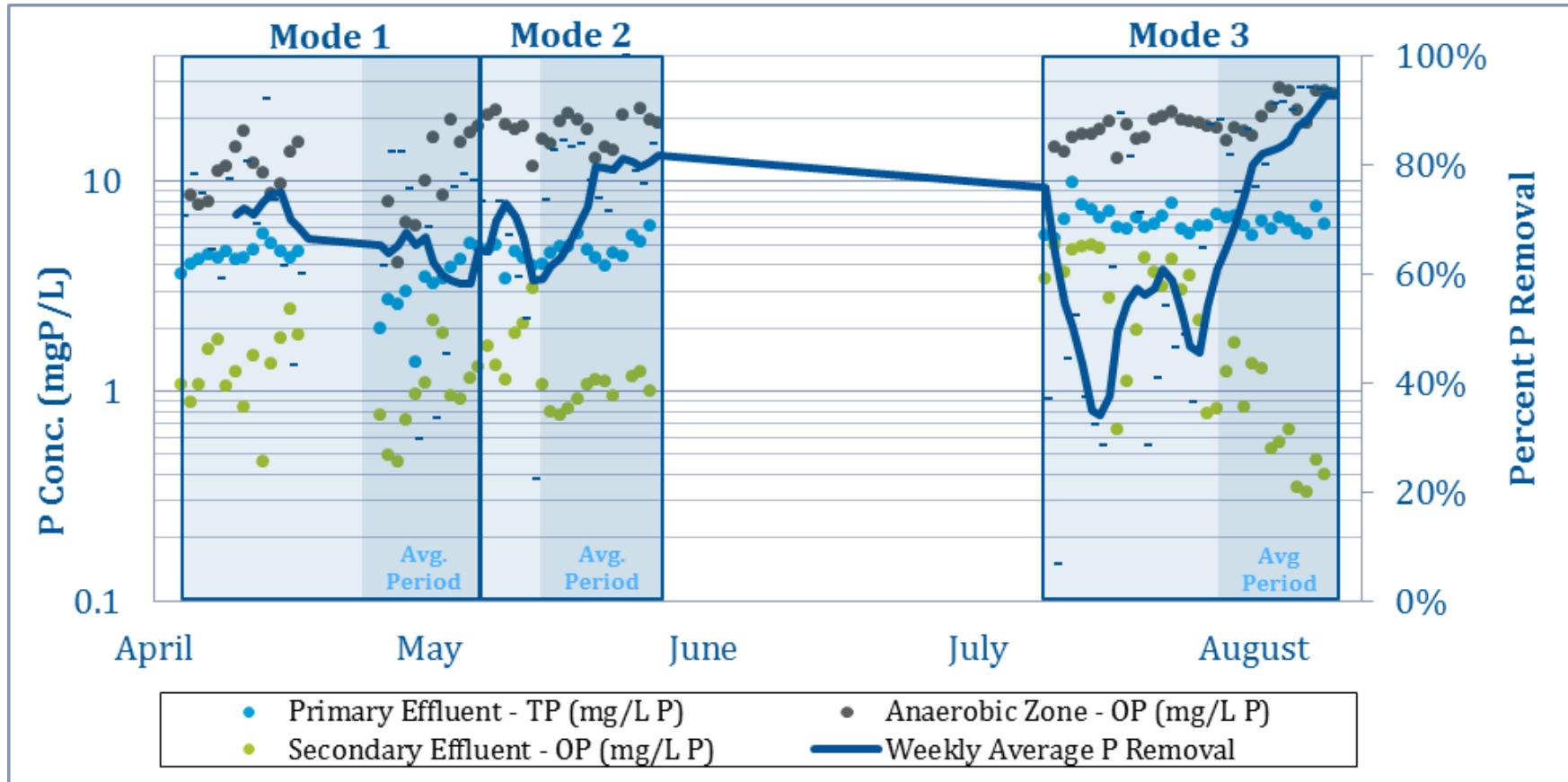


# Challenges in TMC BPR Study

- Operating at lower flows through existing basins meant equipment operated outside of normal ranges.
  - Primary Clarifier, RAS Flow, Blowers
- Wet weather events led to low influent concentrations and masked underlying control issue with RAS meter
- Changes to normal procedures can be stressful to operators – blower control
- Operators gained confidence in the process with experience and time



# Daily Operational Data to Establish EBPR performance



Ortho-P Profile through 3 Modes also average over last two weeks to inform model calibration



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# Questions?

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