

From Odors to Ocean Breezes

Odor Control Improvements

Water Pollution Control Facility

City of Newburyport, Massachusetts



NEWEA Annual Conference

January 29, 2019



Agenda

- 1. Water Pollution Control Facility Background
- 2. Facility Assessment
- 3. Odor Control Improvements – Facility Operations
- 4. Odor Control Improvements – Construction
- 5. Lessons Learned
- 6. Questions

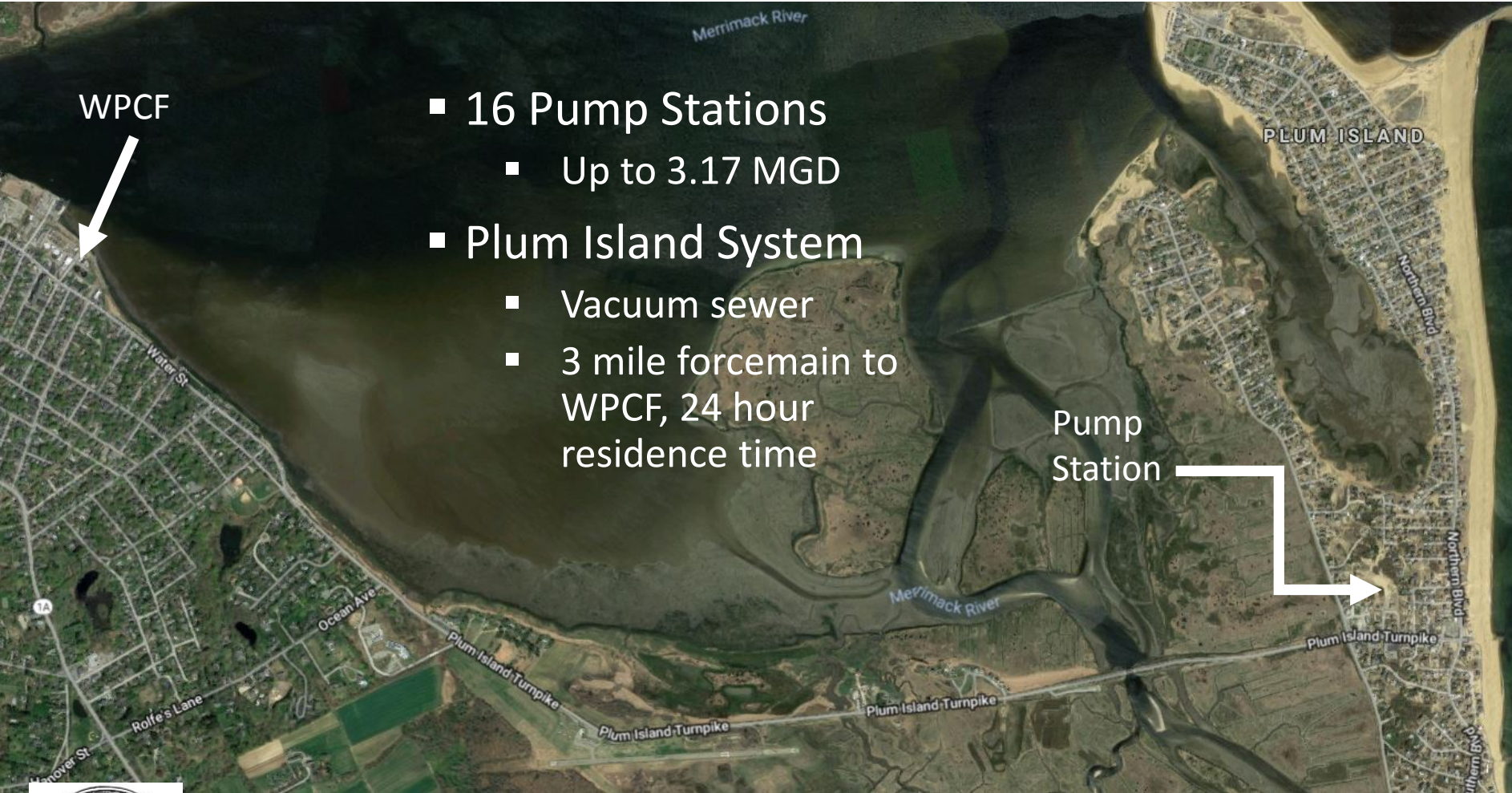


City of Newburyport Water Pollution Control Facility

- 3.4 MGD Design
- Constructed 1979
- Upgrades 2001, 2009-2010, 2017-2018
- Merrimack River outfall



City of Newburyport Collection System



WPCF

- 16 Pump Stations
 - Up to 3.17 MGD
- Plum Island System
 - Vacuum sewer
 - 3 mile forcemain to WPCF, 24 hour residence time

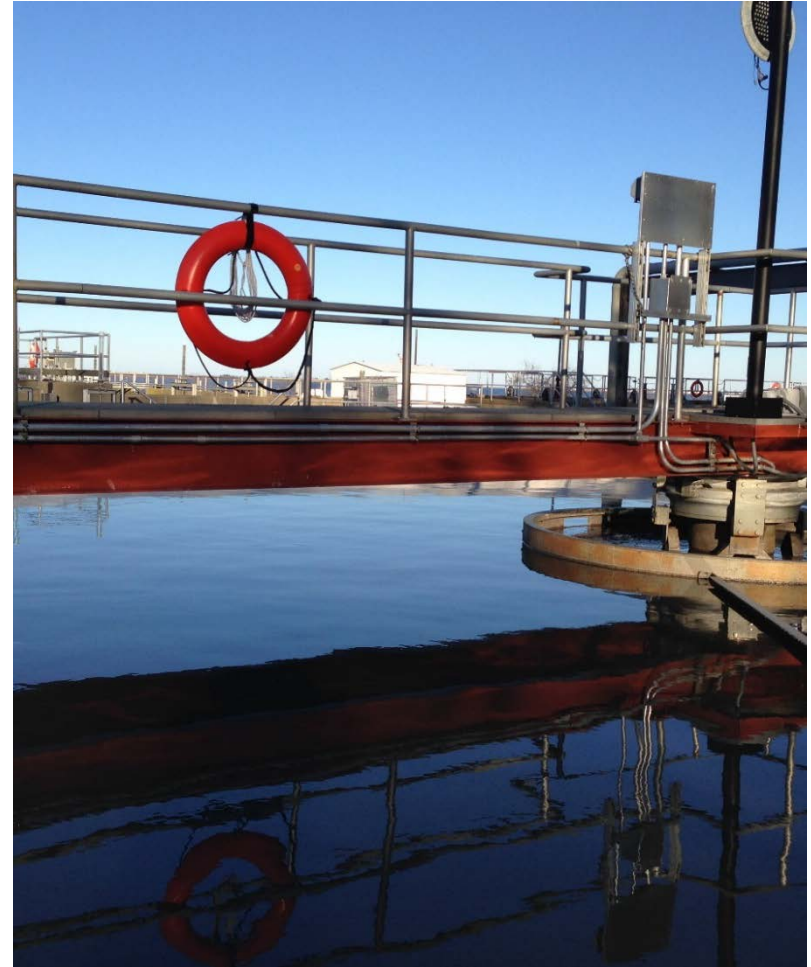
Pump
Station



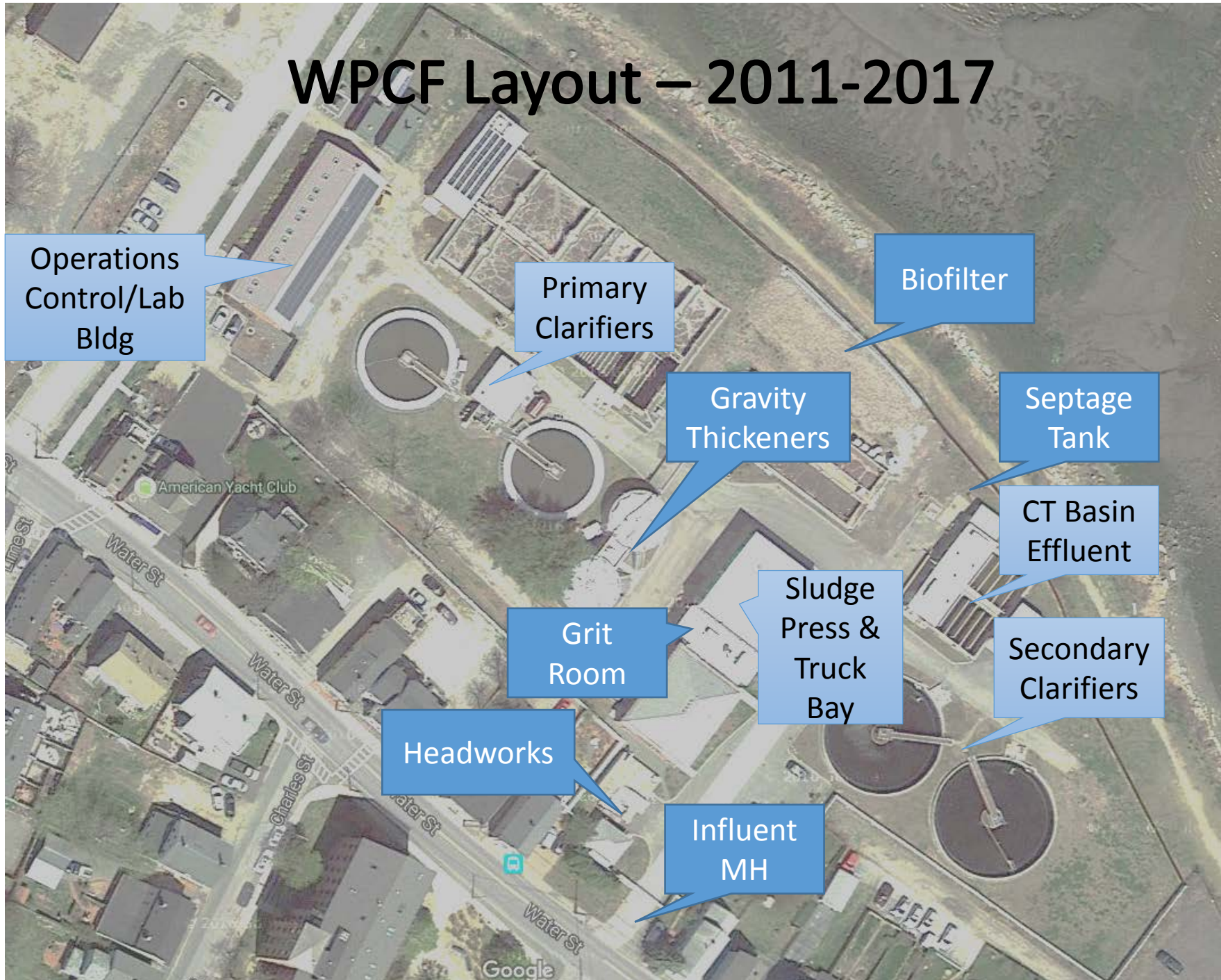
Odor Control Improvements

WPCF Assessment – 2014-2015

- Odor control had become most significant operational issue for the facility.
- Objectives:
 - Assess odor control performance of existing unit processes
 - Develop recommendations for capital and operational improvements for odor control and operator safety



WPCF Layout – 2011-2017



Operations
Control/Lab
Bldg

Primary
Clarifiers

Biofilter

Gravity
Thickeners

Septage
Tank

CT Basin
Effluent

Secondary
Clarifiers

Sludge
Press &
Truck
Bay

Grit
Room

Headworks

Influent
MH

American Yacht Club

Google

Odor Control Improvements

WPCF Unit Process Assessment

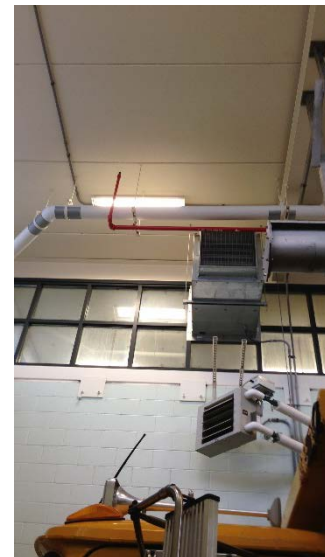
- Headworks
 - Excessive H₂S levels
 - Plum Island FM Contribution
 - Inadequate Ventilation
 - Proximity to Neighbors
 - Corrosion
- Primary Clarifiers
 - Launder covers only
 - Limited odor control exhaust to biofilter



Odor Control Improvements

WPCF Unit Process Assessment

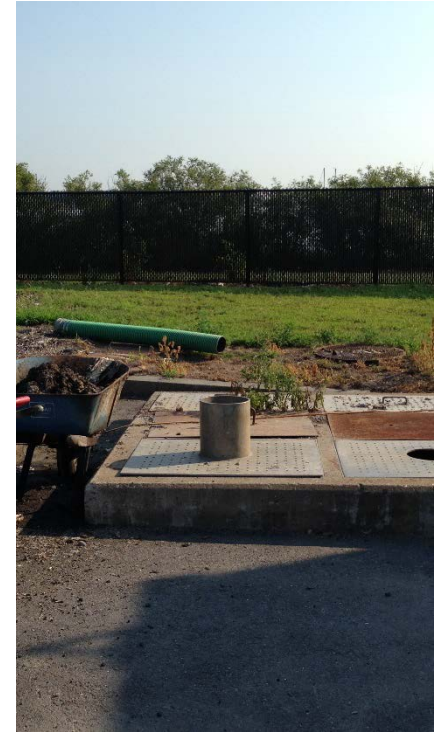
- Solids Processing
 - Grit Room
 - Very odorous location
 - Inadequate ventilation
 - Press Room and Truck Bay
 - Very odorous location
 - Shared ventilation supply and exhaust
 - Short-circuiting ventilation in Press Room
 - Sludge press odor control duct prone to clogging
 - Inadequate ventilation to biofilter



Odor Control Improvements

WPCF Unit Process Assessment

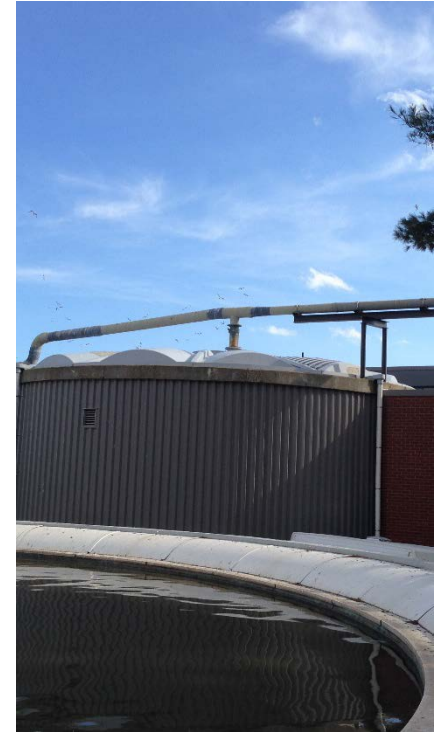
- Septage
 - Two to four deliveries per day
 - Acute intense odor issues
 - No odor control
- Biofilter
 - 10,000 scfm design capacity, woodchips
 - No available capacity for additional unit processes
 - Existing blower performance inadequate to provide necessary air exchanges in operations spaces



Odor Control Improvements

WPCF – Wastewater Analysis

- Consulted with wastewater odor control expert, Bowker Associates
- Sulfide Analysis
 - Typical raw wastewater much lower levels (0.1-0.2 mg/L)
 - Plum Island FM responsible for high intermittent H_2S loadings (5-8 mg/L of Sulfide)
 - Increased sulfide levels across the primary clarifiers 0.1-0.9 mg/L



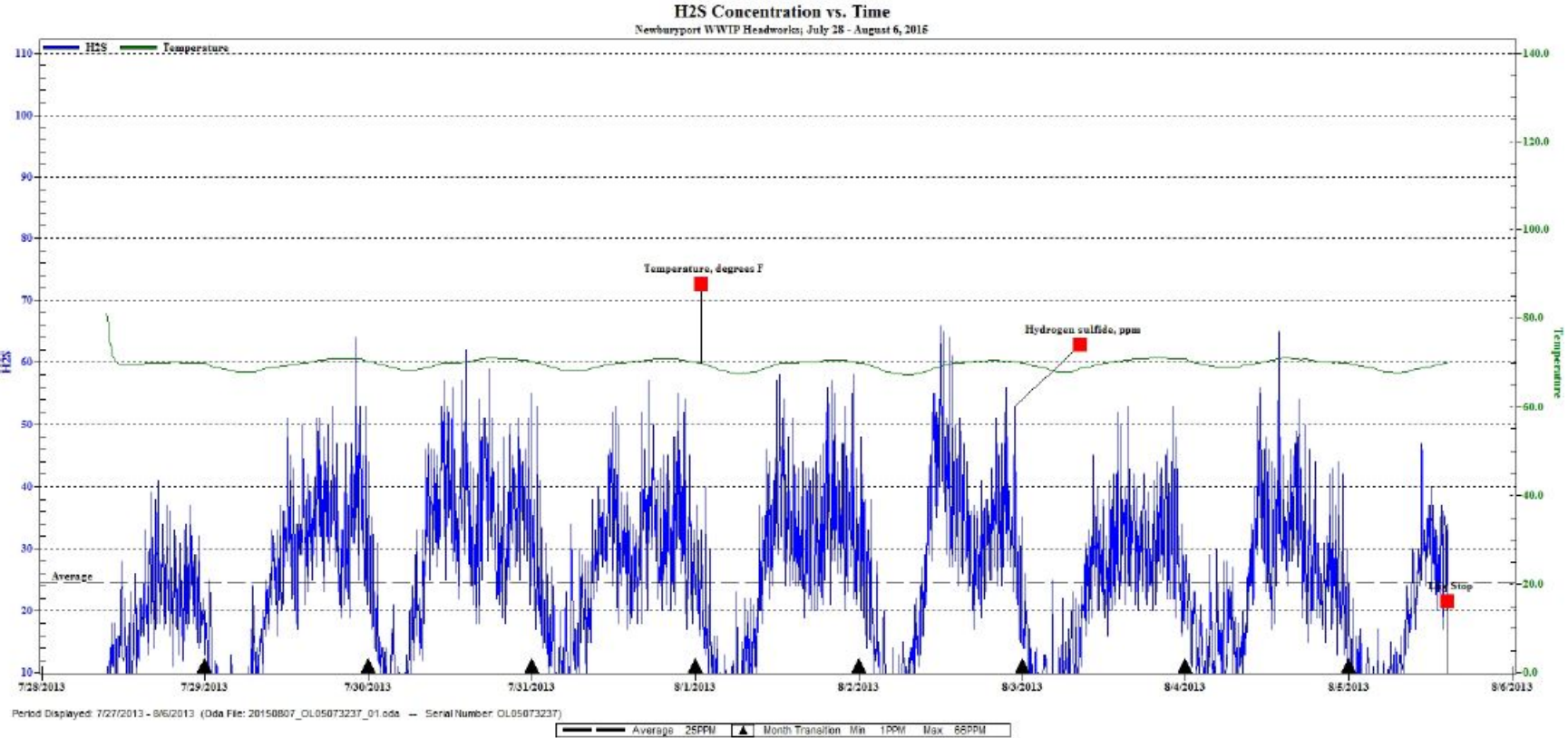
Odor Control Improvements

WPCF – Wastewater Analysis

- Air Analysis
 - Headworks: Inadequate ventilation and operator safety, H₂S levels average 25 ppm without biofilter blower online.
 - Primary Clarifiers: Long detention time, H₂S levels as high as 15 ppm over settling zone.
- Biofilter
 - Operating at half its design air flow rate
 - Poor ventilation of controlled spaces
 - Air flow through biofilter not uniform

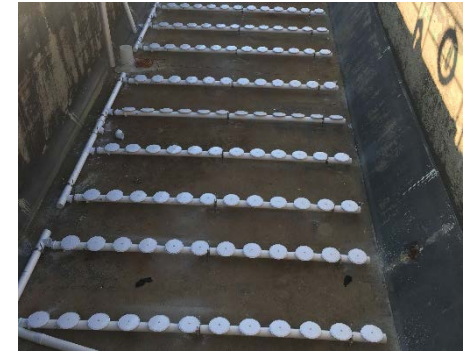
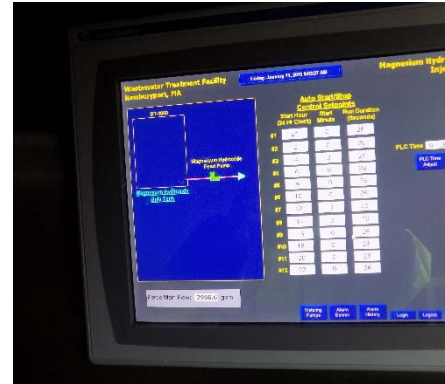


WPCF – H2S Monitoring - Headworks



WPCF Odor Control Improvements Operations

- Plum Island Forcemain
- Influent/Headworks
- Primary Clarifiers
- Gravity Thickeners
- Aeration Basins
- Return Activated Sludge
- Aerobic Digesters



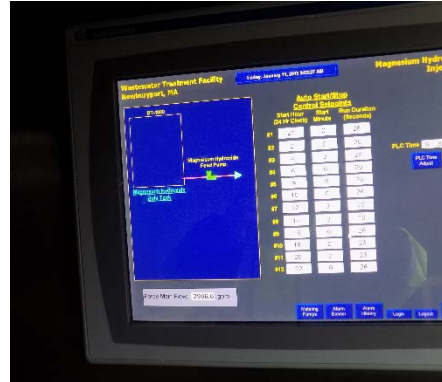
WPCF Odor Control Improvements Plum Island Forcemain

- 3-mile forcemain
- 60,000-80,000 GPD (off-peak)
- 80,000-120,000 GPD (peak)
- Calcium Nitrate feed system
- \$44,000 installed
- 40-50 GPD (off-peak)
- 60-70 GPD (peak)
- Vapor-Link H₂S Monitoring
- Testing for Aqueous H₂S and Nitrate at headworks manhole

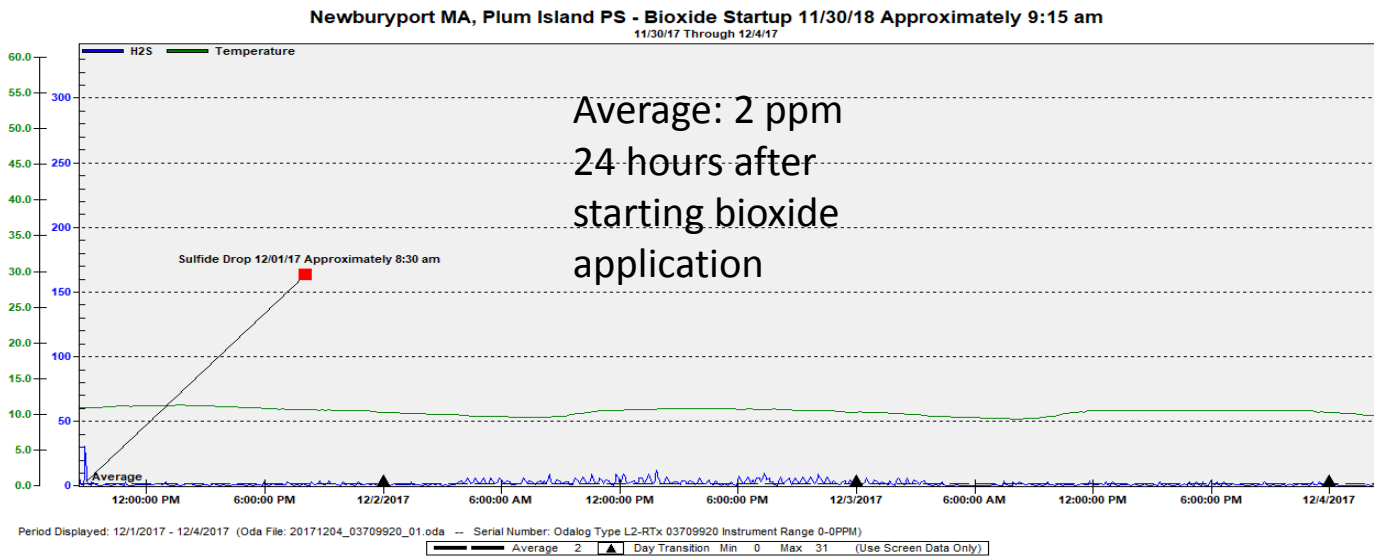
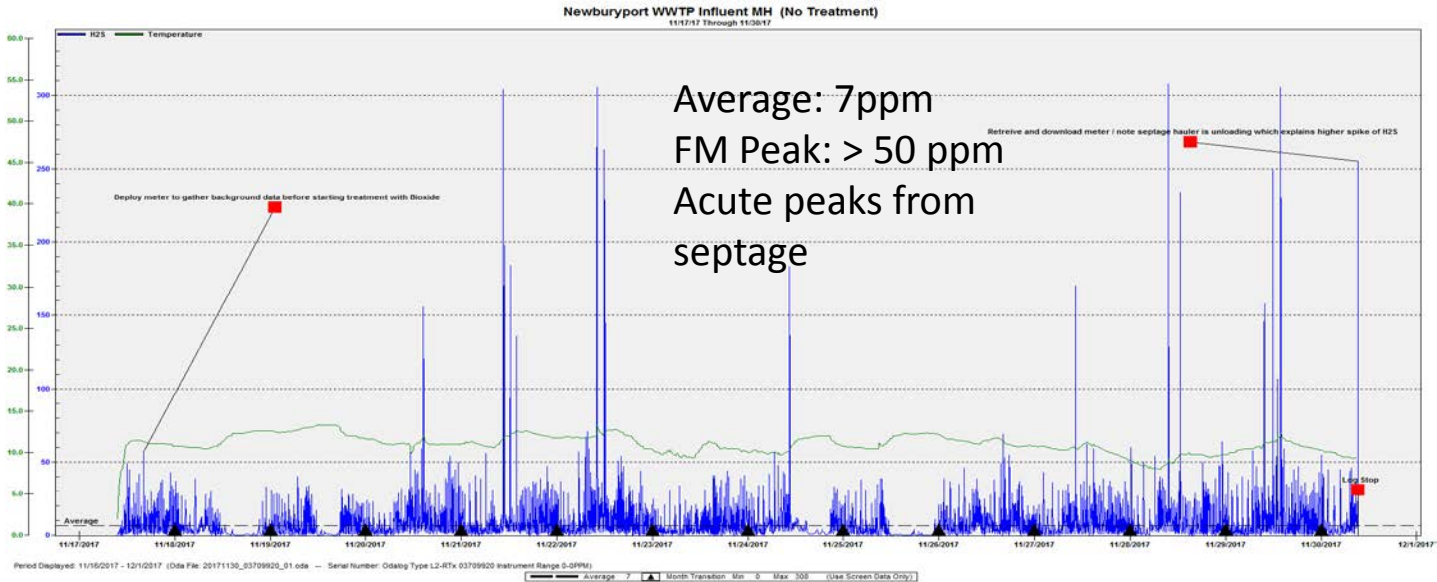


WPCF Odor Control Improvements Influent/Headworks

- Repair Chlorine Feed Line
- Magnesium Hydroxide System
 - pH and Alkalinity adjustment – improved throughout plant
 - Reduce in-plant H₂S and Organic Acid production



WPCF Odor Control Improvements Influent/Headworks



WPCF Odor Control Improvements

Primary Clarifiers

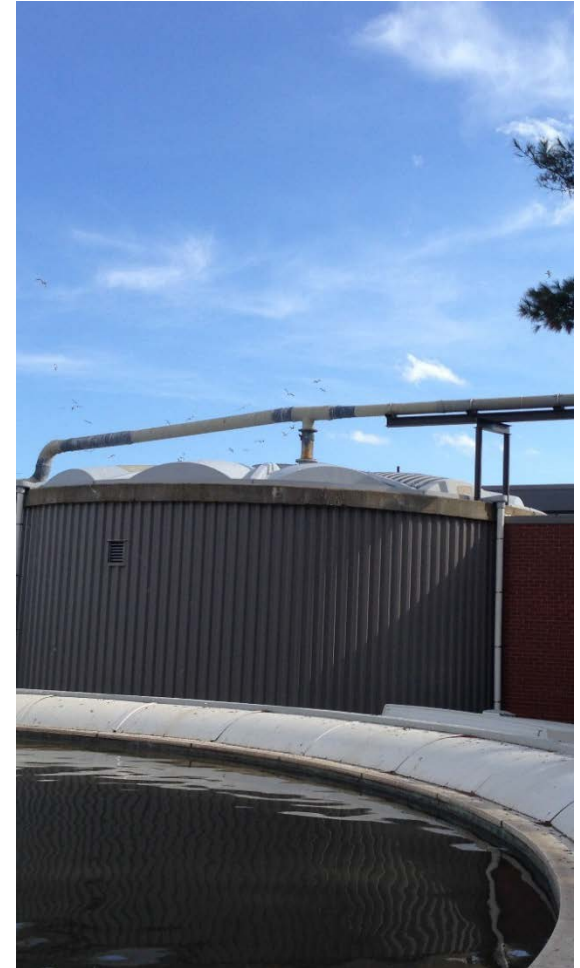
- Operate on single clarifier
 - Lower Detention Time and in-clarifier H₂S production
- Increase sludge withdrawal rate
- Altered timing schedule to provide constant sludge withdrawal



WPCF Odor Control Improvements

Gravity Thickeners

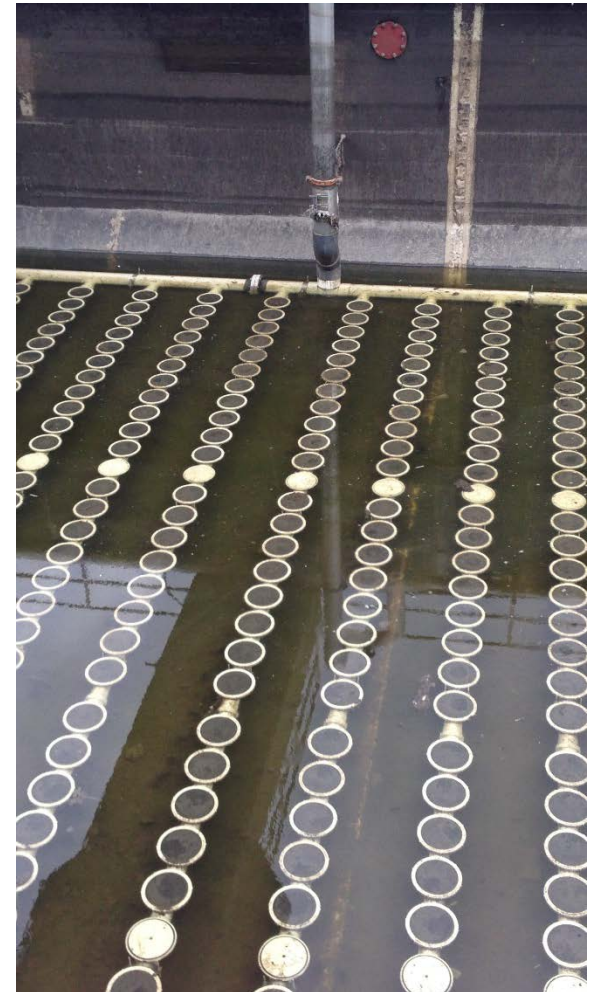
- Constant Feed Rate from Primary Clarifiers
- Decreased Detention Time
- Improved Dewatering
- Typical Design Hydraulic Loading Rate: 400-800 GPD/SF
 - Former Loading Rate: 265 GPD/SF, only pumping 4 hrs/day
 - Current Loading Rate: 450-500 GPD/SF, continuous pumping
- Chlorine Dosage: 50 GPD
- Purging Sludge Line from Primaries after Pumping Scum Pits
 - Reduce grease build-up



WPCF Odor Control Improvements

Aeration and RAS

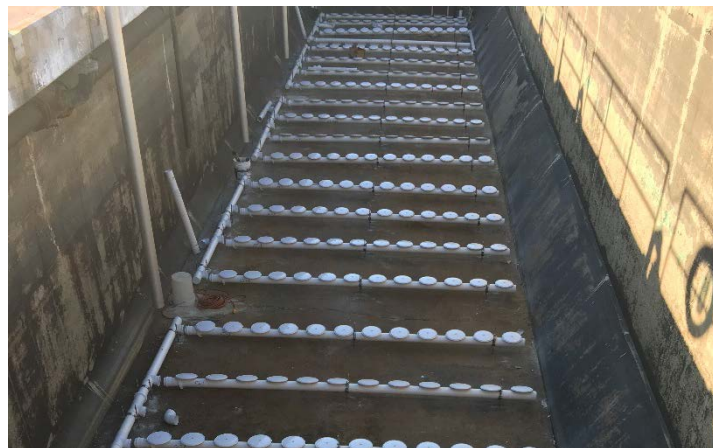
- Aeration
- Increase Dissolved Oxygen Set-Point
 - 2.5 to 4.5-5.0
- Added Third Basin for Improved:
 - F/M
 - H₂S Control
 - Filamentous Control
 - BOD Removal
- RAS
- Increased Minimum Flow rate Set-Point
 - Reduced denitfication and rising sludge



WPCF Odor Control Improvements

Aerobic Digester

- Diffuser Conversion – Coarse to Fine Bubble
 - Improved Dissolved Oxygen: 0.3 ppm to 6.0-8.0 ppm
 - Decreased air consumption by 20%
- Daily dosing of Magnesium Hydroxide
- Periodic dosing of Sodium Hypochlorite
 - Based on microscopic evaluation 2x/week
 - Filamentous control



Recommendations for Odor Control Improvements - 2016

- Chemical Feed Modifications
 - Headworks Chemical Feed System - Winterize storage shed and new chemical feed pumps and appurtenances
 - Sodium Hypochlorite – new chemical feed systems to septage, gravity thickeners, RAS, and influent manhole
- Replace Biofilter and Increase Ventilation Capacity
 - 20,000 scfm (2x existing)
- Increase ventilation rates of process areas for operator safety, comfort, and odor control
 - Headworks, Wet Well and Grit Room
 - Press Room and Truck Bay
 - Gravity Thickeners
- Increase level of odor control
 - Cover primary clarifiers
 - Provide ventilation from septage holding tank



Proposed Odor Control and Ventilation

Newburyport
 Odor Control and Ventilation System Schematic – Worst Case Design
 September 12, 2016

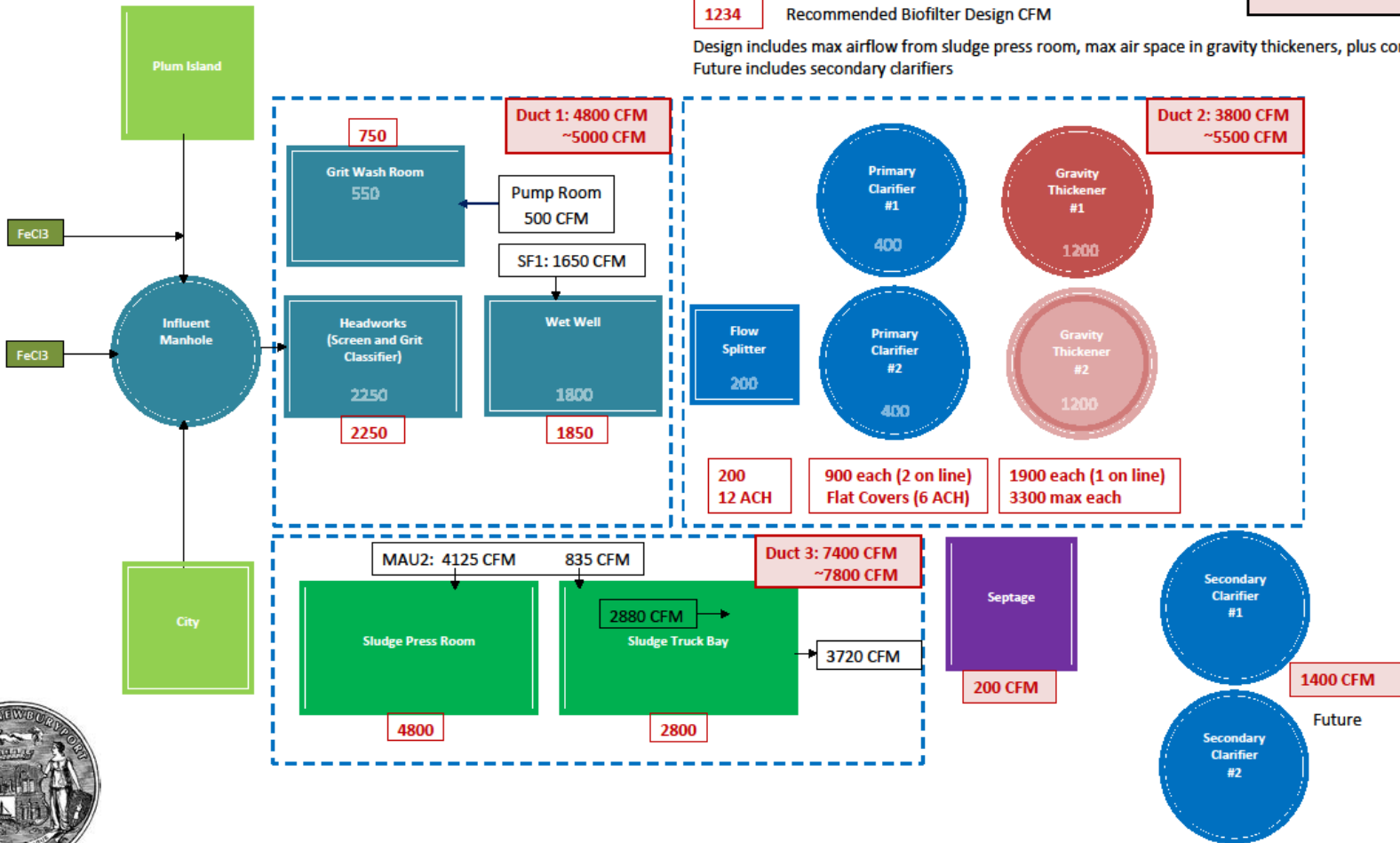


Environmental Partners
 A partnership for engineering solutions. CIOEUP

1234	Existing Biofilter Design CFM
1234	Existing Ventilation CFM
1234	Recommended Biofilter Design CFM

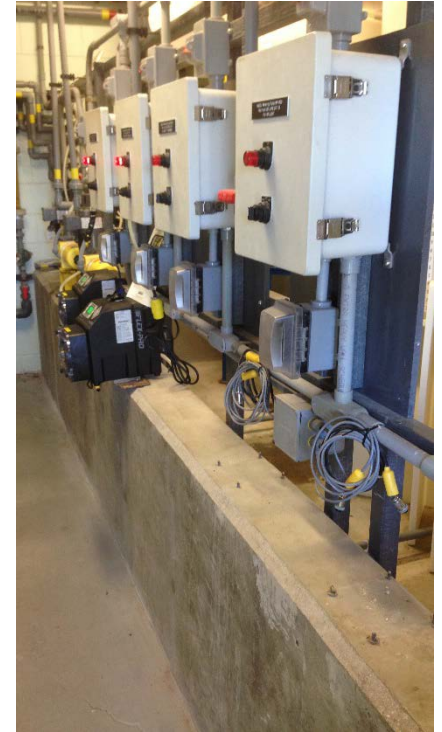
Base ~ 16,000 CFM
Design ~ 18,500 CFM
Future ~ 20,000 CFM

Design includes max airflow from sludge press room, max air space in gravity thickeners, plus contingency
 Future includes secondary clarifiers



Odor Control Improvements - Construction

- Contract 1 – Chemical Feed Improvements
 - Ferric and Hypochlorite Feed Systems
 - Winterize headworks chemical storage shed
 - August 2016 to December 2016
 - Methuen Construction
 - \$267,768



Odor Control Improvements - Construction

- Contract 2 – Odor Control Improvements
 - Pre-Purchase of critical equipment
 - Flat Aluminum Clarifier Covers – Ultraflote - \$237,525
 - Biofilter Odor Control System – Biorem - \$529,000
 - Temporary odor control throughout construction
 - Selective demolition
 - Ventilation improvements
 - New odor control blower building and biofilters
 - Septage receiving station
 - Plum Island Bioxide system
 - Construction June 2017 – March 2018
 - \$4.3M
 - Methuen Construction



Contract 2 – Odor Control Improvements



Contract 2 – Odor Control Improvements

- Primary Clarifiers
 - Flat aluminum covers
 - Trusses oriented parallel with sight-lines from neighboring residences
 - New stainless steel and PVC odor control ductwork
 - Scum pit covers
 - Corrosion coating system repairs
 - Removable stop logs in effluent channel
 - Smoke testing and vacuum test



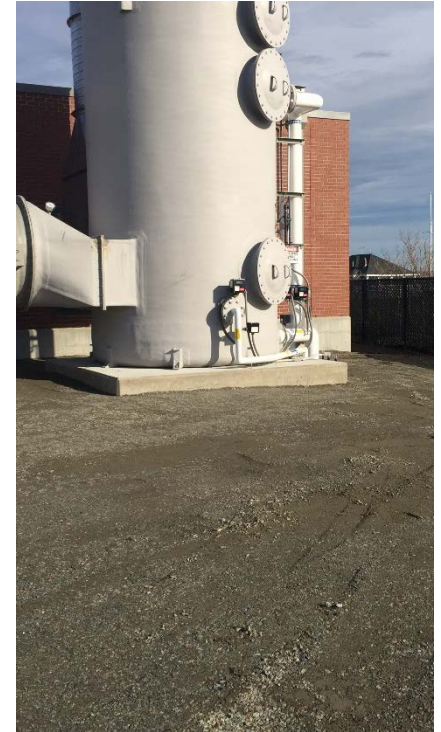
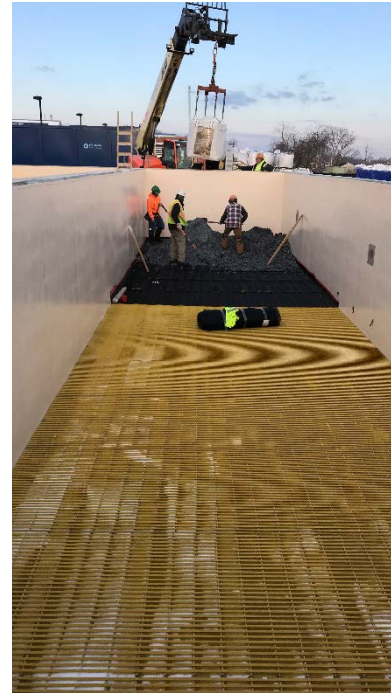
Contract 2 – Odor Control Improvements

- Ventilation Improvements
 - Headworks Makeup Air Unit/Heater
 - Headworks/Wet Well Booster Fan
 - Grit Room Booster Fan
 - Dedicated Truck Bay Makeup Air Unit/Heater
 - Dedicated Press Room Supply and Exhaust Ductwork and Ceiling Fans
 - Increased odor control ductwork and actuated dampers for GTs
 - Septage odor control ductwork



Contract 2 – Odor Control Improvements

- Biofilter System
 - Duty/Stand-by 20,000 scfm blowers
 - Humidifier and biofilter irrigation system
 - Two biofilter basins
 - Engineered biofilter media, 10 year warranty
- Performance Test
 - Air Balancing of Odor Control System
 - H₂S Monitoring of system influent and biofilter effluent



Lessons Learned

- Coordination with Facility Staff
 - Identify areas for improvement and utilize institutional knowledge
 - Design for operations and maintenance
 - Unit process transitions
- Communications
 - Bi-weekly project meetings and routine public project updates
 - Change Mgmt – Hurricane Harvey



Lessons Learned

- Construction Impacts
 - Temporary Odor Control
 - Odor control monitoring and redundancy
 - Only 3 odor complaints over 10 months of construction
 - No complaints post-commissioning
- Process Monitoring
 - On-going H₂S monitoring
 - Ventilation System Balancing
 - Biofilter media sampling and analysis



ODOR HOTLINE / E-MAIL: During Business hours (7:00 a.m. to 3:00 p.m. Monday - Friday) call (978) 465-4461 and choose **General Mailbox**.

Please leave a message if the line is not staffed. After hours and weekends, e-mail odor@cityofnewburyport.com a dedicated e-mail for residents to report odor issues to Waste Water Treatment Facility staff. All reports of odors are tracked and investigated by Waste Water Treatment Facility staff.



Acknowledgements

- City of Newburyport
 - Mayor Donna Holaday
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Questions

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