Jacobs

Challenging today.
Reinventing tomorrow.

DEMONsidestream treatment for nitrogen removal

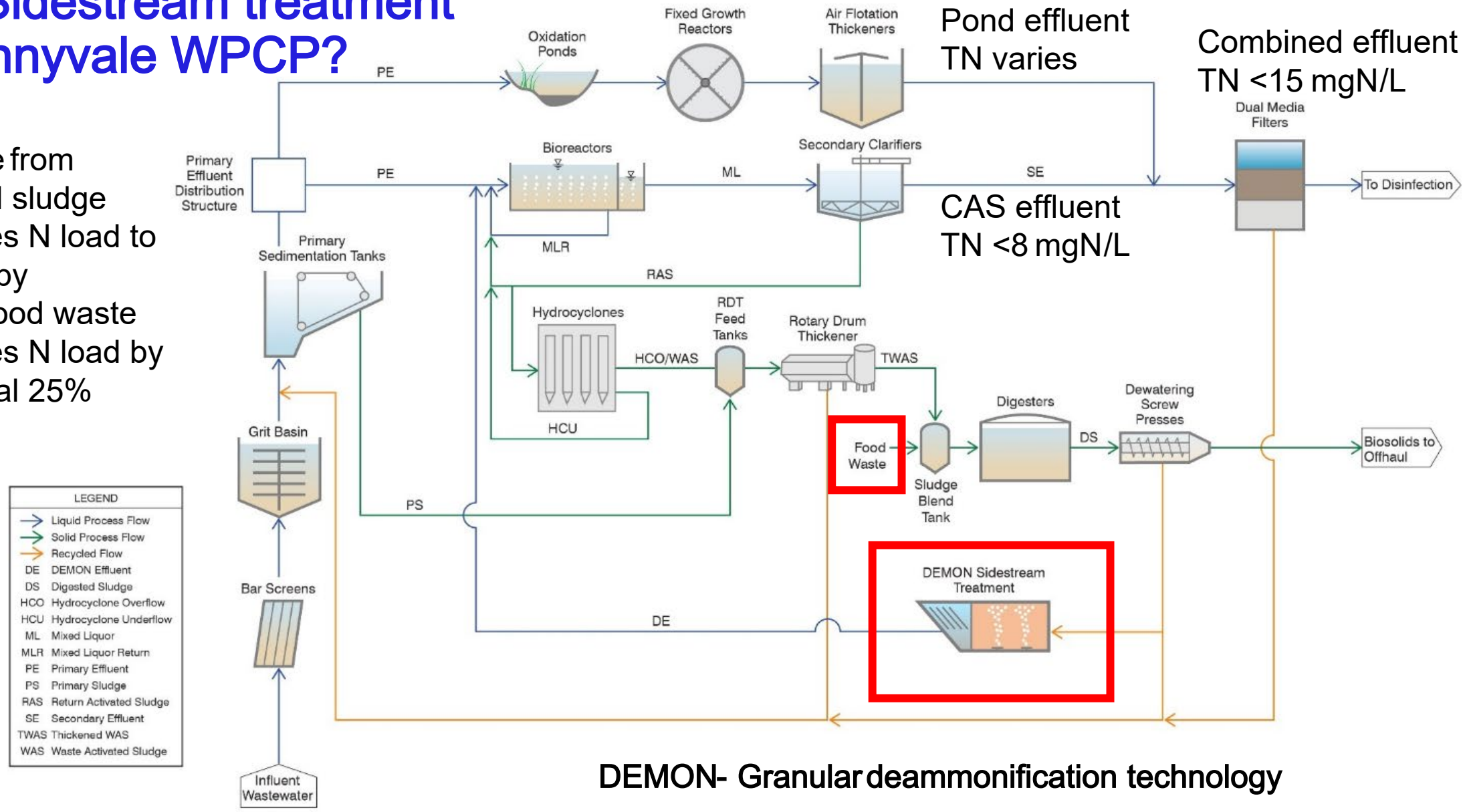
Sunnyvale Water Pollution Control Plant, Sunnyvale, CA

DEMONsidestream treatment, part of the Sunnyvale WPCP Secondary Treatment and Dewatering Project

- Why sidestream treatment at Sunnyvale WPCP?
- Technology impacts on N removal
- Benefits of DEMON
- DEMON improvements
- How does DEMON remove Nitrogen?
- DEMON Design criteria
- DEMON process flow diagram
- 3D renderings of DEMON Facility Design

Why Sidestream treatment at Sunnyvale WPCP?

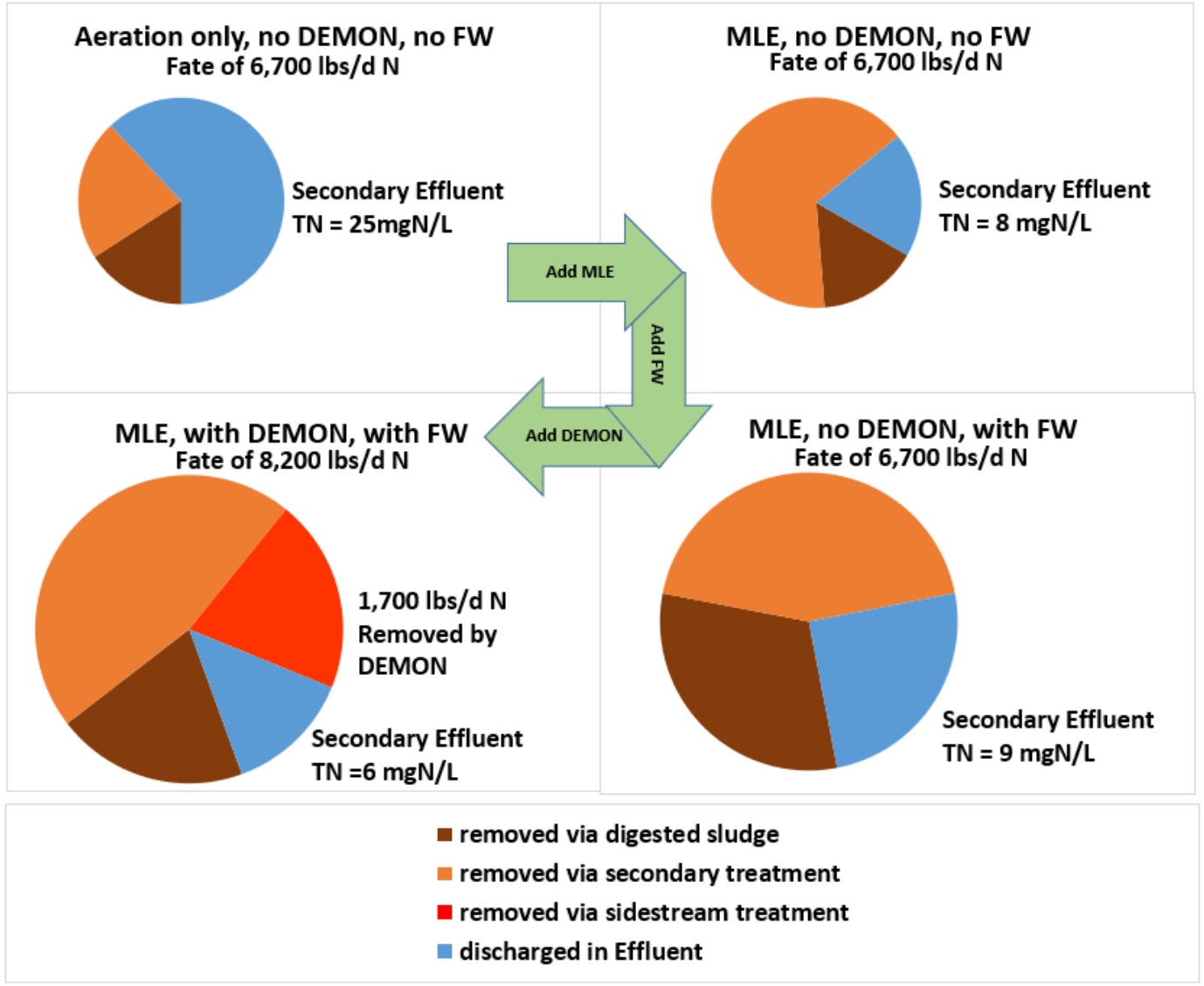
Centrate from digested sludge increases N load to influent by 30%....food waste increases N load by additional 25%



DEMON- Granular deammonification technology

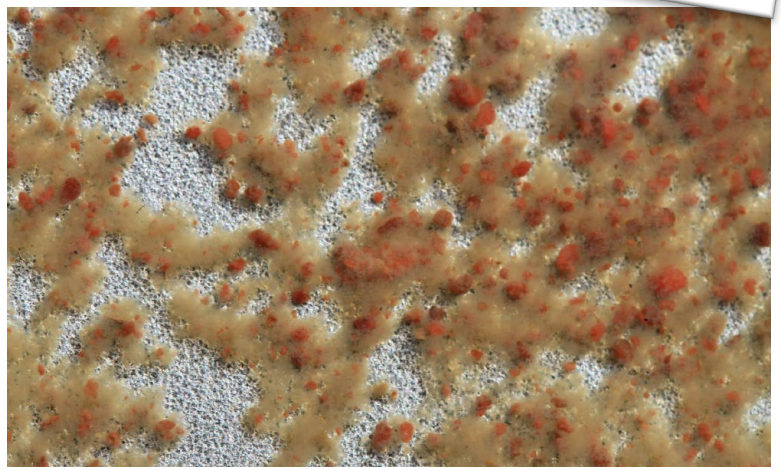
Technology impacts on N removal

- Design loading, 2035
- Full upgrade (not split flow)
- Nitrogen through the WPCP
  - 100% CAS - Aeration only
  - 100% CAS - MLE
  - Add Food Waste to Digestion
  - Add DEMON sidestream treatment
- Allows the WPCP to reliably meet <8 mgN/L



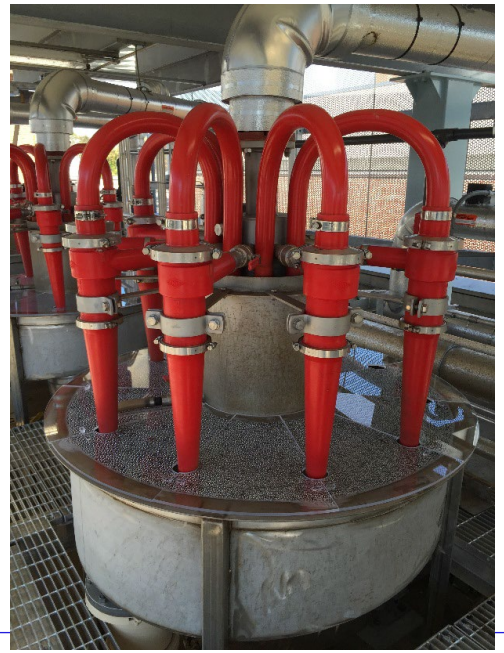
Benefits of DEMON

- Potential for mainstream performance improvements
- No plastic media, no generation of microplastics
- No carbon requirement, either from
  - Supplemental carbon addition (saves cost)
  - Endogenous decay of RAS (maximizes carbon sent to digestion for energy)
- Leverage Jacobs experience with DEMON at Ejby Mølle, Alex Renew



DEMON improvements

- Continuous flow, no longer batch process
- Replaced hydrocyclones with static run-down screens
  - Lower energy
  - Less complexity
  - Greater granule capture (>90%)



hydrocyclones

Static run-down screen

How does DEMON remove nitrogen?

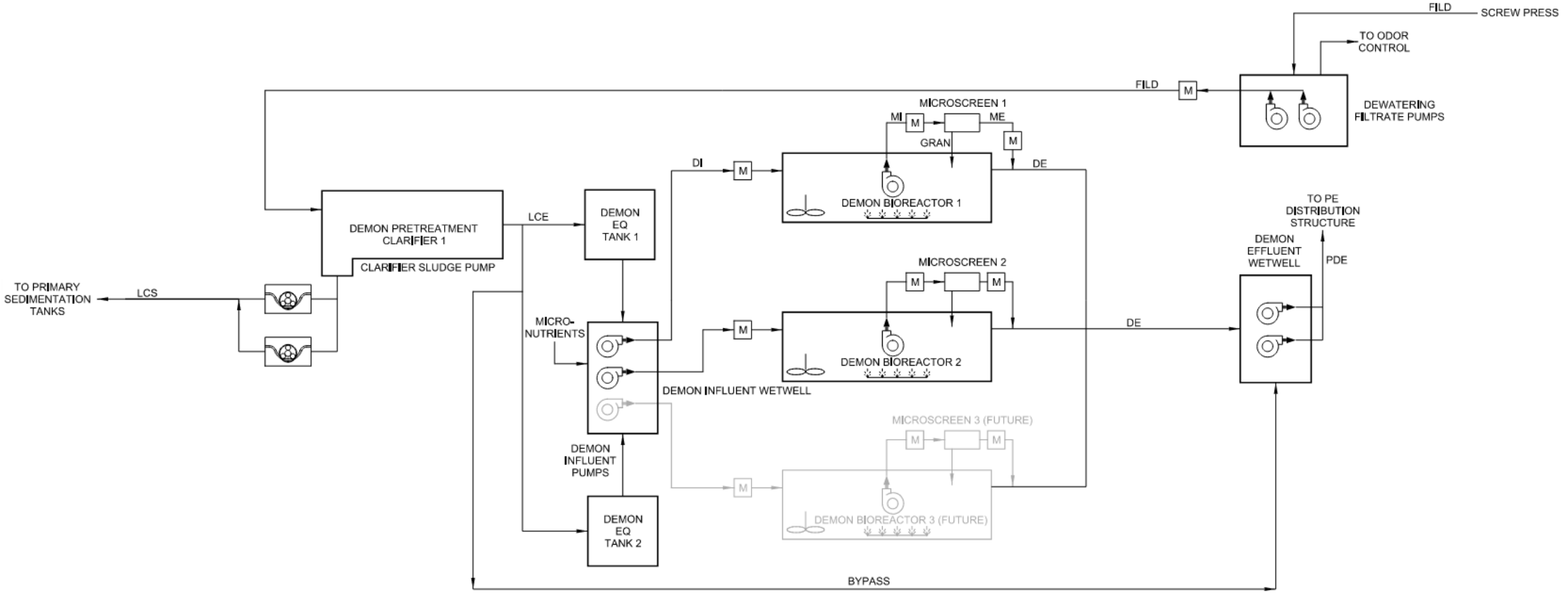
- pH controlled aeration strategy:
  - High pH setpoint blowers turn on, allowing for nitritation – mixers off
  - Low pH setpoint blowers turn off, allowing for deammonification – mixers on
- Microscreen wasting:
  - Recycles bioreactor contents through microscreens
  - Duration a function of water quality
  - Retains anammox granules
  - Washes out (all) floc forming organisms
- Between aeration control and wasting:
  - Retention of anammox granules
  - Retention of floc-forming AOBs (slightly higher growth rate)
  - Washout of floc-forming NOBs (slightly lower growth rate)

Design Criteria

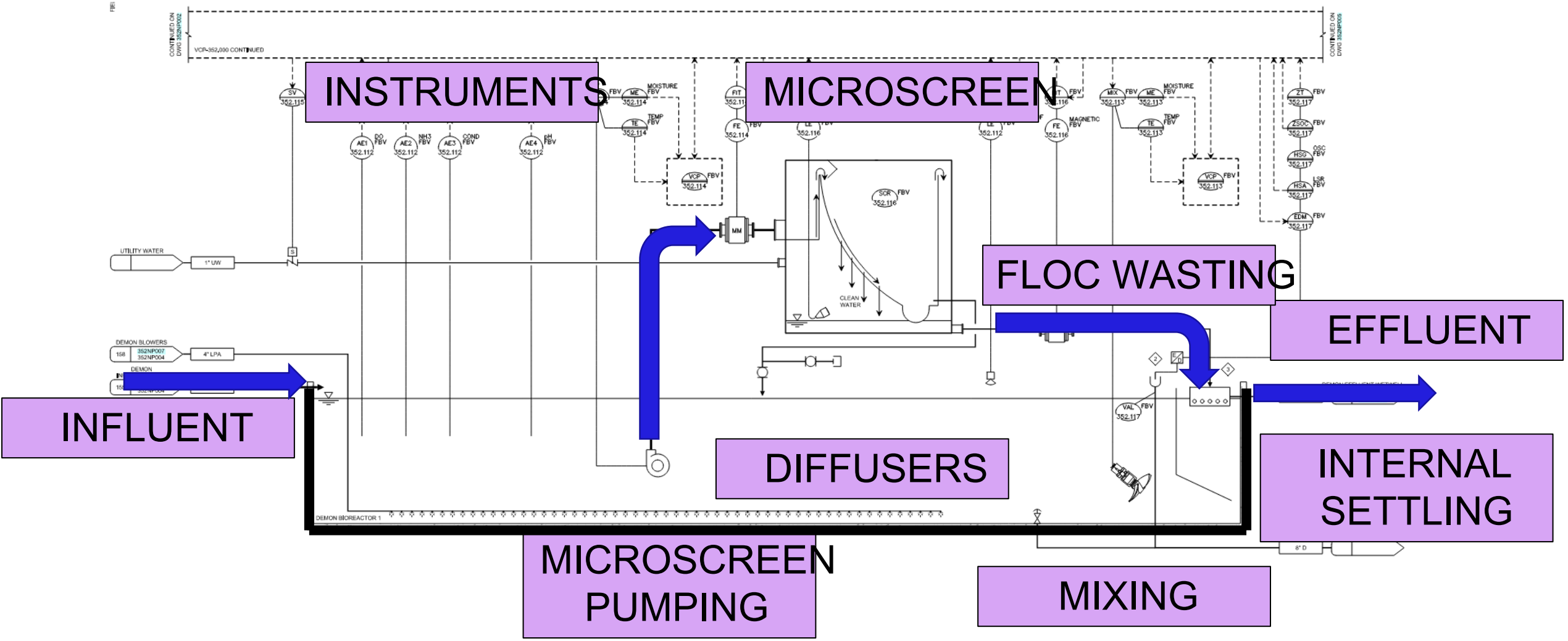
- Design loading rate for bioreactor sizing: 1.0 kgN/m ^{3}-day ammonia
- 5 days/week operation (idle period over weekend)
- Minimum filtrate load, average annual flows, startup, no food waste
  - 820 lbsN/day TKN
  - 75,600 gpd
- Maximum filtrate load, max month flows, 2035, food waste to digestion
  - 2,840 lbsN/day TKN
  - 163,900 gpd
- Design performance guarantee @ 75-95F
  - >90% ammonia removal
  - >80% TIN removal

	Bioreactors	EQ tanks	Influent wetwell	Effluent wetwell
General Characteristics				
Service	Treatment	Equalization storage	Pumping	Pumping
Quantity	2	2	1	1
Length by width, feet	40 feet by 20 feet	15 feet by 24 feet 6 inches	5 feet by 11 feet	5 feet by 11 feet
Min operating depth, feet	20 feet	2 feet	2 feet	2 feet
Max operating depth, feet	20 feet	9 feet	11 feet	11 feet
Normal operating depth, feet	20 feet	7 feet	7 feet	7 feet
Max operating volume, gal each	120,000	27,400		

DEMON Process Flow Diagram

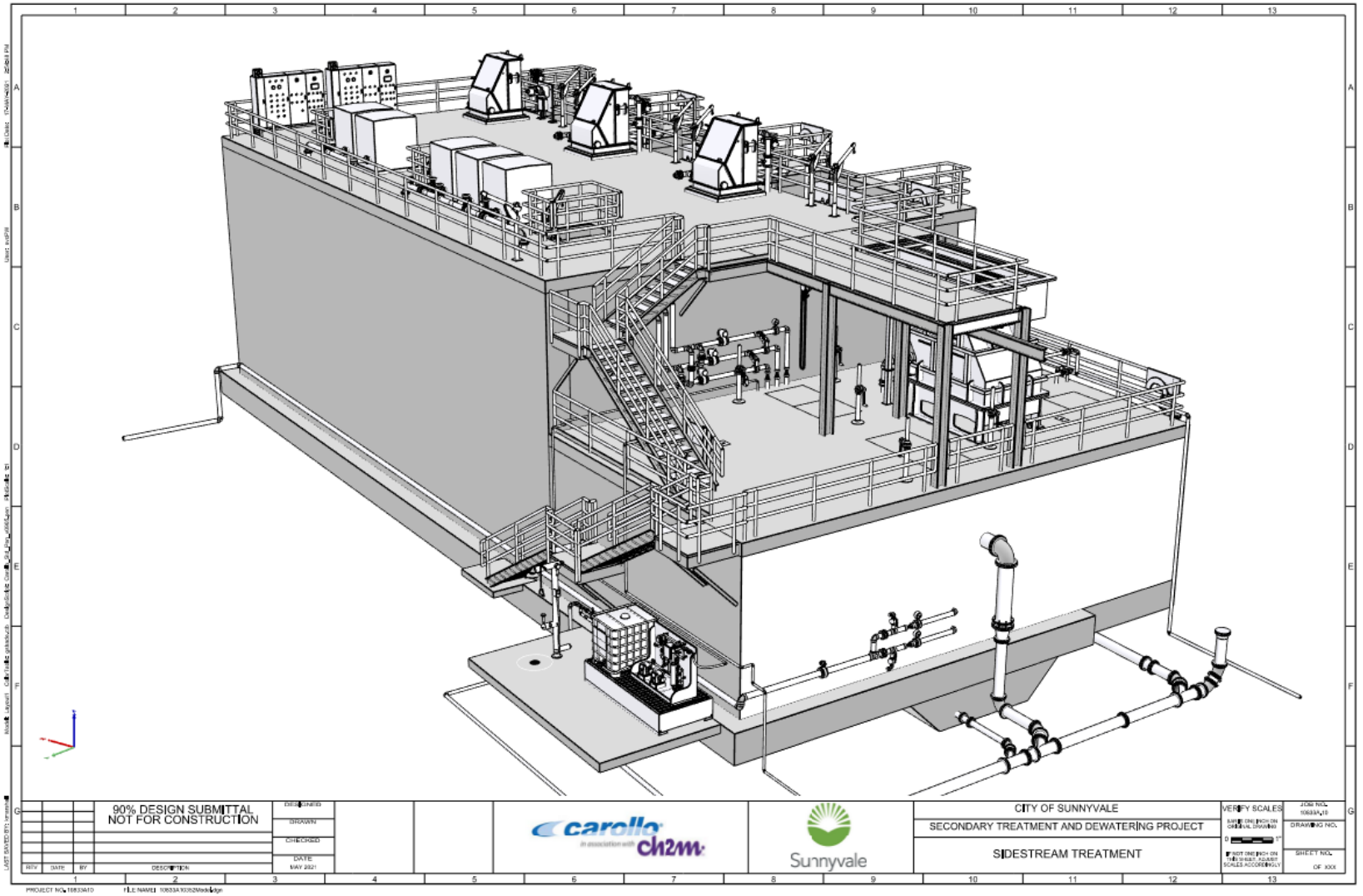


DEMON bioreactor details



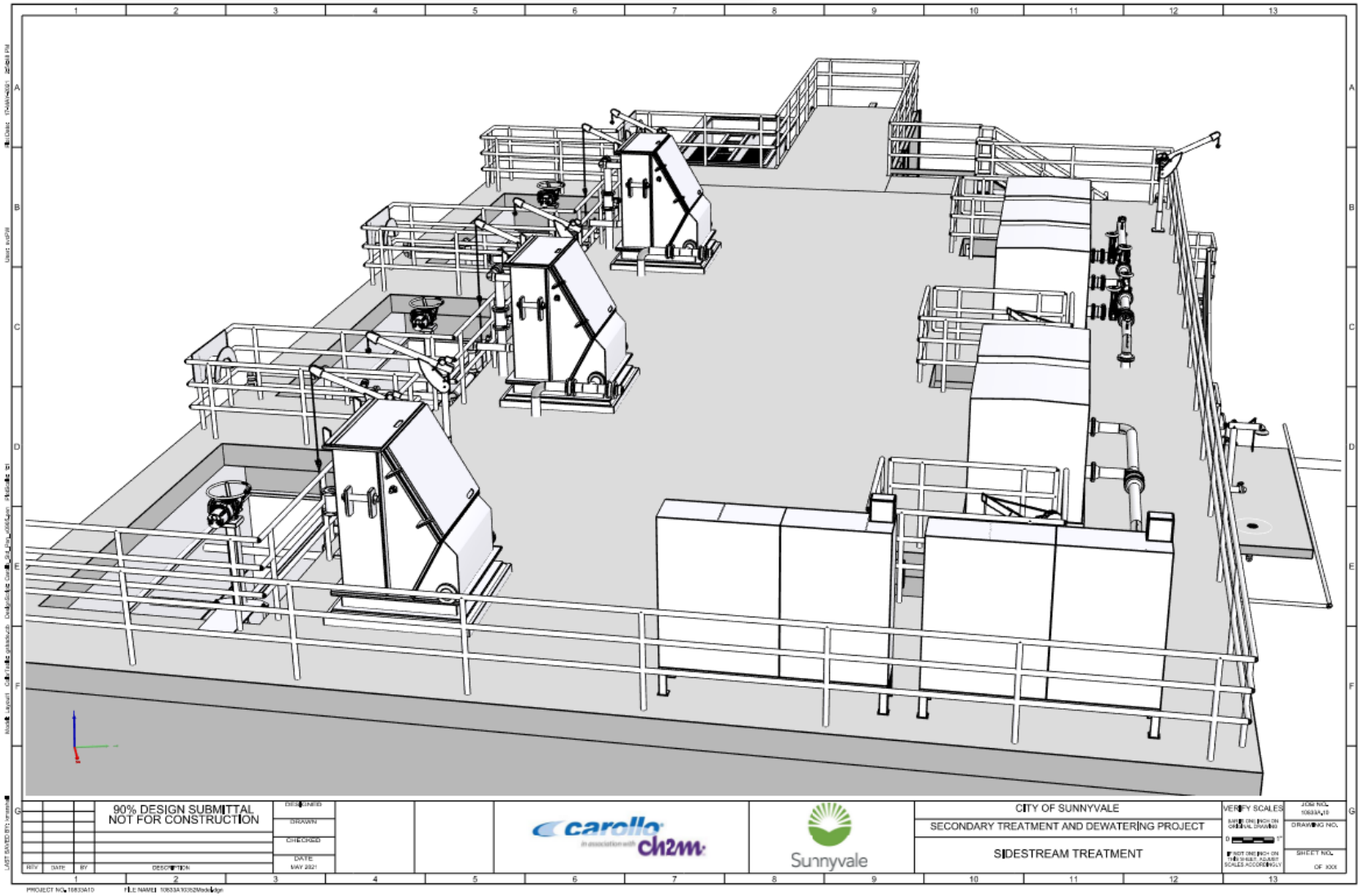
DEMON Rendering– overall facility

- Full build-out shown
- 3 bioreactors
- Equipment for 2 bioreactors as part of this project



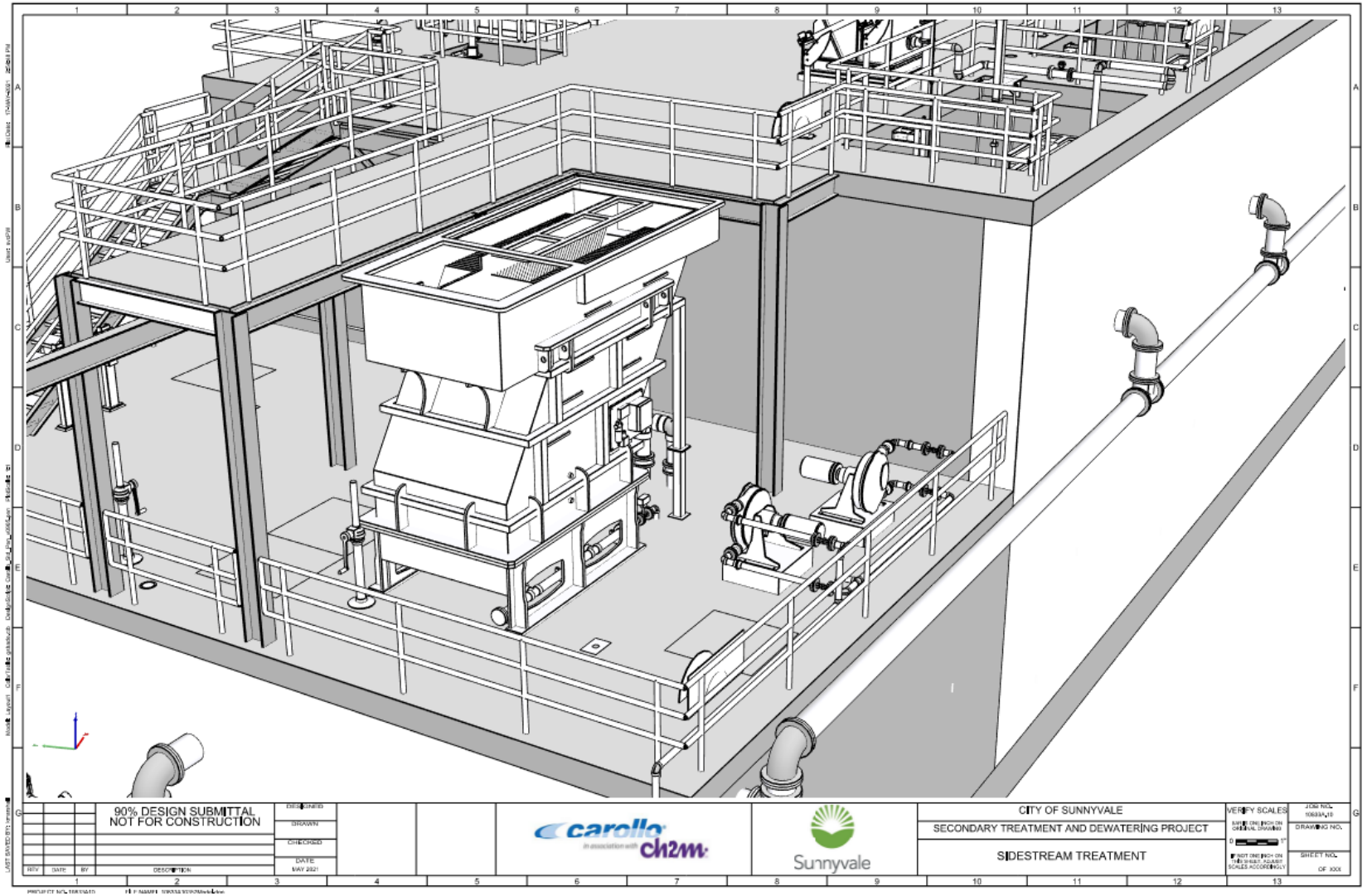
DEMON rendering – upper deck

- Blowers
- Microscreens
- Control panels
- Access for submersible pumps, mixers
- Actuated telescoping valve



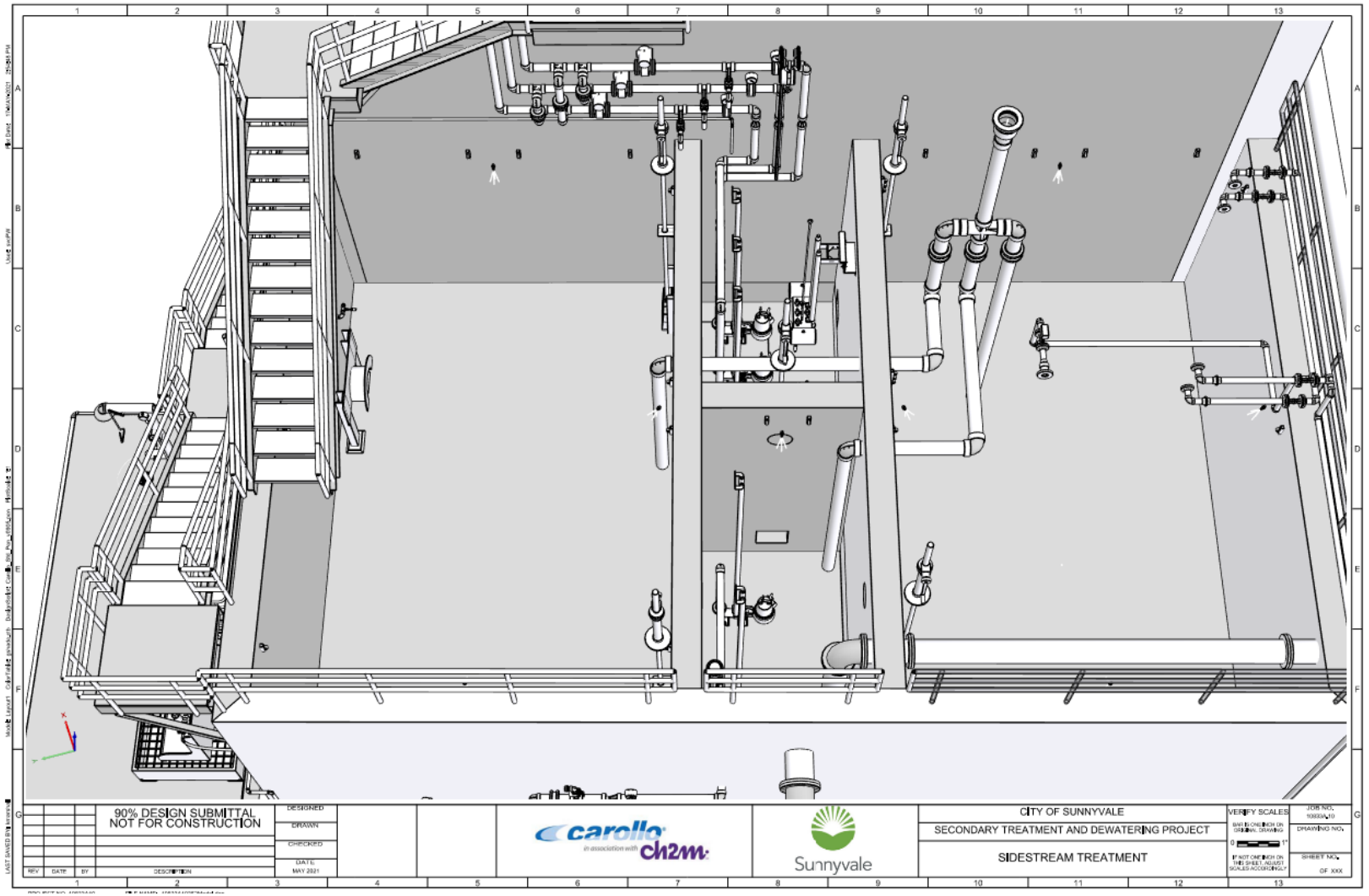
DEMON rendering – lower deck

- Lamella Clarifier
- Hose pumps for clarifier sludge
- Access to influent, effluent wetwells, control gates



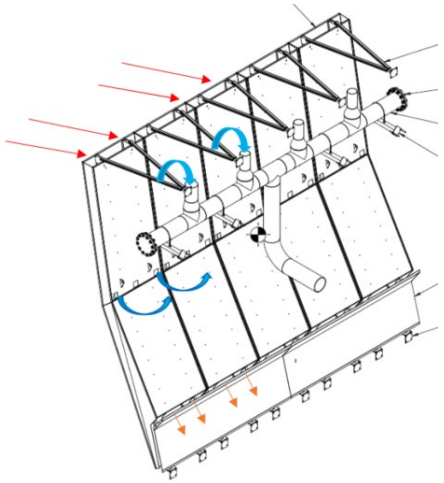
DEMON rendering – EQ tanks, influent % effluent wetwells

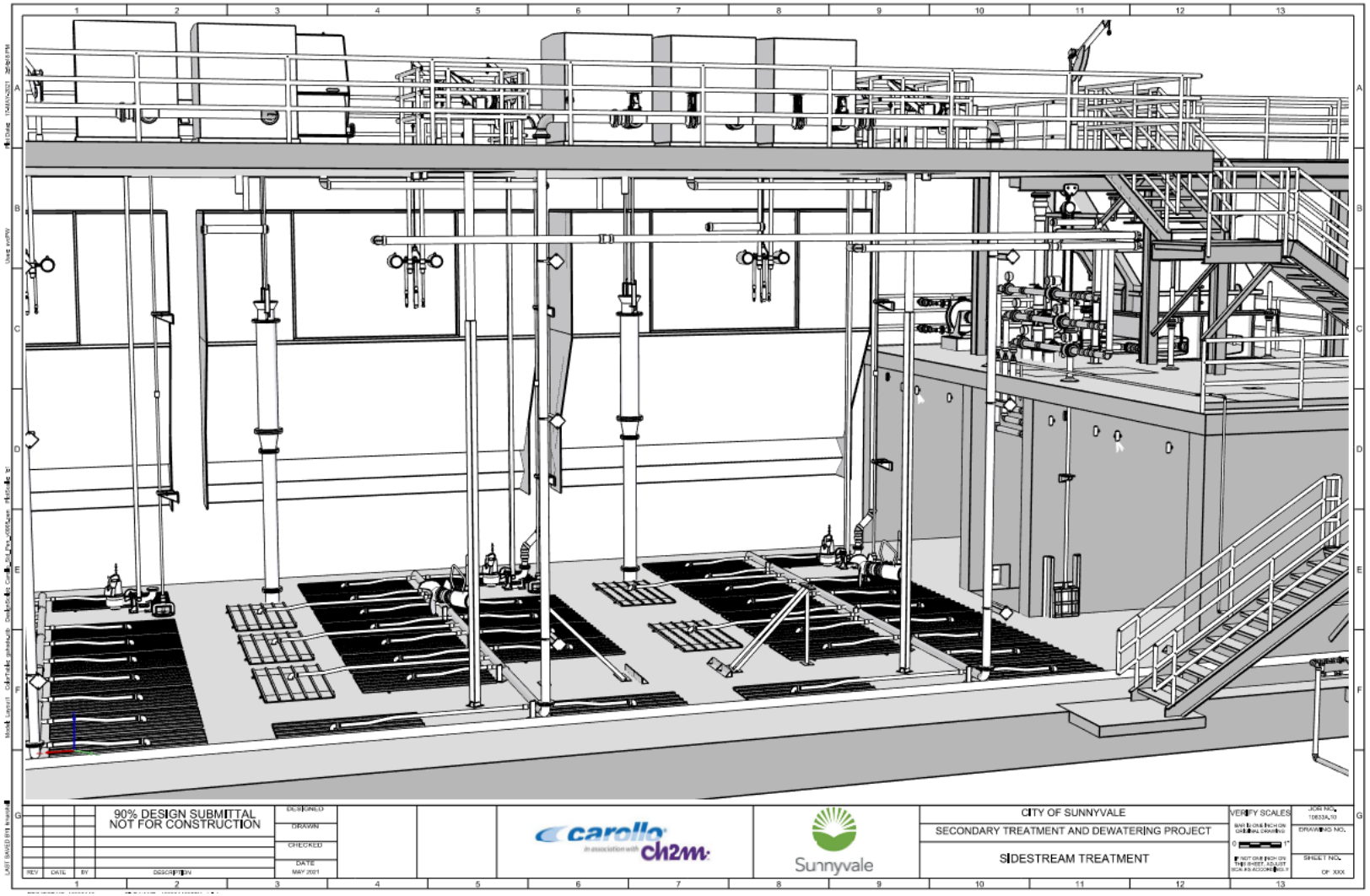
- Influent wetwell and pumping
- Effluent wetwell and pumping
- Internal spraydown
- Flush everything through effluent wetwell
- Overflow and bypass
- Two EQ tanks



DEMON rendering – bioreactor interior

- Telescoping valves
- Panel diffusers
- Submersible pumps and mixers
- Instrument floats
- Internal clarifier (the design of which has since been improved)





Deammonification sidestream treatment - Summary

- Works best treating warm, ammonia-rich centrate from dewatered anaerobically digested sludge
- 60'x80' facility treat up to 2,840 lbs/day of nitrogen
- Improves overall plant nitrogen removal performance
- Sunnyvale WPCP can meet < 15 mgN/L while:
  - Phased expansion and split flow operation
  - Receive 30,000 gpd of foodwaste for codigestion
  - Dewatering 24/5

Thank you

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Questions?

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