



Variability in Fill Material and an Abundance of Underground Utilities Complicates the CSM and Remedial Approach at a MGP Site on Lake Superior

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Outline

- ◆ Site Background
- ◆ Site Investigation history
- ◆ Conceptual Site Model development
- ◆ Remedial Design & Implementation
- ◆ Take-Aways

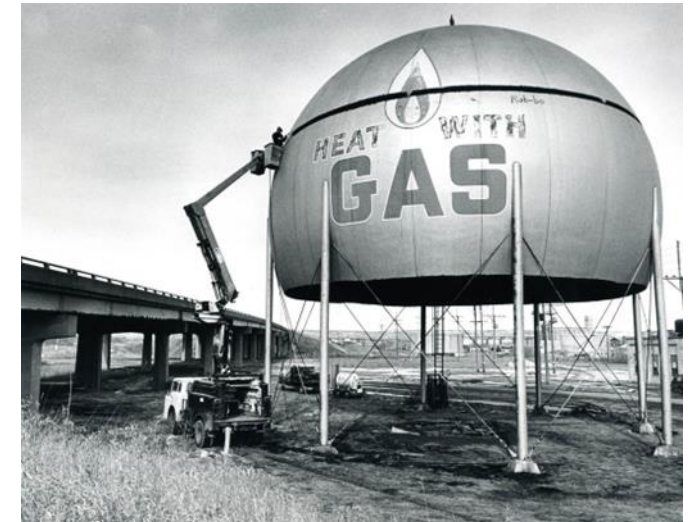
Flexibility in design helped adapt to unforeseen site conditions

Site Background

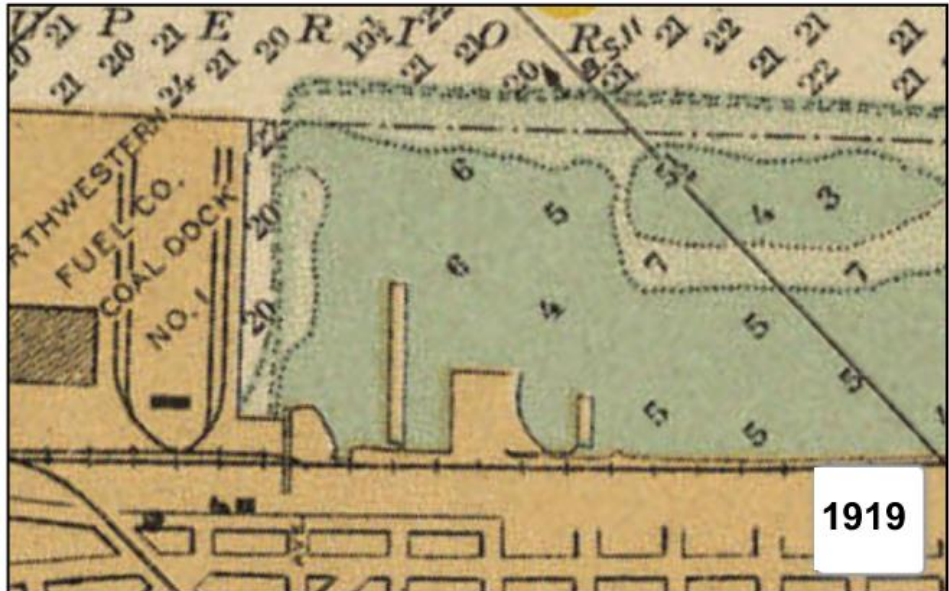
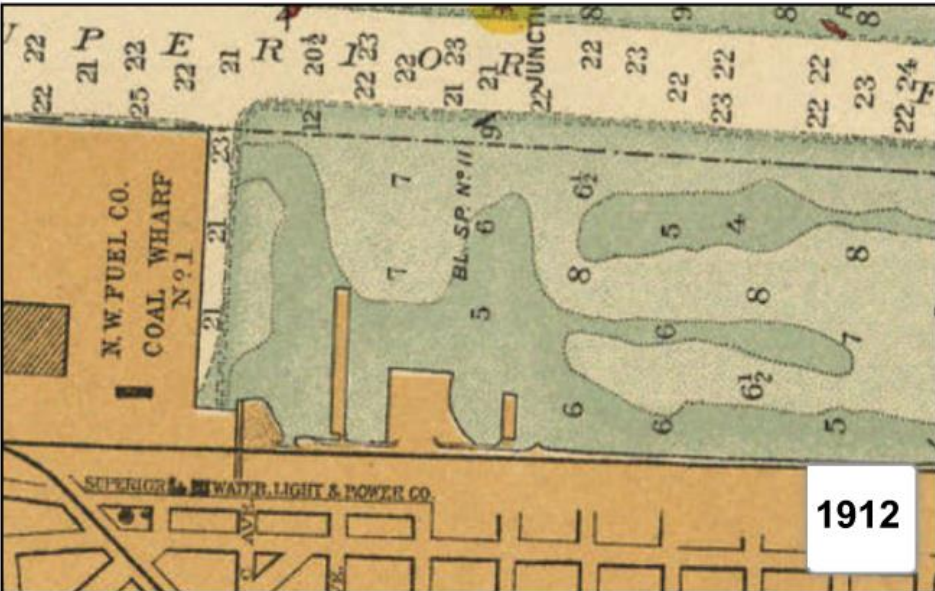
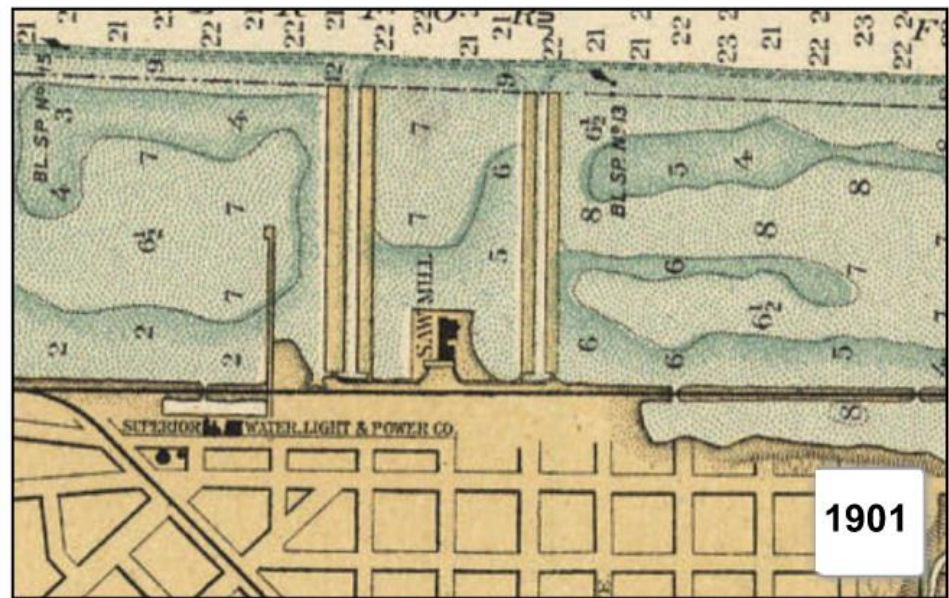
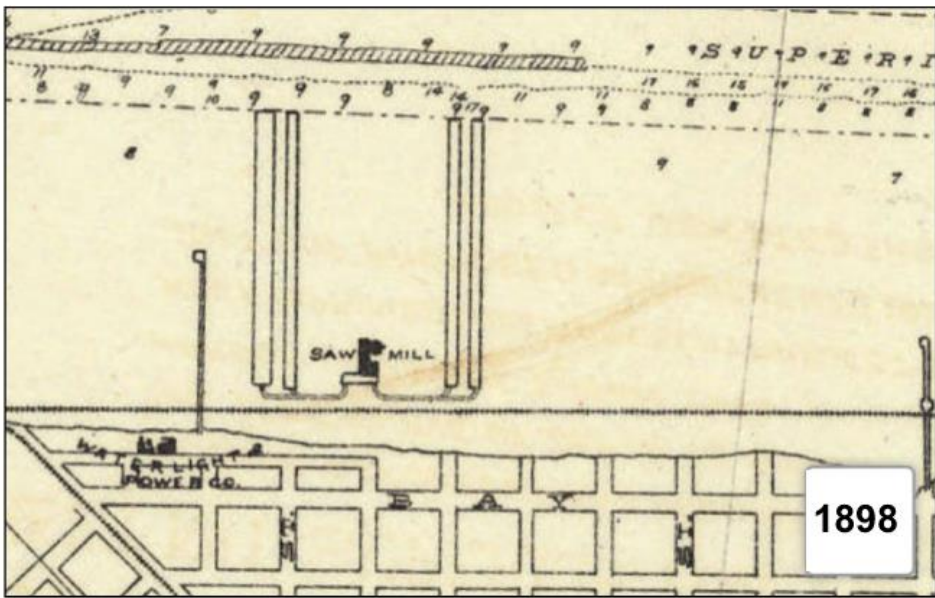
- Manufactured Gas Plant in 1800's
- Oily tar waste released
 - High concentrations of VOCs and PAHs
- Upland remediation completed
 - Soils with high concentrations of VOCs and PAHs



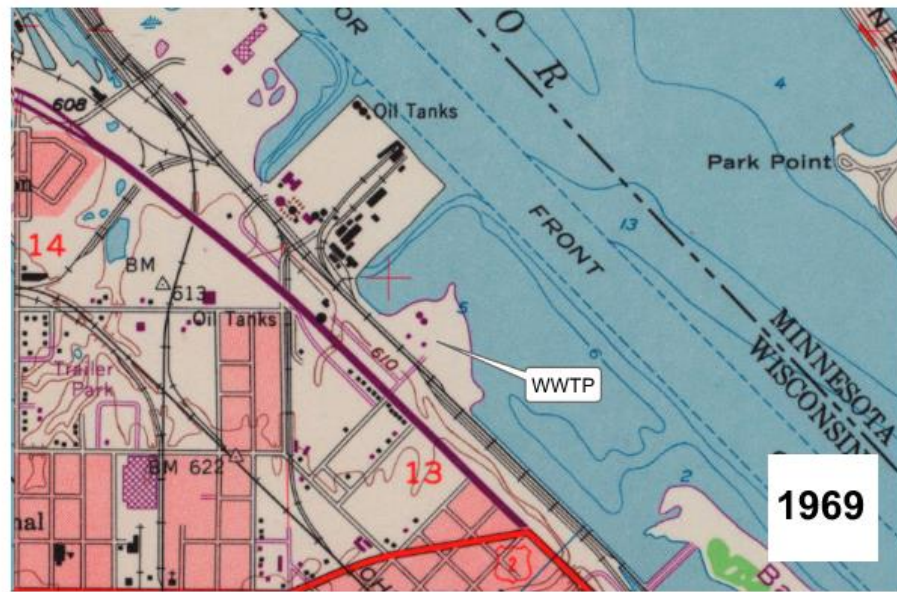
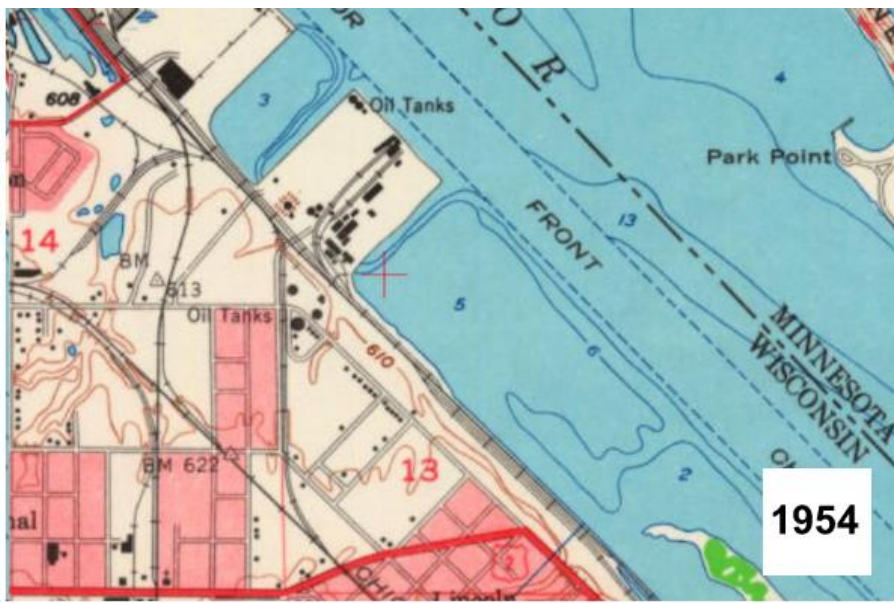
Manufactured gas plant in Superior, Wisconsin, ca. 1889.



Legacy site contamination

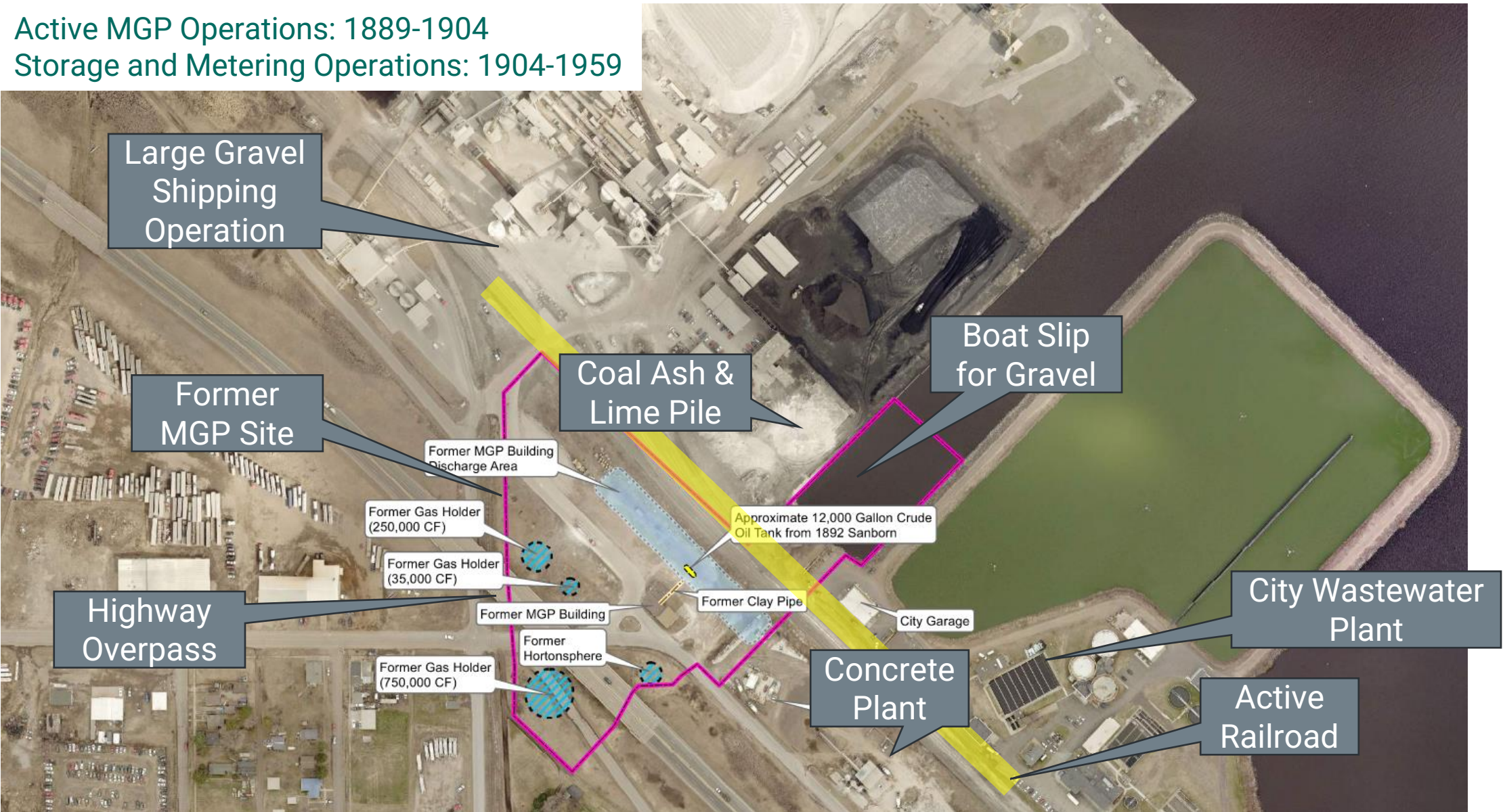


Long industrial history of industrial use



Long industrial history of industrial use

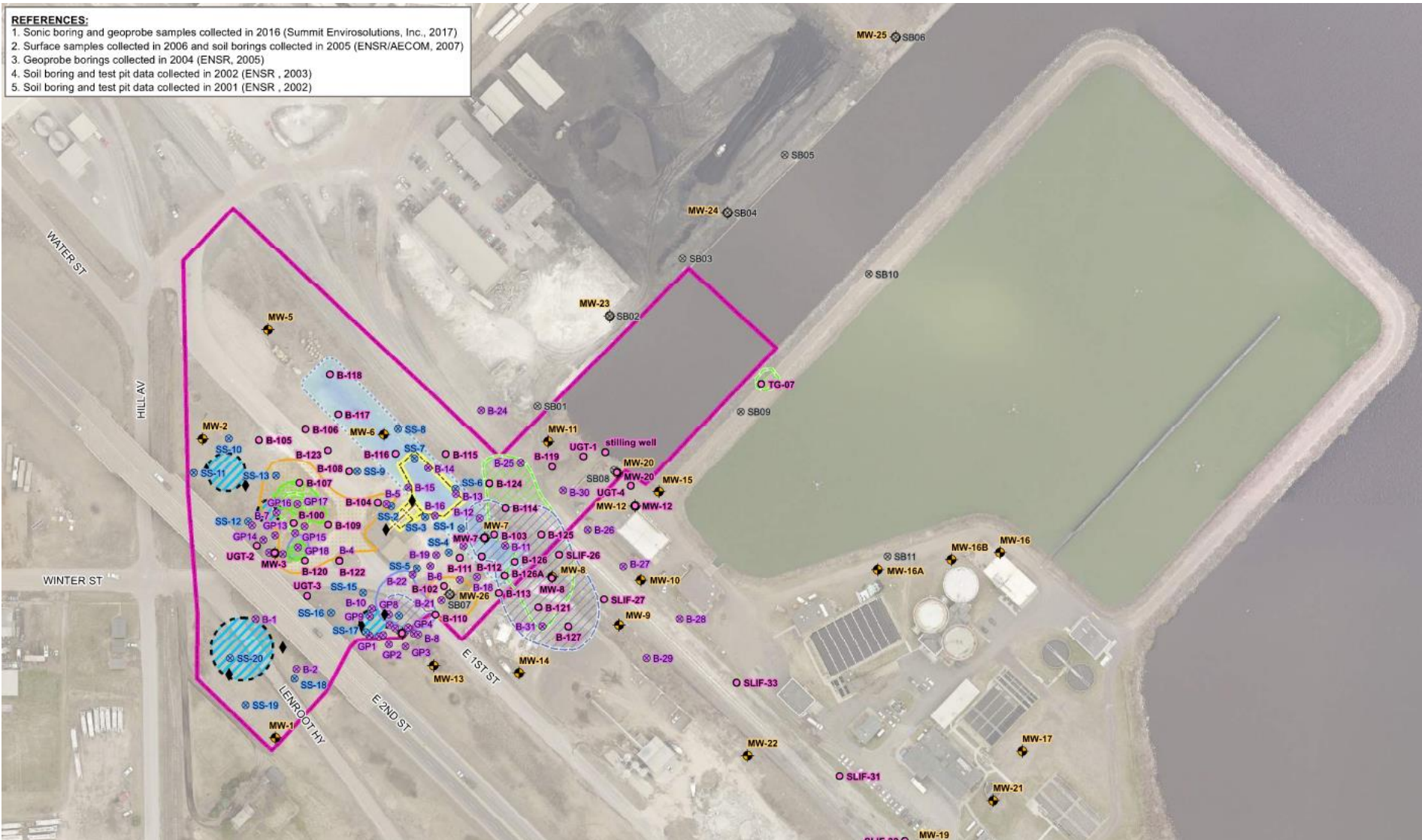
Active MGP Operations: 1889-1904
Storage and Metering Operations: 1904-1959



Heavy industrial area

Remedial Investigation

- Soil borings
- Test pits
- MIHPT
- LIF/TarGOST
- Remedial Excavation



Multi-Phase Investigation

Remedial Investigation Results

- Soil and Groundwater VOCs:

- Volatile organic compounds(VOCs)
 - Benzene, toluene, ethylbenzene, xylenes, and naphthalene
- Polynuclear aromatic hydrocarbons (PAHs)

- Primary contaminant:

- Benzene

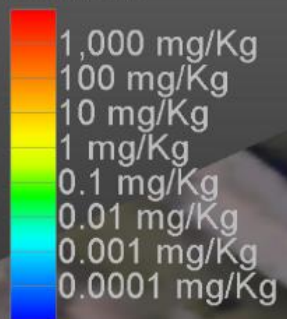
Benzene in soil and groundwater

Average Soil Concentrations (>4 ft bgs) mg/kg			
Parameters	Former Gas Holder	Former Horton-sphere	MGP Discharge Area
VOCs	447,563	48,299	388,381
Benzene	15,393	160,150	141,336
Toluene	29,843	41,812	79,320
Ethylbenzene	44,347	271	18,541
Xylenes	65,164	6,193	116,967
Naphthalenes	308,210	23	173,553
Other PAHs	168,612	72	306,245

RI Results – Benzene in Shallow Soil

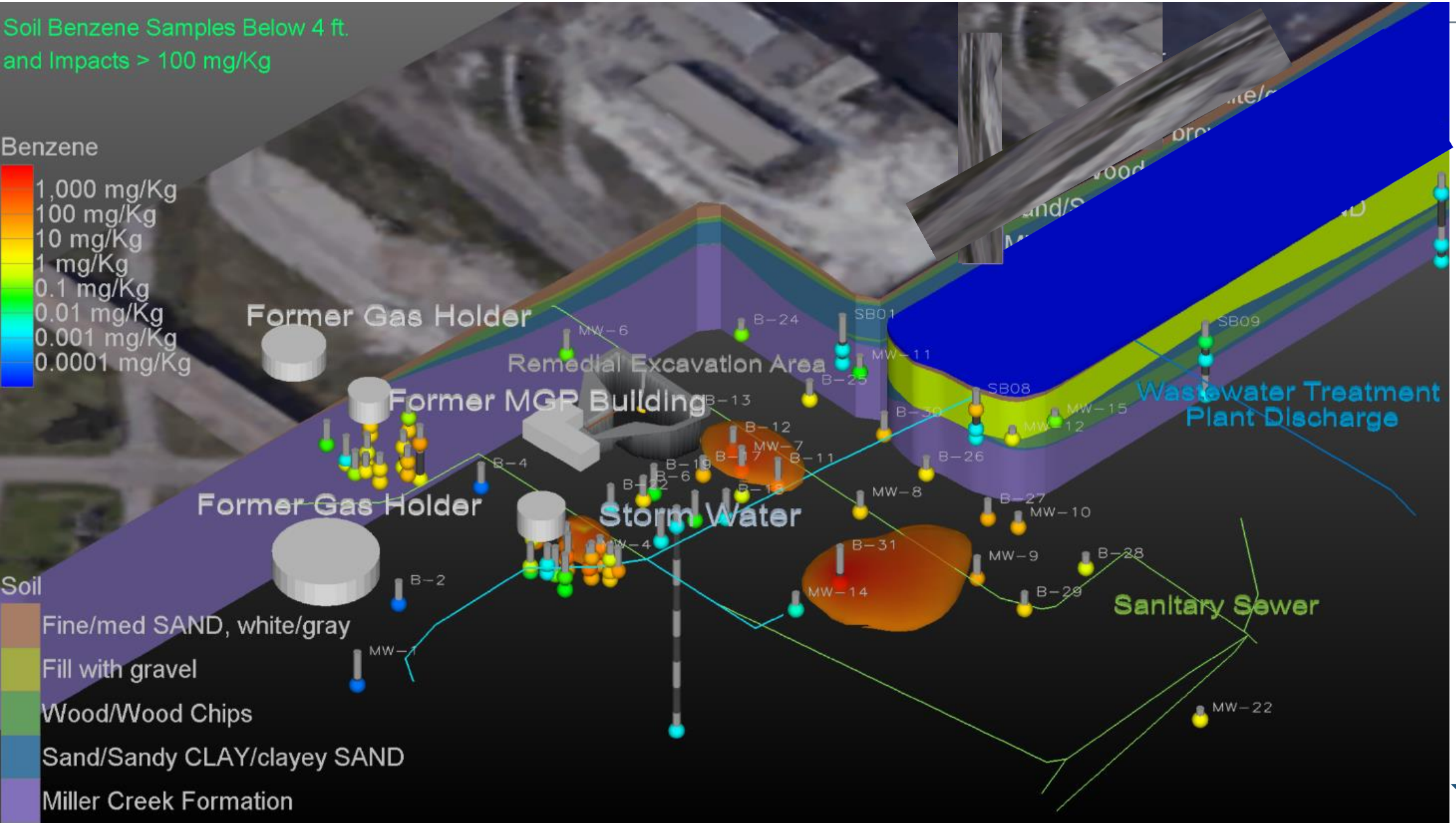
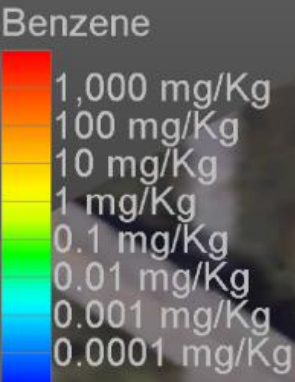
Soil Benzene Samples in Top 4 Ft.
and Impacts > 7.07 mg/Kg
(Industrial Direct Contact Residual Contaminant Level)

Benzene

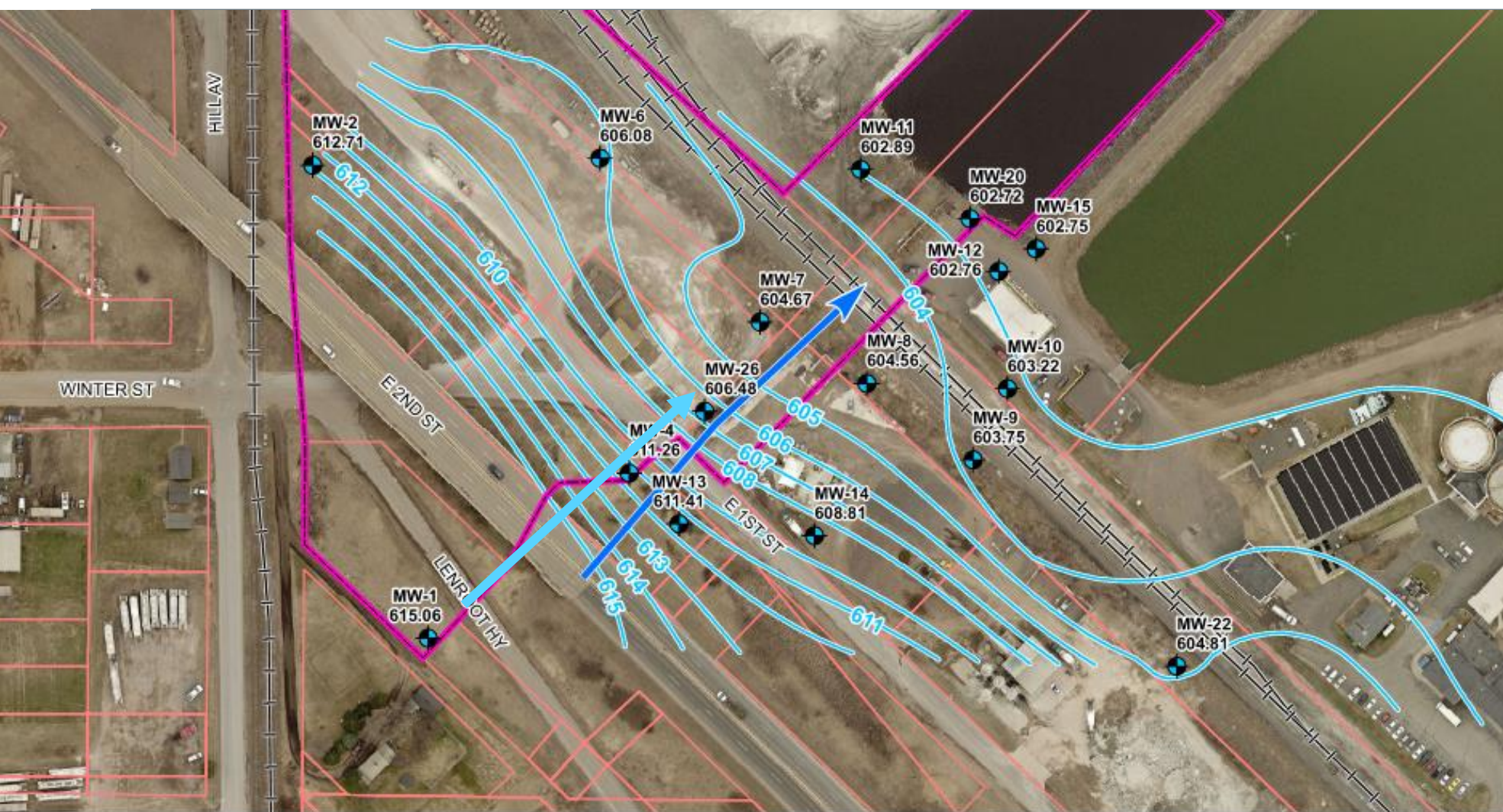


RI Results – Benzene in Subsurface Soil

Soil Benzene Samples Below 4 ft.
and Impacts > 100 mg/Kg

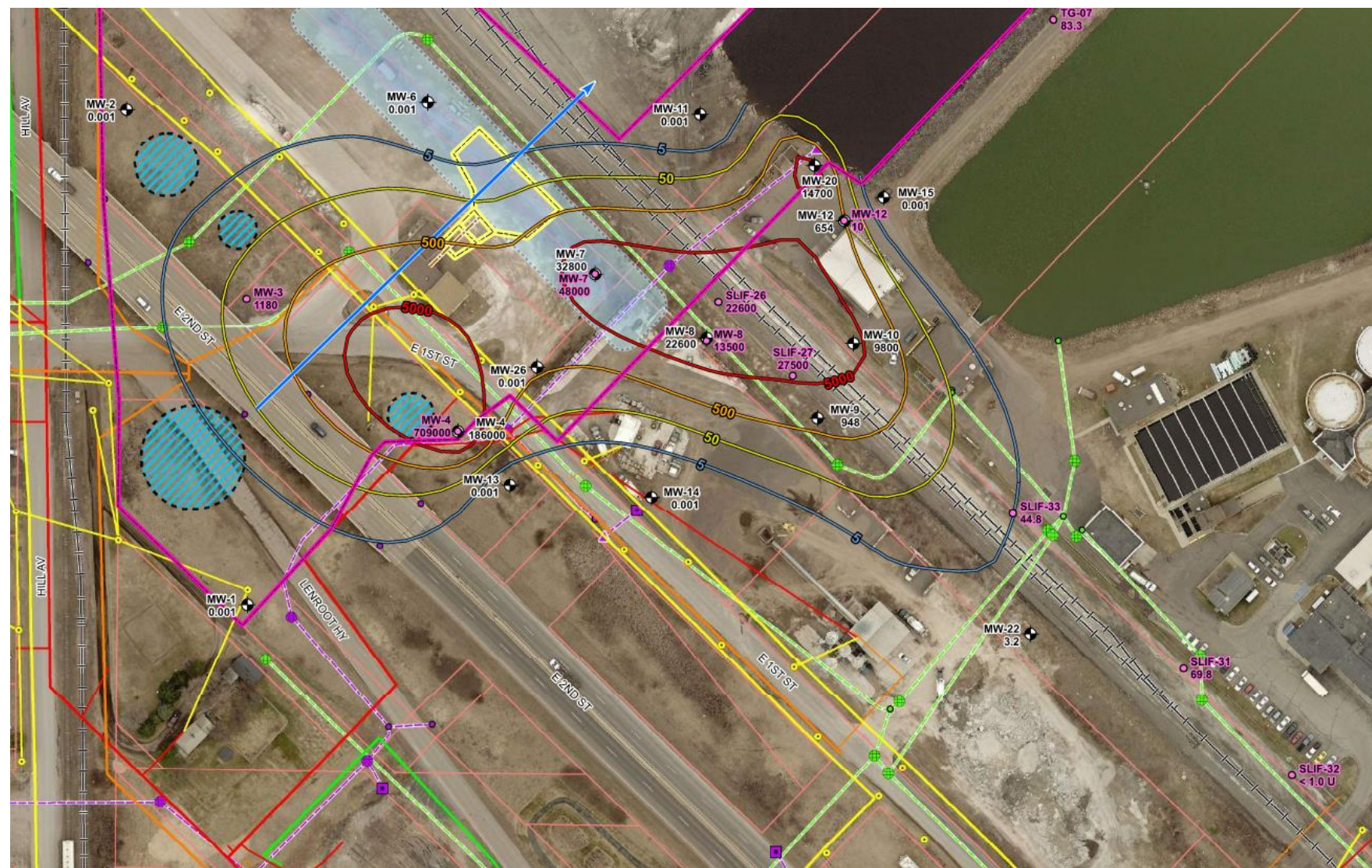


RI Results - Shallow Groundwater Flow



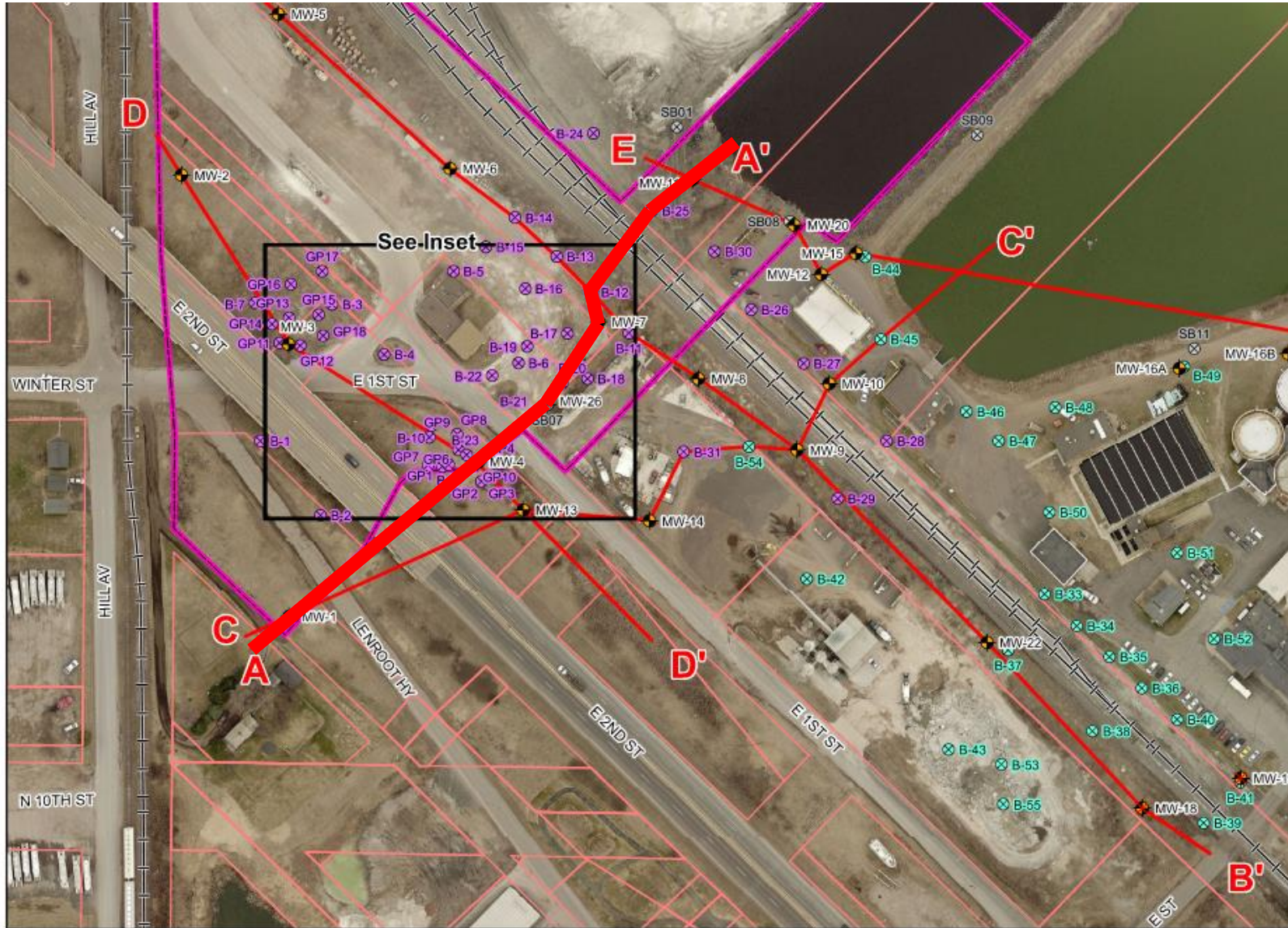
Shallow groundwater flows towards the lake.

RI Results - Benzene in Groundwater

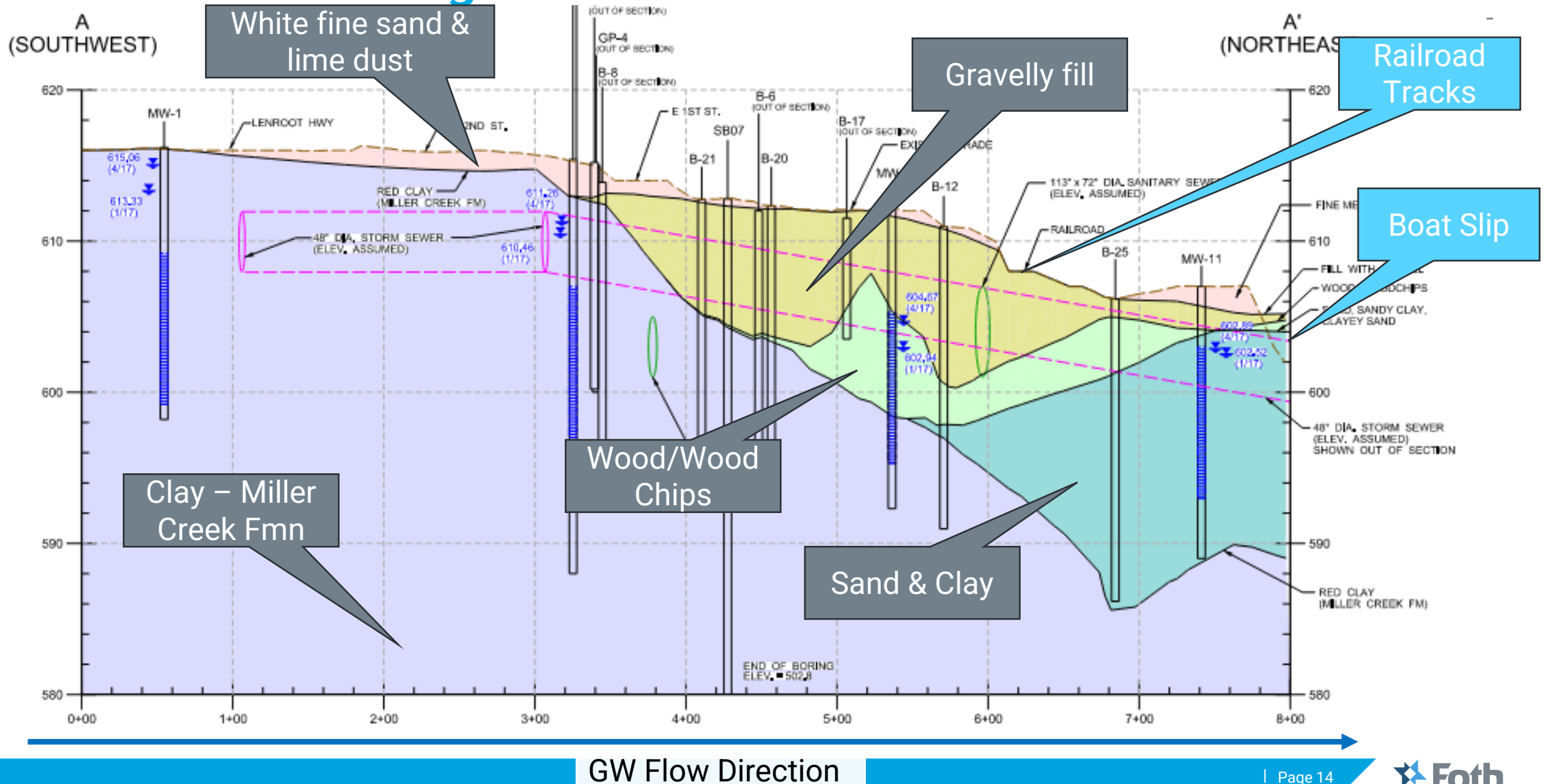


Benzene is the driver for groundwater contamination

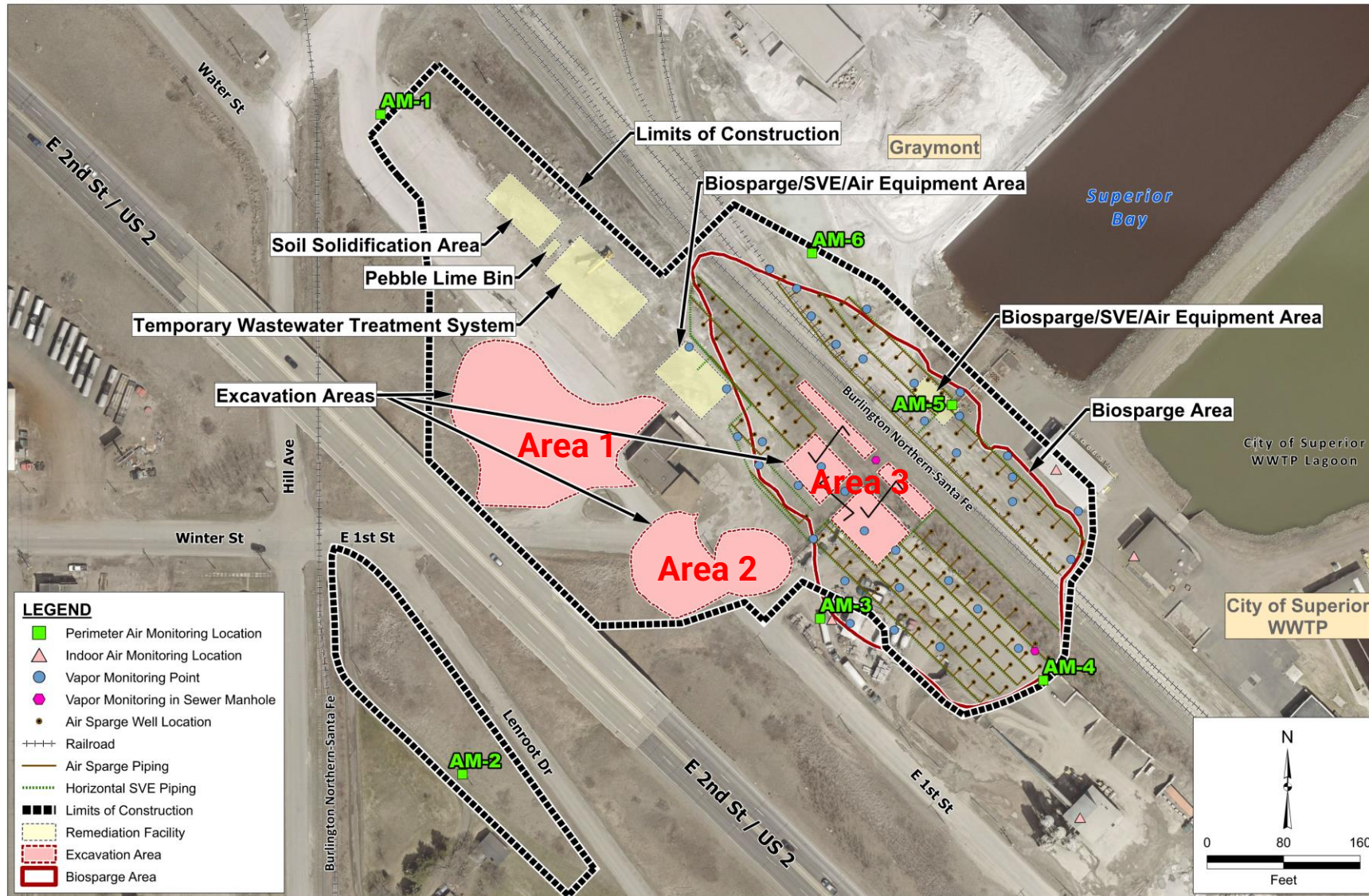
RI Results – Cross-Section Location Plan



Remedial Investigation Results & CSM



Remedial Design - Site Layout and Photos

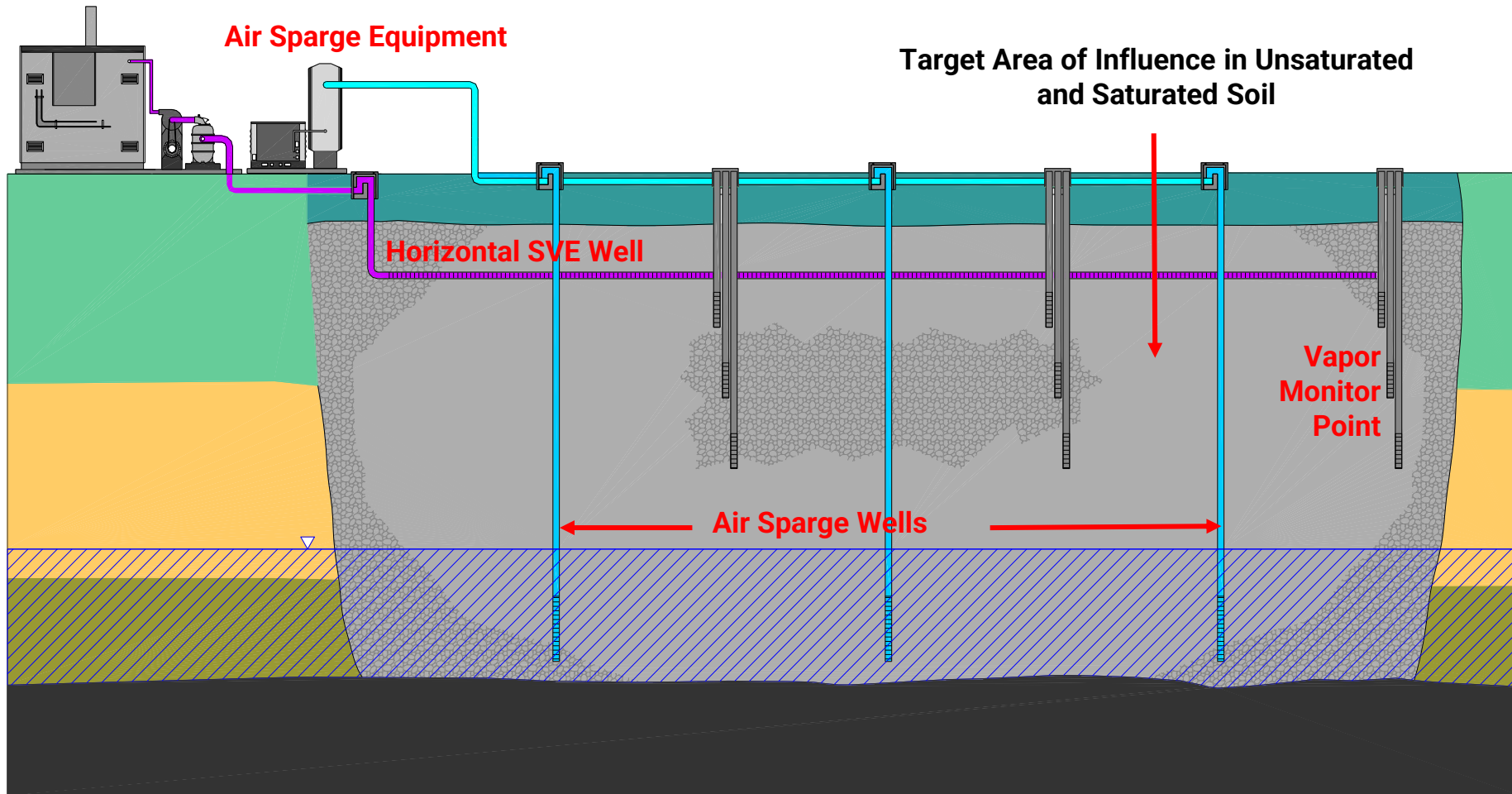


Excavation Areas

- ◆ Area 1: Former MGP Gas Holder
- ◆ Area 2: Former Hortonsphere
- ◆ Area 3: Former MGP Wastewater Discharge Area (Four Sub-Areas)

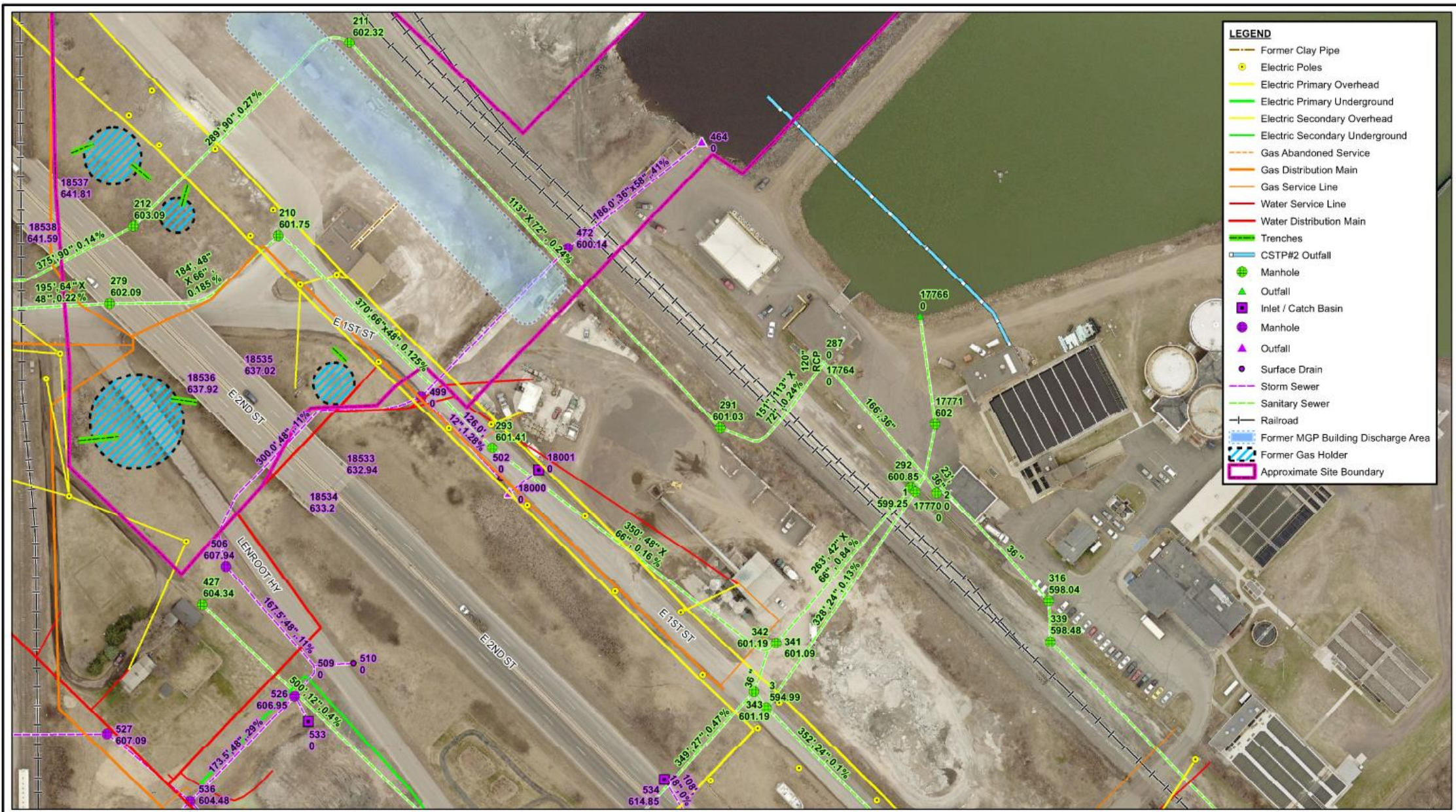
Remedial Design Biosparge/SVE Schematic

SVE Equipment

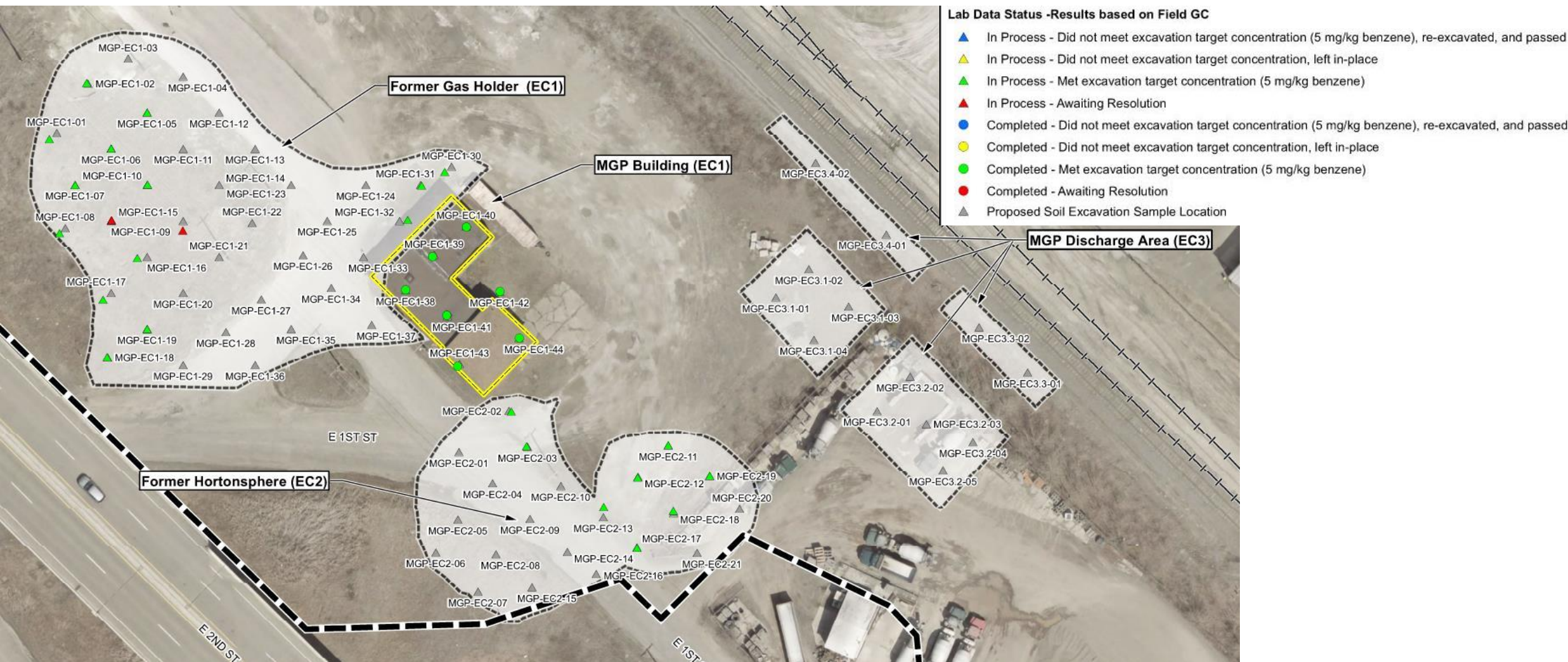


Benzene is the driver for groundwater contamination

Challenges – Underground Utilities



Soil Excavation Sample Results

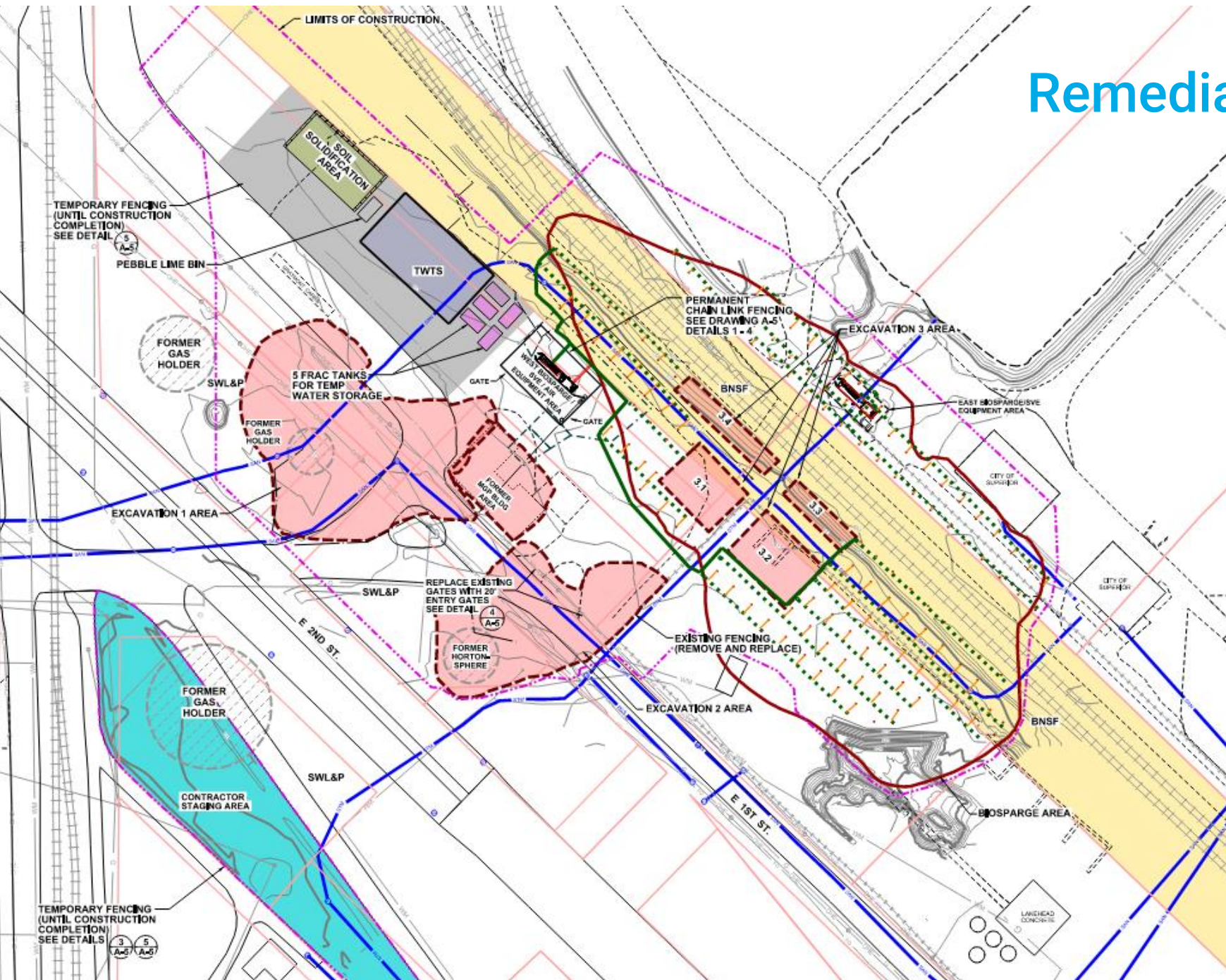


Additional excavation needed based on field screening

Remedial Action Completion

Adjustments made to design:

- Excavation extents expanded
- Excavation added under former MGP building
- Some biosparge wells relocated
- Second biosparge system added



Remedial Action Completion

Confirmation soil samples field screened with Frog 5000 field GC

Remedial excavation extents adjusted to find clean end points

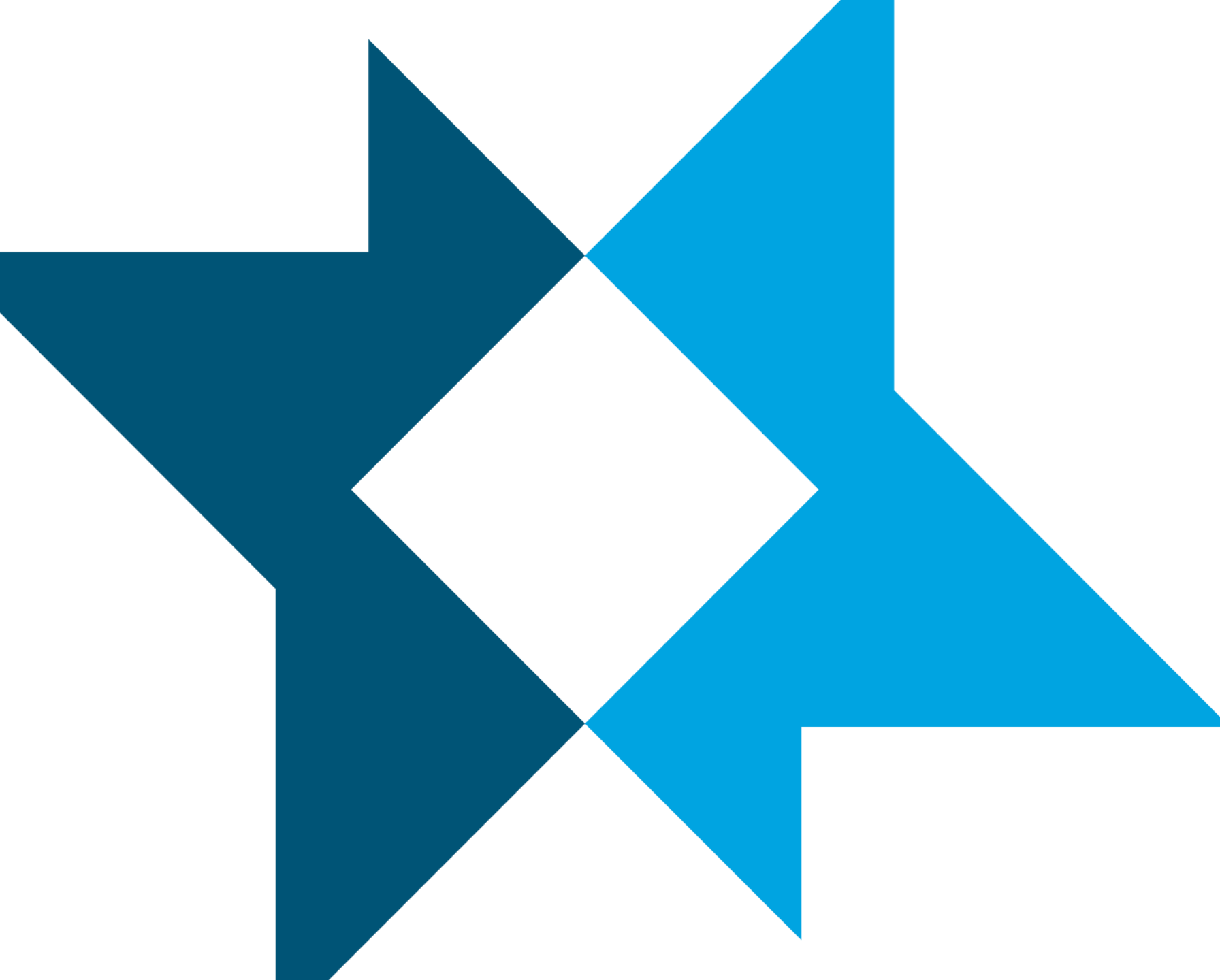
Biosparge system design was flexible, adjusted to observed site conditions



Quick field results and flexibility in design allowed for successful completion

Questions & Answers

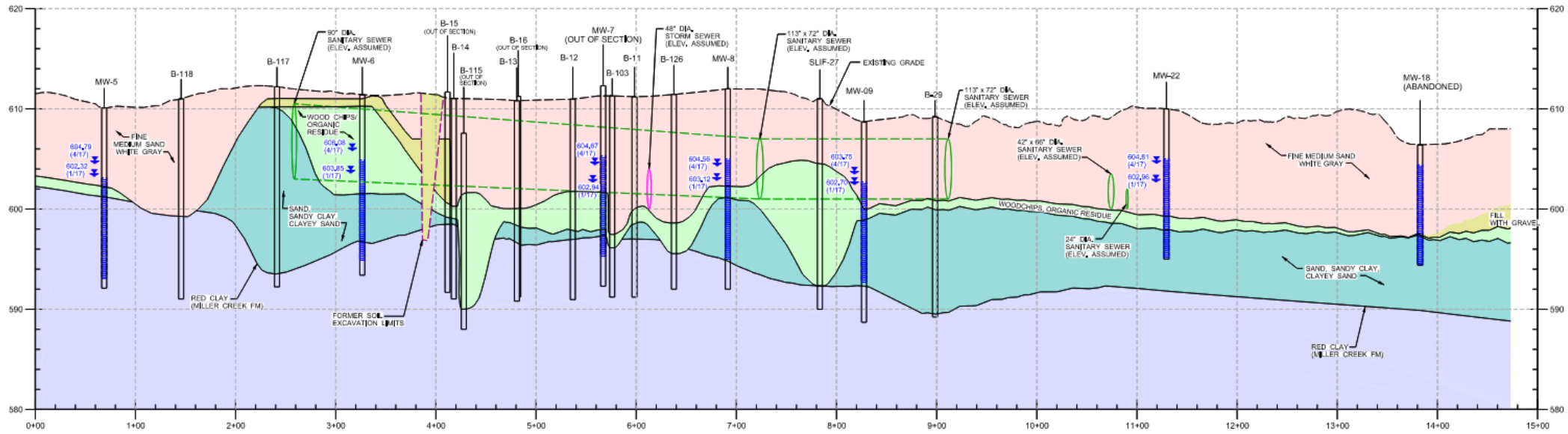




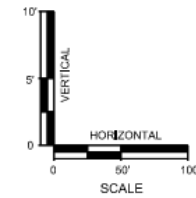
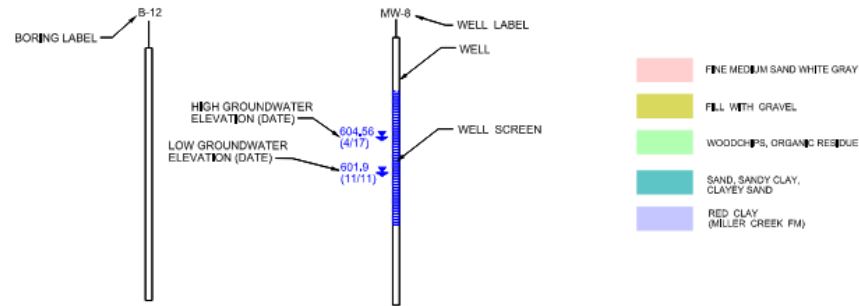
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B (NORTHWEST) B' (SOUTHEAST)



LEGEND

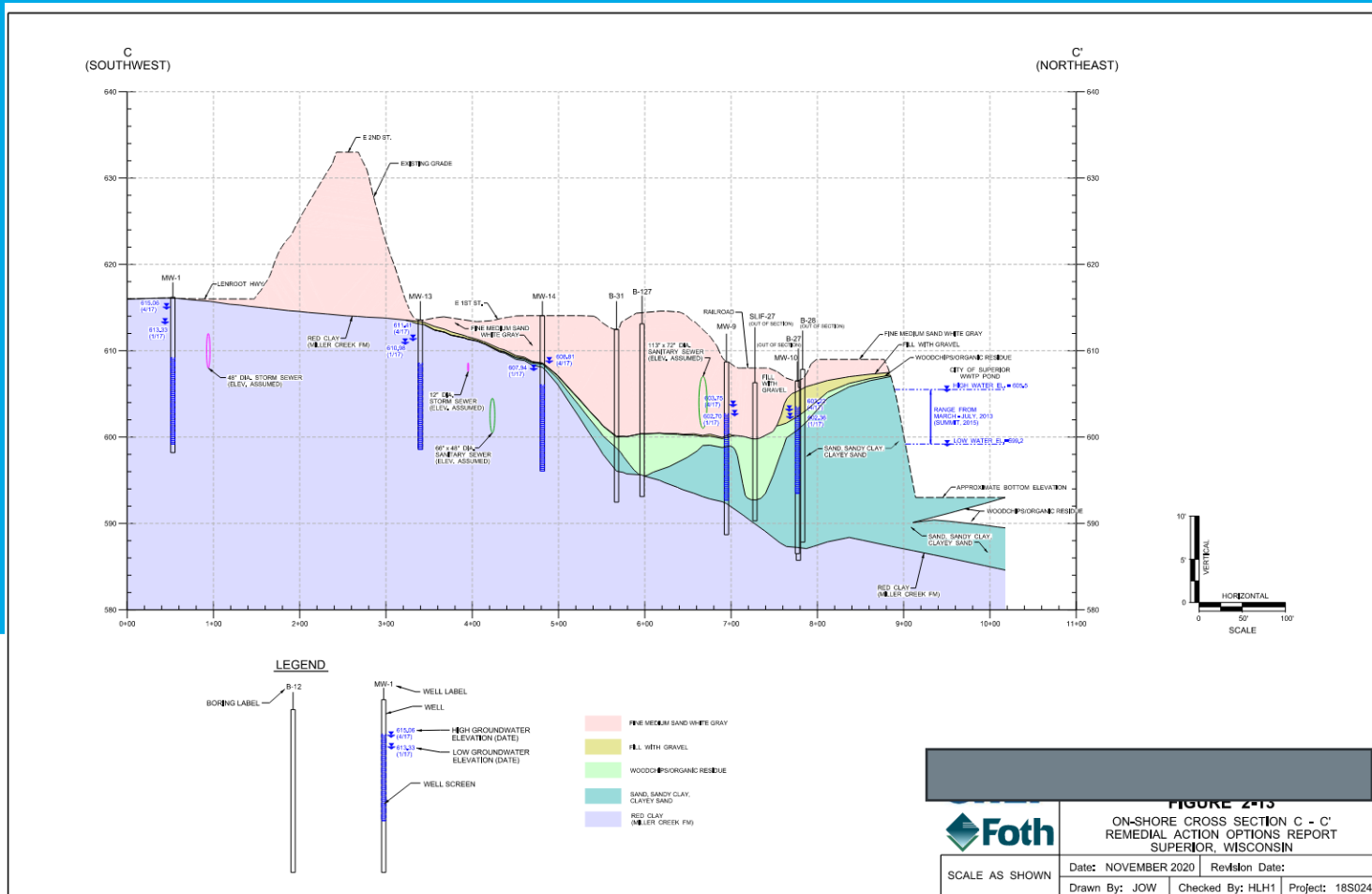


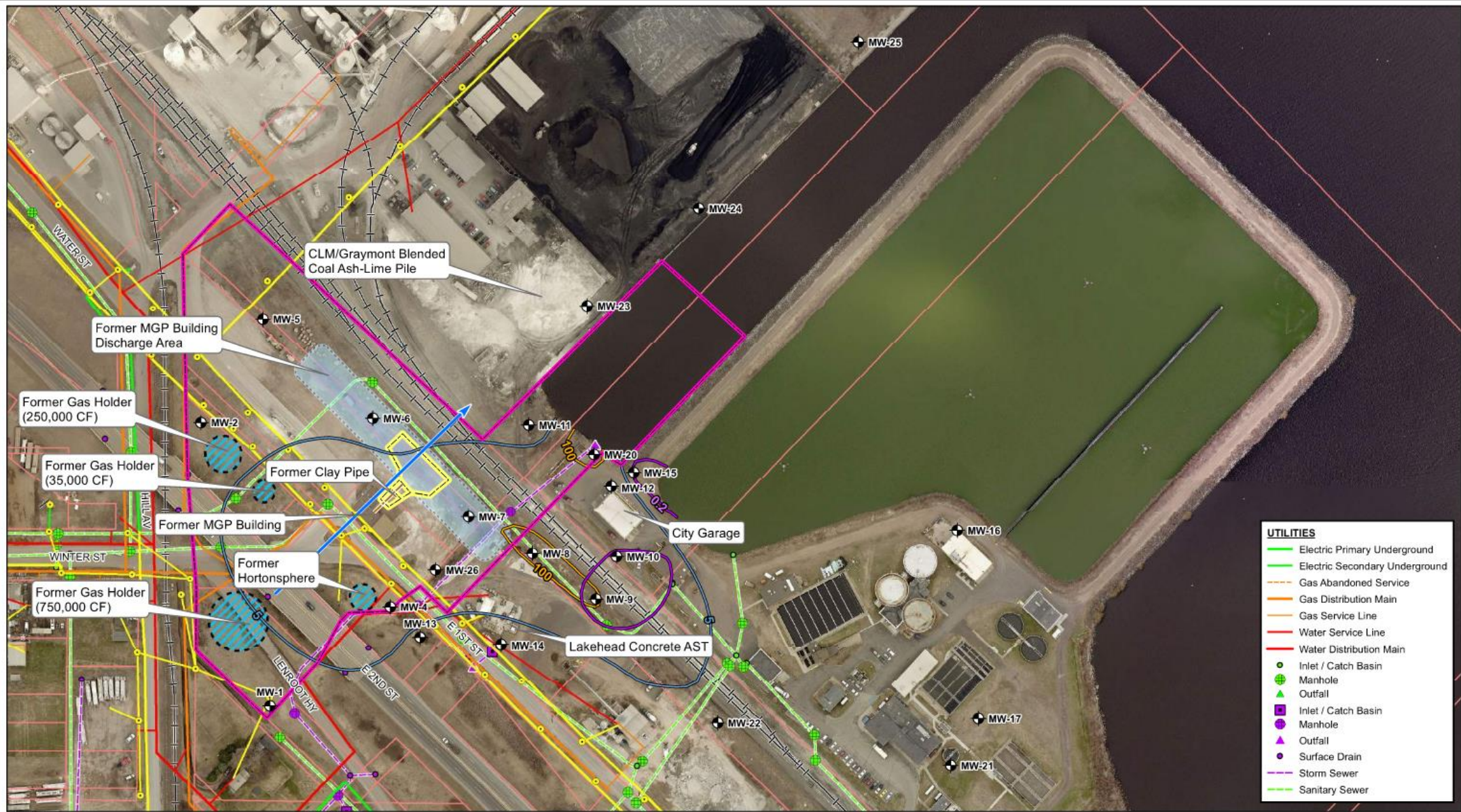
ON-SHORE CROSS SECTION B - B'
REMEDIAL ACTION OPTIONS REPORT
SUPERIOR, WISCONSIN

SCALE AS SHOWN

Date: NOVEMBER 2020	Revision Date:
Drawn By: JOW	Checked By: HLH1
Project: 18S024	







- UTILITIES**
- Electric Primary Underground
 - Electric Secondary Underground
 - Gas Abandoned Service
 - Gas Distribution Main
 - Gas Service Line
 - Water Service Line
 - Water Distribution Main
 - Inlet / Catch Basin
 - Manhole
 - Outfall
 - Inlet / Catch Basin
 - Manhole
 - Outfall
 - Surface Drain
 - Storm Sewer
 - Sanitary Sewer

NOTES:

1. 2016 - 3" resolution air photo from Douglas County.
2. Horizontal coordinate system: NAD 1983 Douglas County, units in feet.
3. Elevation is given in feet above mean sea level.

- LEGEND**
- Groundwater Monitoring Well
 - Groundwater Flow Direction
 - April 2017 Isoconcentration Contour (ug/L)
 - 0.20 NR140 ES Benzo[a]pyrene
 - 5.0 NR140 ES Benzene
 - 100 NR140 ES Naphthalene
 - Former Clay Pipe
 - Former MGP Building Discharge Area
 - Approximate 2008 Remedial Excavation
 - Former Gas Holders and Hortonsphere
 - Railroad
 - Tax Parcel
 - Approximate Site Boundary

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.

Foth

0 80 160 Feet

SUMMARY OF GROUNDWATER IMPACTS REMEDIAL ACTION OPTIONS REPORT SUPERIOR, WISCONSIN		
Date: DECEMBER 2020	Revision Date:	
Drawn By: DAT	Checked By: HLH	Project: 18S024



Presentation Tips: 6-6-6 Rule

- ◆ 6 lines of type per slide
- ◆ 6 words per line
- ◆ Readable at 6 feet from monitor