



Solving Today's Water Challenges for a Better Tomorrow™



ABOUT US

- Established in 1998, Focused on Process Intensification
- WWW Locations
 - HQ Oklahoma City, OK
 - WWW Arxzyme and Laboratory Support, Blacksburg, VA
 - Australia and New Zealand Satellite Office
 - Mumbi, India
 - Dubai, UAE
- Global Leaders
 - Polypropylene Manufacturing
 - ANAMMOX Technologies
 - Industrial Application (MBBR – DAF)
 - Intensification R&D and Implementation
 - Process Intensification Technologies



WWW PROVIDES TREATMENT SOLUTIONS IN BOTH THE MUNICIPAL AND INDUSTRIAL MARKETS

01

WWW™ **DEMON**®
Side Stream Anammox Treatment

02

WWW™ **BIOCOS**®
Hybrid Activated Sludge

03

WWW™ **IFAS**
Integrated Fixed Film Activated Sludge

04

WWW™ **MBBR**
Moving Bed Biofilm Reactor

05

WWW™ **DAF**
Dissolved Air Flotation

06

WWW™ **inDENSE**™
Process Densification

07

WWW™ **AVN**®
Advanced Aeration Control

08

WWW™ **Triple A Settler**™
Biologically Advanced Primary Treatment

09

WWW™ **DETOUR**
Mainstream Anammox Treatment

10

WWW™ **miGRATE**
Migrating Carrier Intensification

11

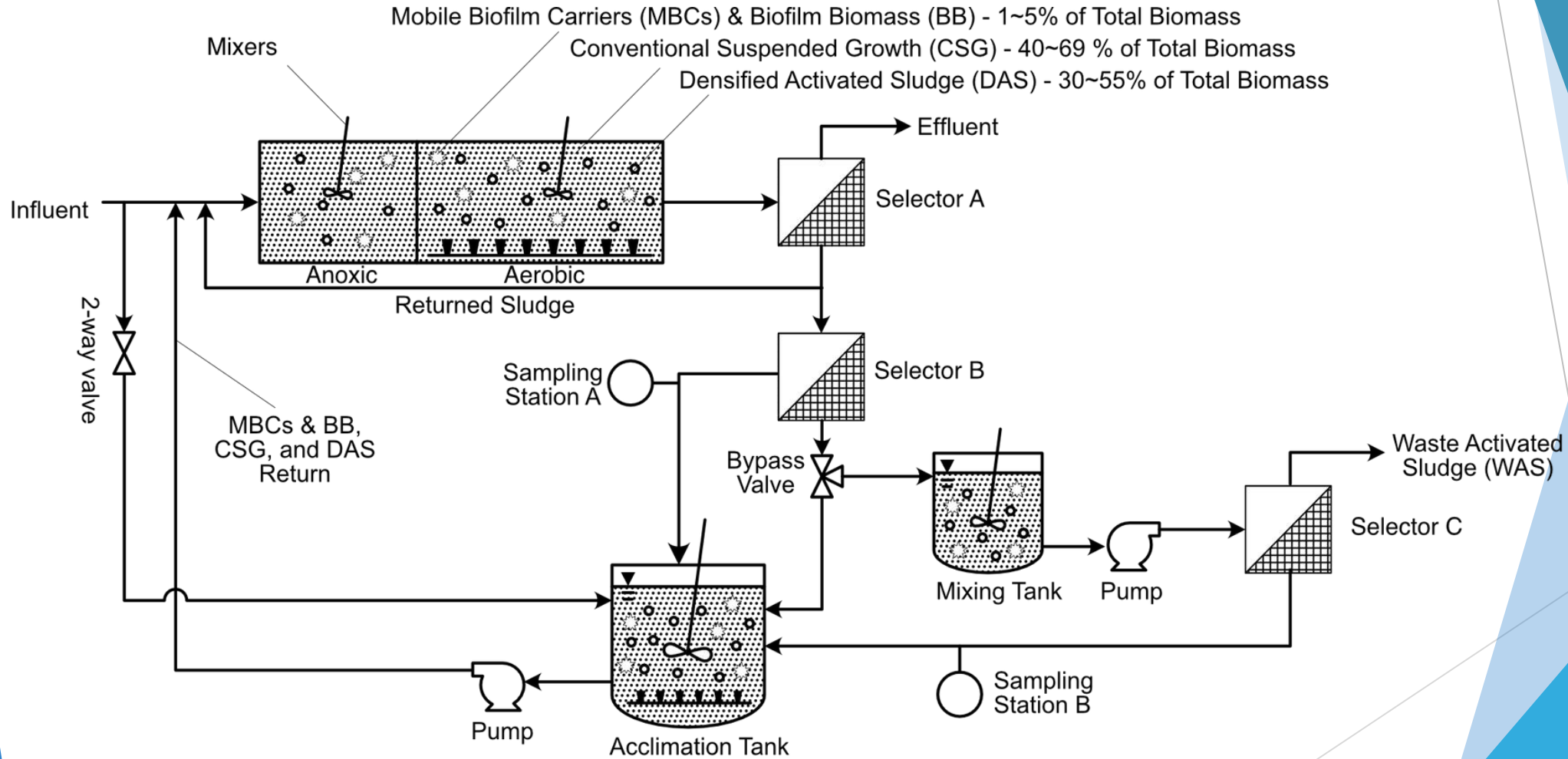
WWW™ **MINION**
Larger Bubble Process Mixing



Process Intensification miDense!



miGRATE





Core Technology

- Utilizes a fully natural mobile media
 - Gen1 or Gen 2
- Retention Screens
 - Rotary Drum Screen
 - Static Sidehill Screen



Optional Add on Technology

- inDense - Granule Capture
- AvN - ABAC or SND Aeration Control Strategy

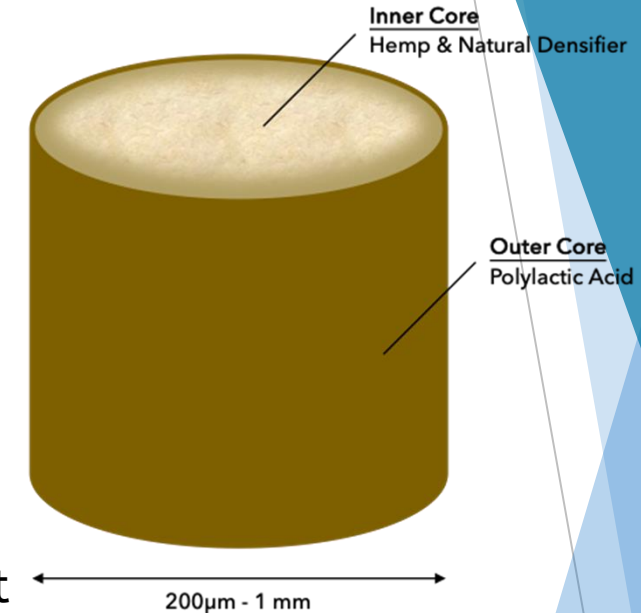




- Fully Green Bio-composite, Plant-Based, Compostable Carrier
- Carbon Negative Renewable Resource
- Customizable
- Compostable
- Ecological Friendly

Advancements

- Known Surface Area
- Controlled Specific Gravity - Predictable Settling
- Engineered Surface Area - Biofilm Growth, Redox Gradient
- Robust Media - 10-year Guarantee
- Easily Captured - Minimized Loss Rate





Media Retention Options



or



or



Static Sidehill

Rotary Drum
Screen

Static Screen
inDense

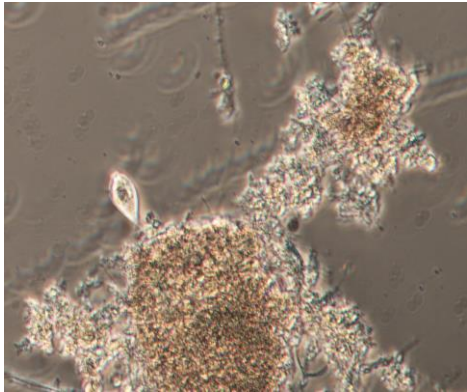


Decoupled SRT - Backbone of Intensification

SRT 1

MLSS

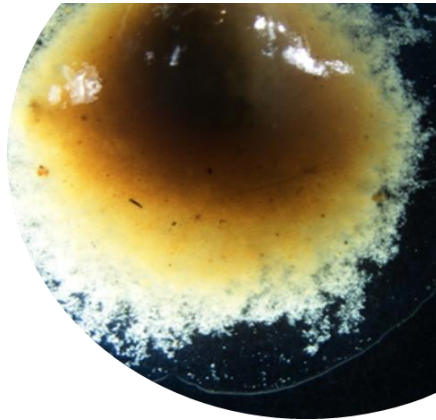
- Low SRT 2-8 Days
- Heterotroph Growth
- BOD and P Removal



SRT 2

Fixed Film

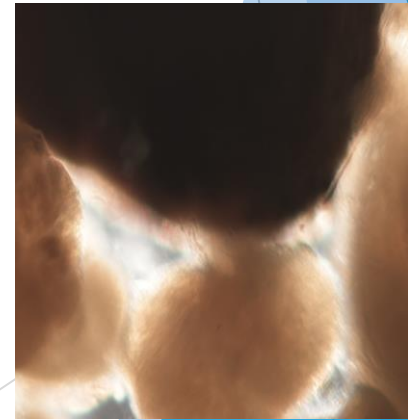
- 80 - 120 Day SRT
- Redox Gradient
- BOD, Total N, P Removal



SRT 3

Densified Activated Sludge

- 60- 80 Day SRT
- Redox Gradient
- Total P and Settling





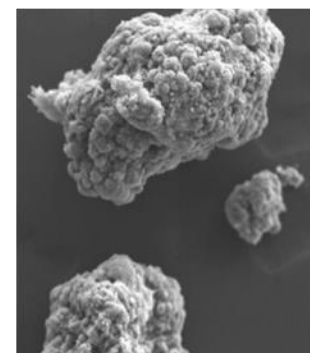
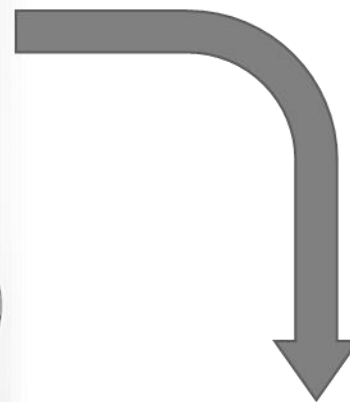
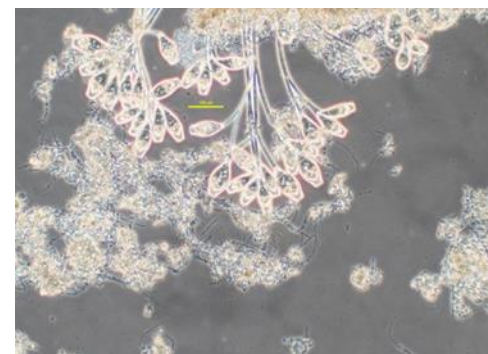
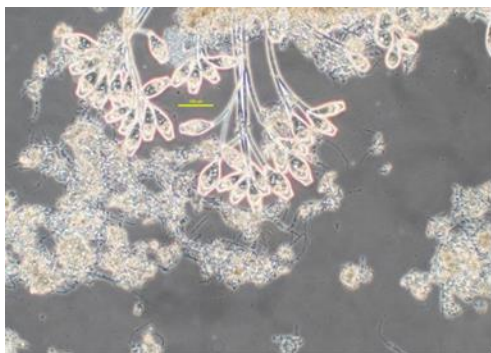
process intensification with densified biomass

- Over 200 Installations Globally
 - Benefits
 - Selection of Dense Floc – AGS
 - Improved SVI
 - Reduced Filaments – Dense Floc
 - Zoogloal Reduction
 - MLSS Control
 - Improved BNR
 - Increased Clarifier Capacity
 - Chemical Reduction
 - Energy Reduction



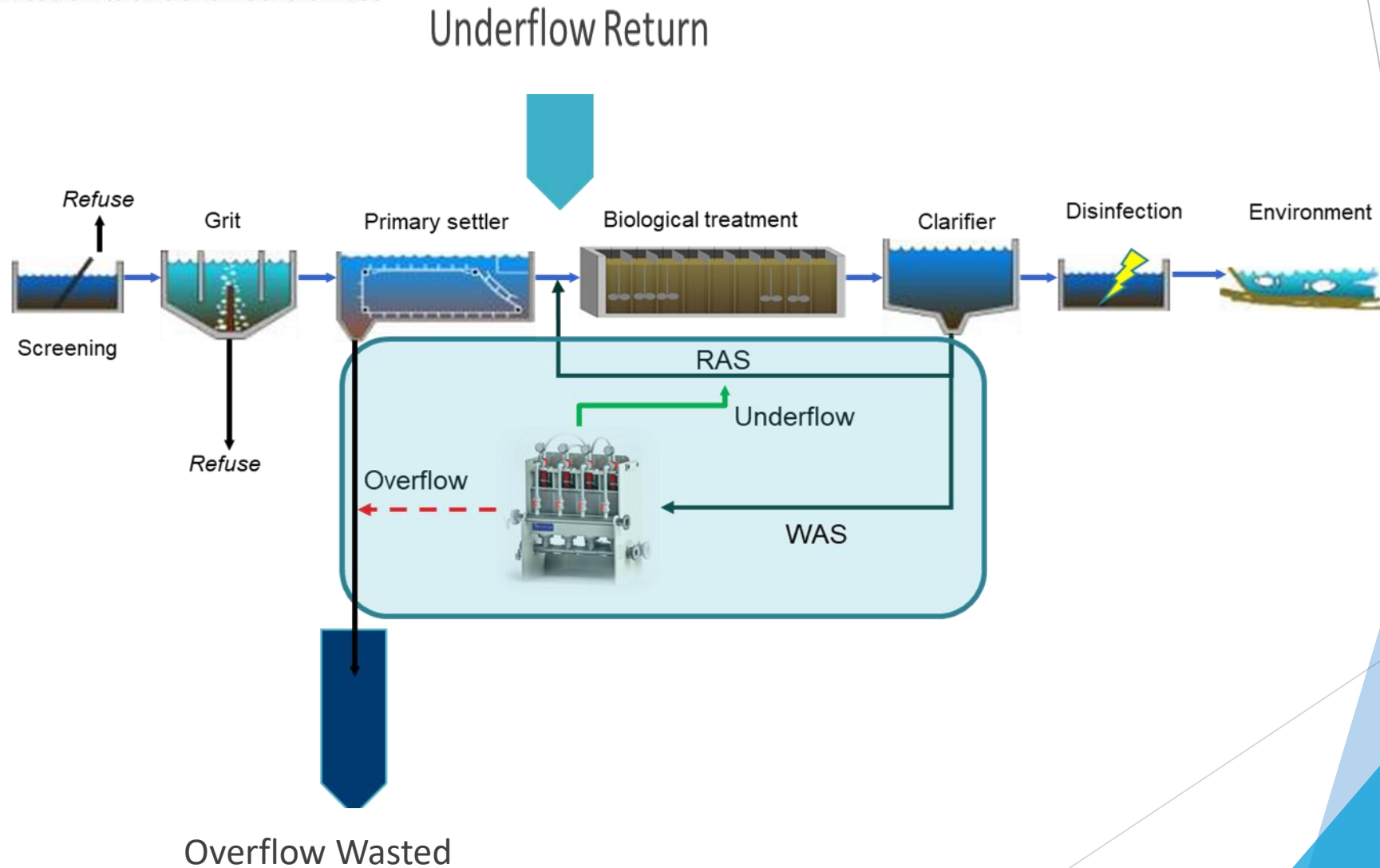
inDENSE

process intensification with densified biomass



inDENSE

process intensification with densified biomass





- Real-time control philosophy that modulates aeration based on the ratio of ammonia-N to oxidized nitrogen.
- Holds the NH_4 - NO_x Ratio near a user defined set-point (1.0 mg/L).
- AvN selectively suppresses nitrite bacteria, keeping most of the oxidized nitrogen in the nitrite form to unlock short-cut nitrogen-removal pathways.

Benefits

- Up to 60% less aeration by aerating only when necessary.
- Enhanced BNR - Shortcut nitrogen removal.
- Lower Carbon Demand
- Process Stability that handles fluctuations in influent loading and low temperatures.
- Metabolic SRT Control



How it Works

- Sensors measure ammonia and nitrate concentrations, real time.
- The system calculates AvN Ratio.
- Based on this ratio, aeration is increased, decreased or paused to maintain ideal microbial activity for partial nitrification and denitrification.
- This promotes deammonification pathways, PdNA and ANAMOX growth.

Piloting Options

Full Scale Pilot

- Isolate a Single Train or Full Facility
- Add Media and Temporary Screen and inDense Skid
- Trial 6 - 12 Months
- 100% of the Trial Cost Goes Back to Project Cost

Sidestream Pilot

- 20,000 gpd miGRATE pilot skid
- 4-cyclone inDense Skid
- Isolate Influent Flow or Primary Effluent Flow
- Trial 6-12 Months
- 20% of Trial Cost Goes Back to Project Cost



Warminster WRF Warminster, PA



➤ Background

- Facility Name: Warminster WRF
- Location: Warminster, PA
- Process: A2O
- Flow: 8.18 MGD, Municipal

➤ Goals

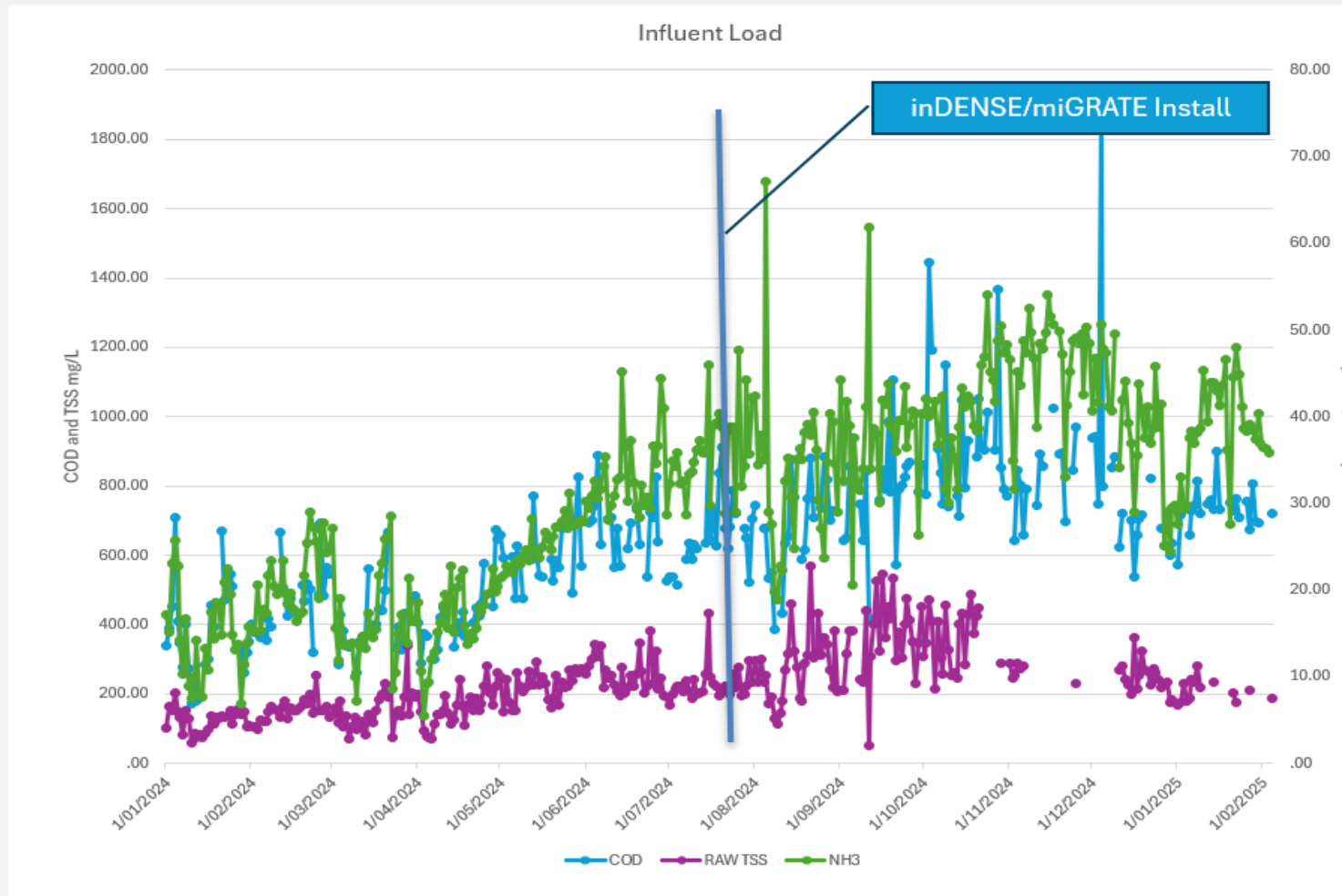
- Filtrate Treatment
- Total N Limit (<7 mg/L, Seasonal)
- Total P Limit (1.0 mg/L)
- Capacity (Loading and Flow)





A package 2-in-1 unit was specifically designed to fit in the tight space

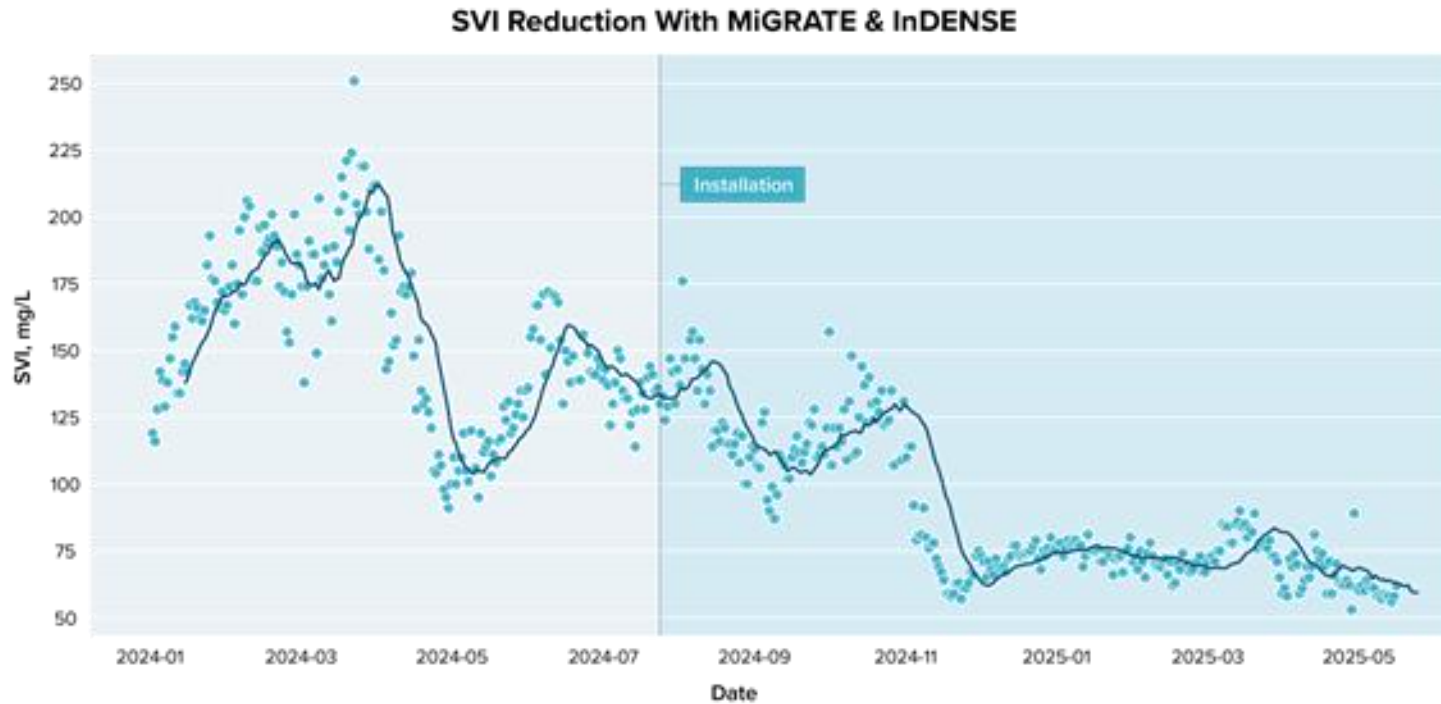
Increased Influent Loading Trend



- Increased NH₃ Loading due to Centrate Flow.
- COD Increase from Centrate and Population Growth.
- Variable Increase in TSS Loading.



SVI - Improvement



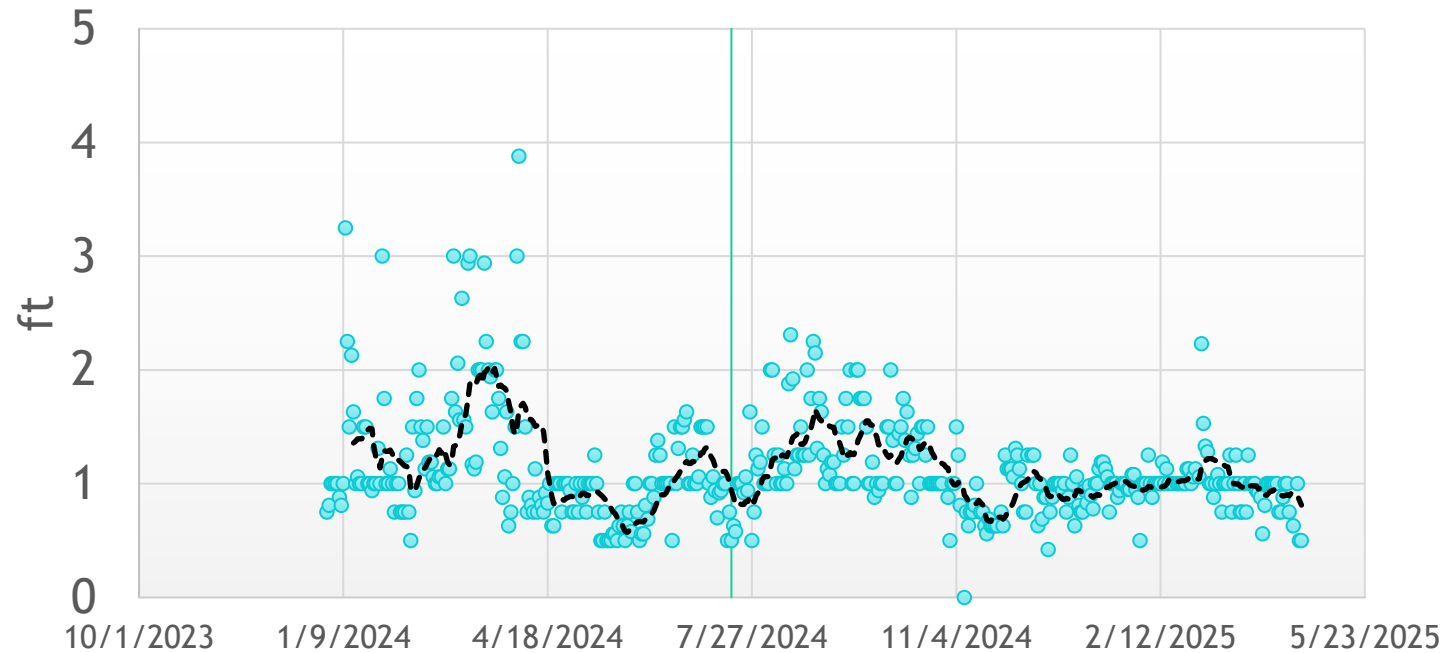
- SVI from 220 mg/L to 55 mg/L.
- Reduced Filament Abundance.
- Increased Transmittance.

<https://icnk.io/u/ektFSBrbauUn/>



Sludge Blanket Performance

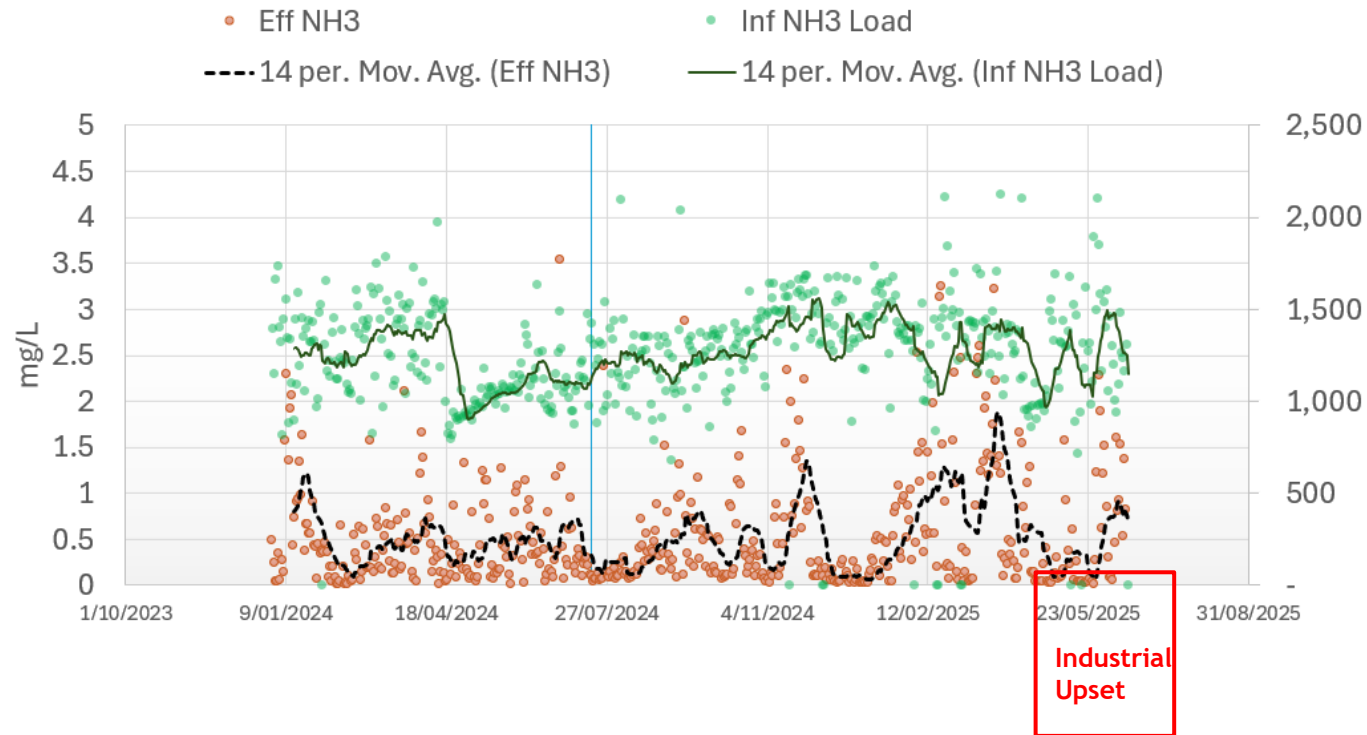
SC1 Sludge Blanket



- Stable Sludge Blanket
- Increased % Solids to Digester
- Improved Dewatering
- Reduced Chemical Cost

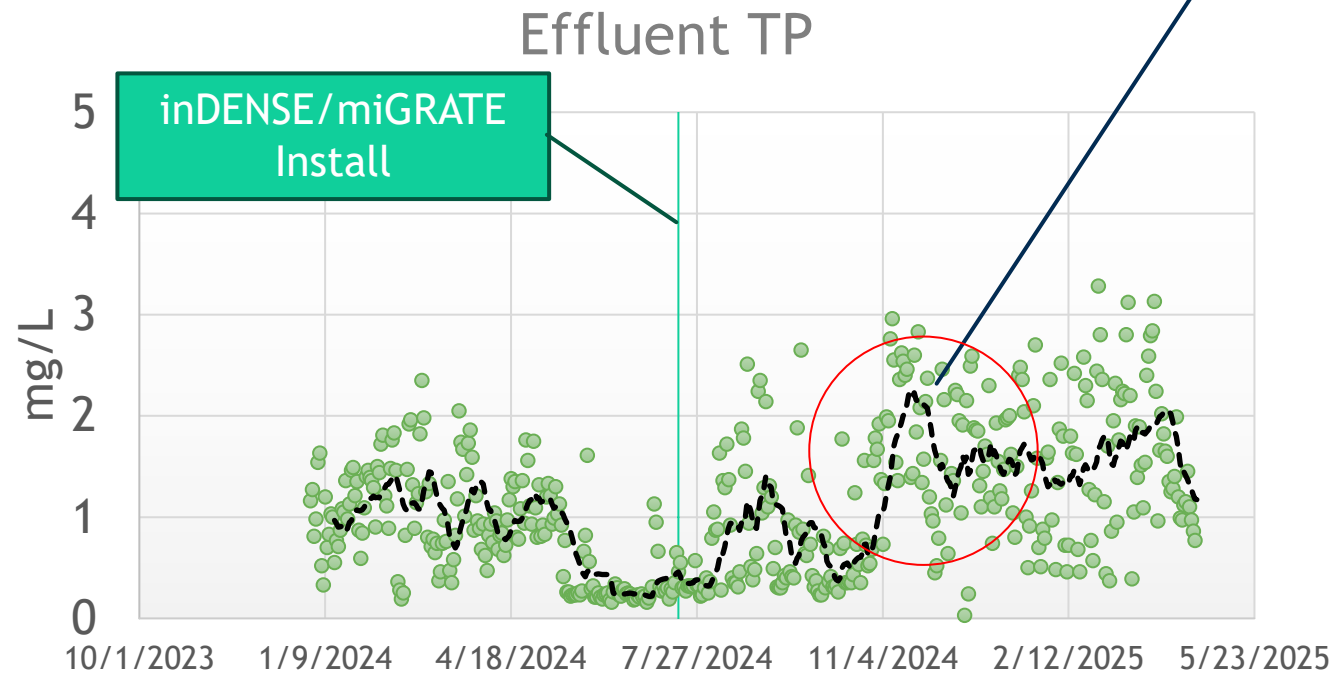


NH₃ Removal Trend

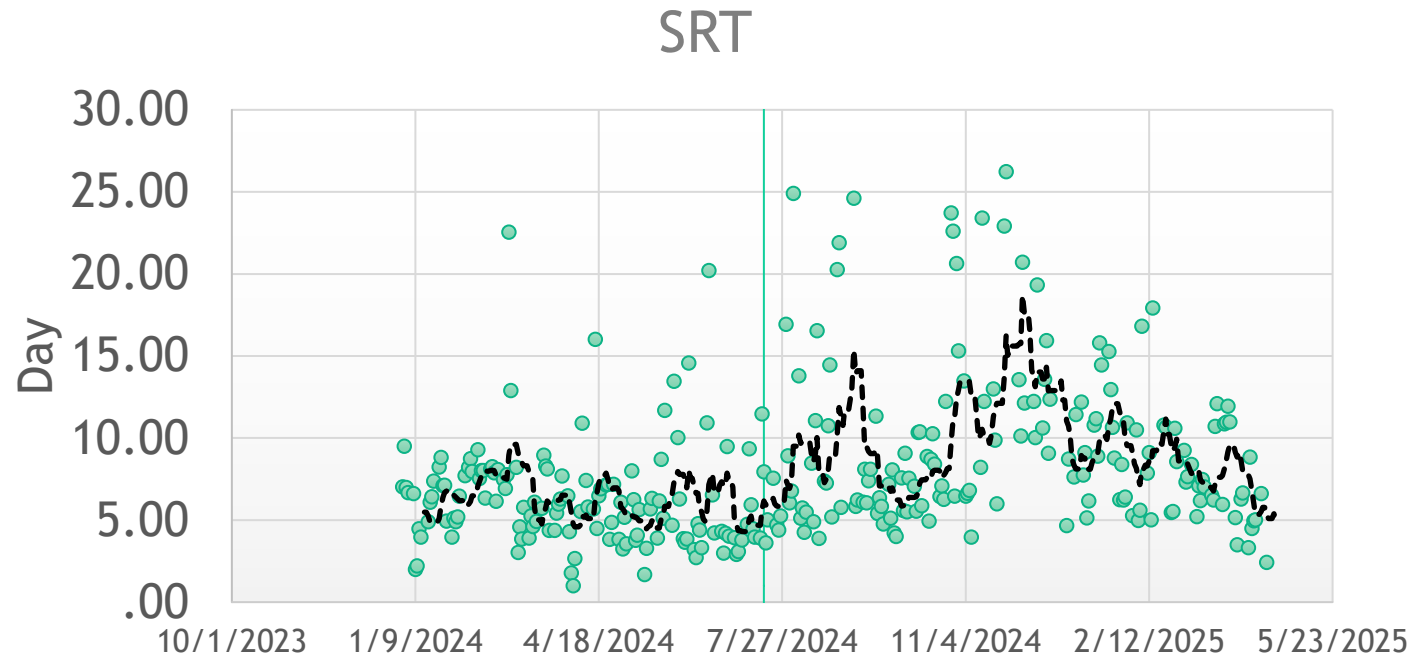


- Average of < 0.5 mg/L of Effluent NH₃

Effluent TP



SRT



- Down to 5-day SRT
- Higher SRT in Winter due to Toxicity



Summary

- 2.5 x Increase in Capacity - Biological and Clarification
- Improved Settleability
- Improved Removal of Total N (<5 mg/L)
- Biological Phosphorous Removal (<1 mg/L)
- Cold Weather Nitrification and Robustability
- Increased Transmittance for Improved UV Performance
- Saved \$39MM of Capital Cost
- Installation Cost Reduced, Operating Cost Reduced, 8 Week Lead Time.



Thank You

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Questions?