



June 27, 2019

BWARI Biofilter Rehabilitation Converting a Liability into an Asset

BUILDING A WORLD OF DIFFERENCE®

THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES



BLACK & VEATCH

Agenda



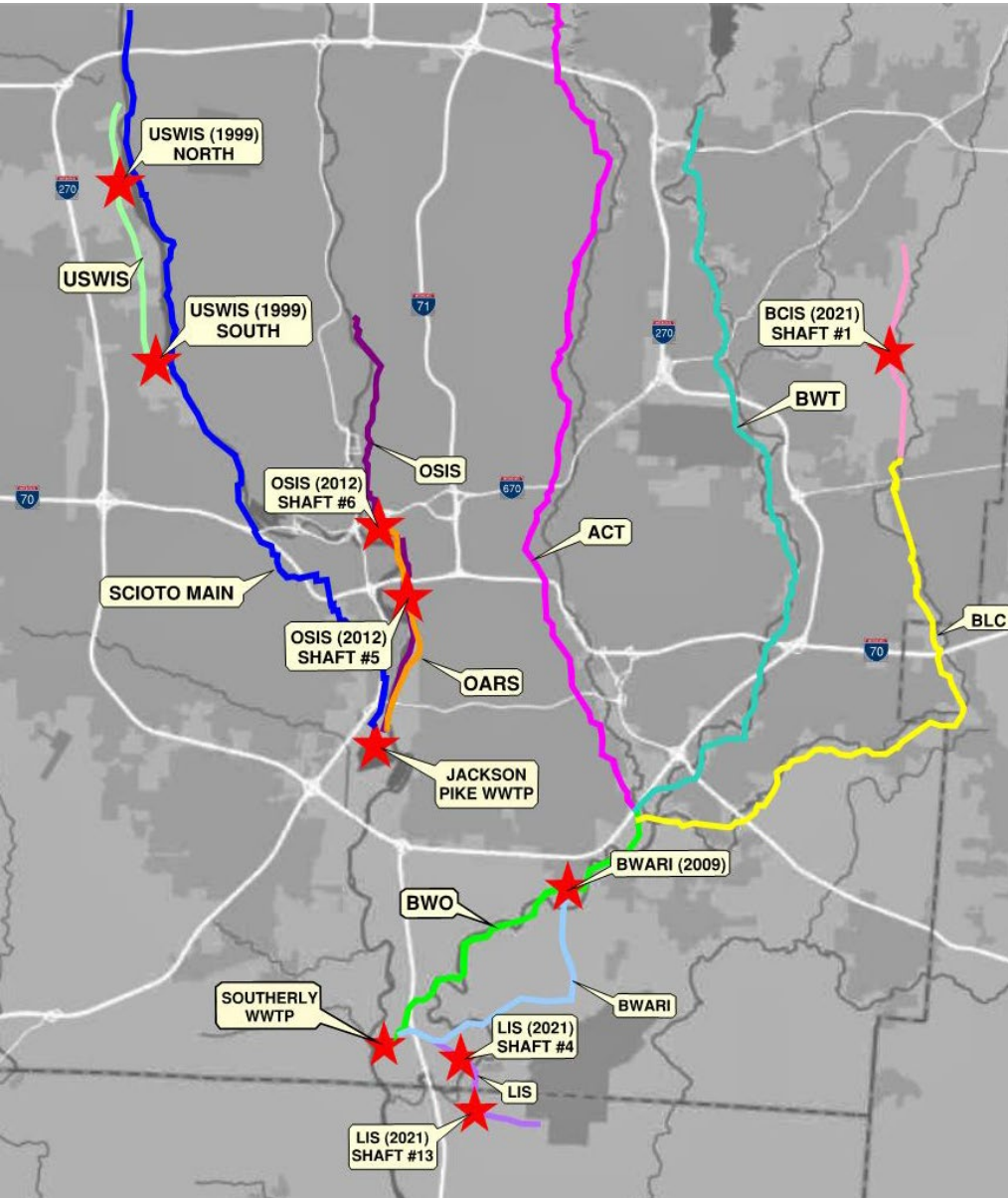
- **City of Columbus Collection System Odor Control Facilities**
- **BWARI Biofilter Background**
- **Condition Assessment**
- **Ventilation Evaluation**
- **Biofilter Rehabilitation Design**
- **Construction & Start Up**

City of Columbus Odor Control Facilities

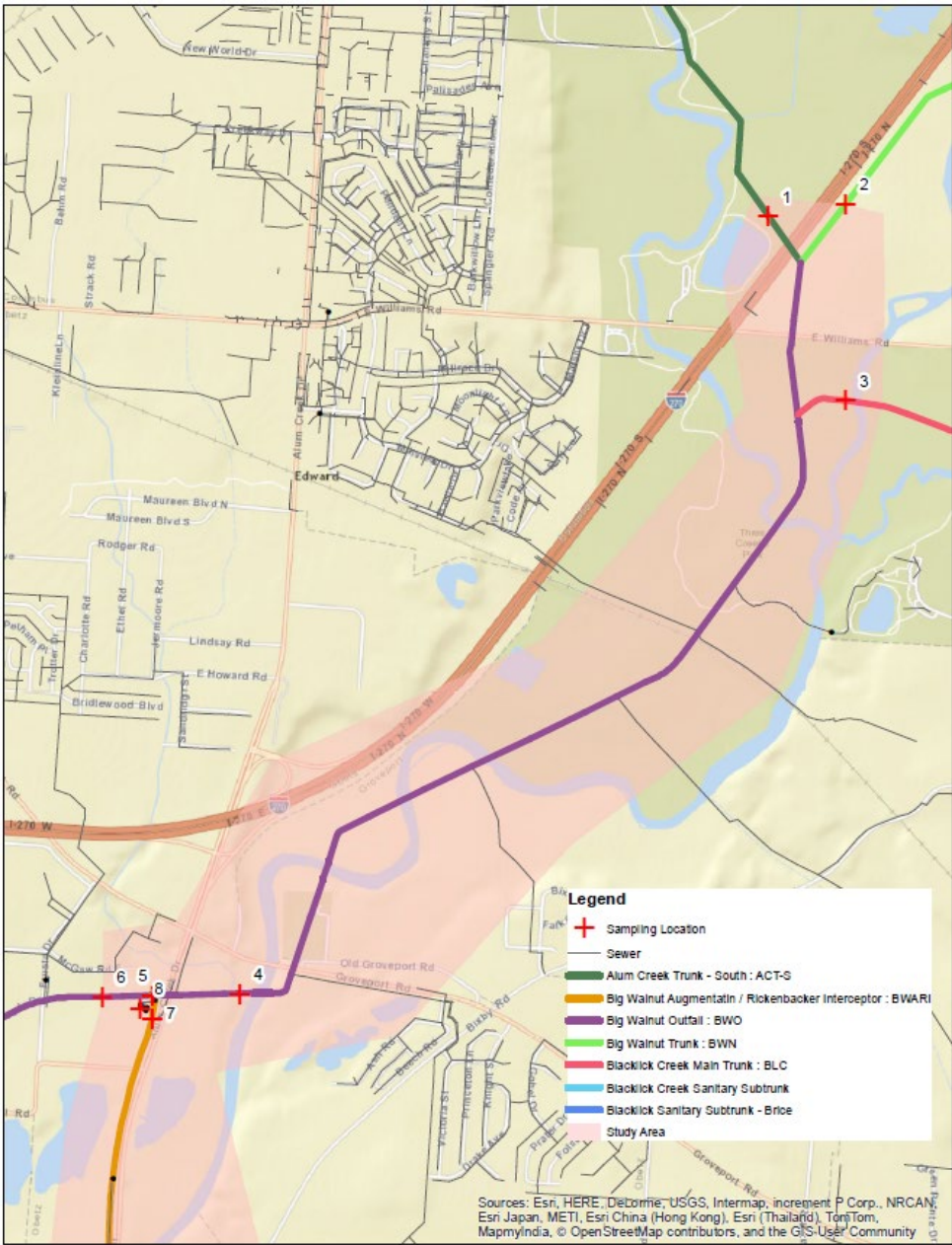
City of Columbus Odor Control Facility Locations

- Upper Scioto West Interceptor Sewer (USWIS) Biofilters
- Olentangy Scioto Interceptor Sewer (OSIS) Downtown Biofilters
- Big Walnut Augmentation and Rickenbacker Interceptor (BWARI) Biofilter
- Lockbourne Intermodal Subtrunk (LIS) Biofilters
- Blacklick Creek Interceptor Sewer (BCIS) Biofilter

The City maintains 3,300 miles of sanitary and combined sewers.



BWARI Biofilter Background

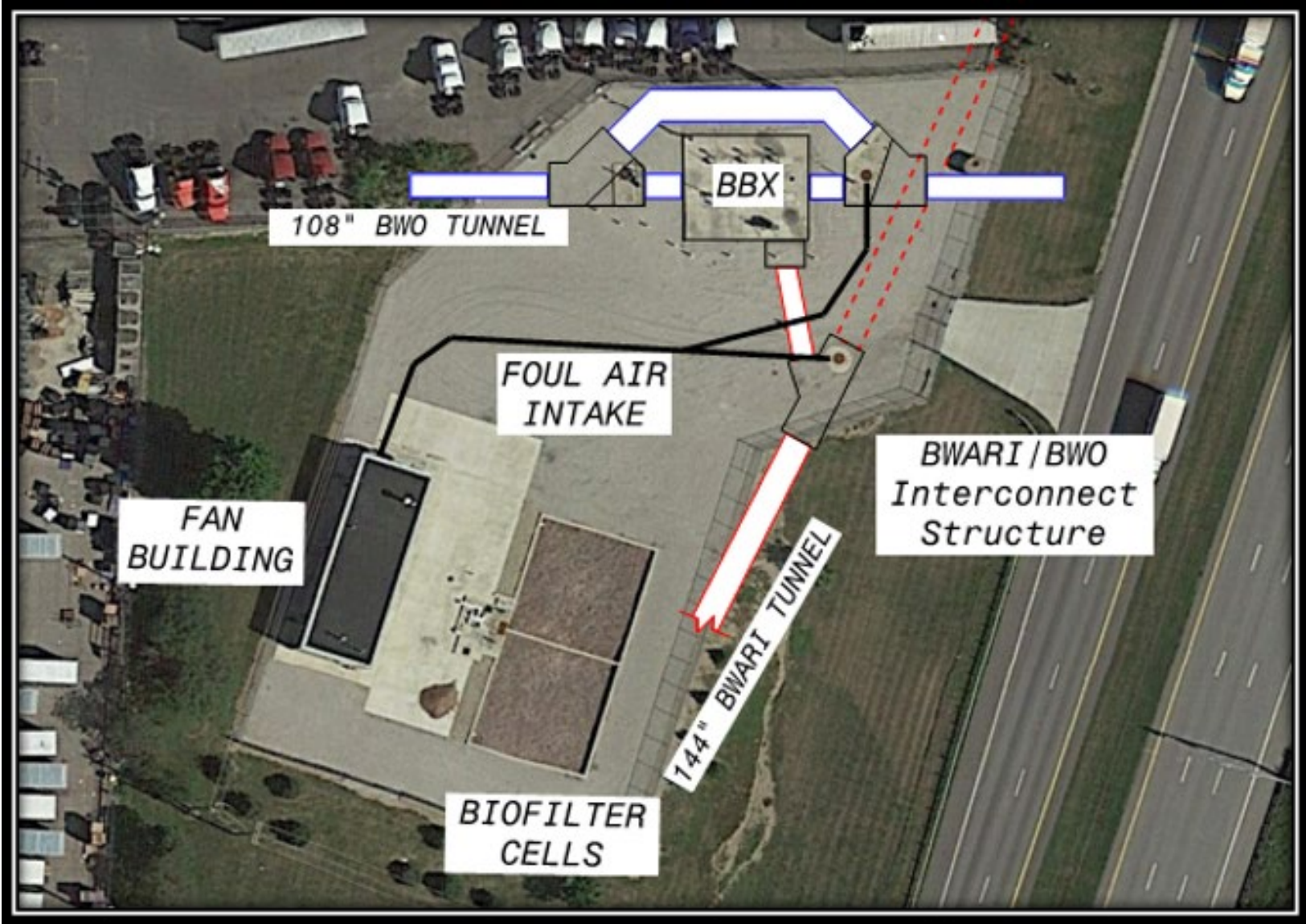


Collection System

- Big Walnut Augmentation and Rickenbacker Interceptor (144")
- Big Walnut Outfall Sewer (108")
- Big Walnut Trunk Sewer (96")
- Alum Creek Trunk Sewer (102")
- Blacklick Trunk Sewer (96")

Average flow in BWO upstream of BWARI was 70 MGD (2014).

BWARI Biofilter Site Layout

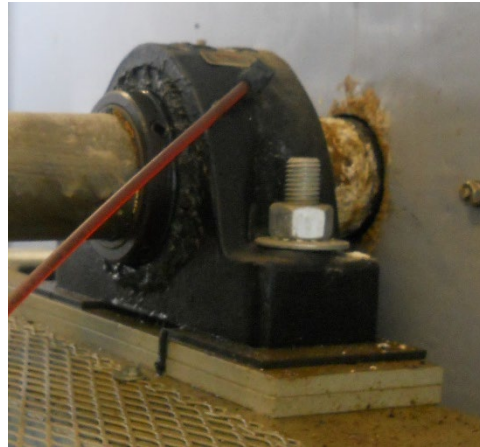




Facility History

- **Constructed in 2009**
 - 23,500 CFM
 - Numerous Start Up Issues
- **2012-2013 “Repairs”**
 - Bypassed multiple systems to get fans running
 - Irrigation/Humidification issues
 - Issues with BBX
 - Air flow reduced to 8,000 CFM due to odor complaints
- **RFP for Rehabilitation Issued in 2014**
- **AFD for Fan #1 failed mid-2015**
- **AFD for Fan #2 failed in early 2016**

Condition Assessment



Biofilter

- Ductile Iron Drain Lines
- Foul Air Duct and Pipe
- Fan Maintenance
- Biofilter Media
- Biofilter Concrete
- Scrubber

Humidification System

- Humidification System
 - NPW
 - Boiler
 - Spray Nozzles
 - Recirculation Pumps
 - Controls
- In-Bed Irrigation Failure

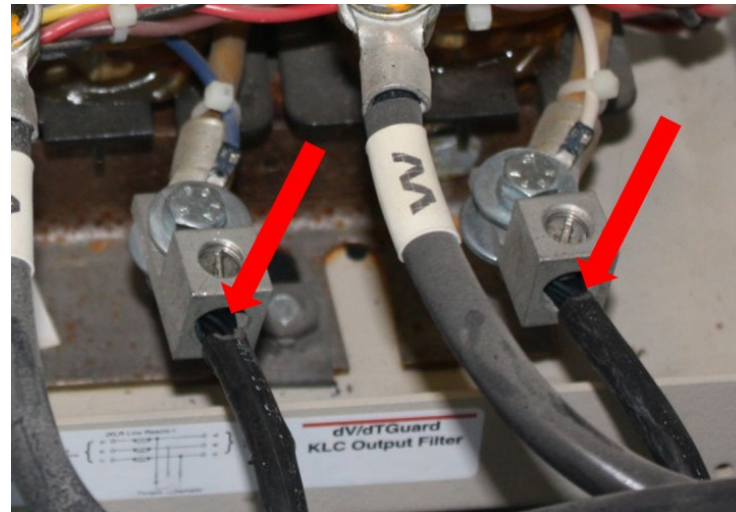
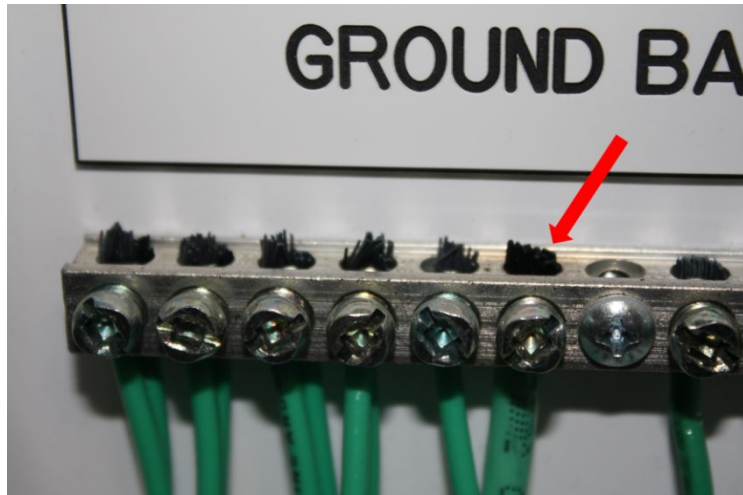


The system complexity resulted in numerous failures.



Fan Building

- MAU & Vent Fans
- Electrical Room A/C
- AFD
- Electrical Panels
- Instrumentation
- PLC





BBX

- Slide Gates & Weir Gates
- Level
- PLC & Radio
- Actuators
- RTC



Ventilation Evaluation

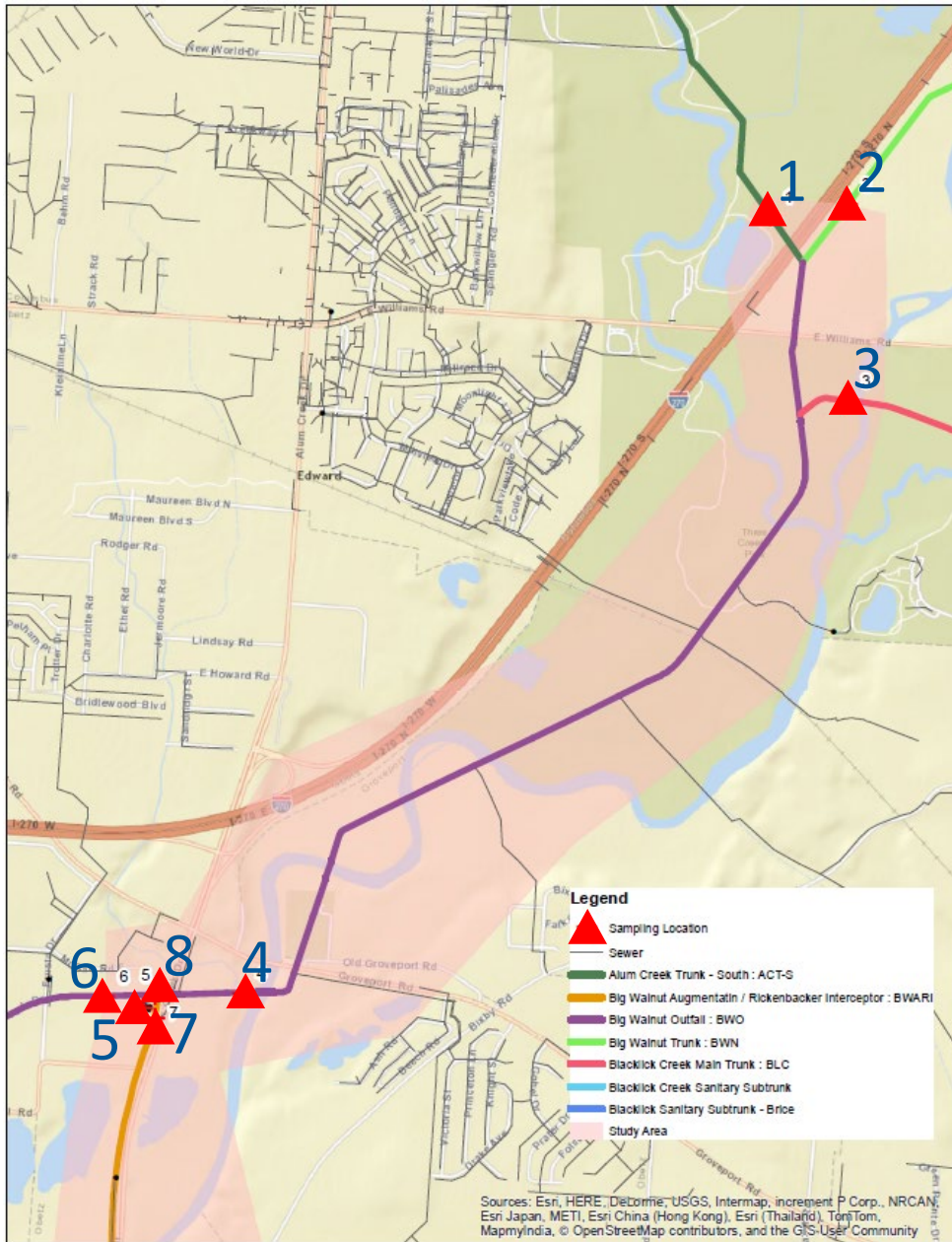
Ventilation Evaluation

- Determine Required Ventilation Rate
 - Control Odor (Negative Pressure)
 - Reduce Corrosion
 - Multiple Scenarios
- Characterize Foul Air Stream
 - Seasonal Effects
 - Loading Rates



Study Area

- Sampling
 - March 2014
 - August/September 2014



SAMPLE POINT	LOCATION	ODALOG	DIFFERENTIAL PRESSURE
1	ACT-S	X	X
2	BWN	X	X
3	BLC	X	
4	BWO	X	X
5	BBX	X	
6	BWO	X	
7	BWARI	X	X
8	Biofilter	X	

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

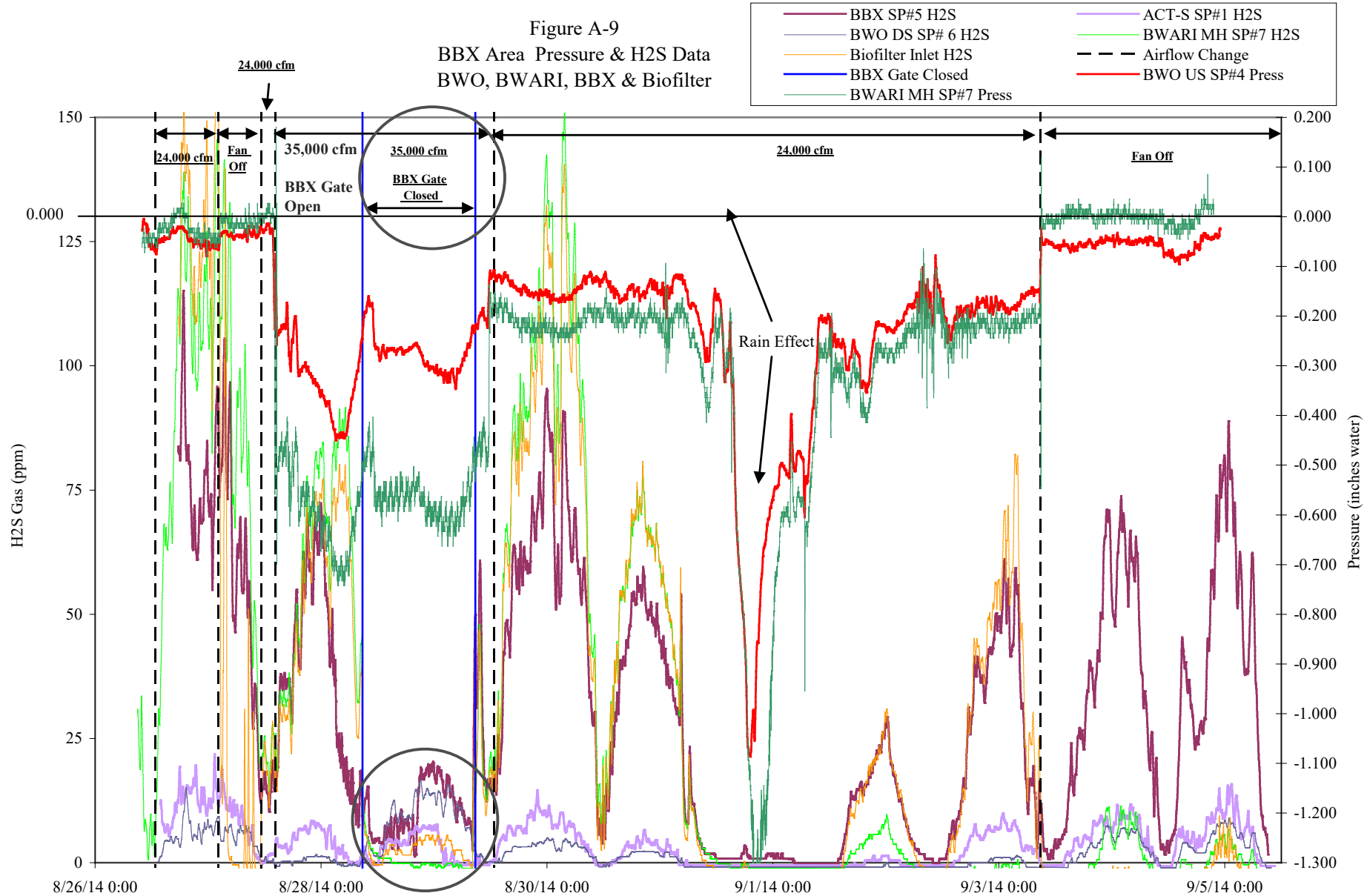
Winter Sampling Results

- **March 2014**
 - **Biofilter Inlet Only**
 - **8,000 CFM**
 - **H₂S**
 - **Average: 2 ppm**
 - **Maximum: 25 ppm**



Sampling Results

Figure A-9
BBX Area Pressure & H2S Data
BWO, BWARI, BBX & Biofilter



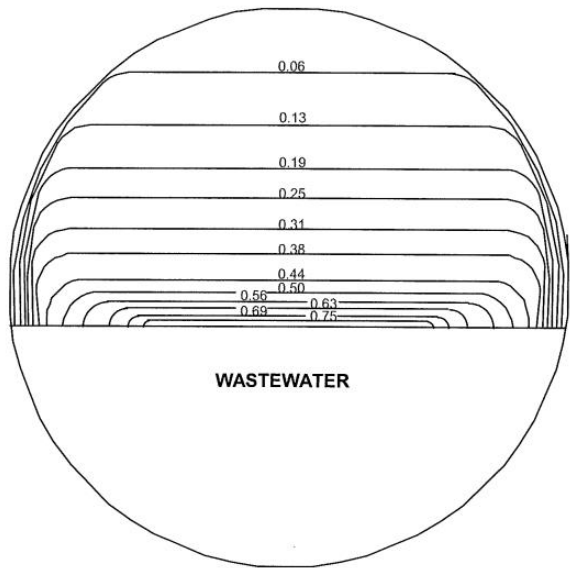


Figure 1

Idealized Air Velocity Contours in Percent of Wastewater Velocity

Ventilation & Corrosion

• Ventilation Modelling

- Average Dry Weather Flow from SWMM Model
- Pescod & Price Method
- $ACT + BLC + BWT > BWO =$ Pressurization
- Field Work Confirmed Modelling Results

• Corrosion

- City Rehabilitating BWO, ACT and BWT
- Historic Corrosion in BWO: 23 yrs for 1 inch
- Model Predicts 25 yrs for BWO at 10 ppm H_2S
- Trunk Sewer Life Extended Significantly
 - Lower H_2S



Biofilter Rehabilitation



Recommended Improvements

- Increase Air Flow to 35,000 CFM
 - Raise Cell Walls
- Remove, Screen and Reuse Lava Rock
- Install New Organic Media
- Keep Hallsten Floor System
- Rehabilitate Concrete
- Install Corrosion Protection Lining System



Recommended Improvements

- Remove Existing Humidification and Irrigation
- Install New Simplified Irrigation System
- Fan Maintenance
- Replace MCC
- Replace PLC
- Rectify Radio Communication Issues

Recommended Improvements

- Replace Hazardous Gas Monitoring System
- Replace and Simplify HVAC Systems
- Replace BBX Actuators
 - Position Indication
 - RTC Considerations
- Add Level and Flow Sensing

Keeping dry weather flows in the BWO reduced H₂S levels in the collection system significantly.

Construction & Start Up

Construction Start August 2016

- Raised Wall
- Removed Existing Media



And Then....

Concrete Corrosion

- Corrosion Significantly Worse Than Expected
 - 2-year Period Between Condition Assessment and Construction
 - Could Not Inspect Biofilter Floor
- Contract Included Significant Allowance



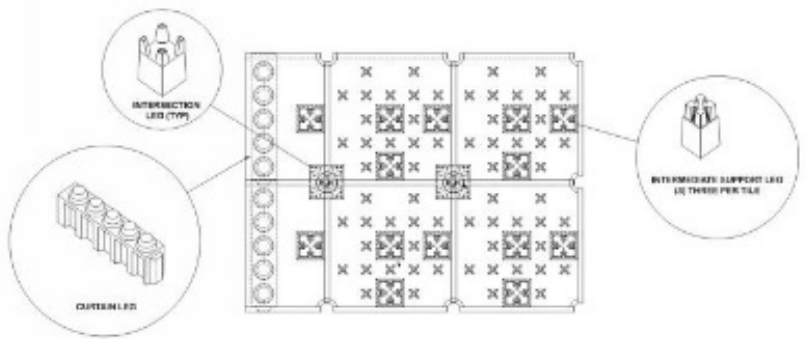
Changes in Scope

- Installed New Concrete Floor in Cells
- Changed to HDPE Liner
- Added FRP Pipe Header
- Hallsten Floor Replacement



Plenum Floor

- Hallsten Floor Issues





“Plumbing” Issues

- Tunnel Venting Through Building Plumbing Vents
 - Odors Prevalent at Site with Fans & Dampers Off
- Plumbing Vent Penetration in Electrical Room
- Added Trap on Sanitary Lateral



And Then.....

- Fan Motors
 - Fans Failed in 2015 and 2016
 - Motors Leaking Grease in early 2017
 - Replaced both Fan Motors
- BBX Gate Coupling Failure
 - Bronze Couplings Failed
 - Stainless Steel Couplings Installed





Start Up

- Media Replacement
- Commissioning
 - Operational Demonstration
 - System Reliability
 - >99% Removal of H₂S



Conclusion

- **Ventilation Evaluation was Critical**
 - Confirmed Required Airflow
 - Dry Weather Flow Diversion
- **Condition Assessment**
 - Be as Thorough as Possible
- **Change is the Only Constant**
- **Simple & Reliable Operation Achieved**
- **All Work Completed for Original Contract Amount**
 - \$3,606,900 Bid Amount
 - \$3,597,829 Final Cost



Special Thanks to:

- **City of Columbus**
 - Nick Domenick
 - Jeremy Cawley
 - Greg Fedner
 - Larry Lamp
- **The Righter Company**
- **PRIME AE Group**
- **CDM Smith**
- **HWS**
- **Hatch**
- **DLZ**

The success of the project was due to a collaborative effort between the City, Contractor, Construction Manager and Design Team.

BUILDING A WORLD OF DIFFERENCE

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