Metropolitan Water Reclamation District of Greater Chicago

Welcome to the November Special Edition of the 2020 M&R Seminar Series

NOTES FOR SEMINAR ATTENDEES

- All attendees' audio lines have been muted to minimize background noise.
- A question and answer session will follow the presentation.
- Please use the Chat feature to ask a question via text.
- The presentation slides will be posted on the internal MWRD website after the seminar.

Jonathan Grabowy, P.E. Managing Civil Engineer

Capital Facilities Planning, Wastewater Research and New Technology Evaluation

Monitoring and Research Department

Jonathan Grabowy joined the District in 1999, as an Assistant Structural Engineer in the Process Facilities Design Division of the Engineering Department. Since that time he has as worked in various areas including local sewers permitting, engineering planning, civil design, stormwater management, capital facility planning, and is currently the Managing Civil Engineer overseeing Capital Facilities Planning, Wastewater Research and New Technology Evaluation programs in the M&R Department. Significant accomplishments in Jonathan's career include: Calumet Sag Channel and Poplar Creek Detailed Watershed Plans, MWRD's Stormwater GIS Inundation Application, Long-term Capital Facilities and Biosolids Planning, Districtwide Odor Reduction Planning and Capital Project Evaluations. Jonathan is active in the Water Environment Foundation (WEF) Odor and Air Pollutants committee and he was a reviewer of the WEF "Manual of Practice 25 - Control of Odors and Emissions from Wastewater Treatment Plants" and participates in the NACWA Climate & Resiliency Committee.

He received his Bachelor of Science in Civil Engineering from Purdue University; a Master of Science in Computer Science, Telecommunication and Information Systems, De Paul University; and Master of Engineering Management, Northwestern University

He is a Professional Engineer licensed in Illinois and Wisconsin.

The Thornton Composite Reservoir – Odor Lessons Learned from the Operation of a Unique 30 Billion Liter (7.9 Billion Gallon) Combined Sewer Overflow Mega-Structure

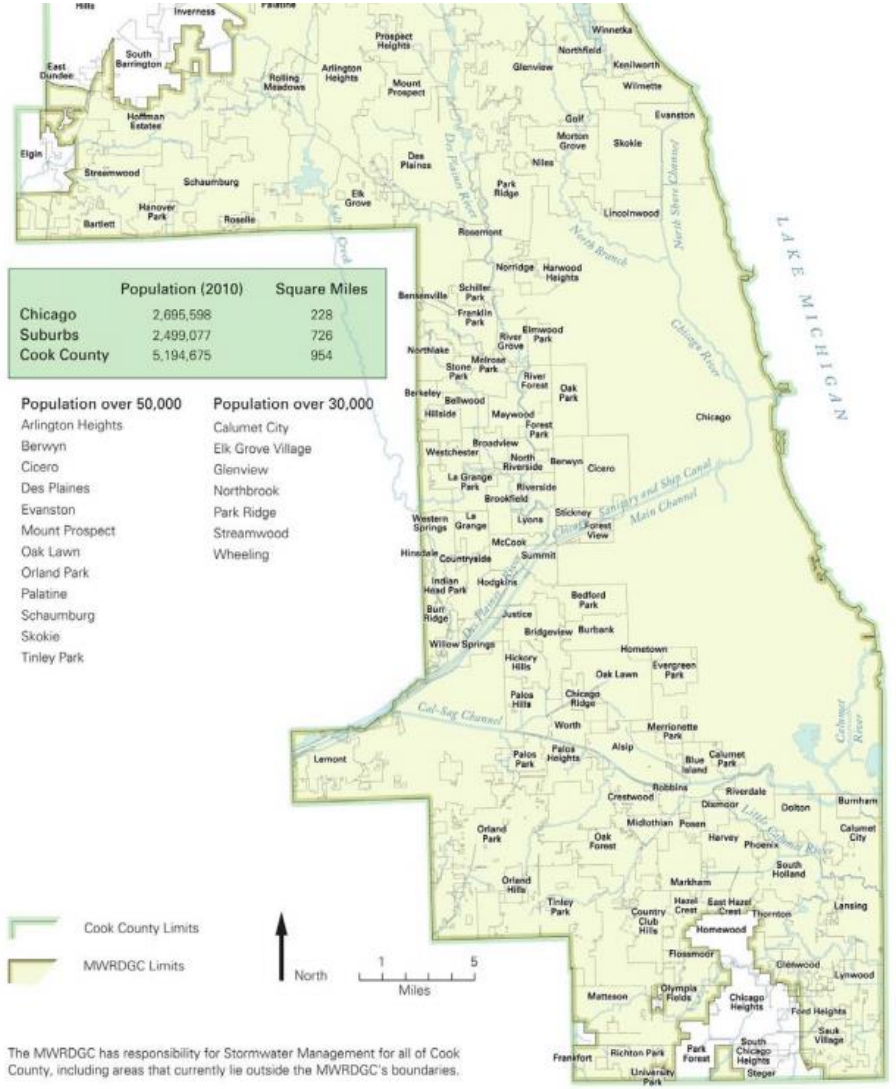
Jonathan Grabowy, PE – Metropolitan Water Reclamation District of Greater Chicago

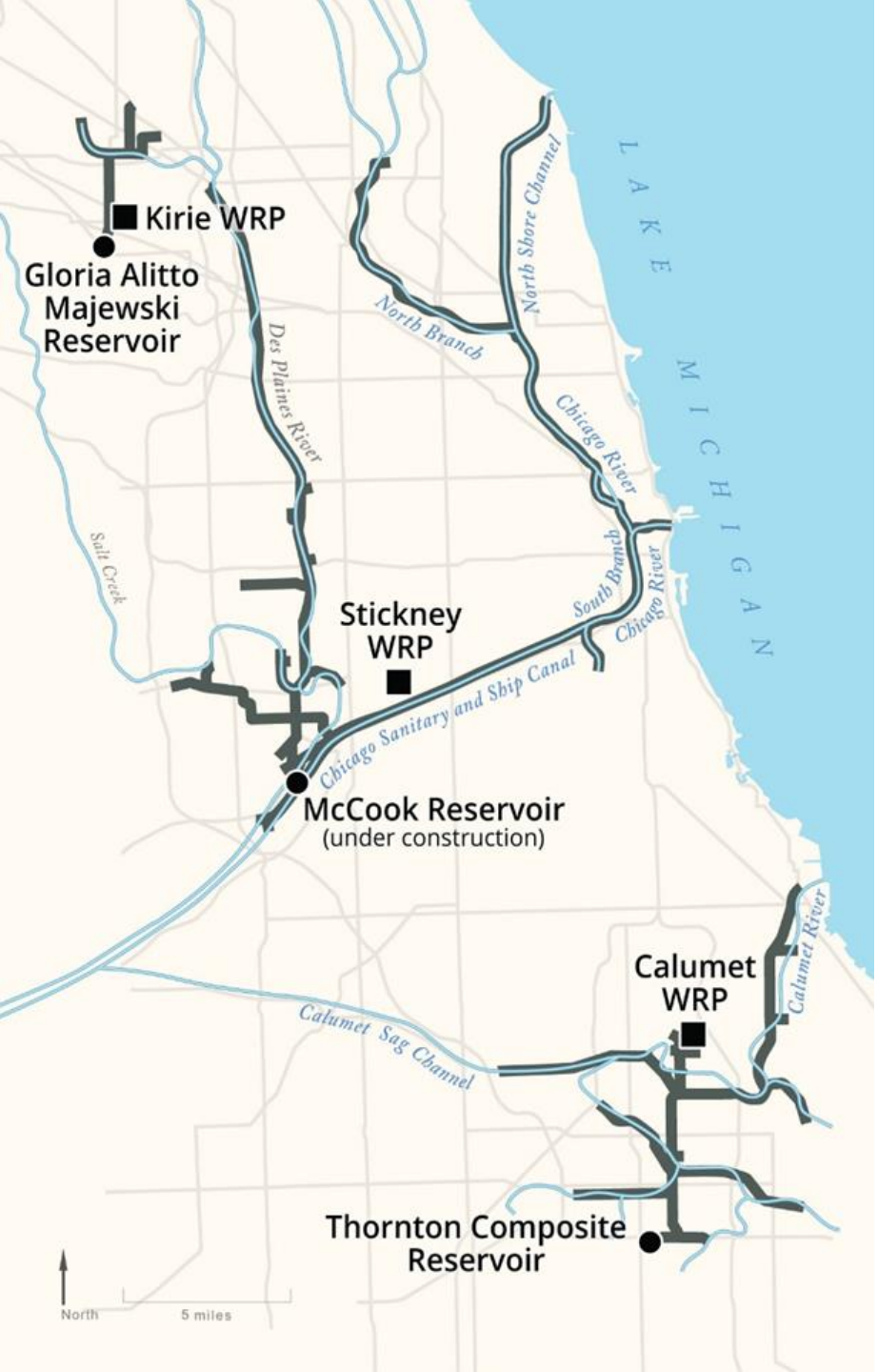
A few notes

- Presentation originally prepared for the 2020 WEF Odors and Air Pollutants Conference, scheduled for March 15-18, 2020
- The paper is available upon request.
- Co-Authors
  - Kevin Fitzpatrick – Engineering
  - Reed Dring (retired M&O)
  - Dominic Brose – M&R
  - Brent Bedell – M&R
  - Weizhe An – M&R
  - Kuldip Kumar – M&R

The Metropolitan Water Reclamation District of Greater Chicago

- Created in 1889
- Located in Northeast Illinois
- 92% of Land and 98% of Assessed Valuation of Cook County
- Chicago and 128 Suburbs
- Responsible for Wastewater and Regional Stormwater
- Serves and Equivalent Population of 10.35M
    - 5.25M People
    - 4.5 M Industrial Equivalent
    - 0.6 M CSO



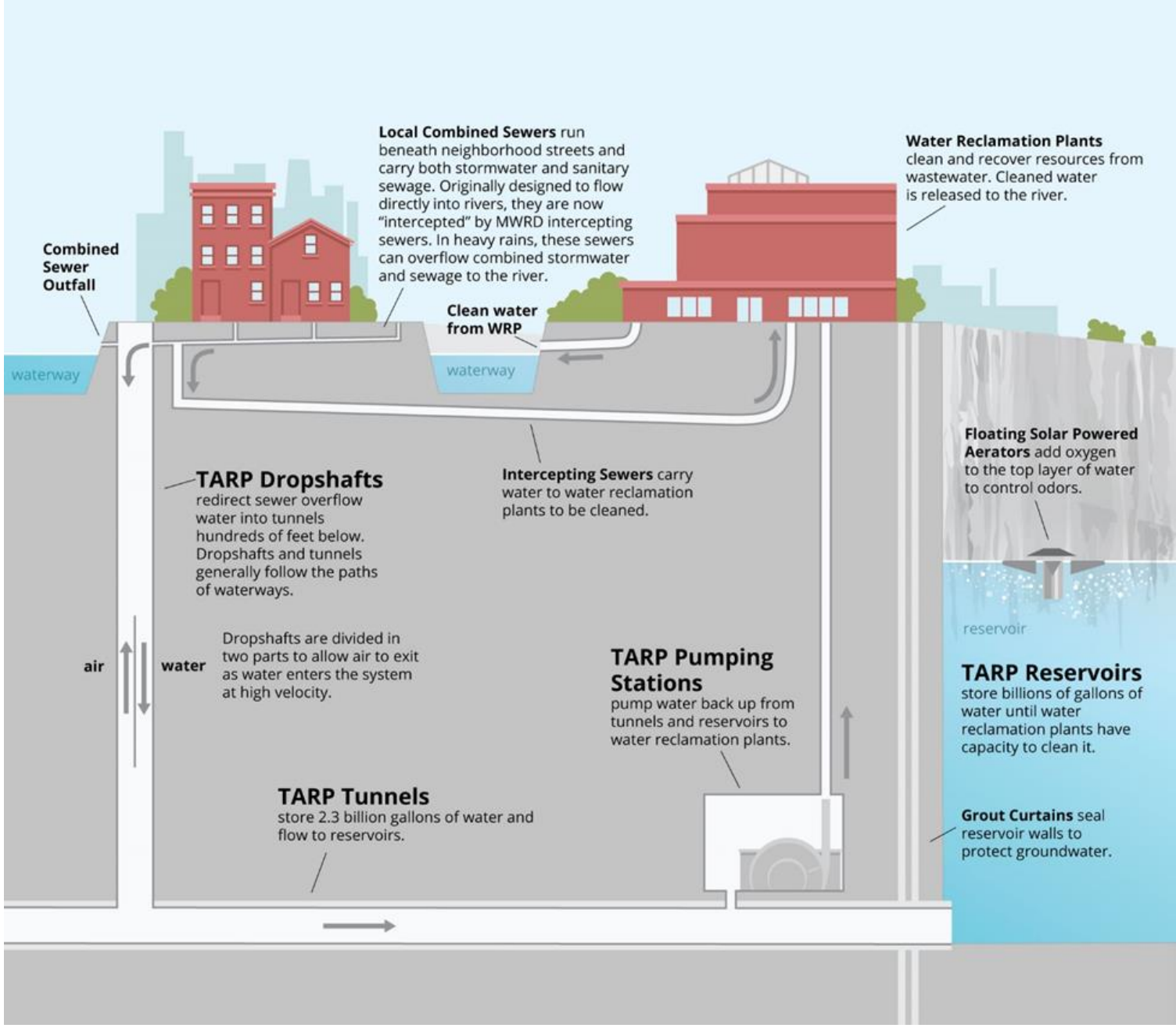


Tunnel and Reservoir Plan

- MWRDGC Long Term Control Plan for CSOs
- Started in 1975
- Phase I Tunnels (Completed 2006)
  - 109.4 Miles, 2.3 BG
- Phase II – Reservoirs
  - Majewski (1998) – 350 MG
  - Thornton (2003, 2015) 3.1 BG, 7.9 BG
  - McCook (2017, 2029 est.) 3.5 BG, 10 BG

TARP Operations

- Over 450 CSOs in MWRDGC Service Area
- Approx. 100 days of overflow to local waterway
- TARP provides additional volume for the sewers and WRPs to “catch-up”

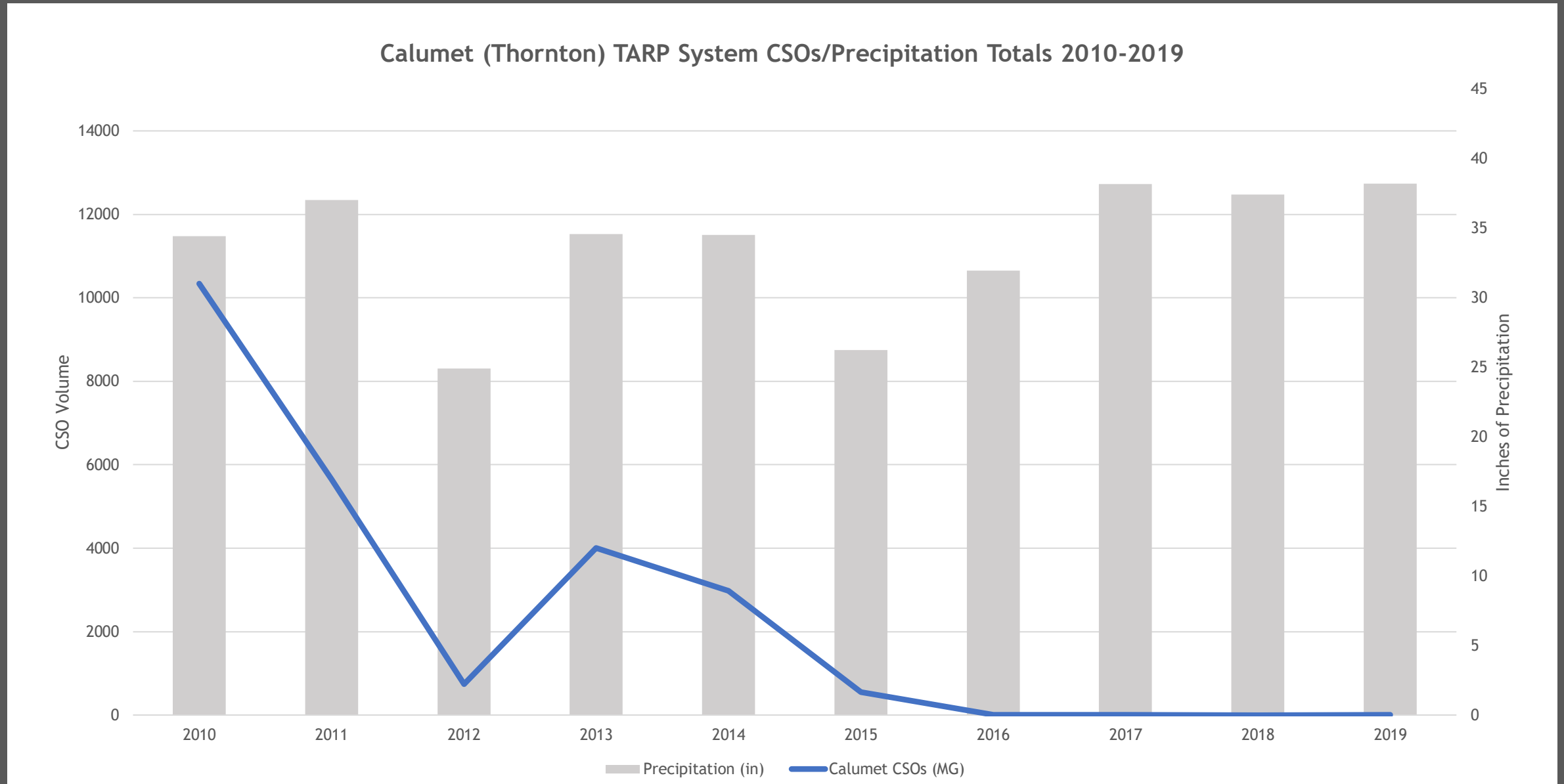


Thornton Composite Reservoir

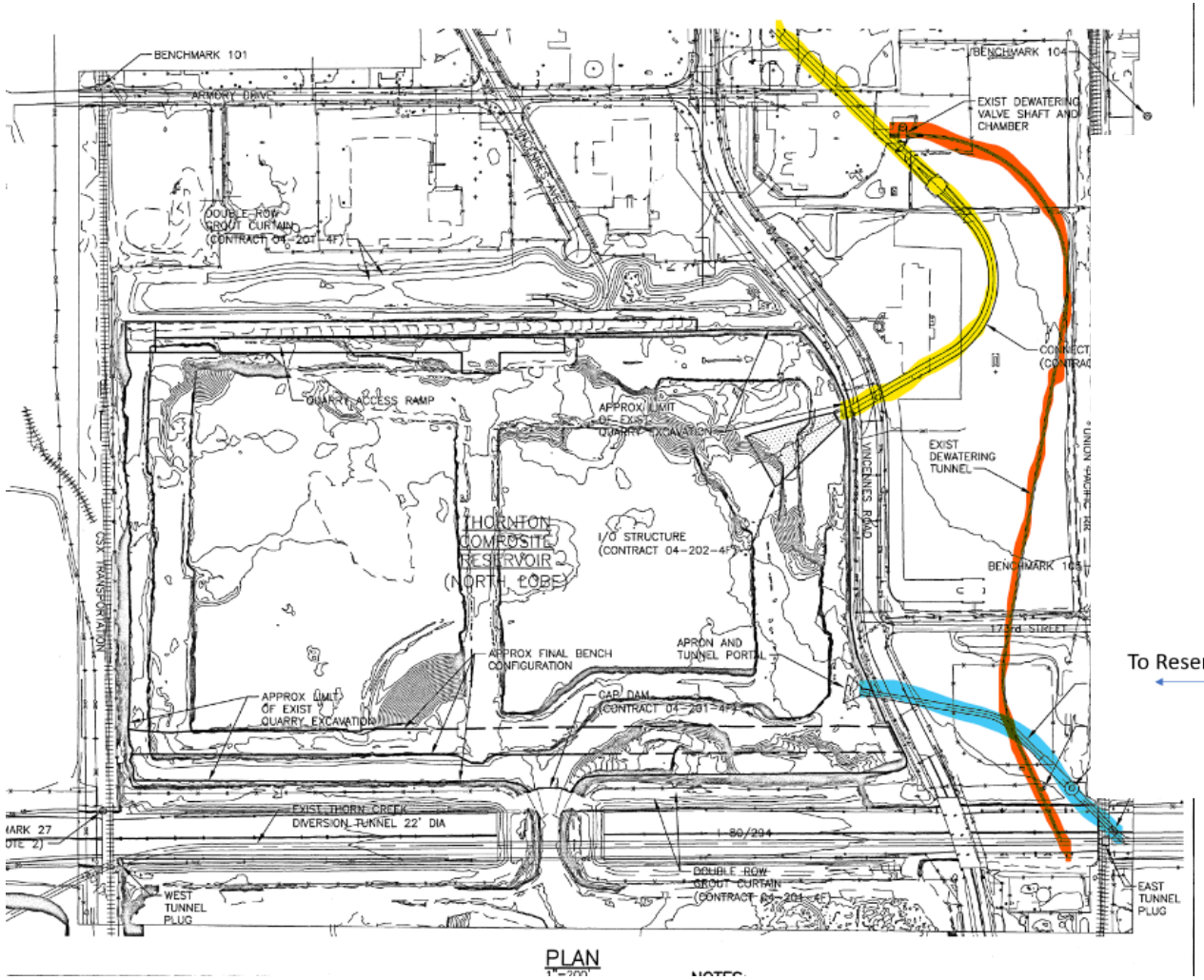
The Thornton Reservoirs

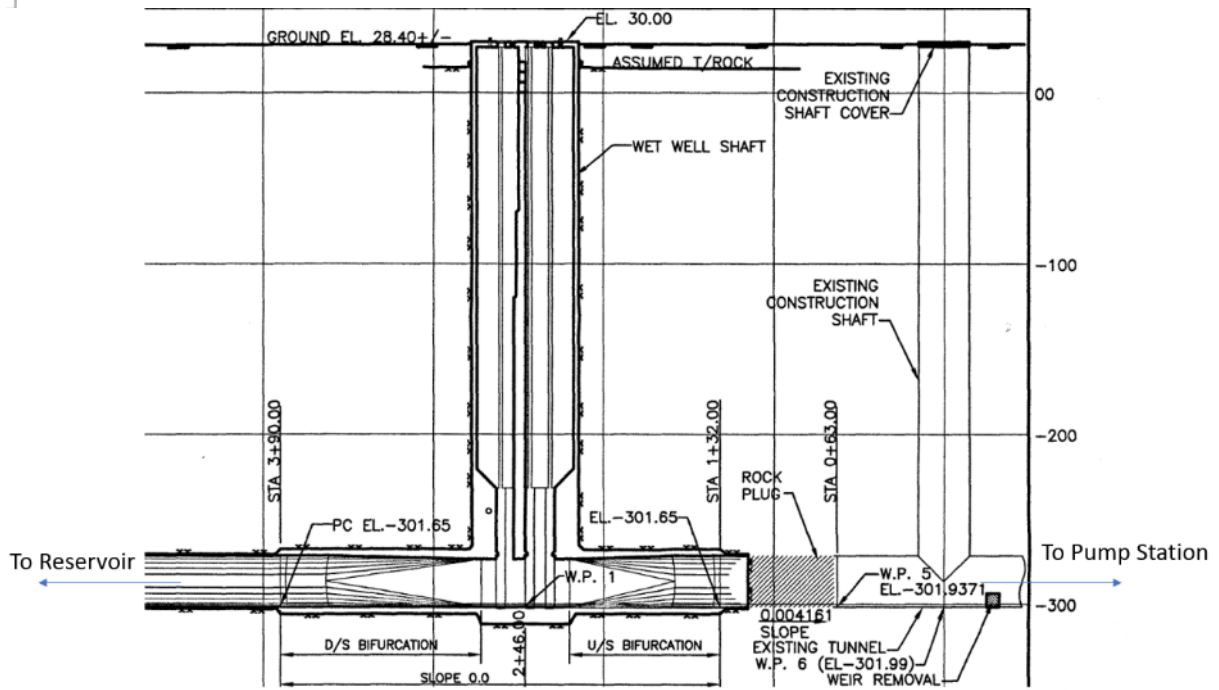
- Thornton Transitional Reservoir
  - Completed in 2003
  - 3.1 Billion Gallons
  - Protects 9 Communities
  - Thorn Creek Overflow
  - 70 fill events – 51 Billion Gallons
- Thornton Composite Reservoir
  - First fill November 2015
  - Protects 14 Communities
  - 38 Billion Gallons of CSOs

*Numbers as of 6/30/2020

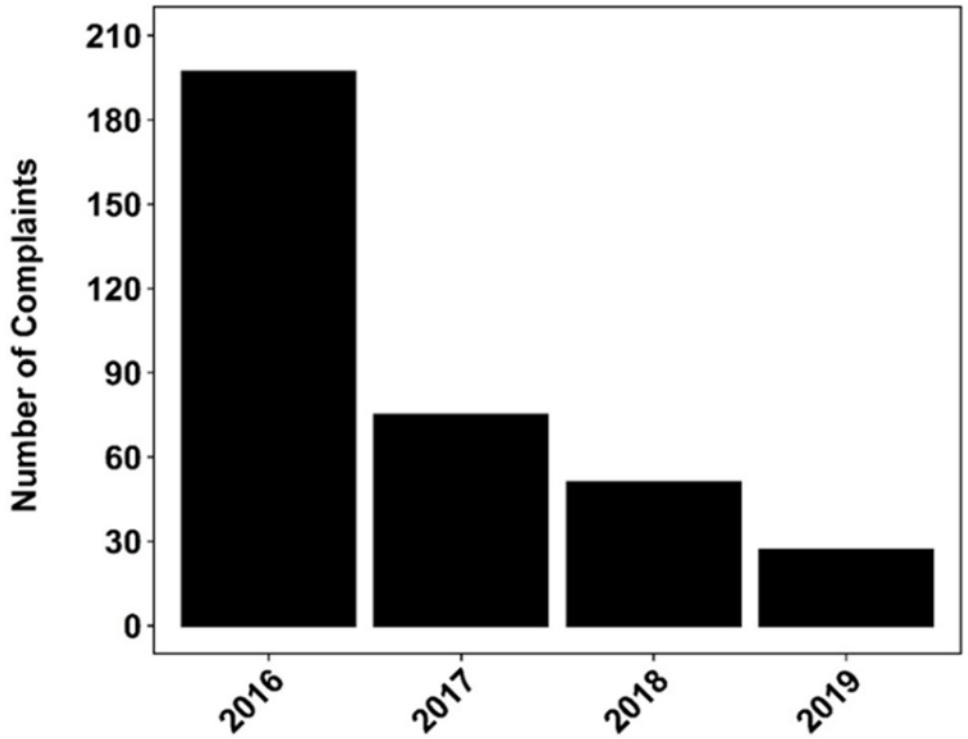

Calumet (Thornton) TARP System CSOs/Precipitation Totals 2010-2019
CSO Volume
Inches of Precipitation
14000
12000
10000
8000
6000
4000
2000
0
45
40
35
30
25
20
15
10
5
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Precipitation (in)
Calumet CSOs (MG)

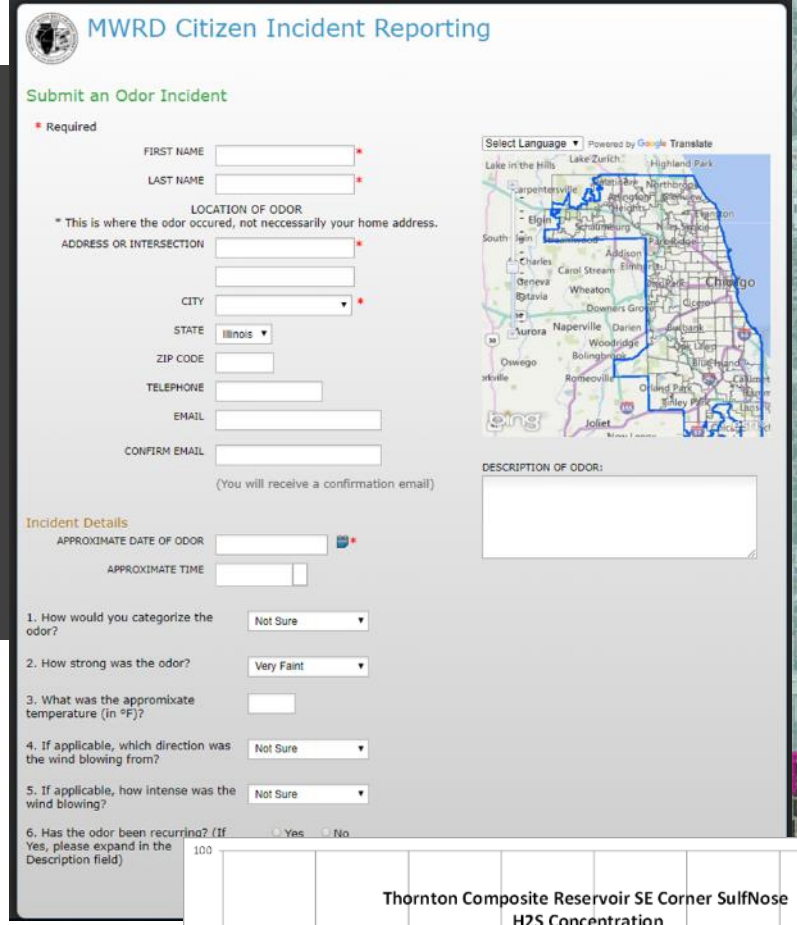
Thornton Composite Reservoir

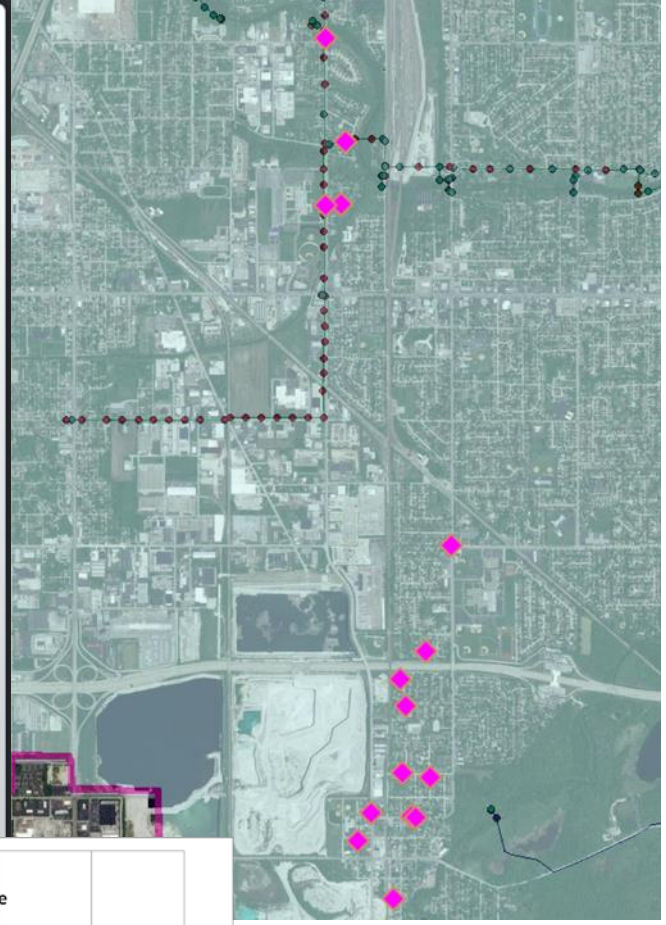


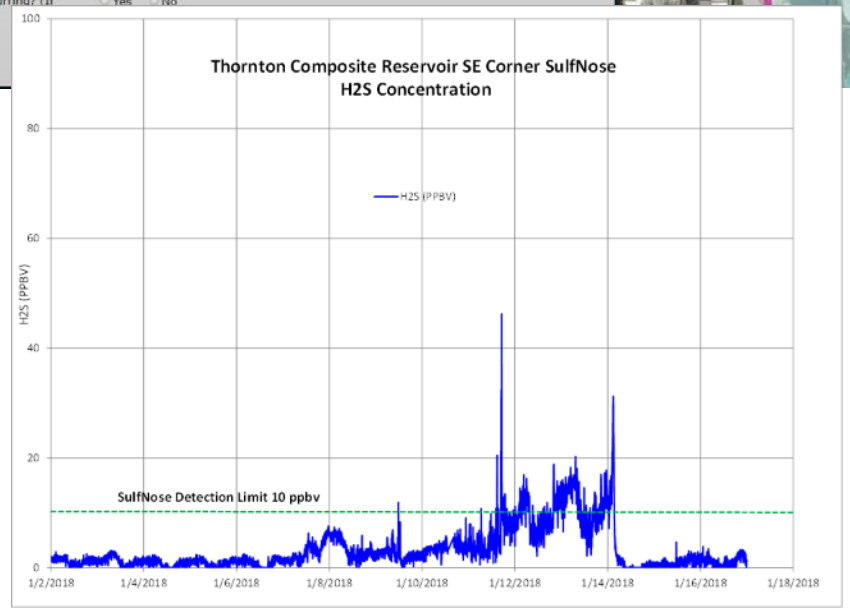


Complaint Data









H_2S Data Collection

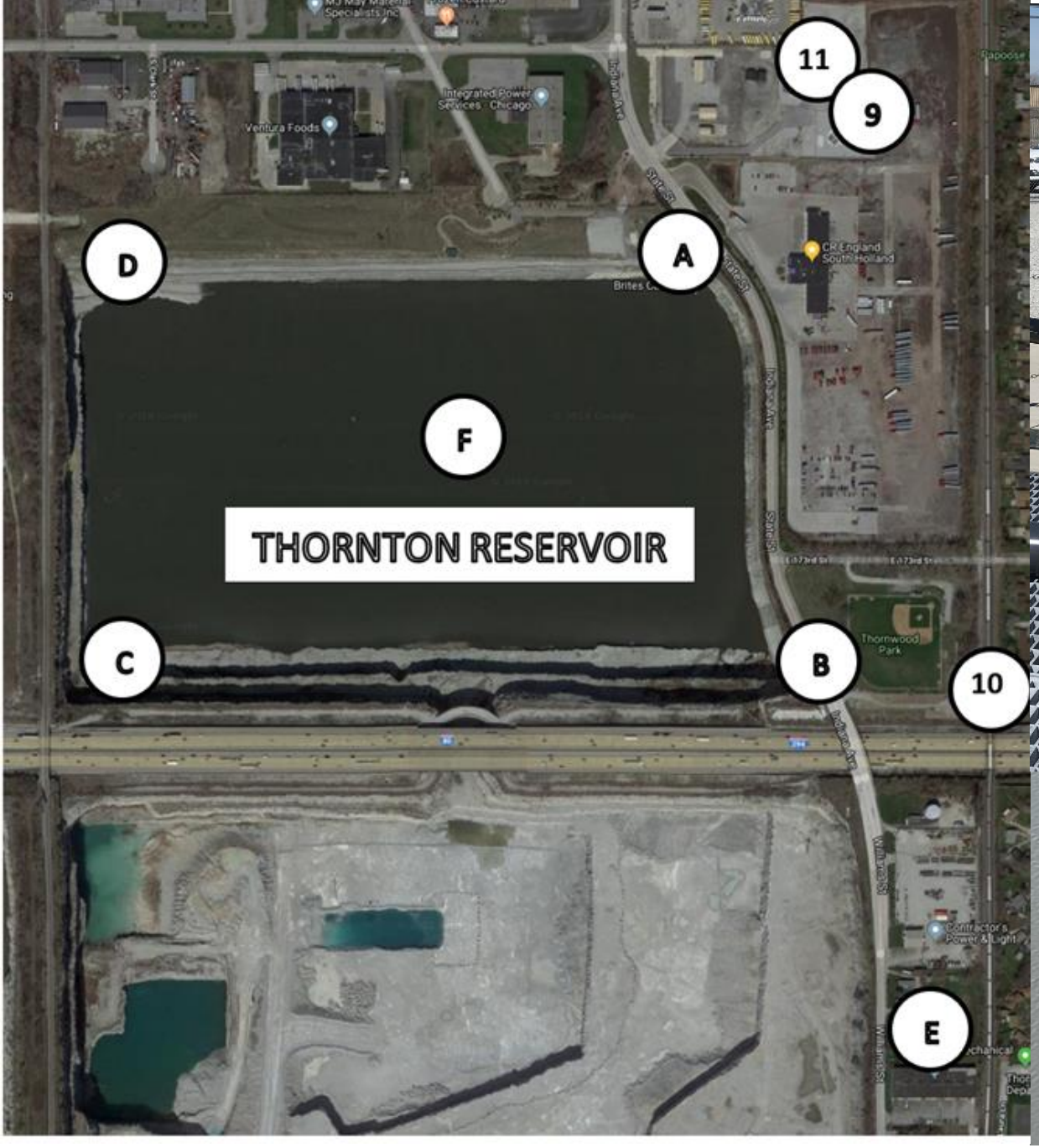
- Jerome H_2S Analyzer
  - Detection Limit of 0.003 parts per million by volume (ppmv) to 30 ppmV (631-X) or 10 ppmV (605J)
  - Used for manned inspections, reliable and industry standard
- OdaLog – High Range and Low Range
  - Detection Limits 1 to 50, 200 or 1000 ppmv (high range), 0.01 to 2 ppmv (low range)
  - Temporary temporal based monitoring – requires weekly maintenance visits
- Envea
  - Detection Limit 0.02 to 1 ppmv (low range) and 0.30 to 20 ppmv (high range)
  - Solar powered monitoring with telemetry

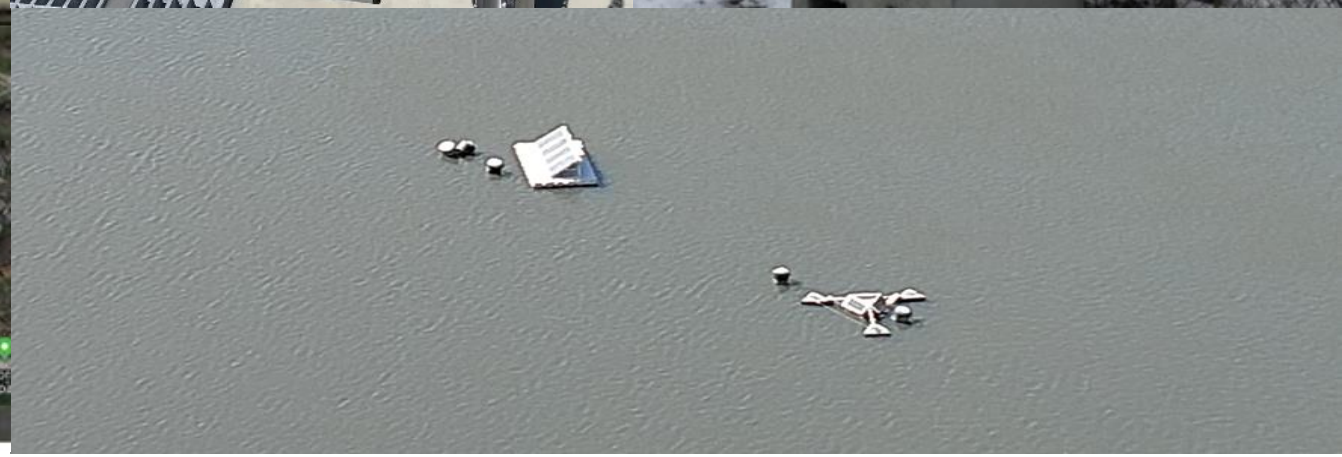
Odors

* From WERF Minimization of Odors and Corrosion in Collections Systems Phase 1 (2007)

Table 2-1. Odorous Compounds in Wastewater.

Name	Formula	Characteristic Odor	Detection Threshold (ppm)
Hydrogen sulfide	H_2S	Rotten eggs	0.0005
Ammonia	NH_3	Irritating, pungent	17
Skatole	C_9H_9N	Fecal, nauseating	0.001
Indole	$C_6H_4(CH)_2NH$	Fecal, nauseating	0.0001
Methylamine	CH_3NH_2	Putrid, fishy	4.7
Allyl mercaptan	$CH_2=CHCH_2SH$	Disagreeable, garlic	0.0001
Amyl mercaptan	$CH_3(CH_2)_4SH$	Unpleasant, putrid	0.0003
Benzyl mercaptan	$C_6H_5CH_2SH$	Unpleasant, strong	0.0002
Ethyl mercaptan	C_2H_5SH	Decayed cabbage	0.0003
Dimethyl sulfide	$(CH_3)_2S$	Decayed cabbage	0.001
Trimethylamine	$(CH_3)_3N$	Pungent, fishy	0.0004
Sulfur dioxide	SO_2	Pungent, irritating	2.7
Methyl mercaptan	CH_3SH	Decayed cabbage	0.0005
Thiocresol	$CH_3C_6H_4SH$	Skunk, irritating	0.0001
Thiobismethane	CH_3SCH_3	Rotting meat	0.0011


11
9
D
A
F
THORNTON RESERVOIR
C
B
10
E
Integrated Power Services - Chicago
Ventura Foods
CR England South Holland
Thornwood Park
Contractor's Power & Light

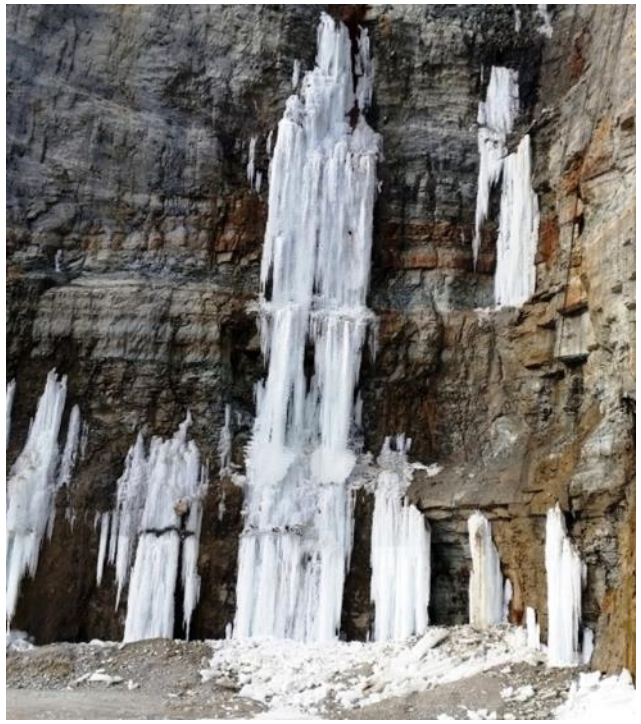


Liquid Sample Collection

- Liquid and sediment sample collection only occurred for about a month
- Data collected was inconclusive due to limited data points
- Onsite liquid and sediment samples canceled for safety reasons

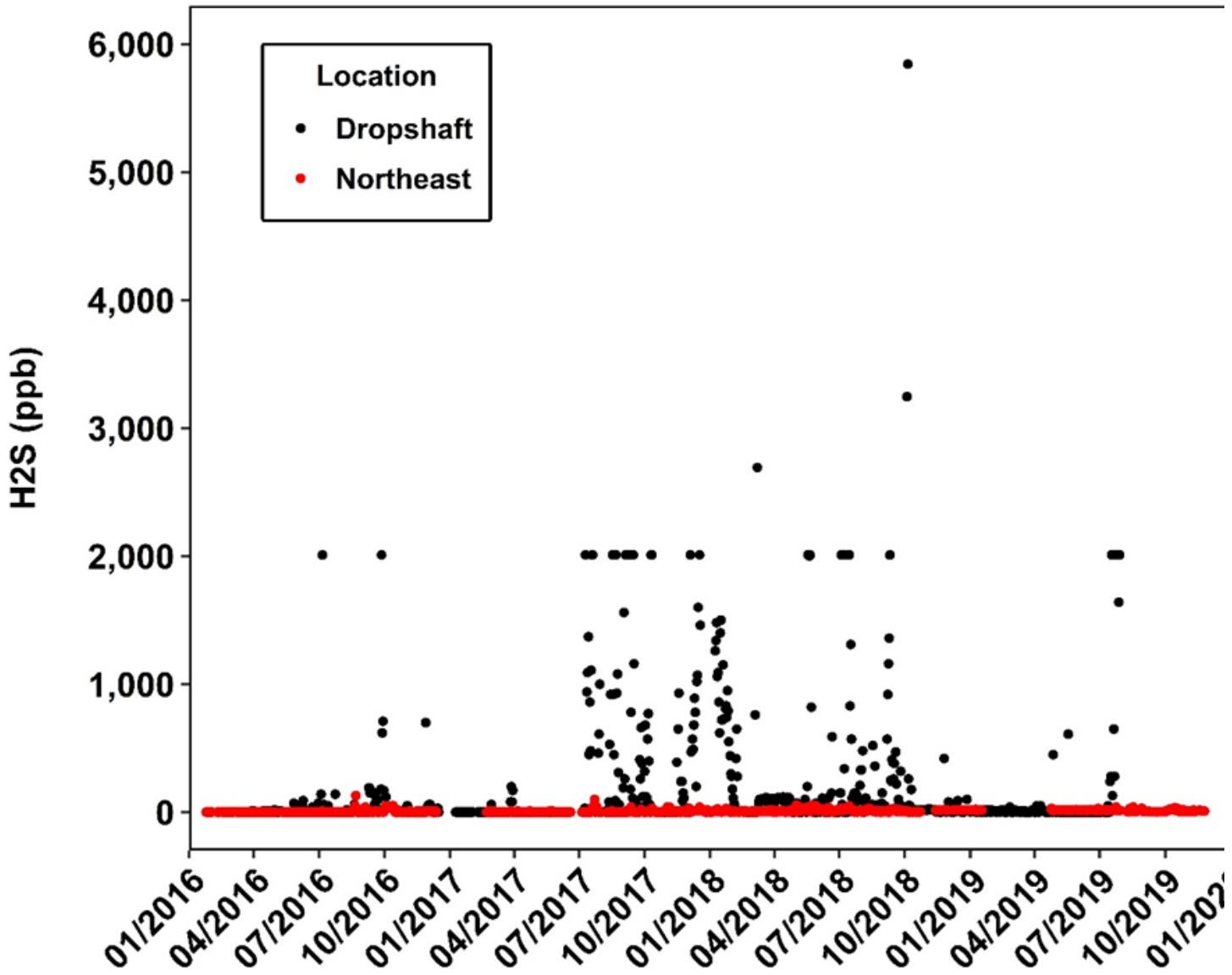
Sampling Issues

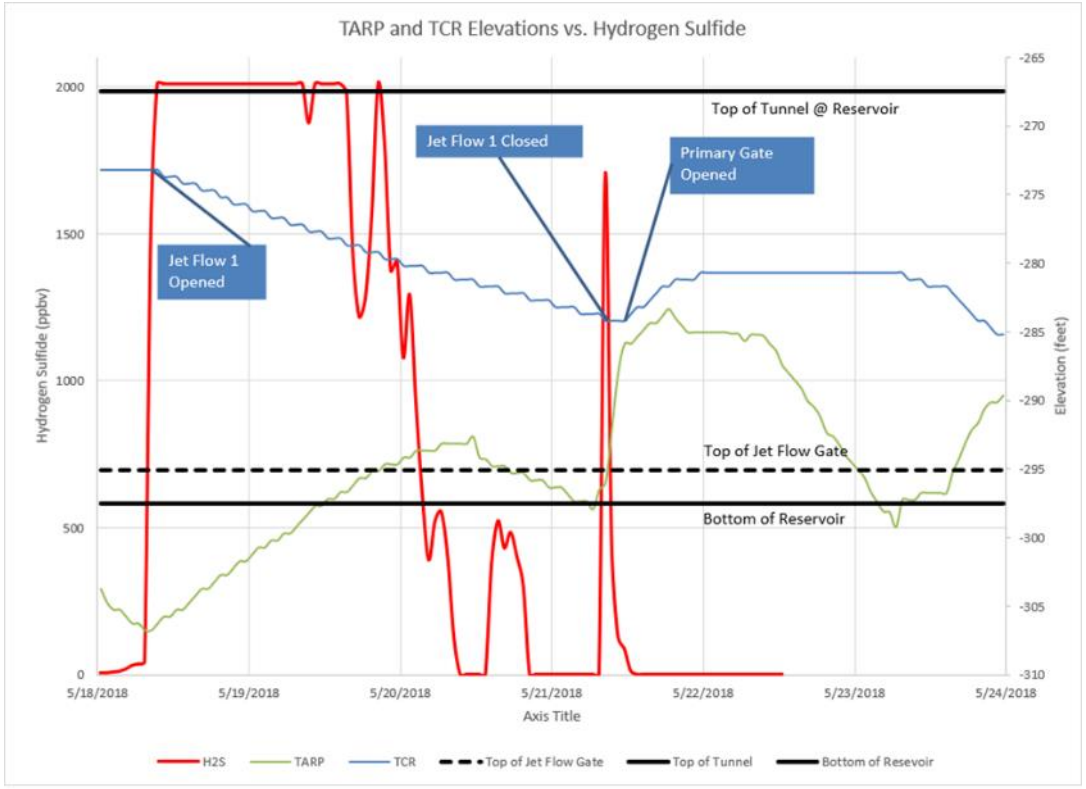
- Falling Ice/Rocks
- Confined Space
- Limited Rescue
- Wind
- Vandalism

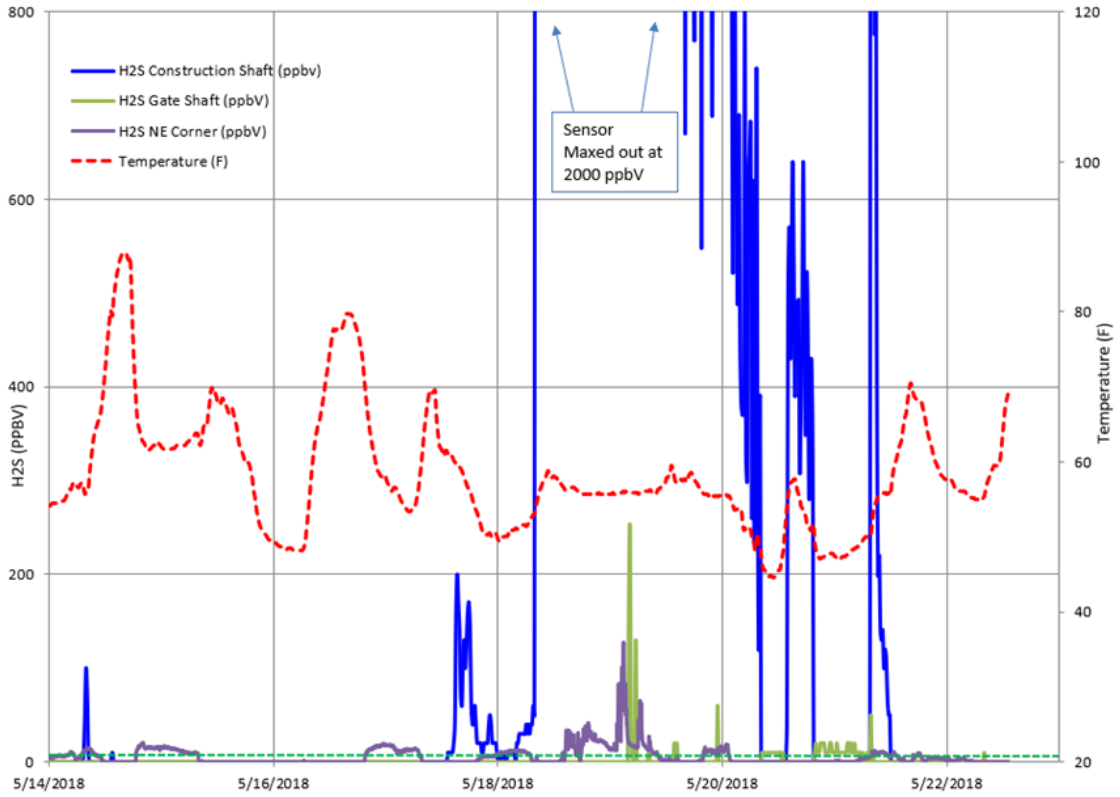


2 Distinct Odor Sources Identified

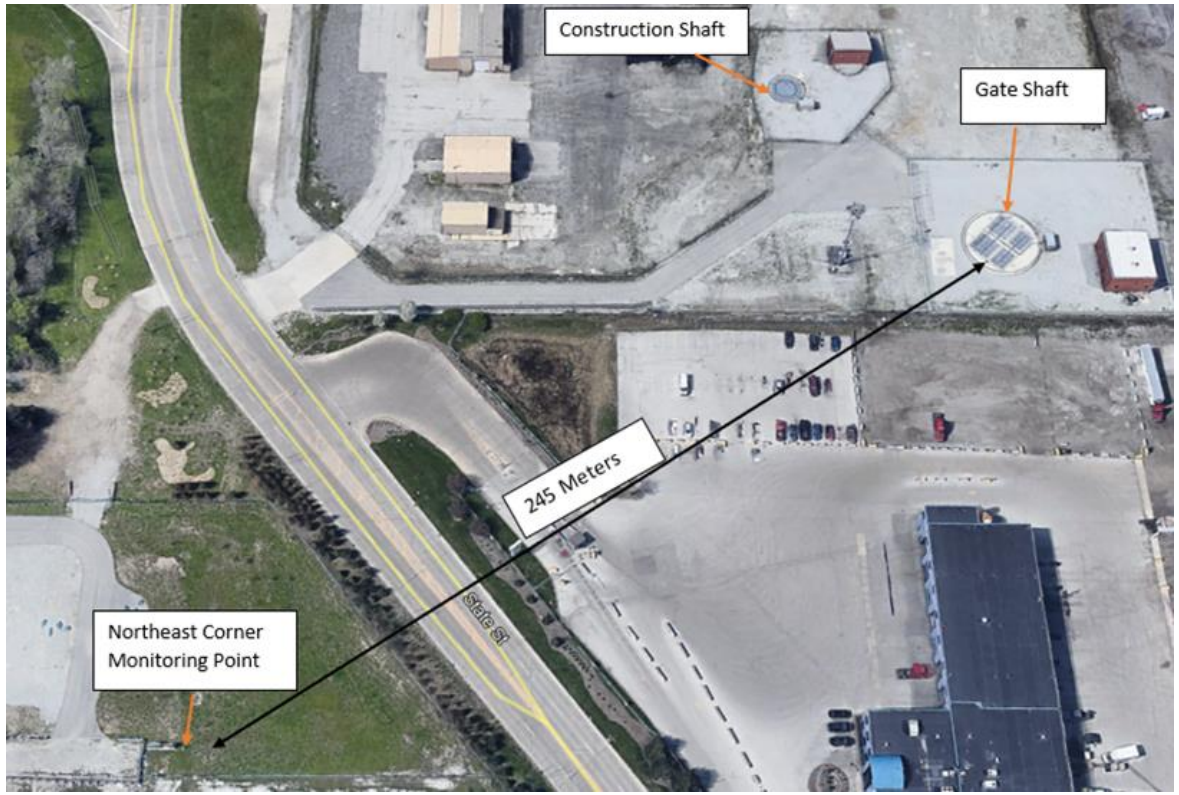
- Drop Shafts
  - Elevated readings with water movement
  - Localized and acute
- Primary Pool
  - More chronic reading
  - Larger area affected

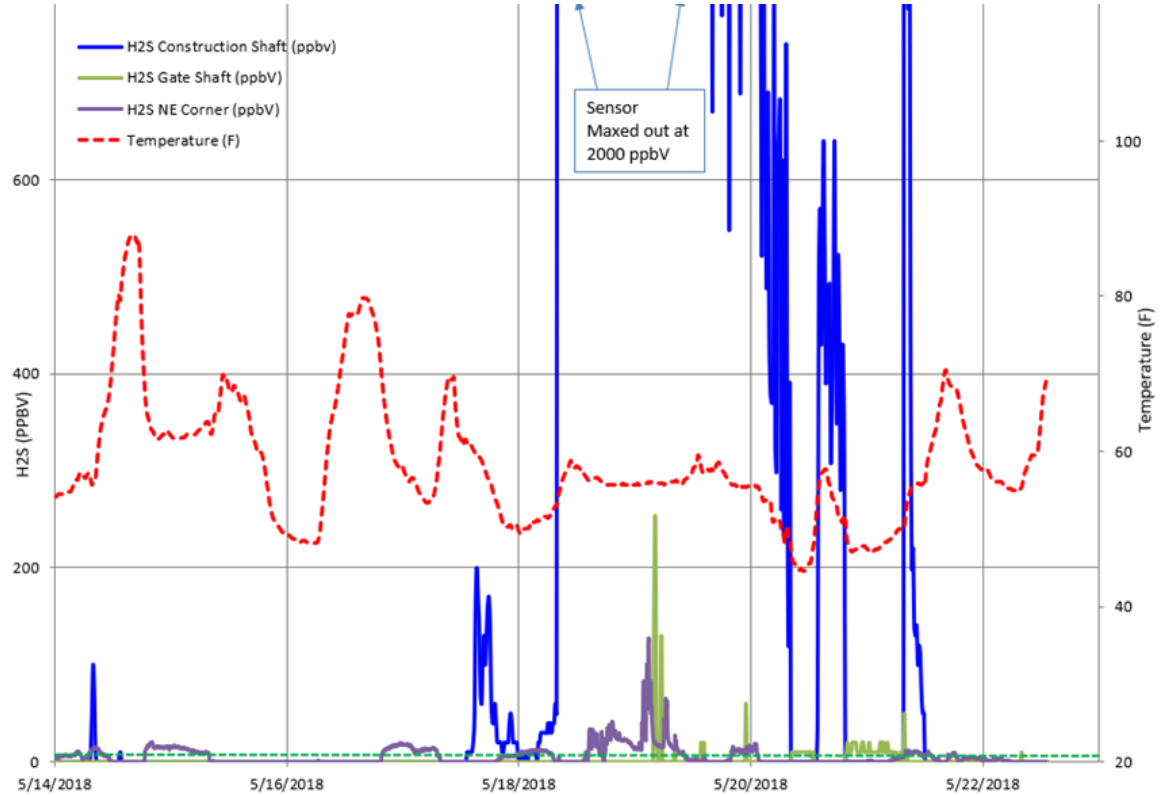






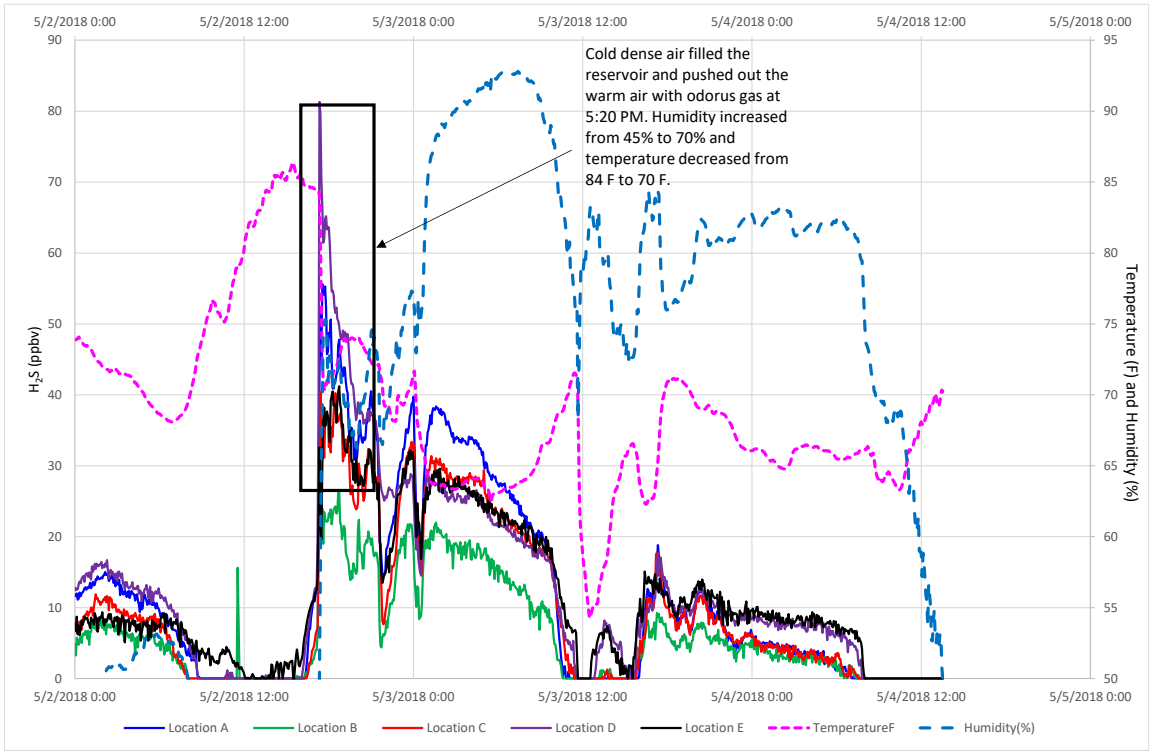
Low Volume – Higher Levels from Tunnels

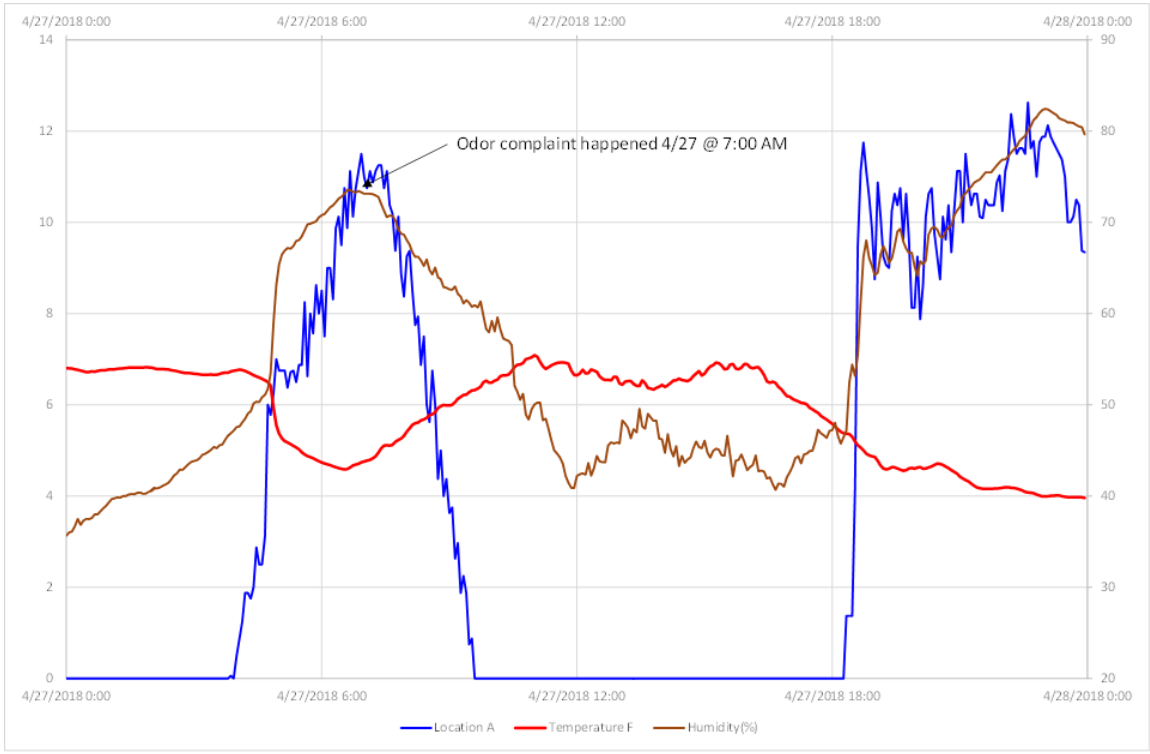




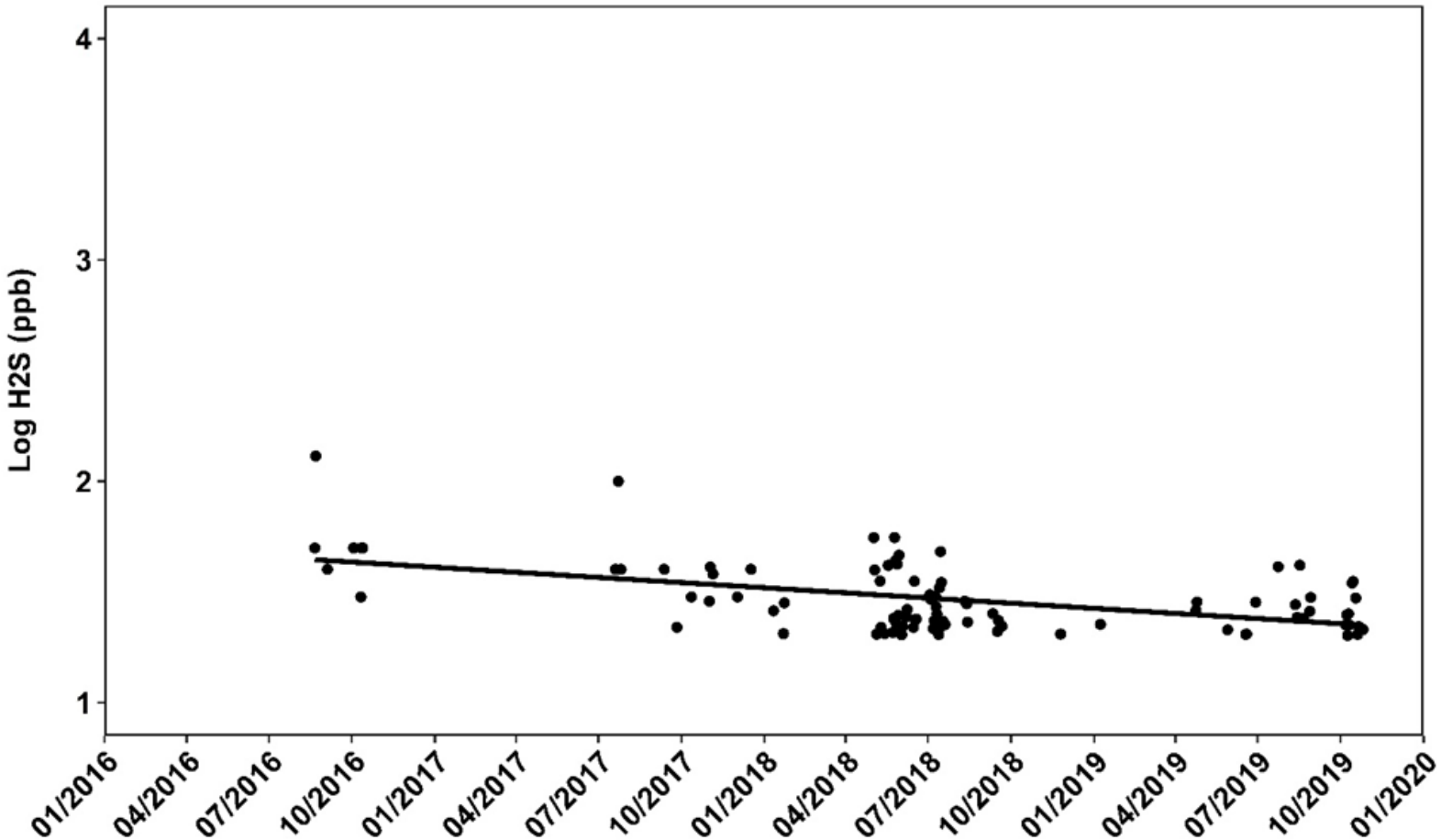
Influence from Tunnels to Pool

High Volume - Low Level From Pool





Debris and Pool Odor Over Time



Conclusions

- 2 Primary Sources of Complaints
- Tunnels are “easy” to fix
  - Temporary misting system
  - Carbon adsorption to be installed by 2022 as part of TTR decommissioning
- Primary Pool
  - Years of sediment in the tunnels were exposed to environment in 2015
  - Operational changes helped
  - Time was needed for system to stabilize
  - Odors complaints appear to be trending downward