



→ **Tom Kinney, CPG, PG**
Contaminant Assessment &
Remediation Team Leader, Senior
Geologist, GHD

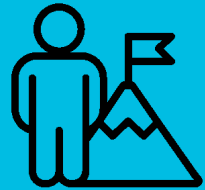
Battelle 2023

Welcome

Key takeaways



Performed HRSC at two large manufacturing facilities



Completely different CSMs - therefore, different approaches to site characterization

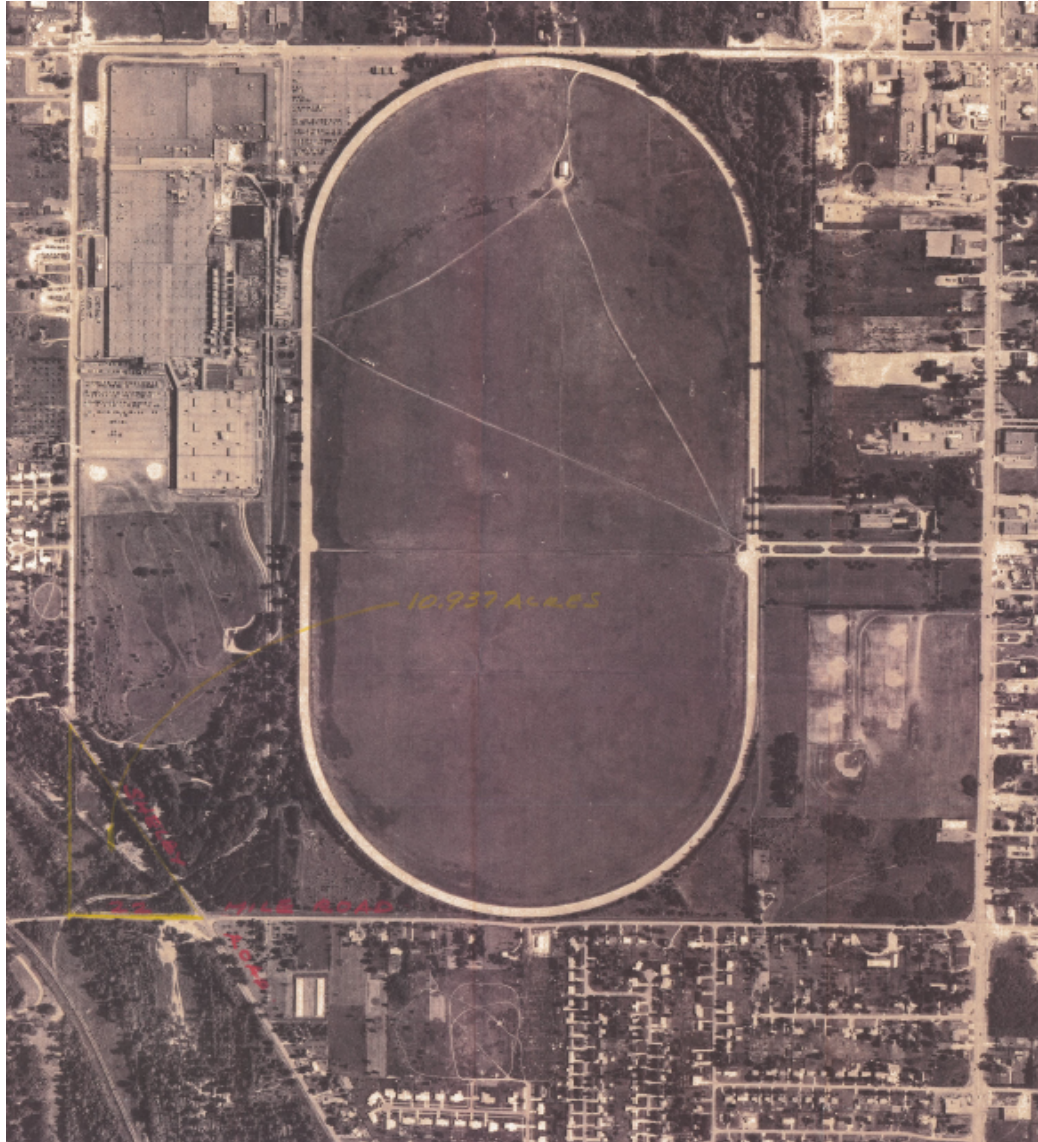


Quickly and accurately characterized sites – significant site characterization cost savings



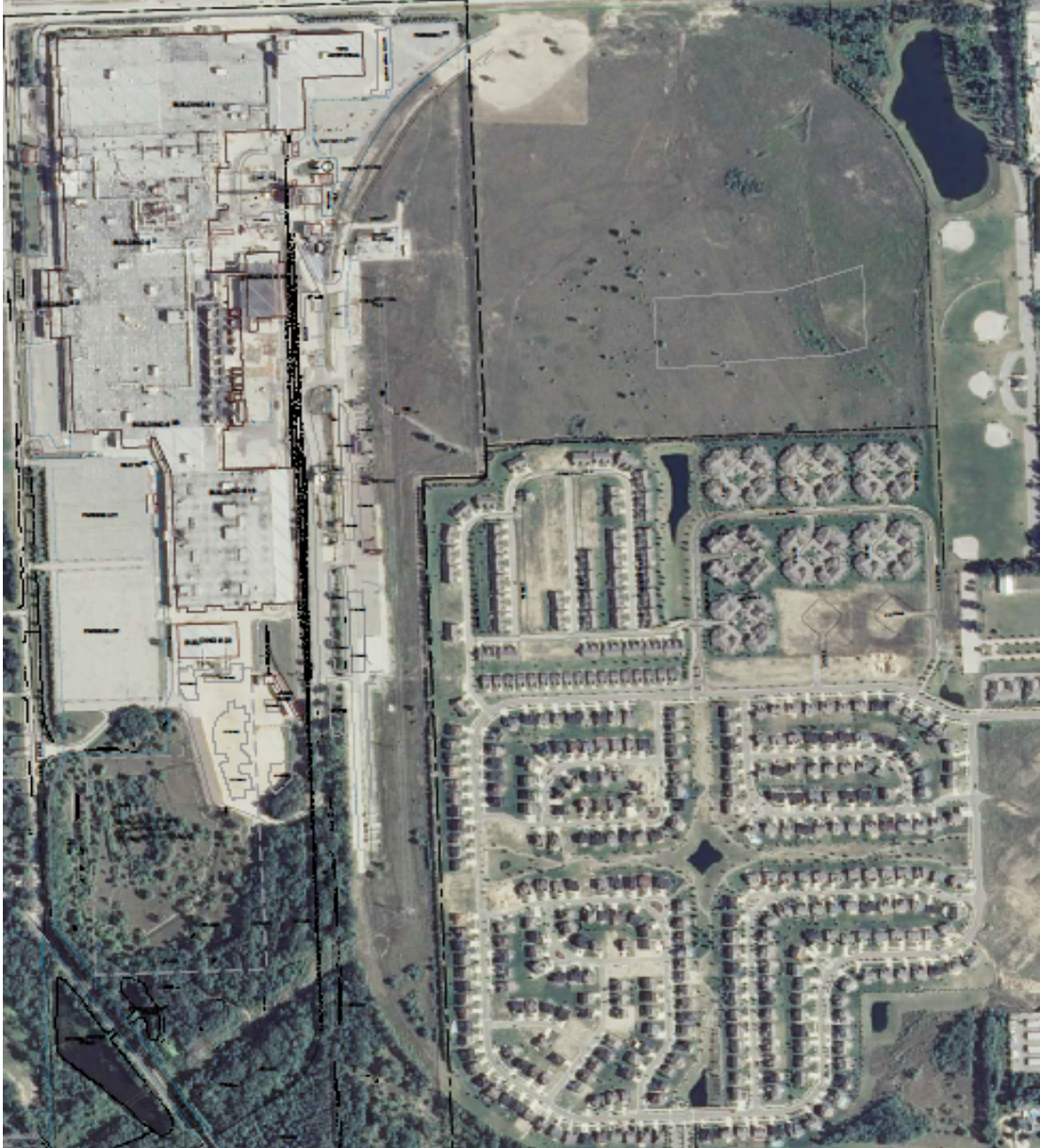
Accurate CSMs allowed for better FSs and successful implementation of site remedies

Site 1 Setting



- Located in Michigan
- 1-mile square site
- Historical usage as manufacturing facility and test track
- Test track sold & redeveloped in 1990's
- No drinking water wells on or adjacent

Background



- Prior to the RI, an extensive Phase II ESA was completed using traditional investigative methods. Findings from the Phase II ESA indicated the presence of TCE at the property boundary
- TCE identified in intermediate interval of ~30ft-thick sandy aquifer

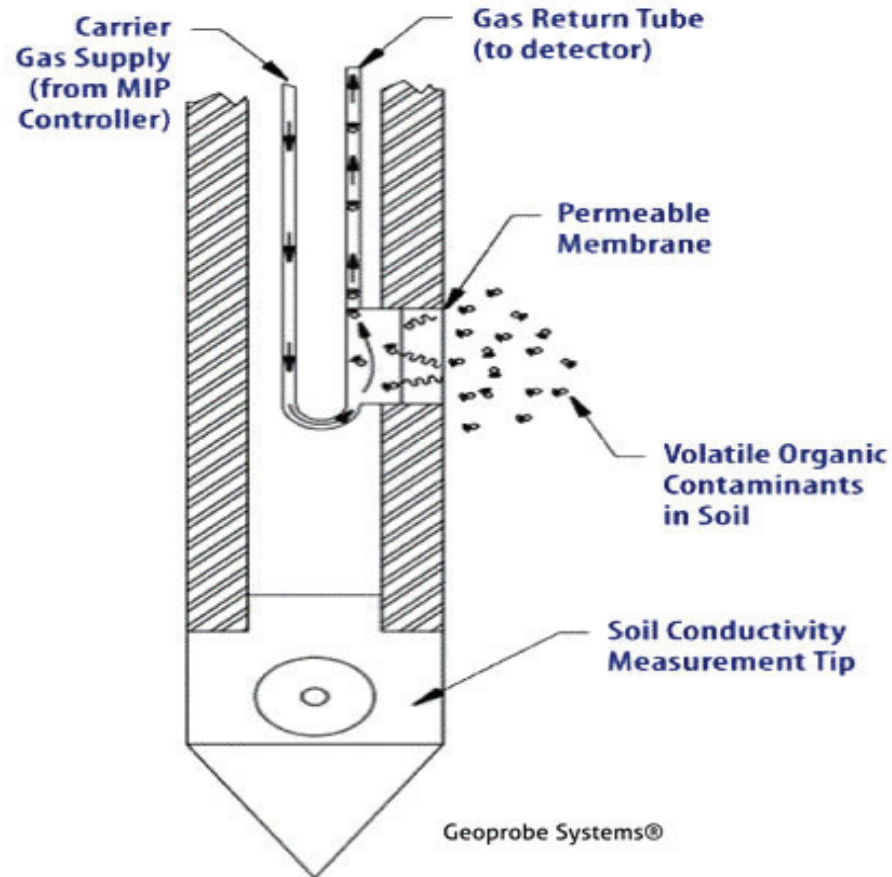
Remedial Investigation



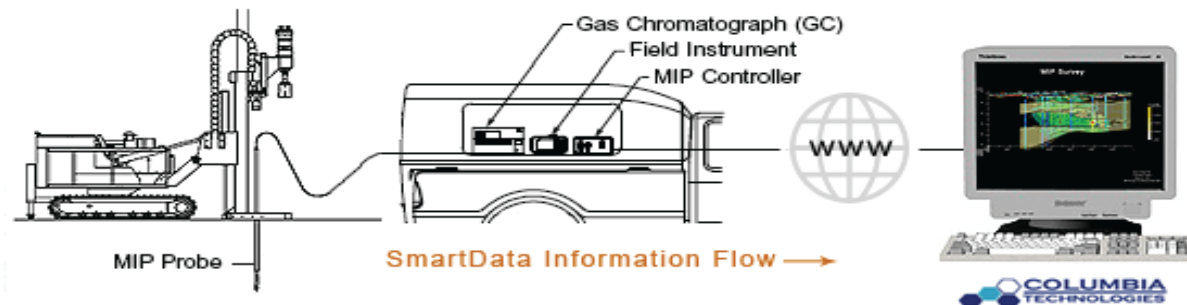
RI included:

- Membrane Interface Probe (MIP)
- Hydraulic Profiling Tool (HPT)
- Traditional drilling and sampling
- Aquifer testing
- 3-D models
- TCE Isotope analysis
- Treatability studies

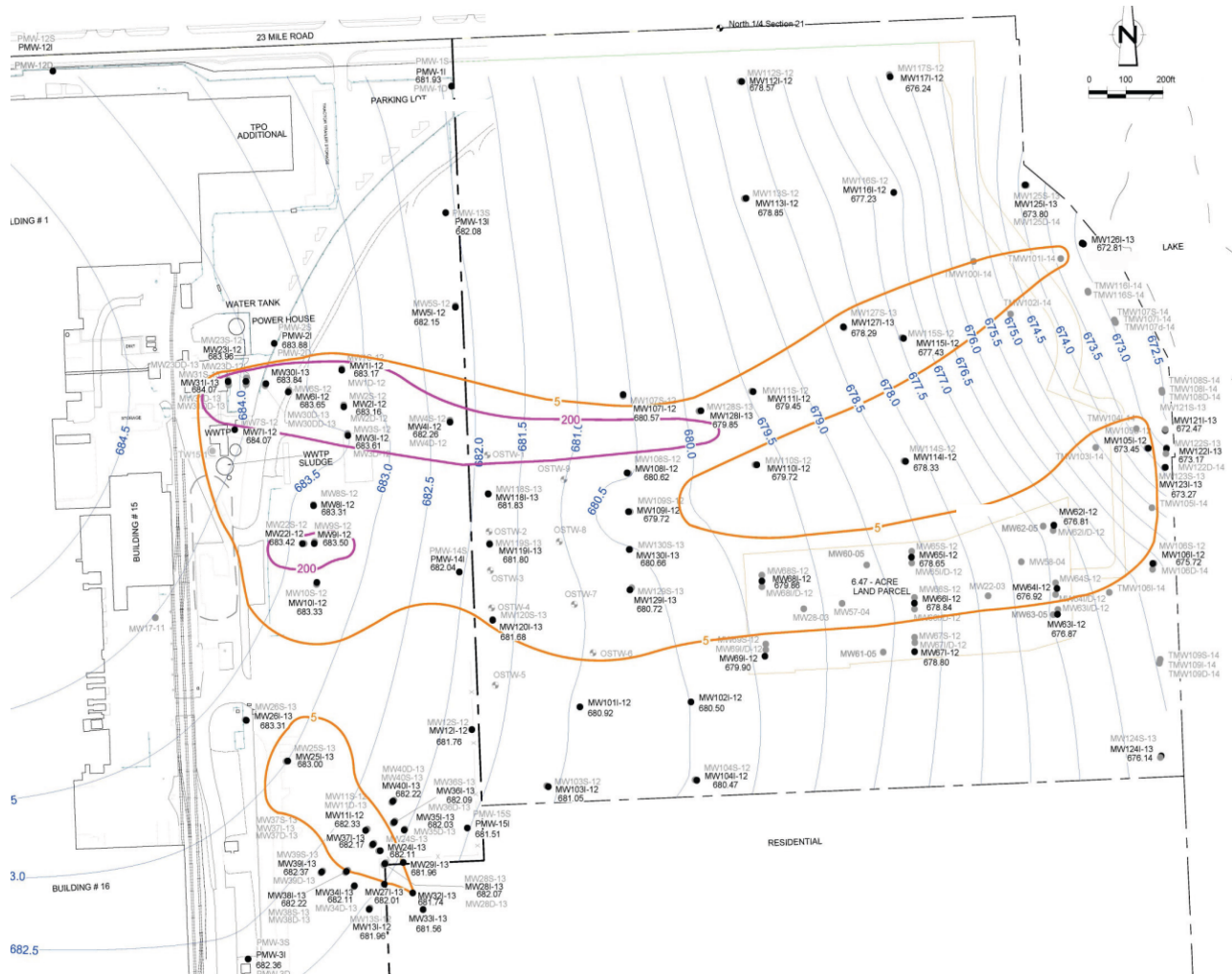
Remedial Investigation



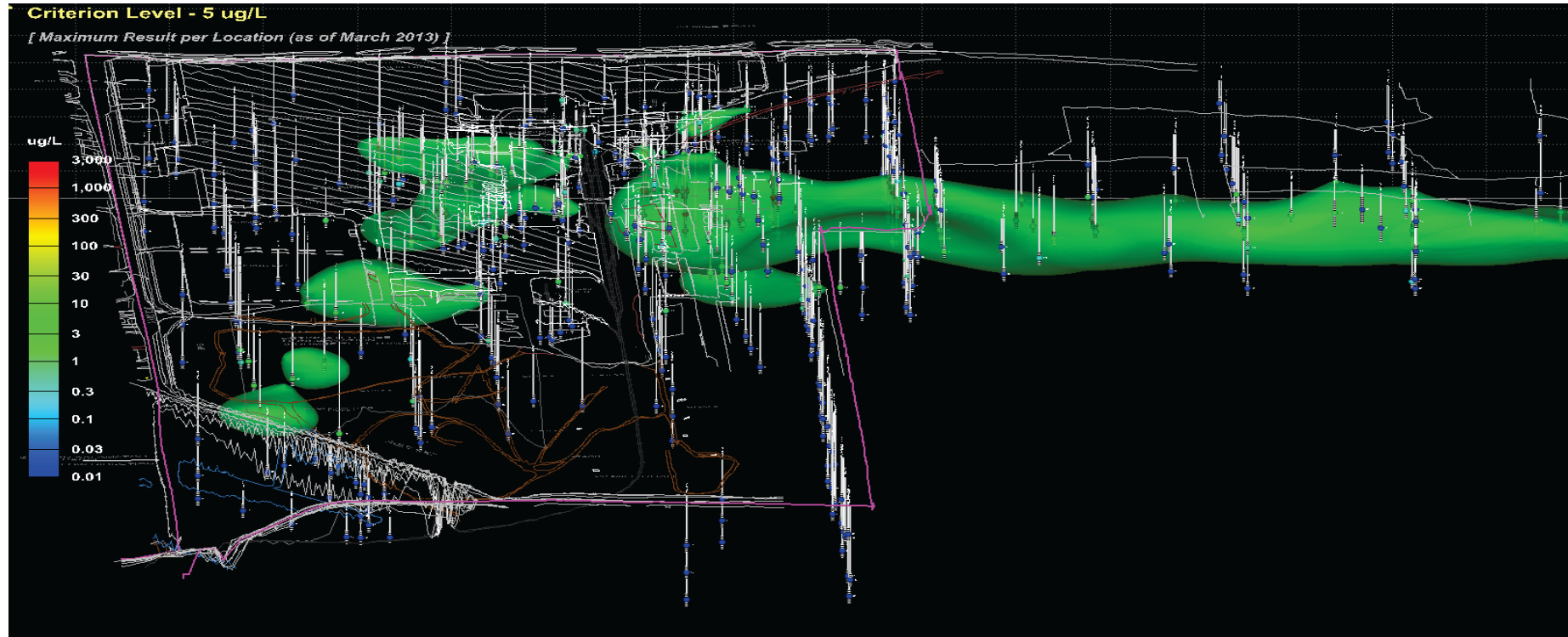
The extensive size of the site and the thin plumes of TCE present, MIP technologies were utilized to rapidly identify and delineate the vertical and horizontal extent of TCE



Conceptual Site Model



Conceptual Site Model



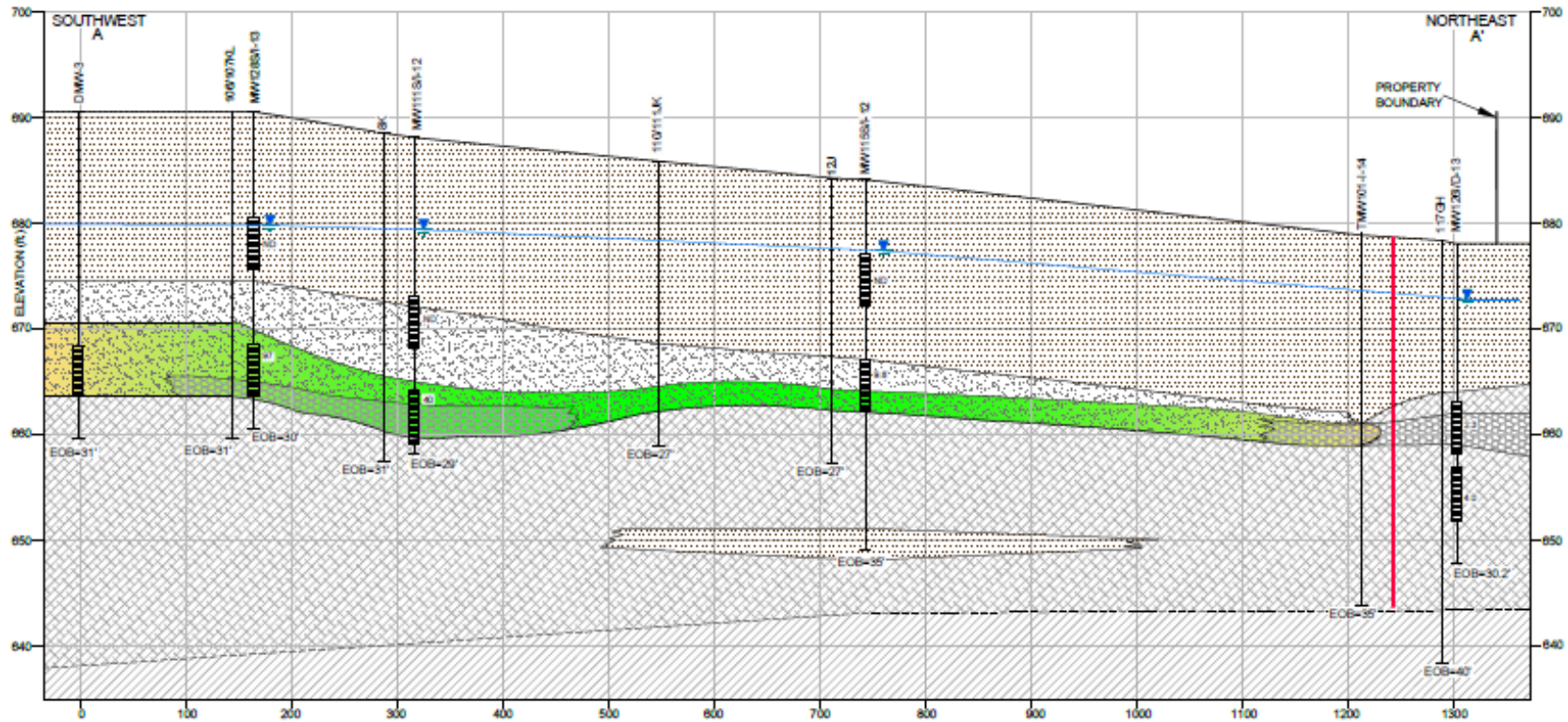
Based on CSM – FS completed selecting PRBs at downgradient edge of plumes

Pre-Design Investigation



- 3D fate & transport model
- Temporary and permanent monitoring wells to verify exact location of plume for PRB locating
- Soil borings along path of proposed PRB to better define stratigraphy
- Slug tests and collection of soil for grain size and permeability tests
- **HPT data was consistent w traditional testing method results**

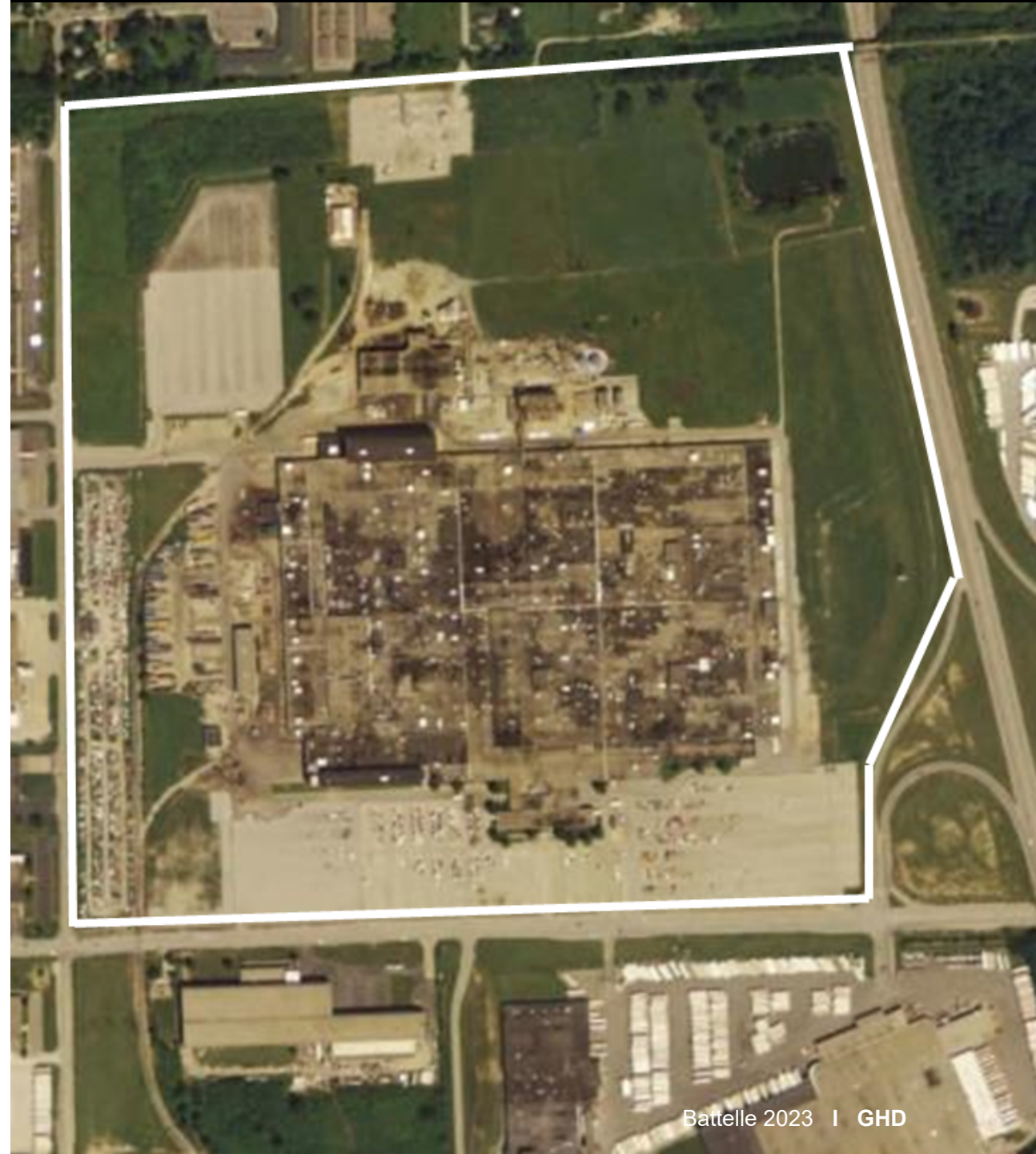
PRB Design



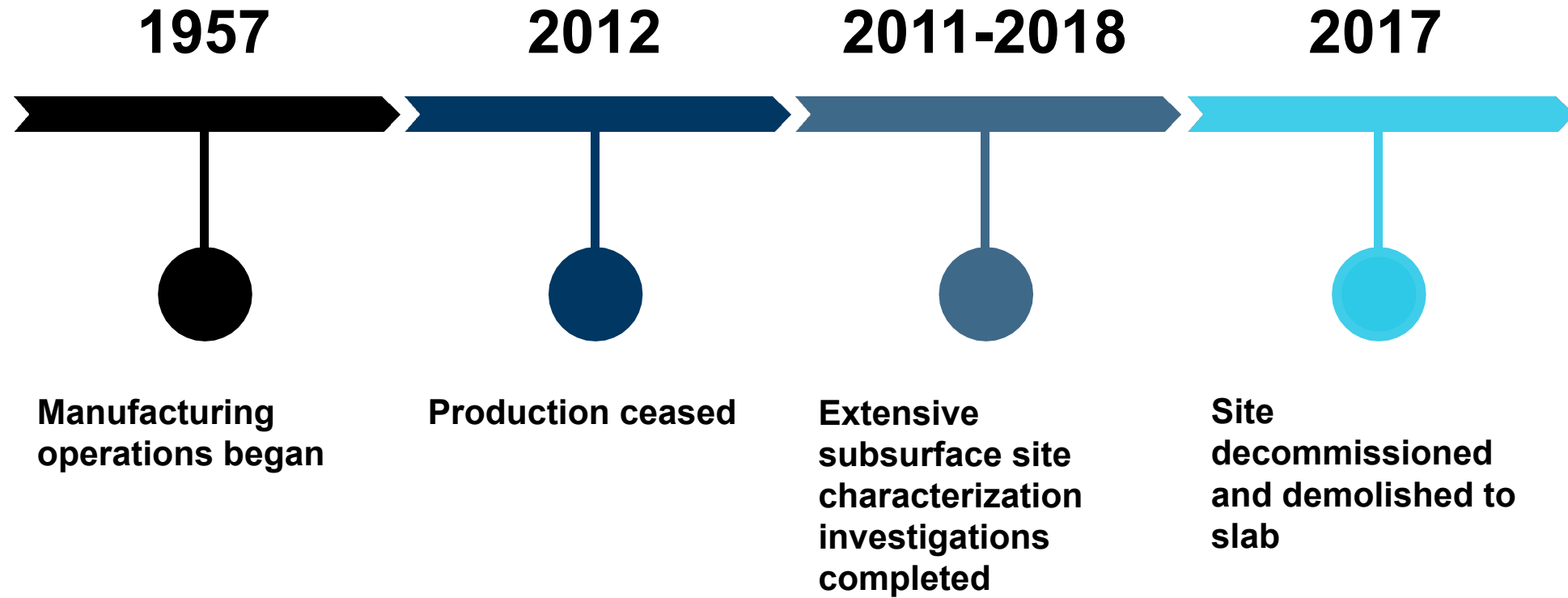
PRB identified in red, tying into the lower clay unit

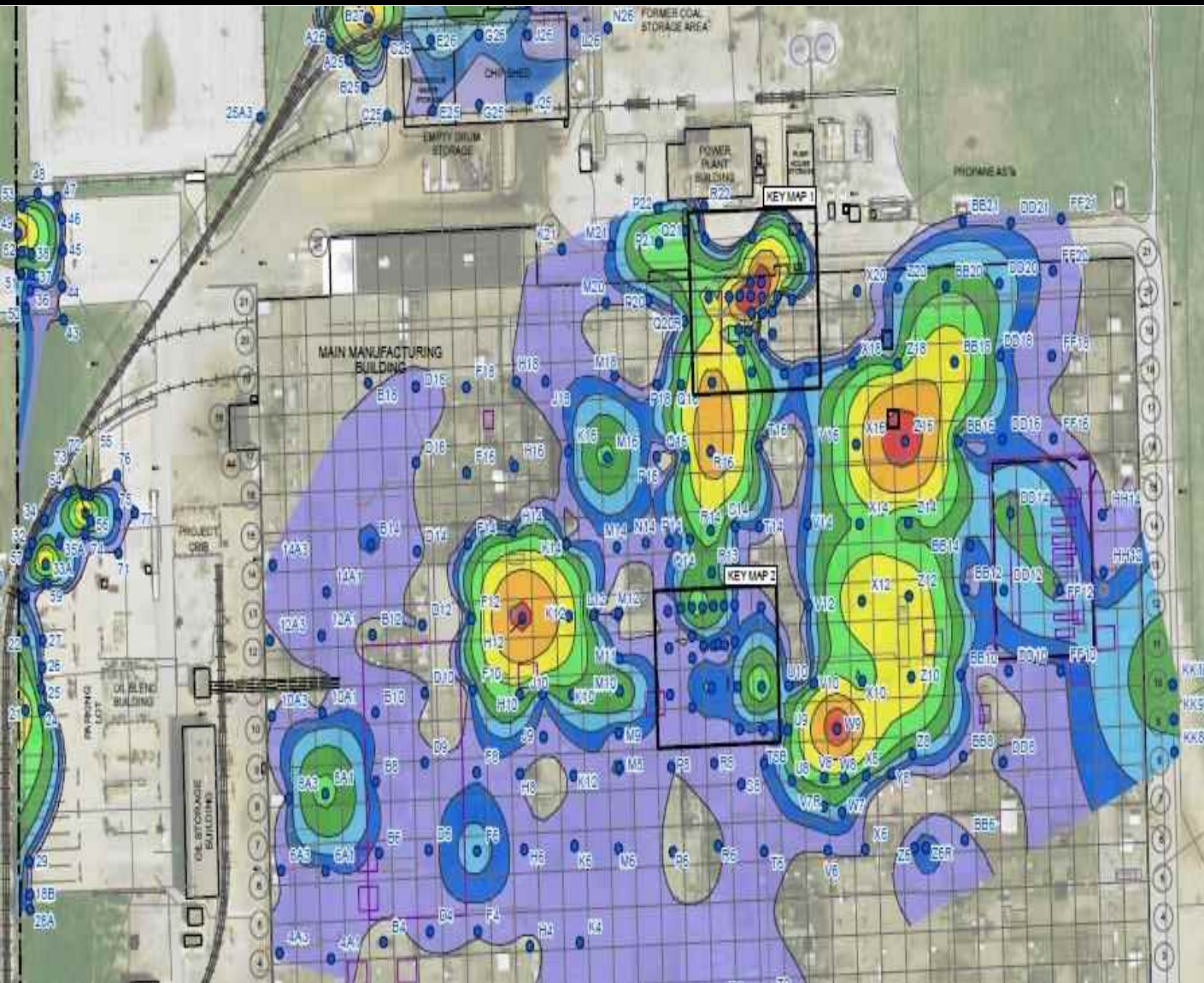
Site 2 Setting

- Located in Indiana
- 148-acre site
- Recently demolished main building ~1.6M square feet
- Primarily a flat site
- No drinking water wells onsite or adjacent sites



Background





Site Investigations

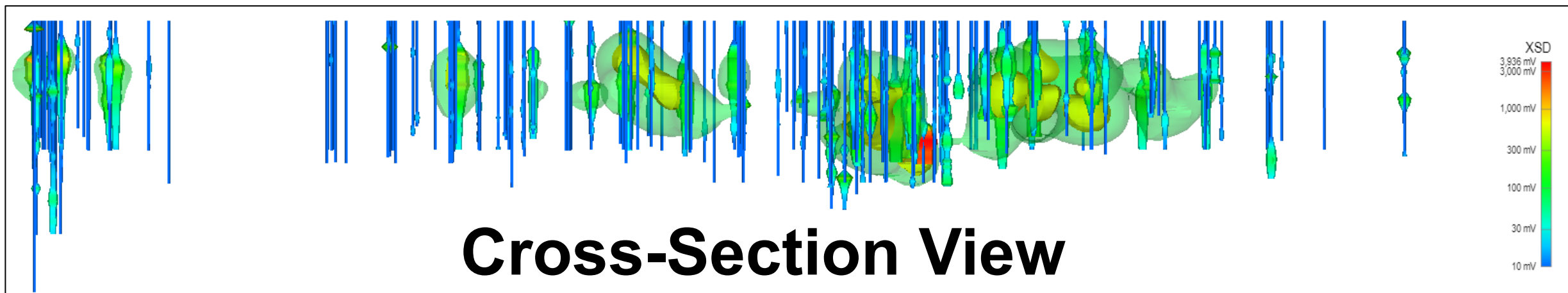
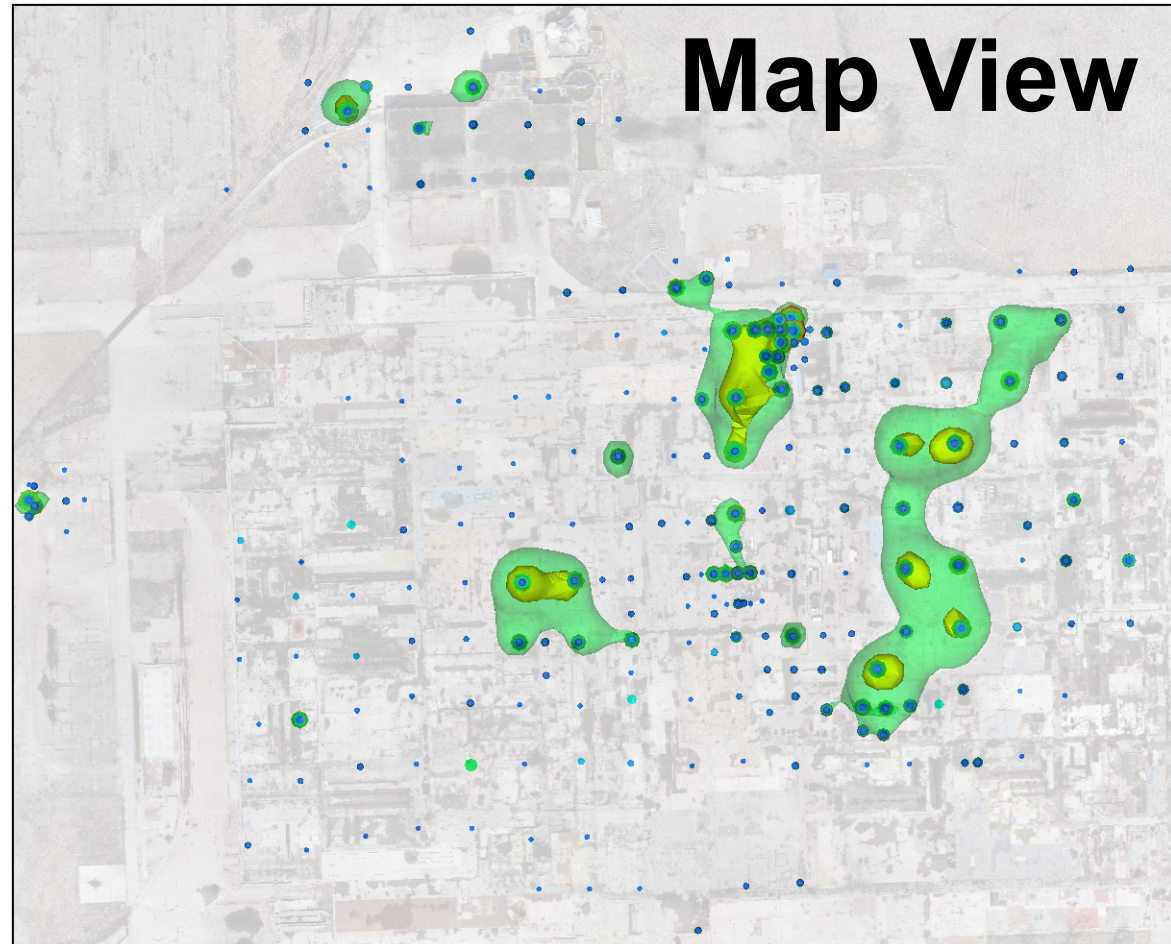
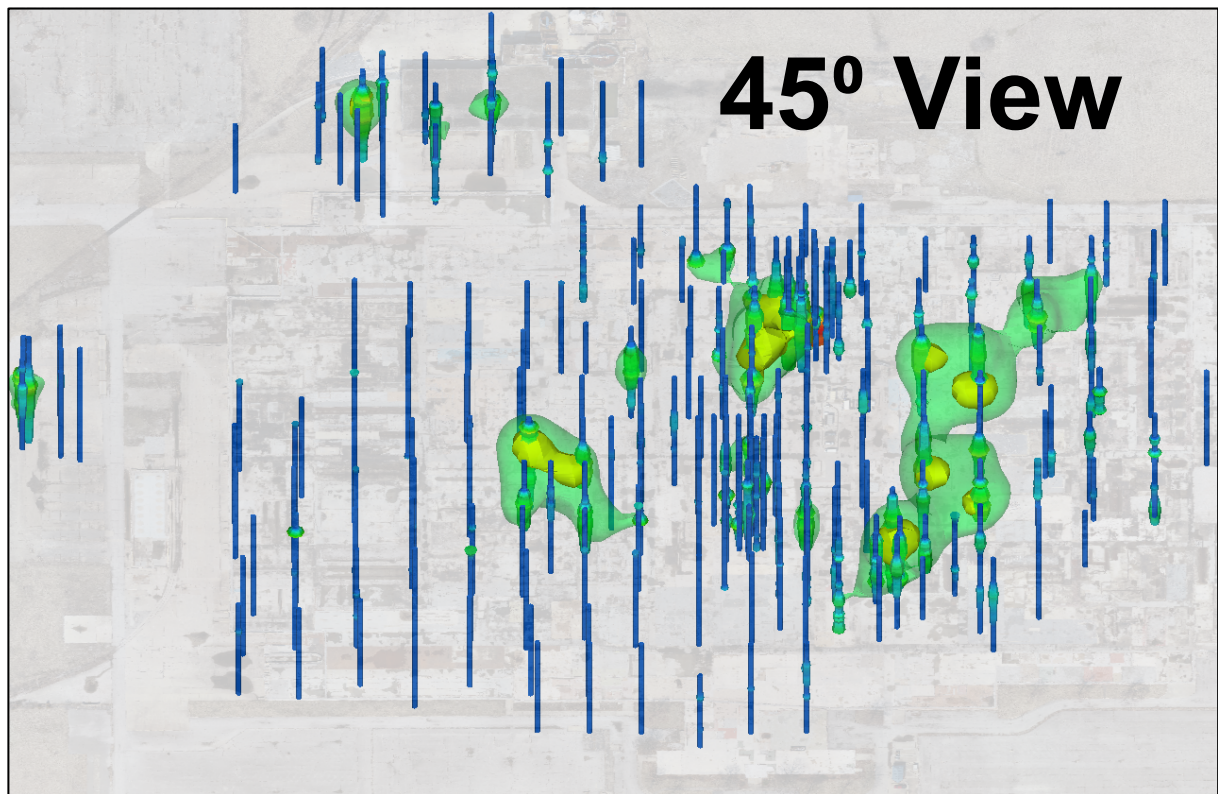
- 400+ soil borings
- 260+ Temporary & permanent monitoring wells installed
- Surface Geophysics

Using high-resolution site characterization tools –

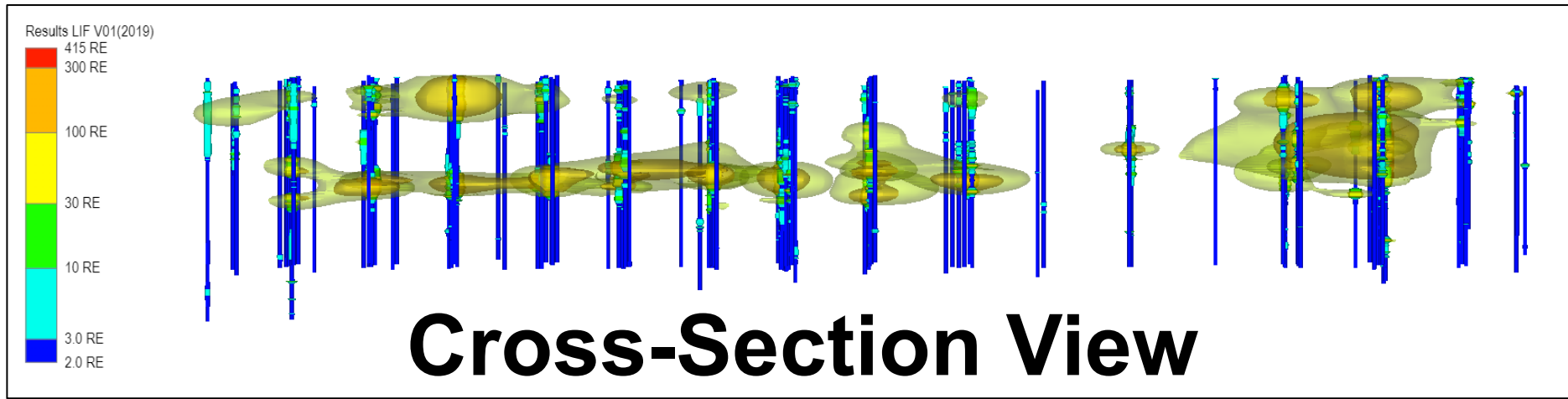
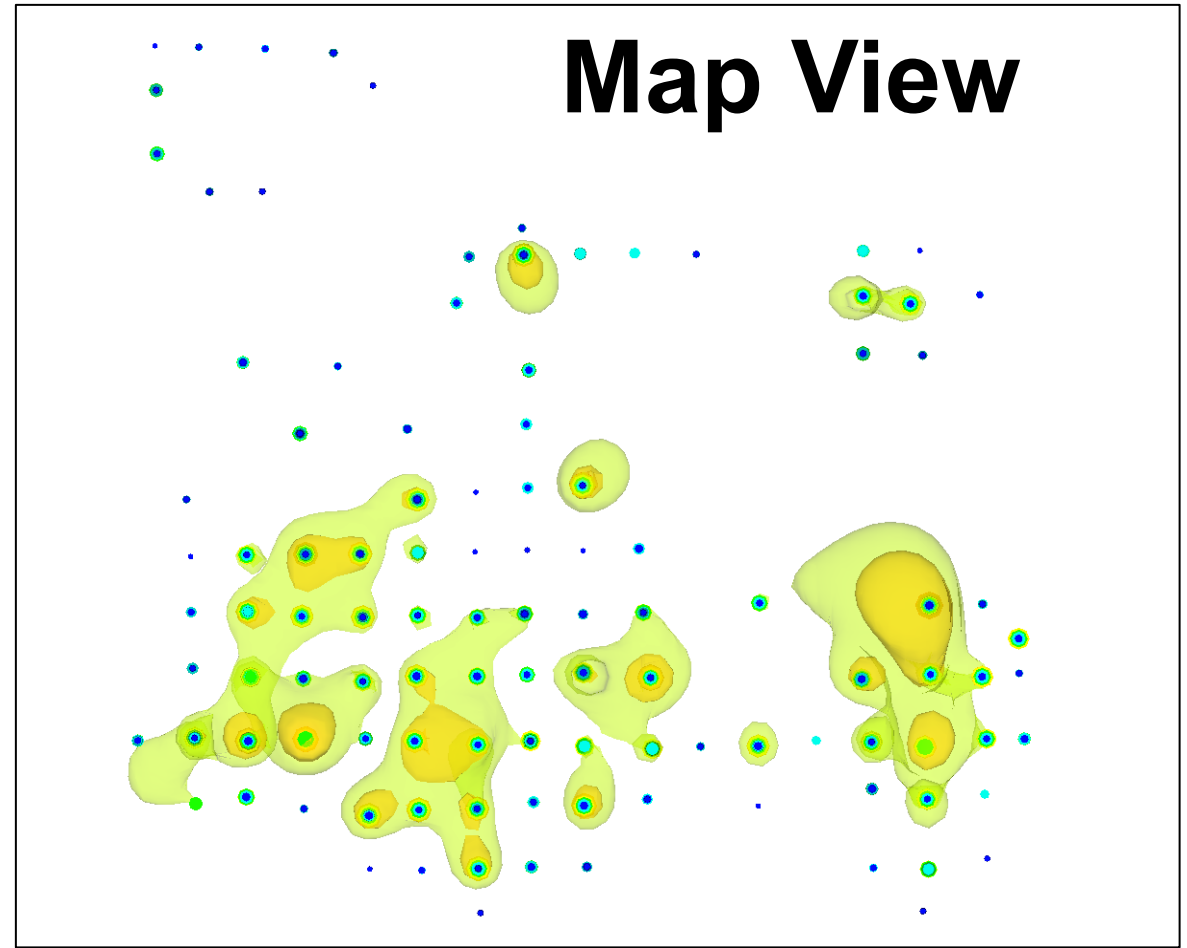
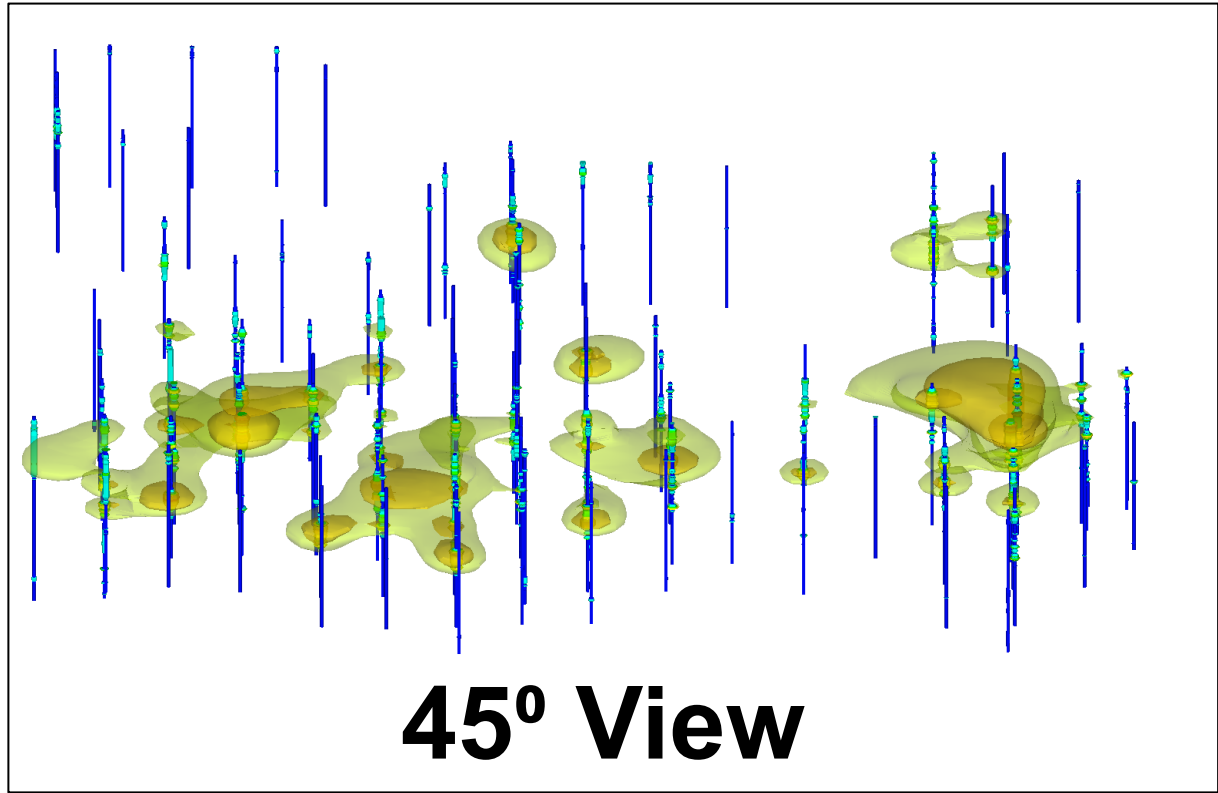
GRID PATTERN

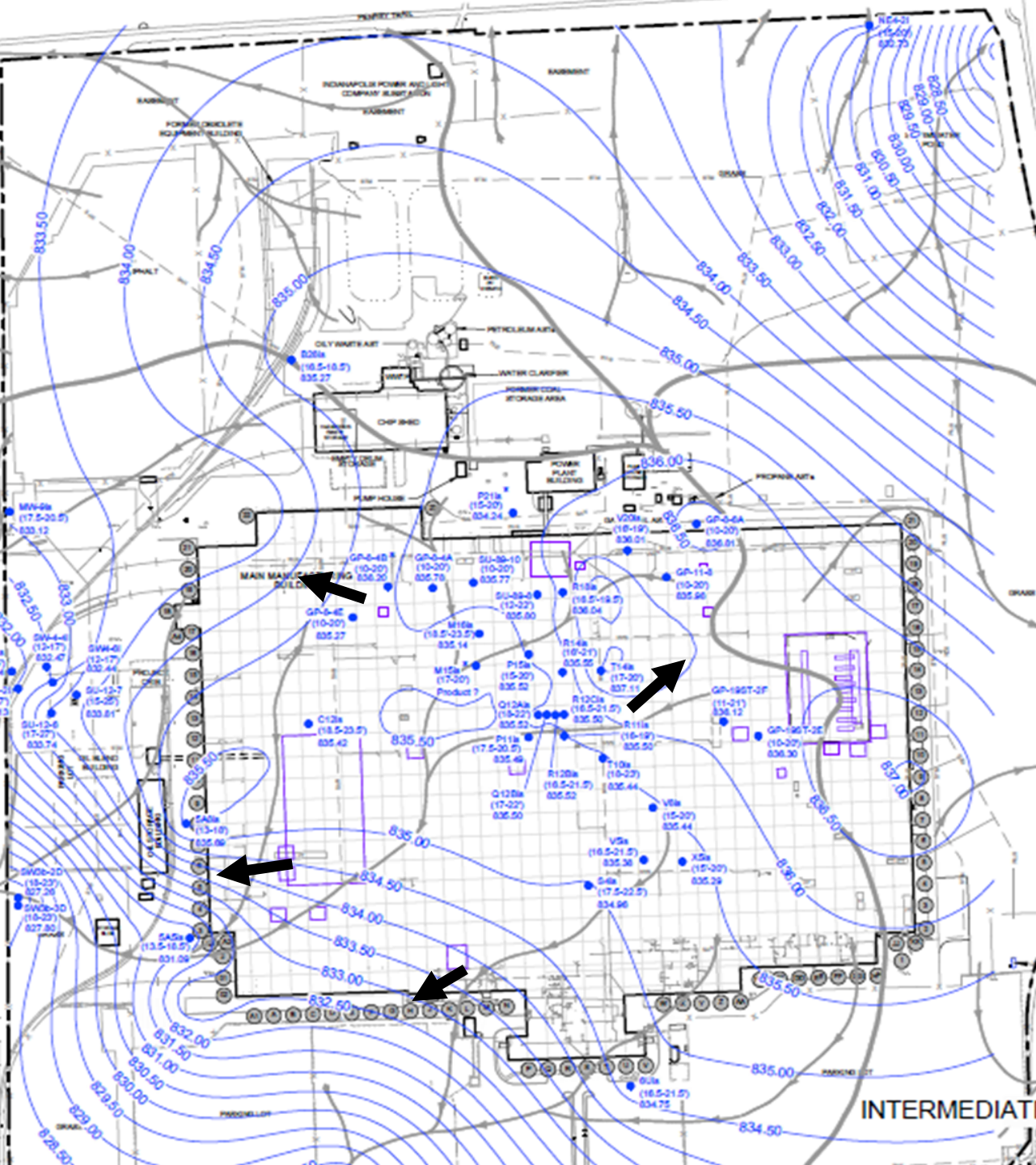
- MIP
 - 280 MIP borings
 - Identified cVOCs
- LIF
 - 158 LIF borings
 - Identified LNAPL

MIP Results and Interpolation



LIF Results and Interpolation





Geology

- Surficial Fill
- Native Clay (75 ft)
- Discontinuous Interbedded Sand Units (various depths within the native clay unit)

Groundwater

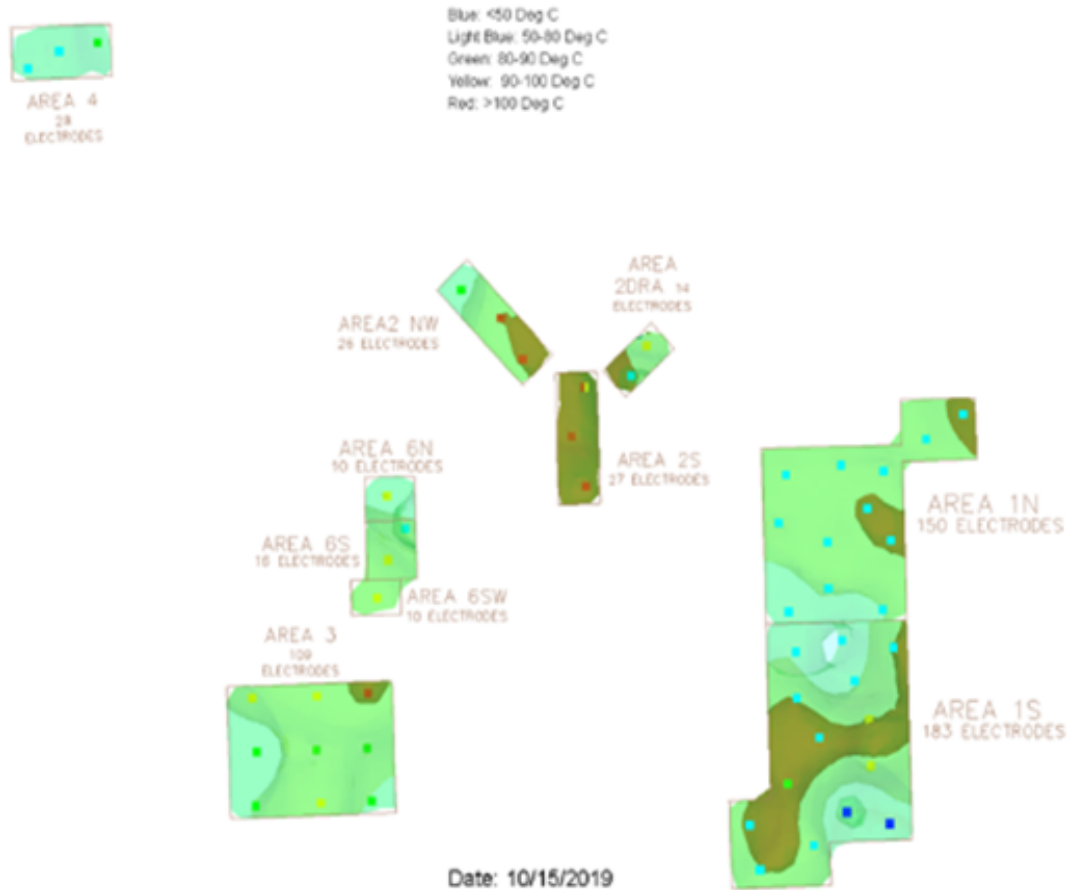
- Depth to water typ. 8 - 10 ft below grade
- Native Saturated Sand Units Semi-Confined to Confined

Constituents of Concern (COCs)

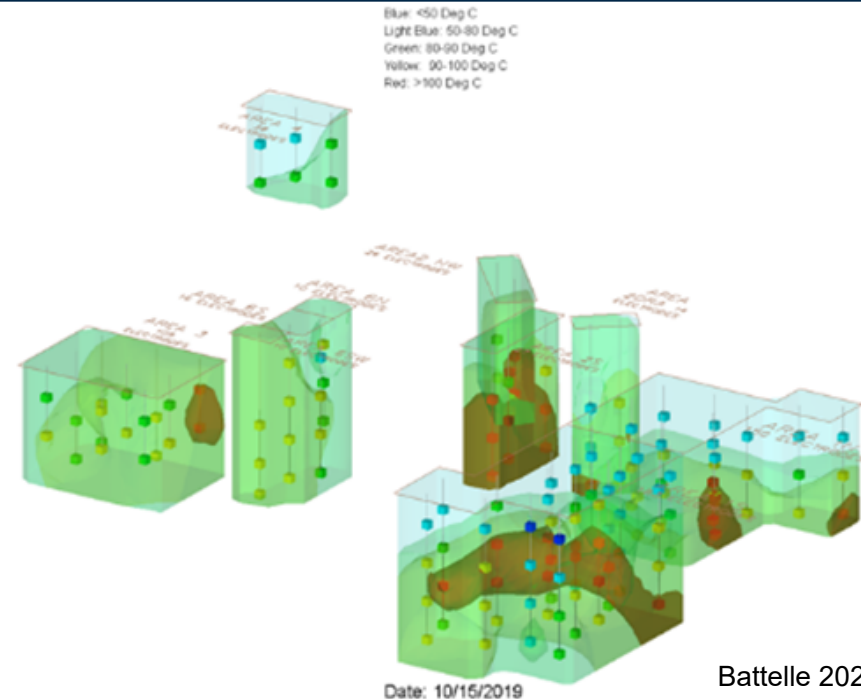
- Under Main Plant Floor - **TCE, 1,1,1-TCA**, Other VOCs, SVOCs & Oil (**LNAPL & DNAPL**)
- Chip Shed - **TCE** & Other VOCs & Oil (**LNAPL**)
- Western Property Boundary - **TCE** & Other VOCs
- Sources of Impact
- Oil - multiple oil containment systems (USTs, pits, vaults, trenches, sumps)
- TCE/VOCs - used equipment storage area (western property boundary), parts vapor degreasers, solvent dip tanks, former waste transport lines

Final remedy approach

- Risk Assessment – no active remediation was required as long as an ERC was placed on the property
- Client selected source area remediation



- WP prepared to select and document how the source areas would be treated in combination with an ERC



Feasibility Evaluation

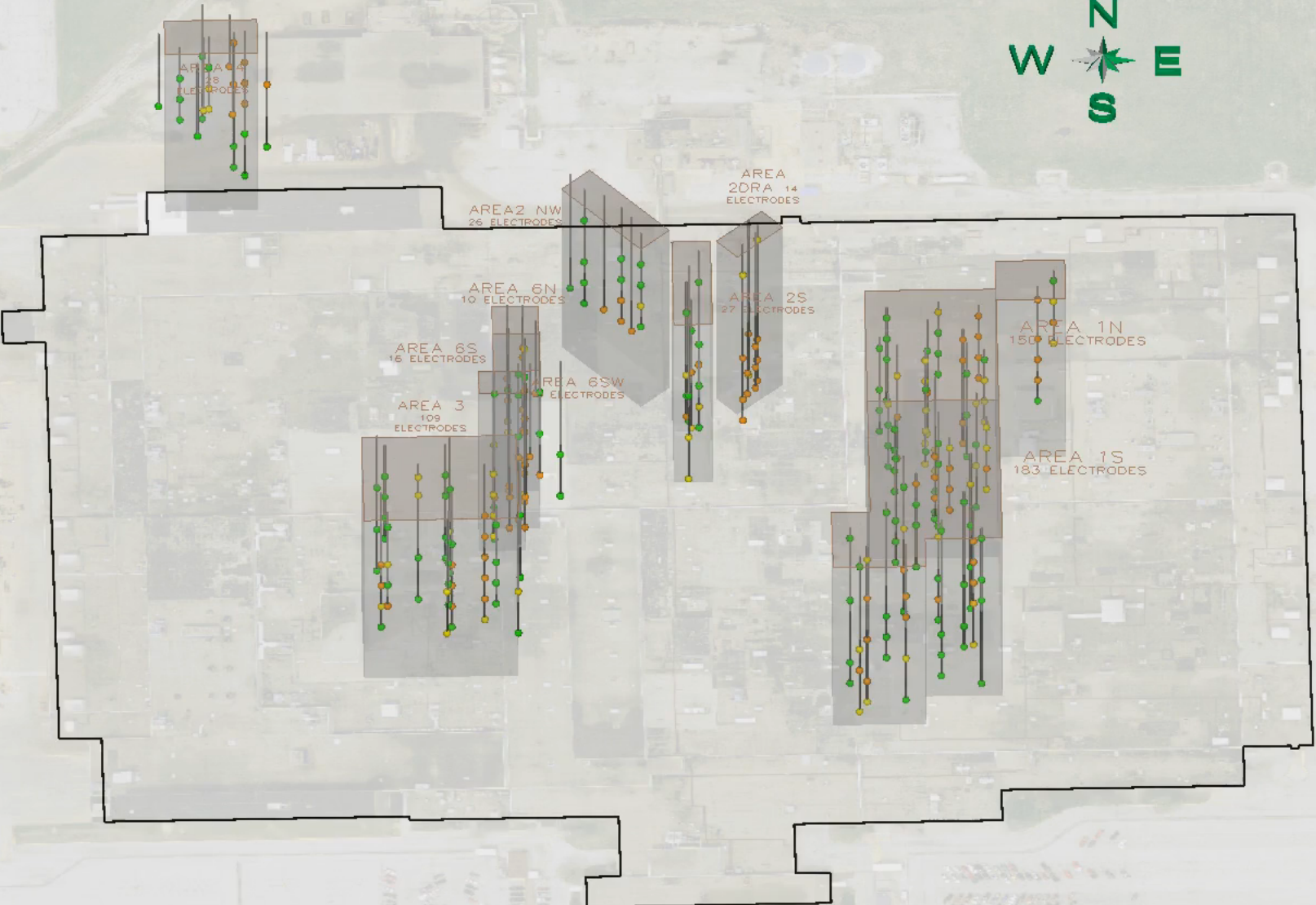
Solvents – shallow zone soil & GW (0 – 15 ft)
Excavation

Liquid Solvents– intermediate zone GW (15 – 25 ft)
In-Situ Thermal Remediation (**DNAPL Area**)

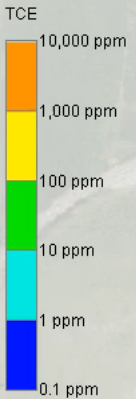


Residual Hydraulic Oil – shallow soil & GW (0 - 12 ft)
Institution Controls – Restrictive Covenant

Solvents – shallow zone soil & GW (0 – 25 ft)
In-Situ Thermal Remediation



Pre-Design Data



Summary



Site 1 - MIPs completed in transects perpendicular to GW flow



Identified three separate TCE plumes; 2 were long thin dilute plumes



TCE present in 0.5 to 5.0 ft thick interval in middle of aquifer



HRSC tools created more accurate CSM & successful remedy



Site 2 – MIPs & LIFs completed in grid pattern



Identified 12 source areas including LNAPL, DNAPL & cVOC impacted soil & GW



VOCs & NAPL present at depths varying from surface to 25 ft bgs



HRSC tools created more accurate CSM & successful remedy



*** Thank You**

> tom.kinney@ghd.com