Implementing Biological Nutrient Removal (BNR) Using a Hybrid Step Feed Process at Springfield's Regional Wastewater Treatment Facility

NEWEA 2025

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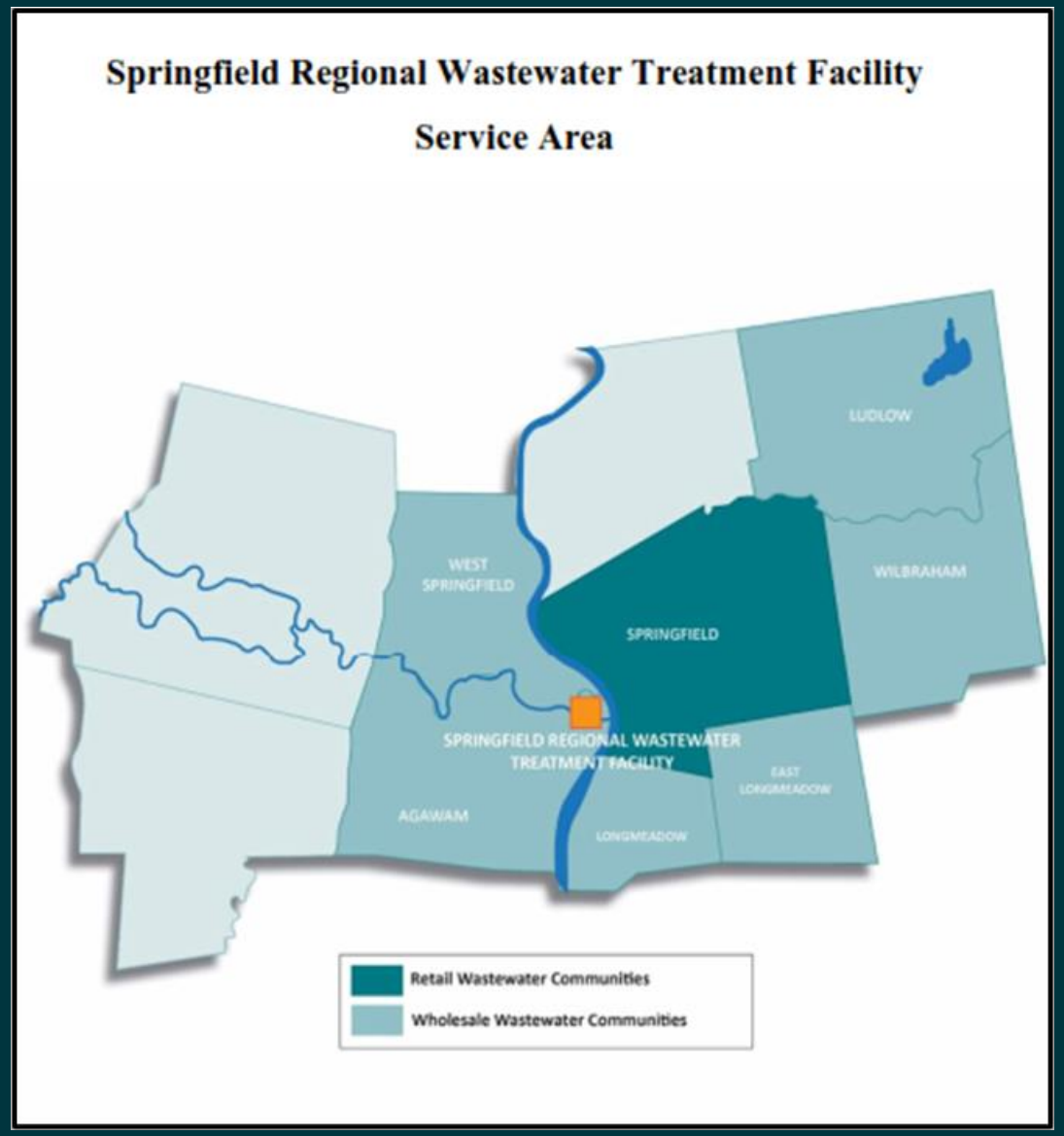
Presentation Outline

- Facility & Project Overview
- Secondary Process Design
- Step Feed Hybrid Approach
- Results & Operations Considerations

Project Overview

Springfield Water & Sewer Commission



SWSC Service Area

- 7 Communities
- 260,000 customers
- CSO System

Springfield Regional WWTF (Bondi's Island Facility)

- Location - Agawam, MA
- 40 MGD Avg. Daily Flow
- 180 MGD Peak (wet weather)
- Discharge - Connecticut River
- Original Construction in 1970s

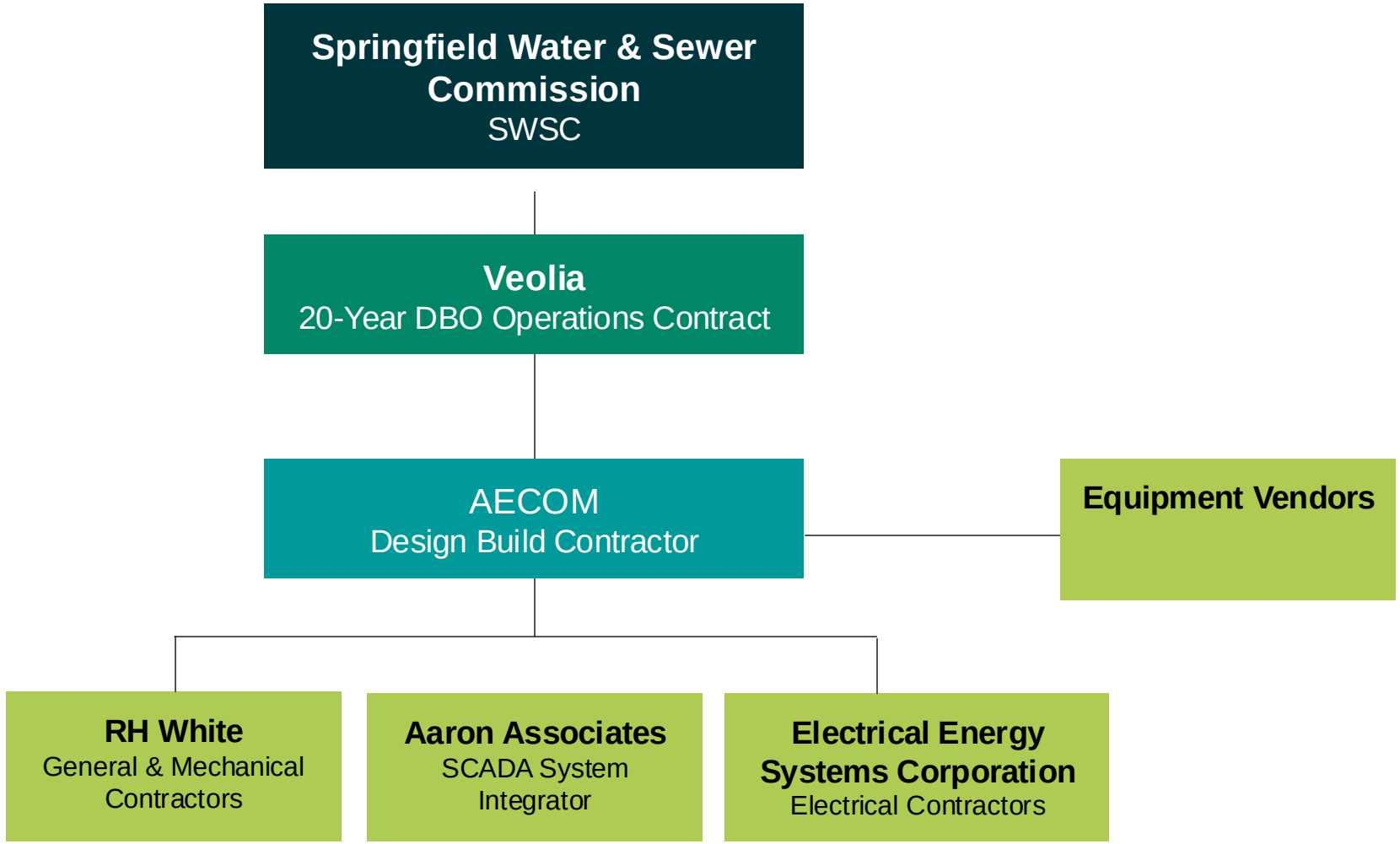
Design Build Improvements 2021-2025

Nitrogen Reduction Needed for Revised Permit Compliance

- Historically, Bondi's Island had acceptable nitrogen treatment, but the Facility was not designed for it
- 2020 – New revised NPDES permit takes effect, setting a mass limit of 2,534 lb/day Total Nitrogen for Facility (rolling average)
- SWSC elects to implement BNR upgrades to the basin & complete diffuser replacement
- Goal is for a reliable BNR system to comply with new permit & capable of handling wet weather events
- Selects Veolia-AECOM team for Operations & Design Build Improvements

Project Team

- Veolia selected for 20-yr Operations Contract
- Subcontracted the DB Capital Improvements to AECOM
- Three Main Construction Subcontractor's
  - R.H. White Construction
  - Electrical Energy Systems Corporation (EES)
  - Aaron Associates

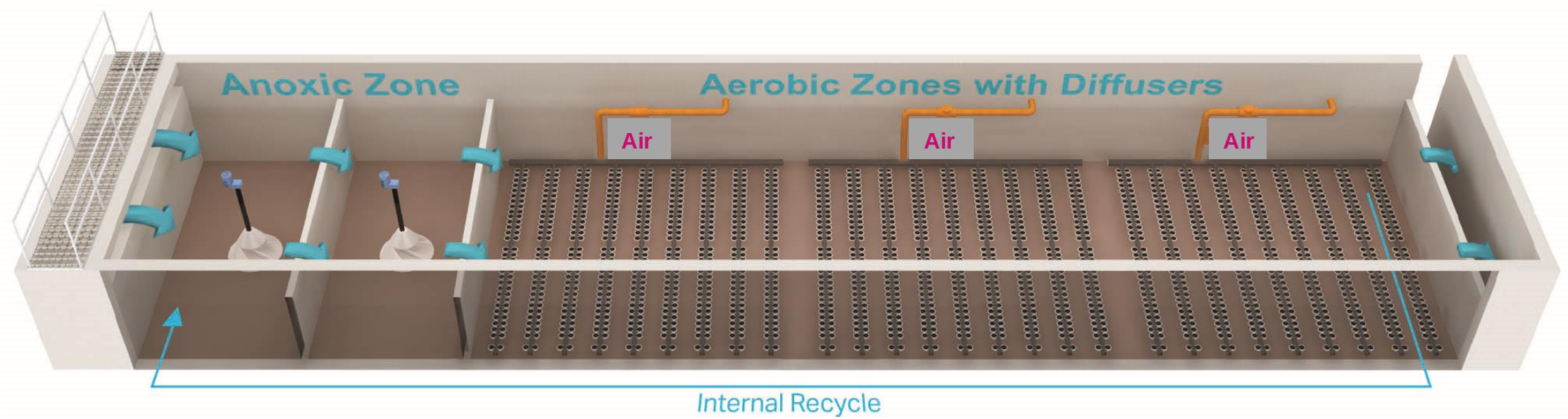


Secondary Process Design

Prior to Aeration Basin Upgrades

Increase Denitrification to Lower Effluent TN Mass Load

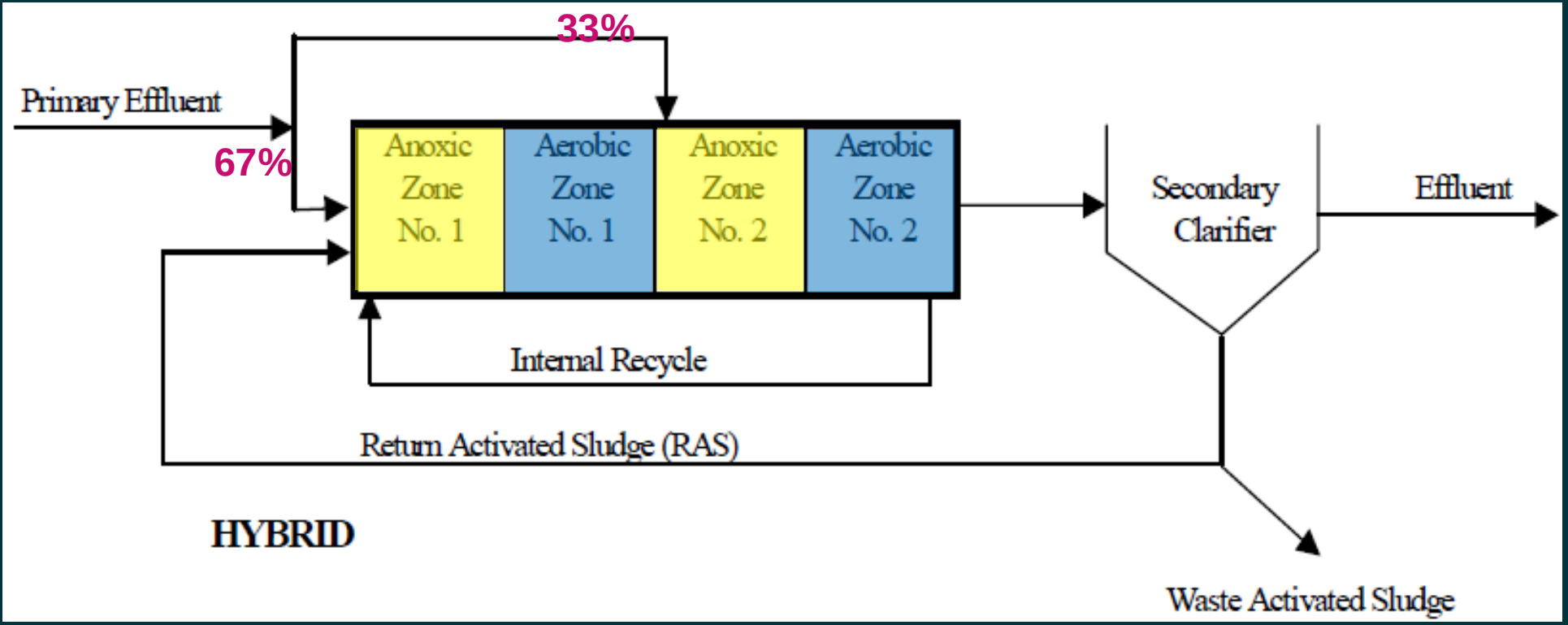
- Conventional approach - Modified Ludzack-Ettinger (MLE)
- Recycle mixed liquor from end of tank to anoxic zones at the head of the tank; up to 400% of primary effluent flow
- All primary effluent and RAS to head of the tank



Step Feed Hybrid Approach

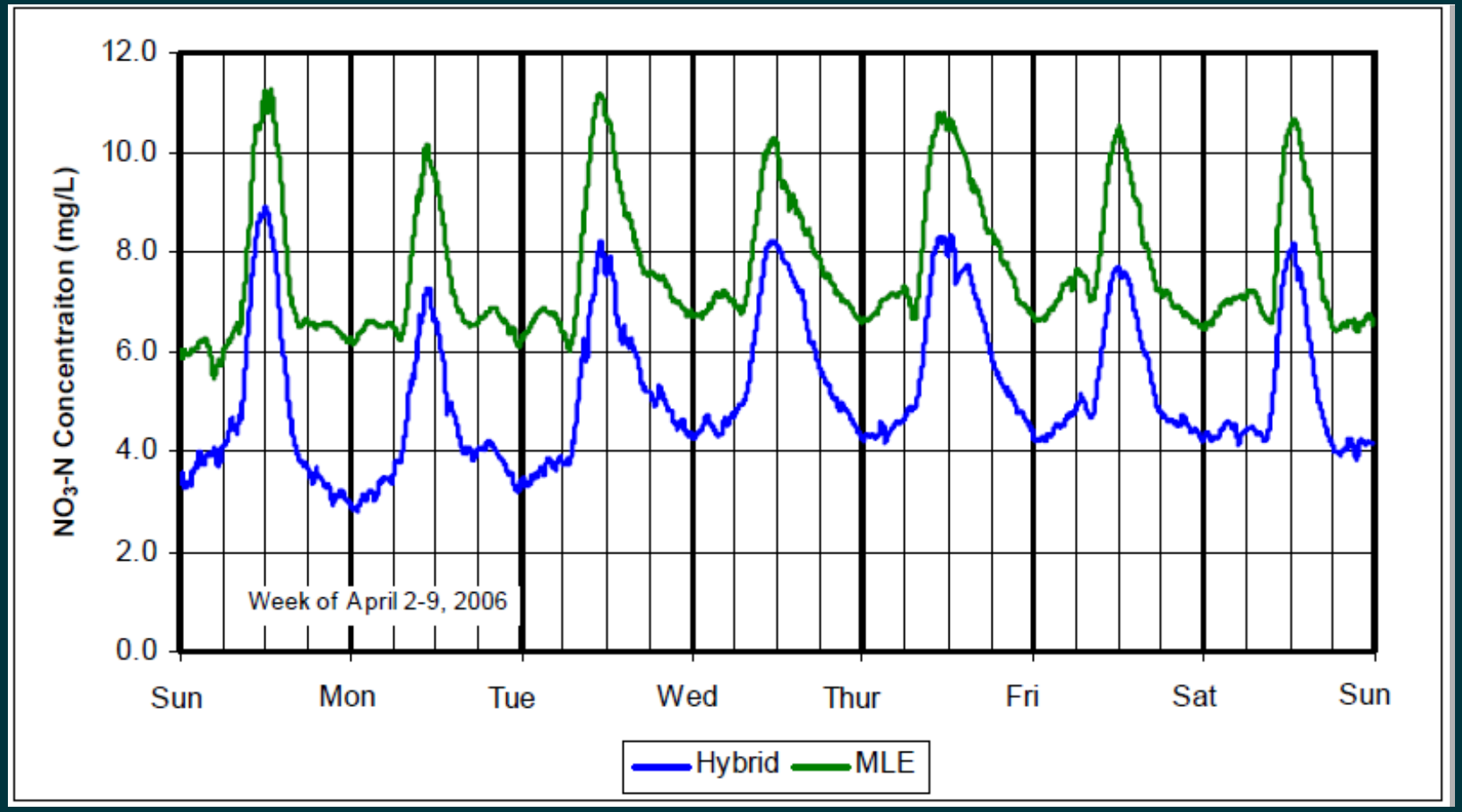
Step Feed Hybrid Approach

- The Facility was originally designed as a Step-feed aeration system
- Step Feed was only used during storms and high flow events
- Was there an advantage to using a continuous flow step feed system with MLE?

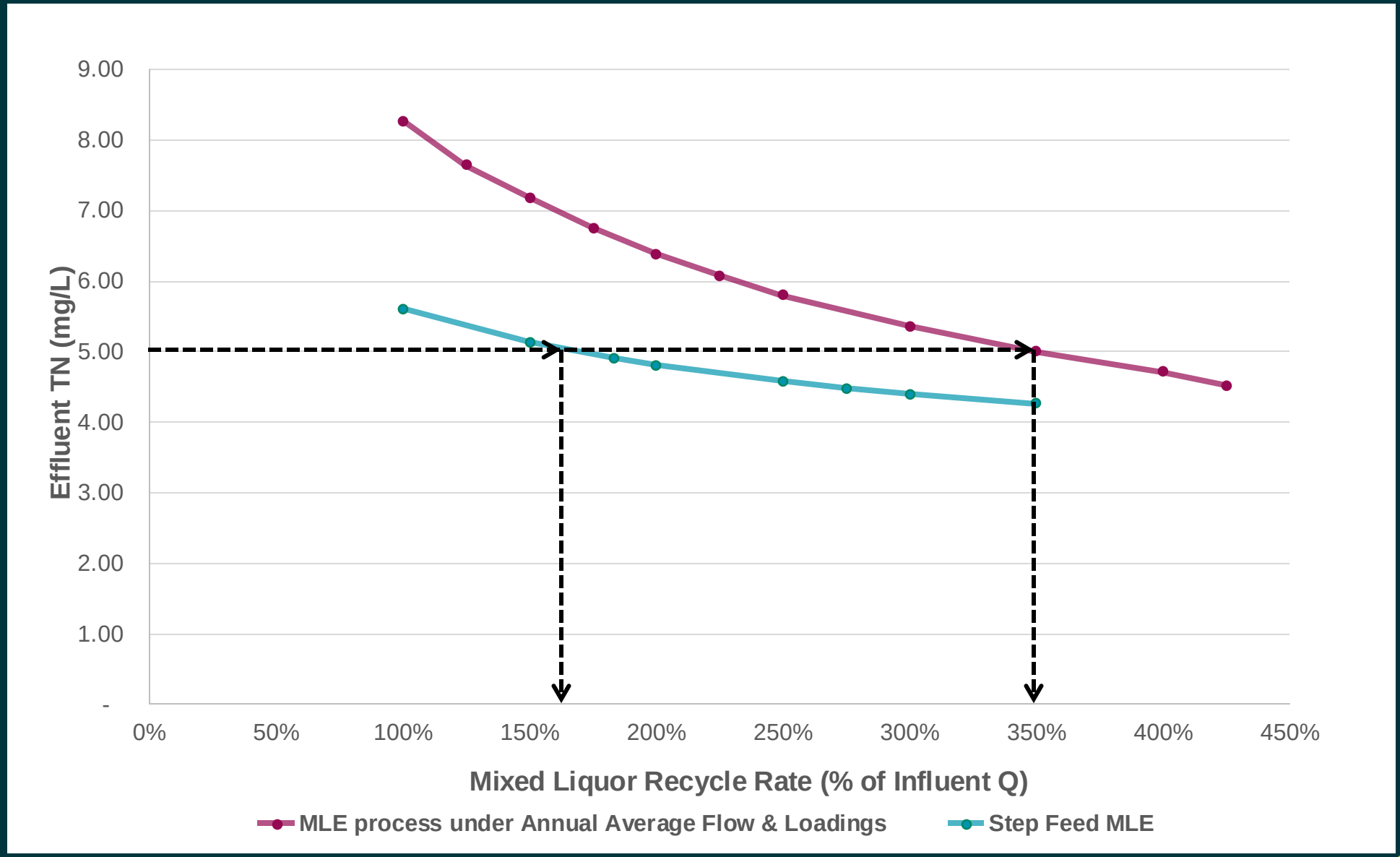


Los Angeles County Sanitation Districts – Valencia

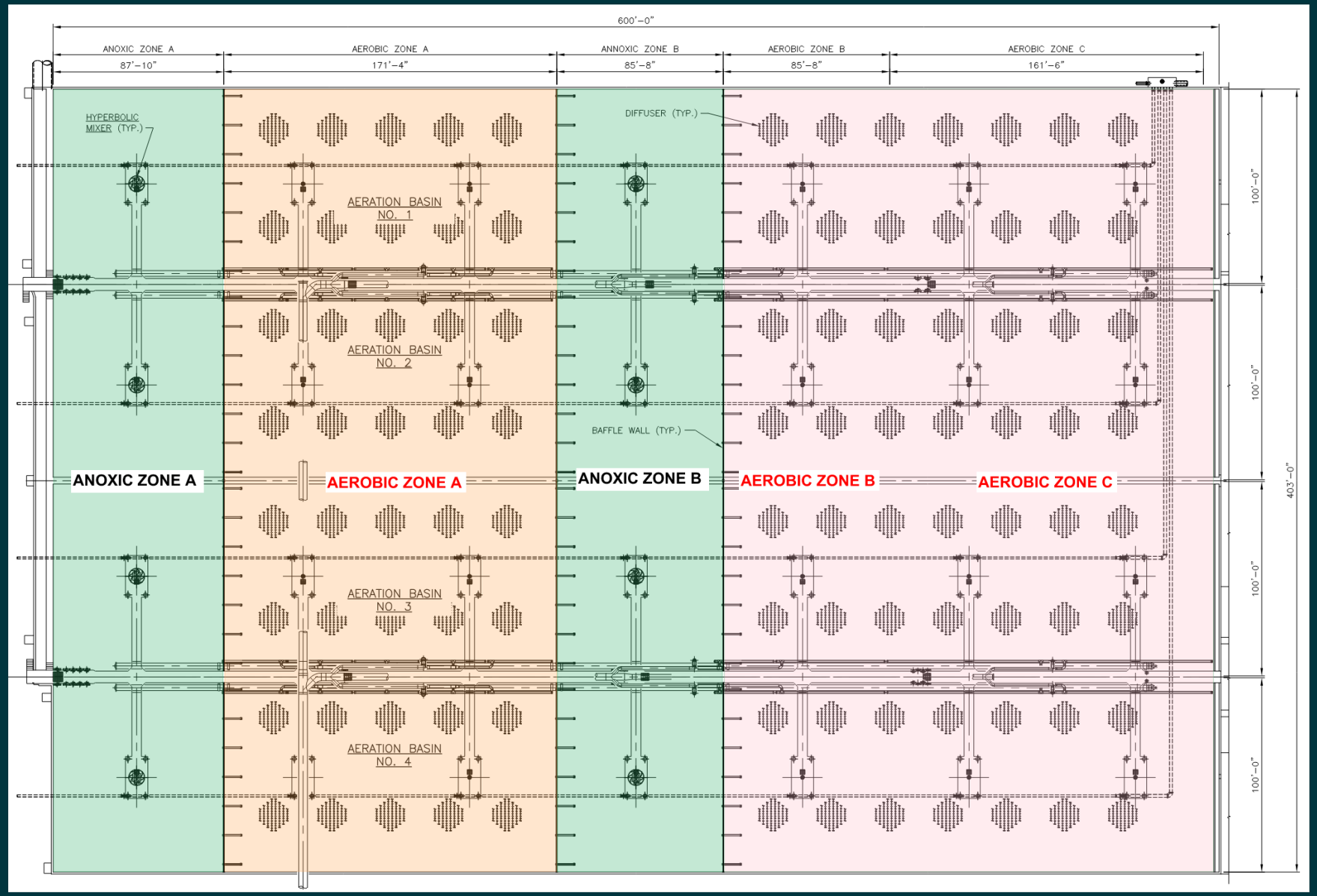
Plant has been practicing the Hybrid MLE configuration for 15+ years



Comparison of MLR Pumping Requirements



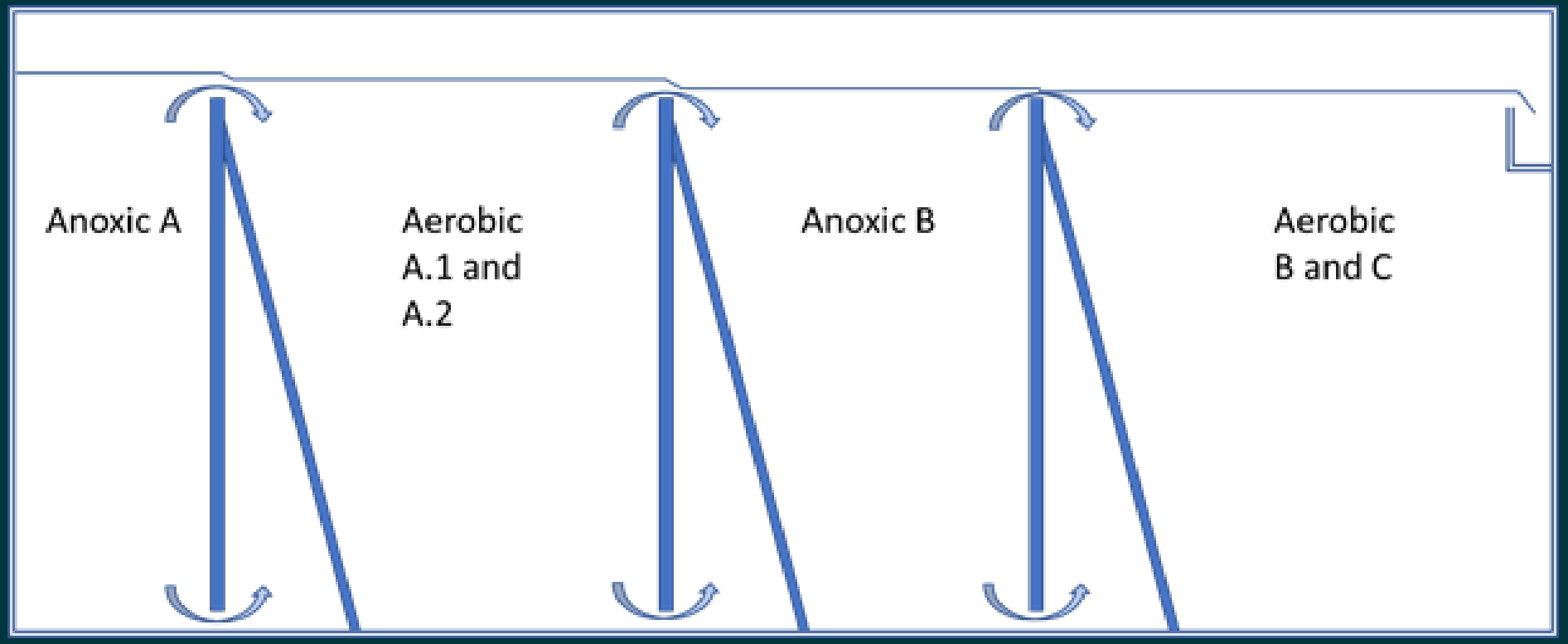
Step Feed Hybrid Overview



Reduced MLR Pumping

Partial Nitrification & Denitrification process through a single flow path

- Flow introduced into 1st anoxic zone is aerated & then flows into 2nd anoxic zone
- Location of 2nd anoxic zone partially accomplishes role of MLR pump

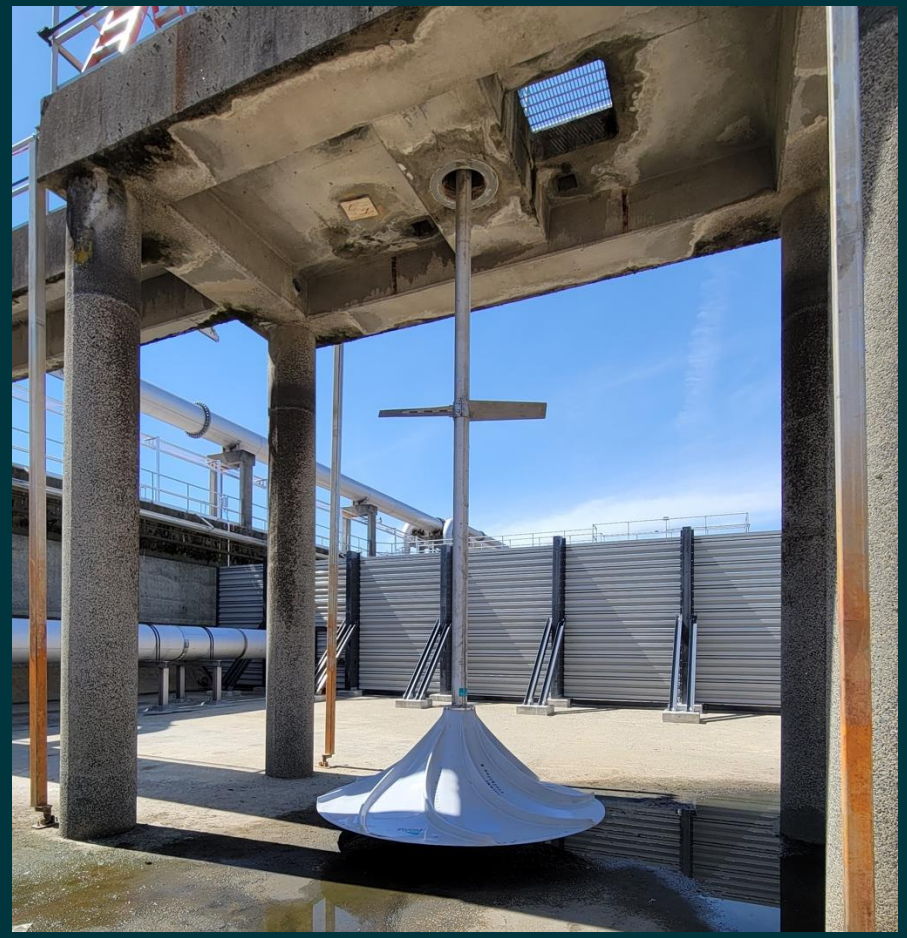


Cost Savings

- Base Design had 12 MLR pumps – 3 per basin for 400% recycle rate
- Each MLR Pump needed separate 30” piping & pipe supports, VFDs, electrical supply, etc.
- Hybrid system reduced design to 4 MLR Pumps – 1 per basin
- Reused existing infrastructure already in place
- Additional cost for (2) baffle walls per basin

Step Feed Hybrid Overview – New Equipment in Basins

Baffle Walls – 3 per Basin



40 HP Mixers in Anoxic Zones - 2 per Basin

Step Feed Hybrid Overview – New Equipment in Basins

Aeration Diffusers –6496 per Basin Across 9 Grids

40 HP Axial Flow MLR Pump

Step Feed Hybrid Overview – New Equipment in Basins

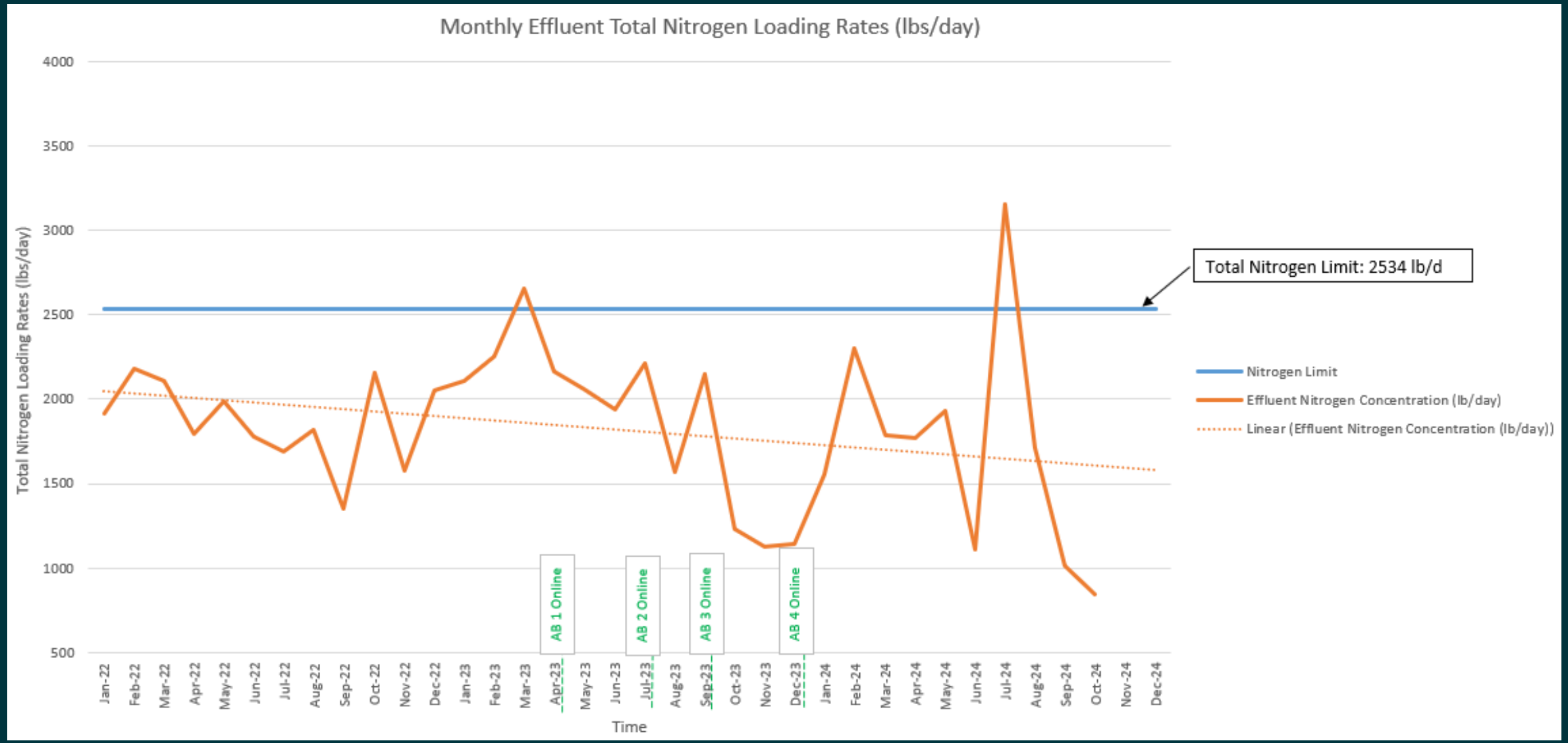
Slide Gate Actuators – 4 per Basin to Control Flow

Aeration Basin 1 Online

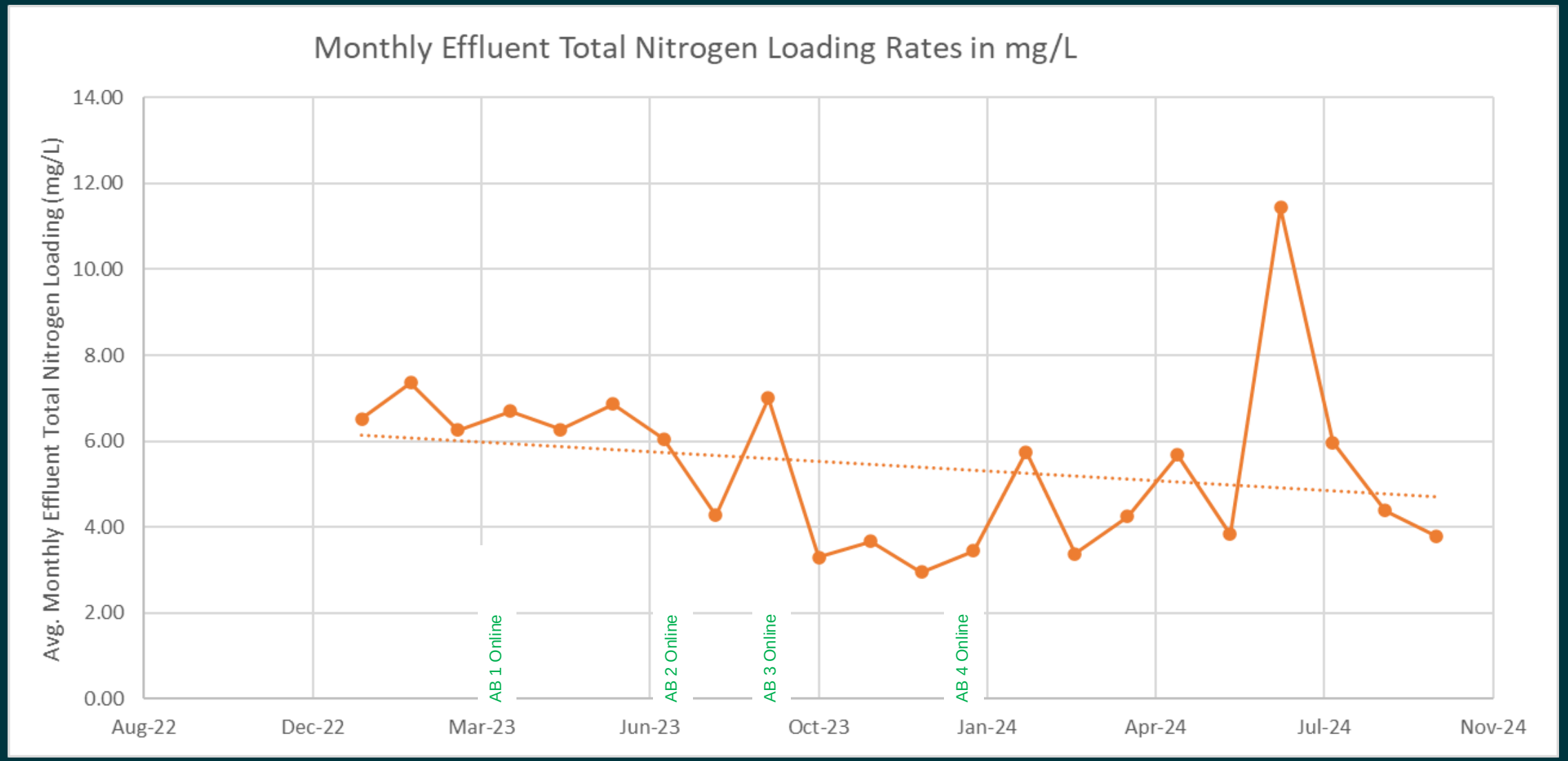
Step Feed Hybrid Overview

Results and Operational Considerations

Ongoing Results



Ongoing Results



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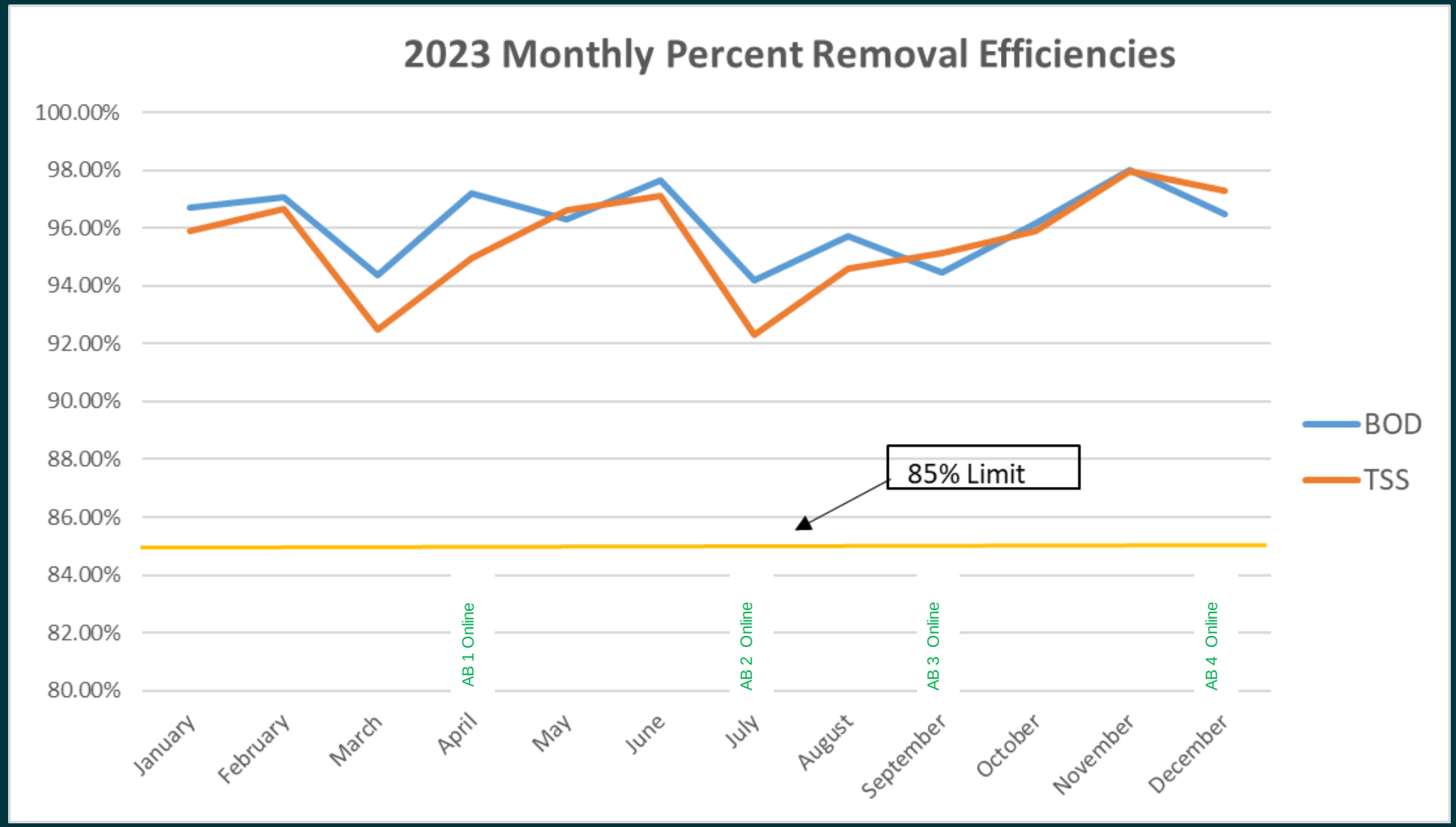

Operational Considerations During Construction

- **Aeration Tank Cleaning** - lessons learned with each tank to make the process more efficient

- **Mid Project Discoveries** – Installing temporary weir walls to protect construction equipment during wet weather events

- **Solids Balancing** - operating with three basins during construction, some with different configurations

- **Carbon Source for Step Feed** - we "proved" the need for carbon at the middle step for nitrogen removal

Thank you.

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