Thermal Remediation in the Vicinity of Dense Utility Installation

The HECO Site
Dyersburg, Tennessee

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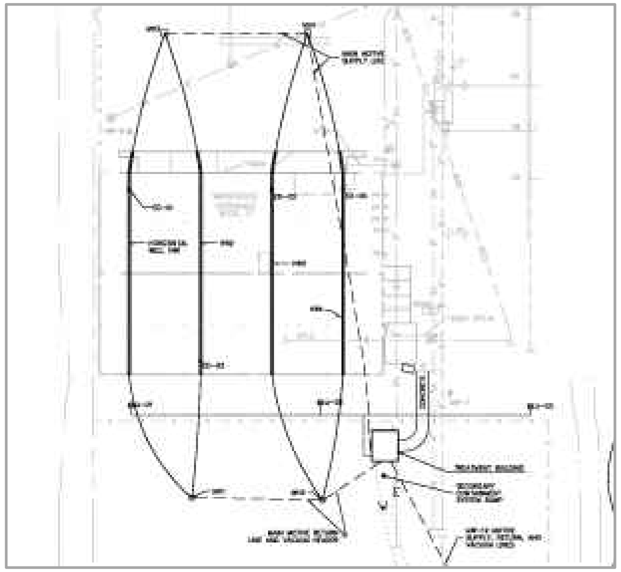
Accelerating Value

Overview

Background/Objectives

Approach/Activities

Results/Lessons Learned

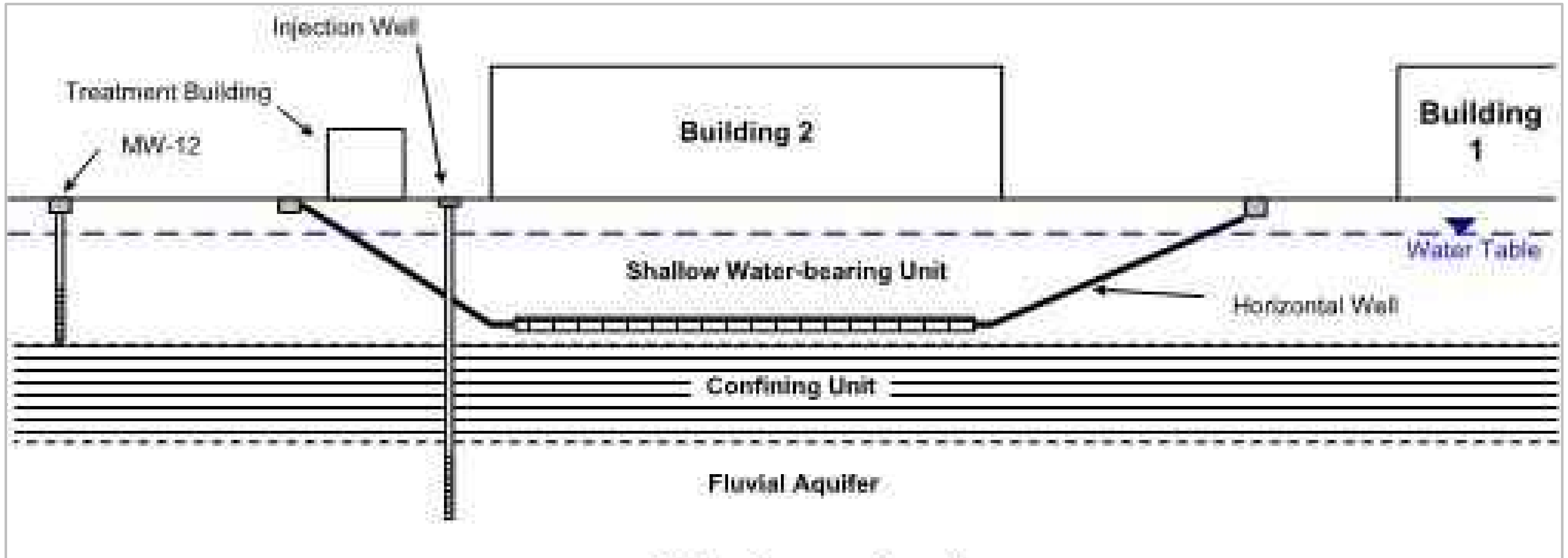


HECO Site
1999 - 2023

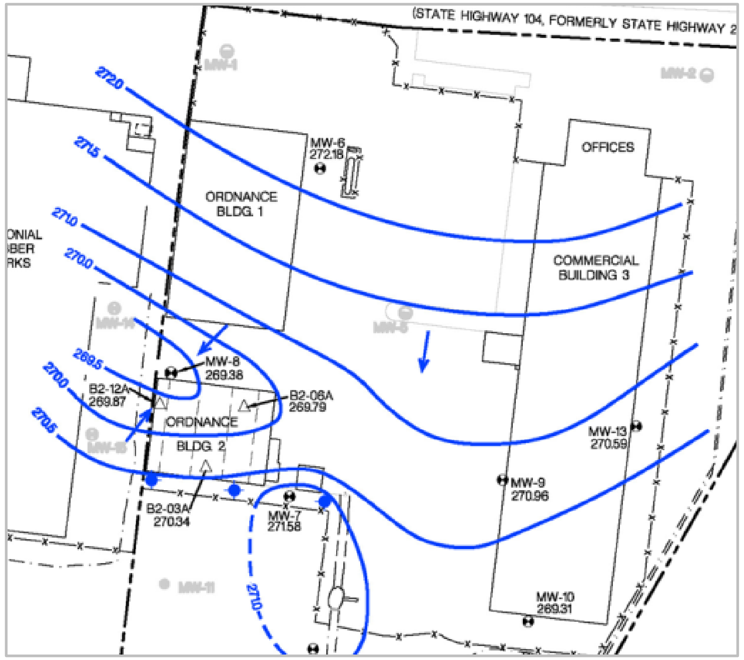
Site History

1963	Buildings 1 and 2 constructed for ordnance casing facility. Extensive TCE contamination under Building 2; evidence of TCE spill affecting nearby drainage channel
1970	Building 3 constructed for commercial products. Some TCE usage there as well.
1995 - 2002	Environmental investigations resulted in the construction of a dual-phase extraction (DPE) system of four horizontal extraction wells and one vertical well beneath and downgradient of Building 2 to address TCE contamination and protect fluvial groundwater by interrupting the migration pathway from saturated overburden soils.
2003 - 2004	Carbon amendment injection system consisting of 3 fluvial injection wells was installed to enhance biodegradation of the fluvial contaminant plume. Recovery well PW-1 installed at southern border to provide source water for the injection wells.
2003 – 2013	DPE system operated from 2003 – 2013.
2003 – 2021	Carbon amendment injection system operated from 2003 – 2021.

Successful COC Containment

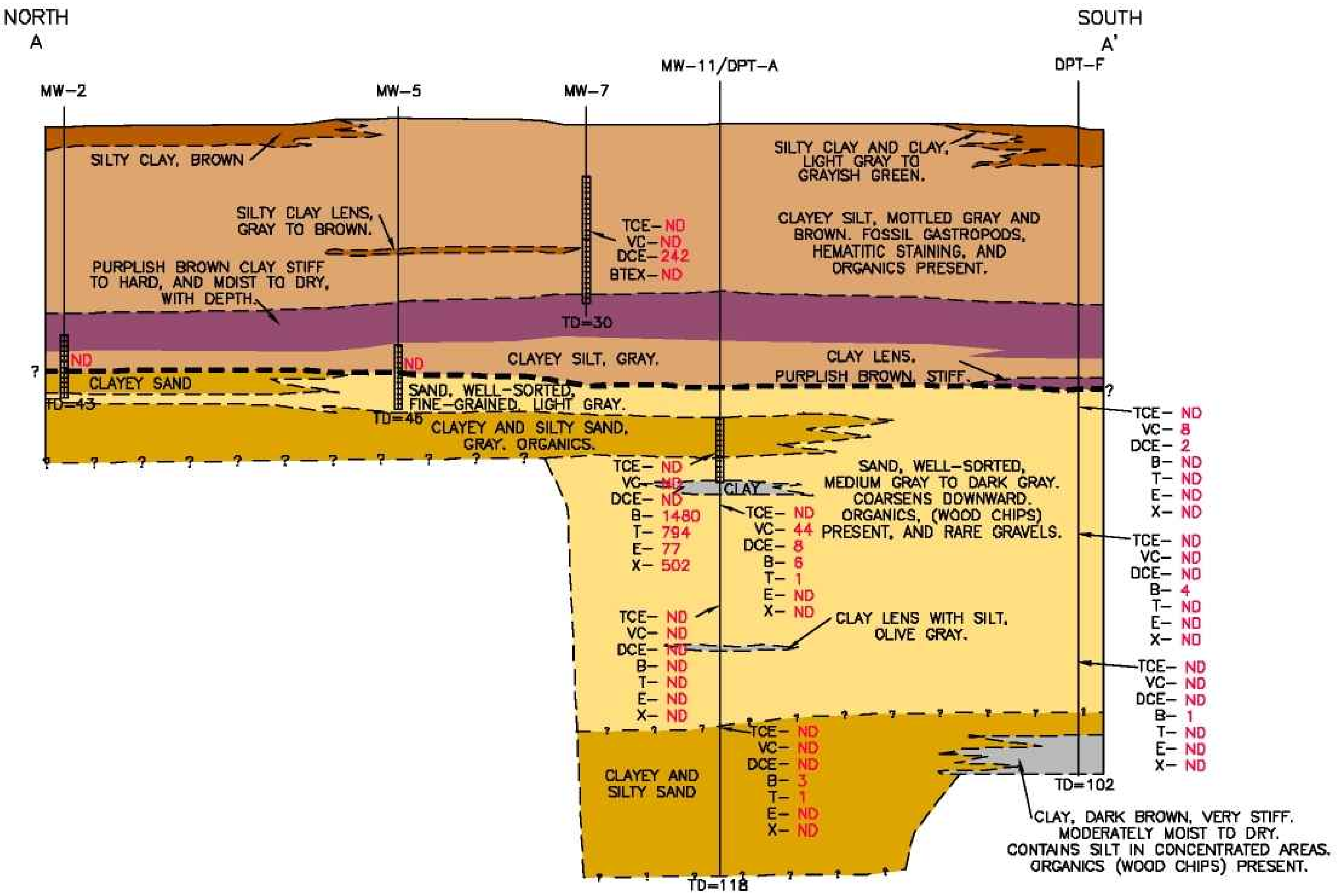


Site Cross Section



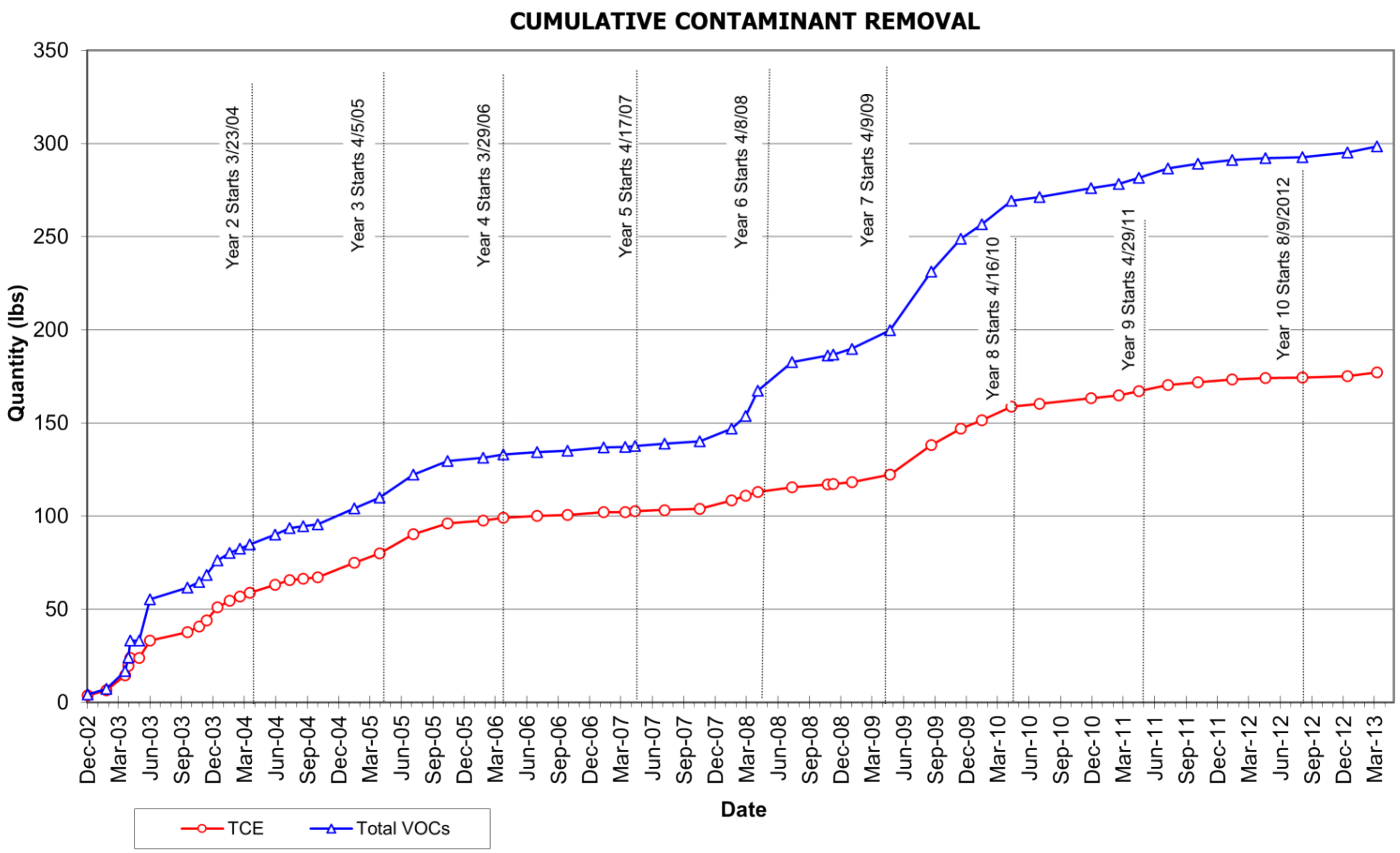
- Objective – protect fluvial aquifer from shallow soil and groundwater contamination.
- Four horizontal DPE wells screened beneath Building 2.
- 3 downgradient CAI wells screened in the fluvial aquifer for bio-remediation.
- One vertical recovery well (MW-12).

Lithology Cross-Section



What changed 20 years later

- Tenant vacated the property in 2018, allowing for unrestricted investigation and remediation for the first time.
- DPE system had reached the end of useful life and contaminant recovery was asymptotic (diffusion limited).
- Injection wells requiring increased maintenance, needed to be re-installed.
- Costs were exceeding projections (30-year rule).
- Improvement in treatment technologies.

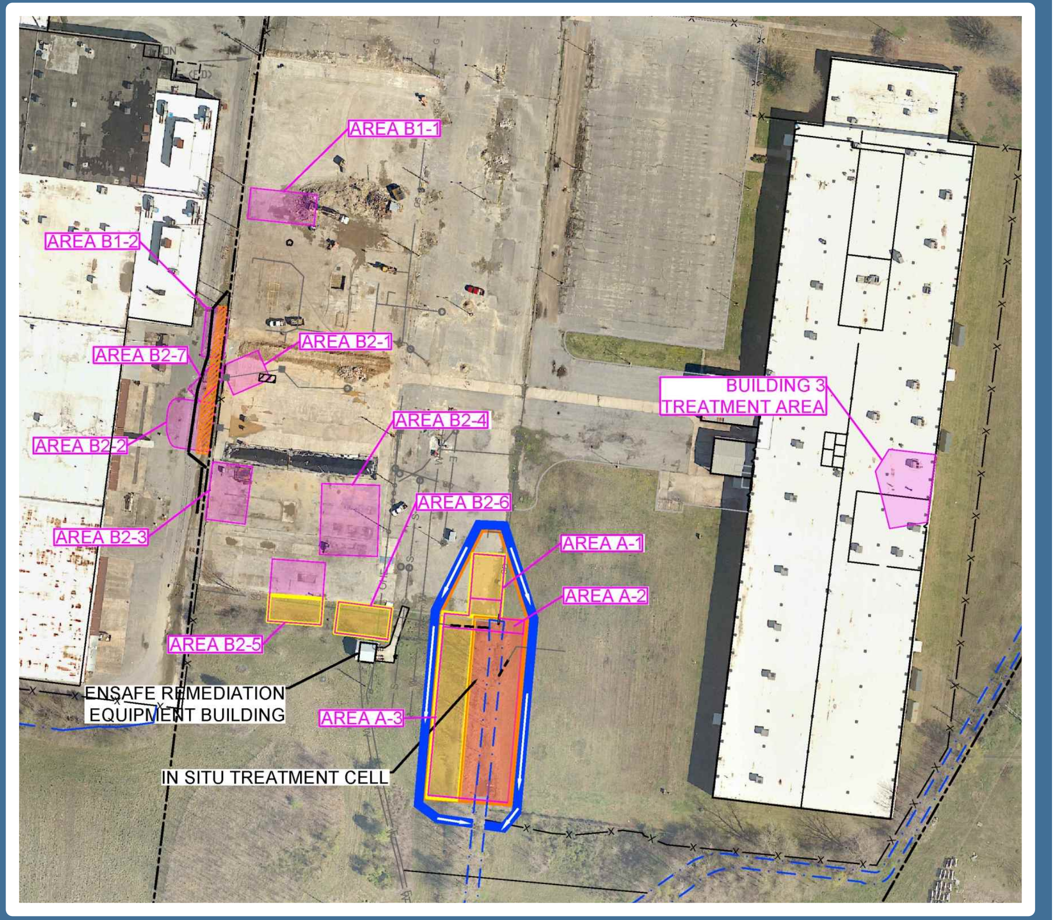


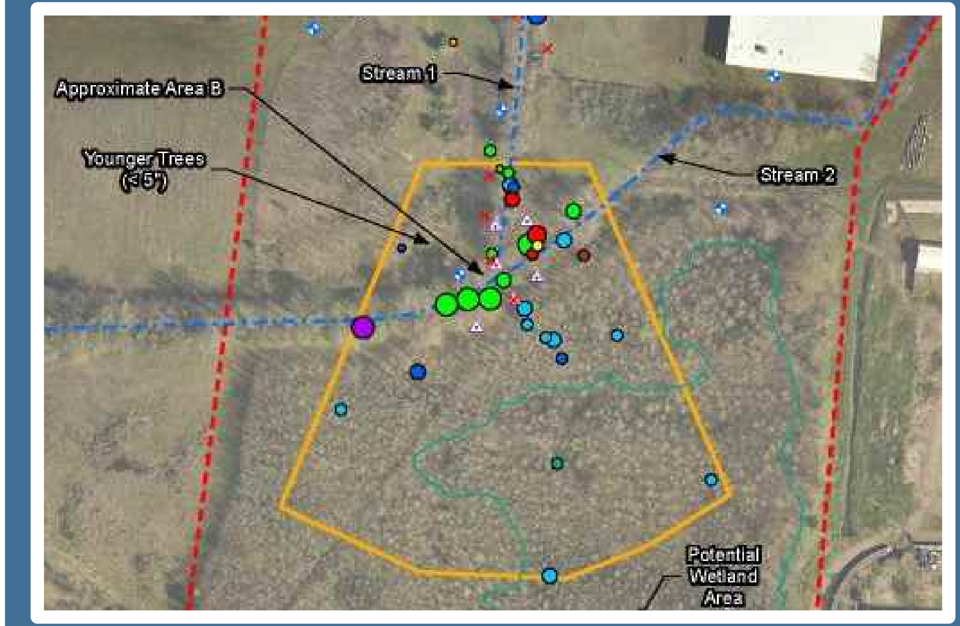
Changed Land Use

- Building 1
  - No longer in use – sub-slab contamination.
  - Low overhead clearance and poor condition.
  - Vapor mitigation vs demolition and thermal treatment.
- Building 2
  - Minimal use as warehouse.
  - Highly contaminated soil mass = thermal treatment.
  - Demolition to facilitate thermal treatment system installation.
- Building 3
  - Available for new tenant/provide jobs for the community.
  - Vapor mitigation vs thermal treatment and monitoring.
- Area A
  - Highly contaminated soil mass = thermal treatment.
- Area B
  - Existing trees provide phytoremediation.
  - Land use controls and monitoring.

New Feasibility Analysis and ISTR Decision

- In Situ Thermal Remediation (ISTR) utilizing Electrical Resistance Heating (ERH) to address soil contamination
  - Building 1
  - Building 2
  - Building 3
  - Area A (northern portion of stream)
- Goal of 99% contaminant mass reduction in soil





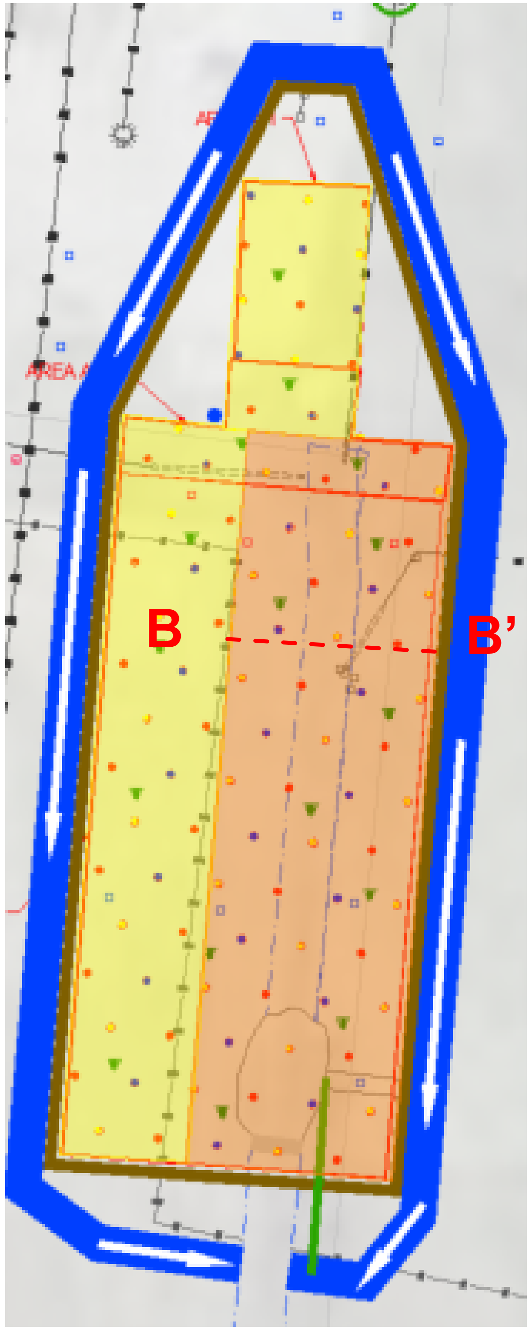
- Downgradient phytoremediation at Area B (southern portion of stream)

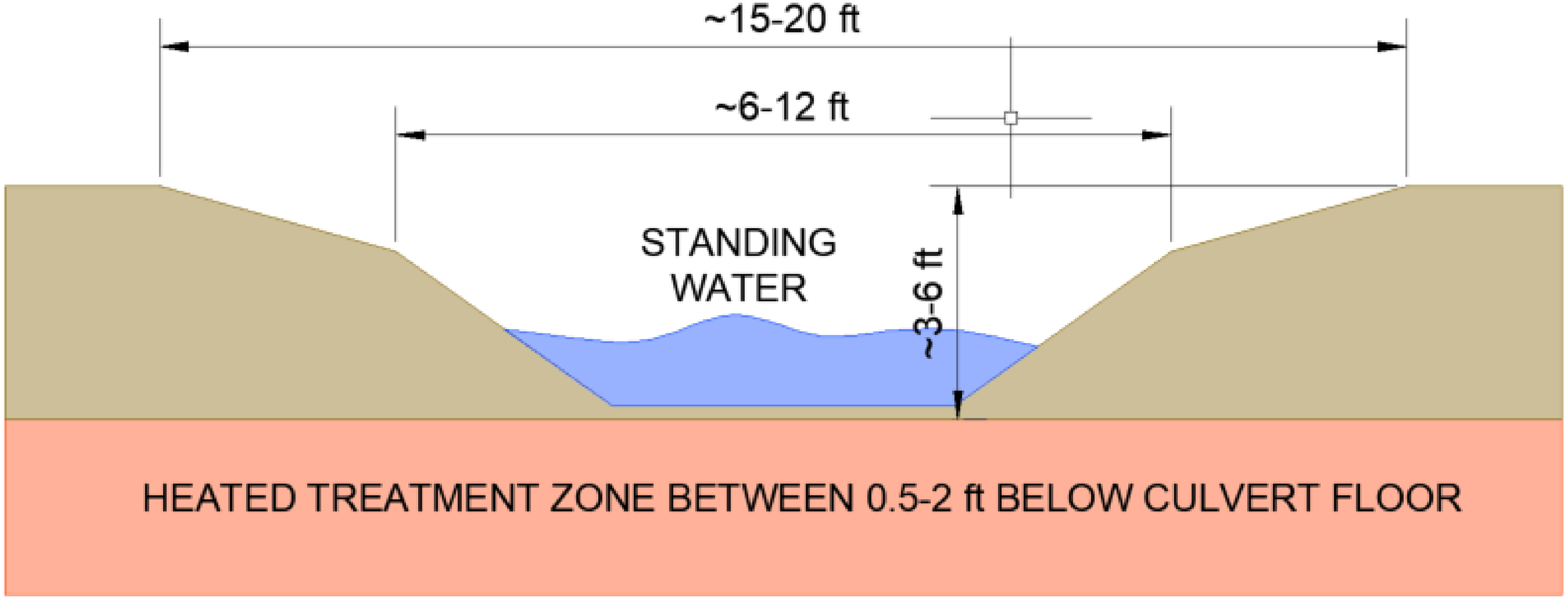
Technical Approach

- Electrical resistance heating
- Regenerative thermal oxidizer vapor treatment
- Treatment partially under building
- Average thermal treatment depths
  - Shallow treatment extent: 2 ft bgs
  - Deep treatment extent: 35 ft bgs

Drainage Diversion Installation

Thermal Treatment & Drainage Plan



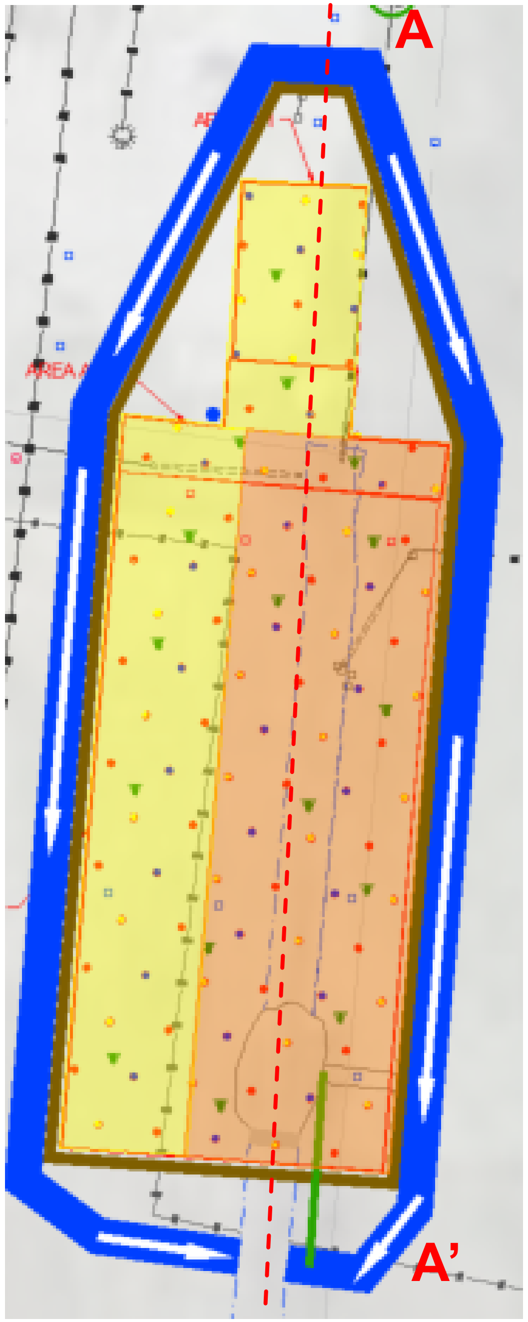


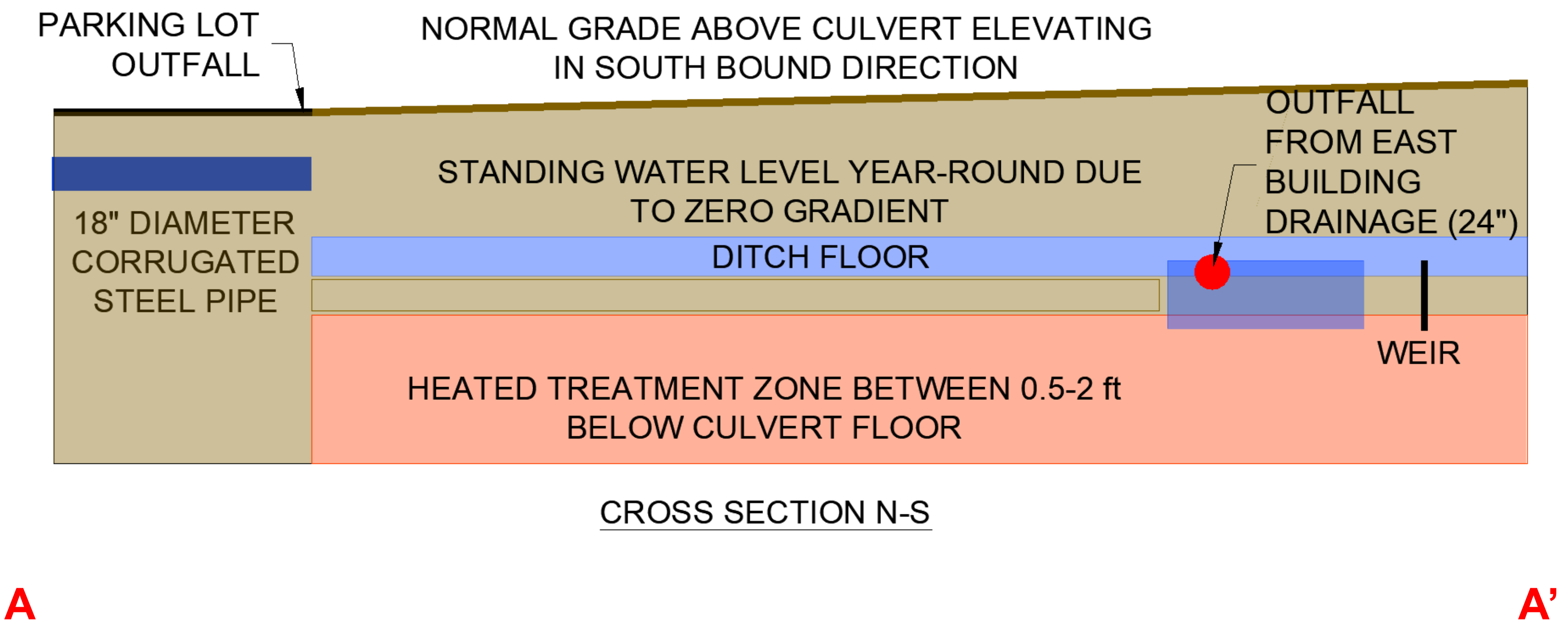
CROSS SECTION E-W

B

B'

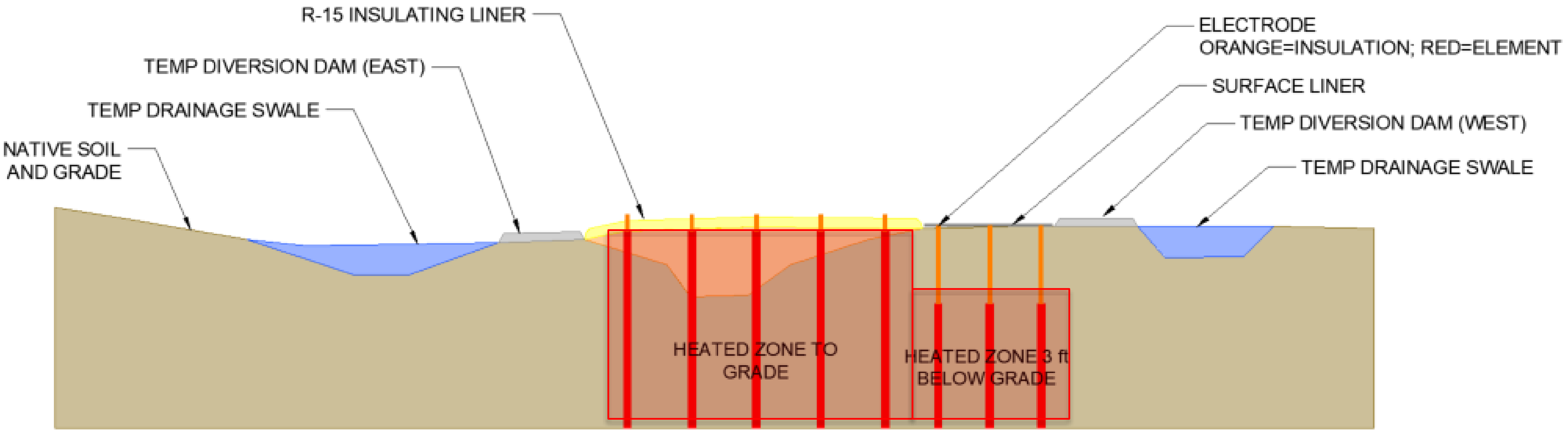
Thermal Treatment & Drainage Plan





CROSS SECTION N-S

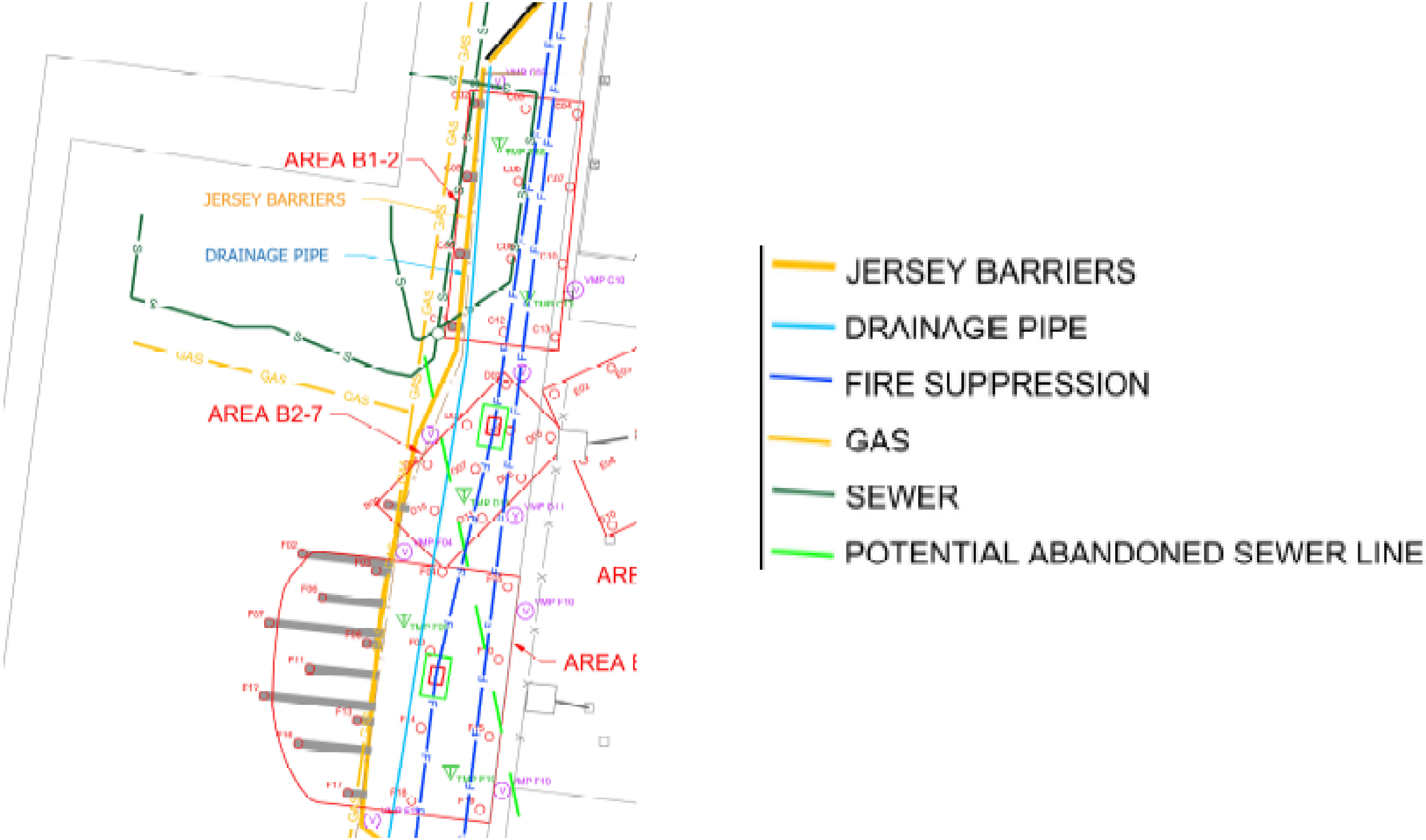
Thermal Treatment Cross Section



CROSS SECTION E-W

Field Installation

Dense Utility Corridor



Utility Protection & Monitoring

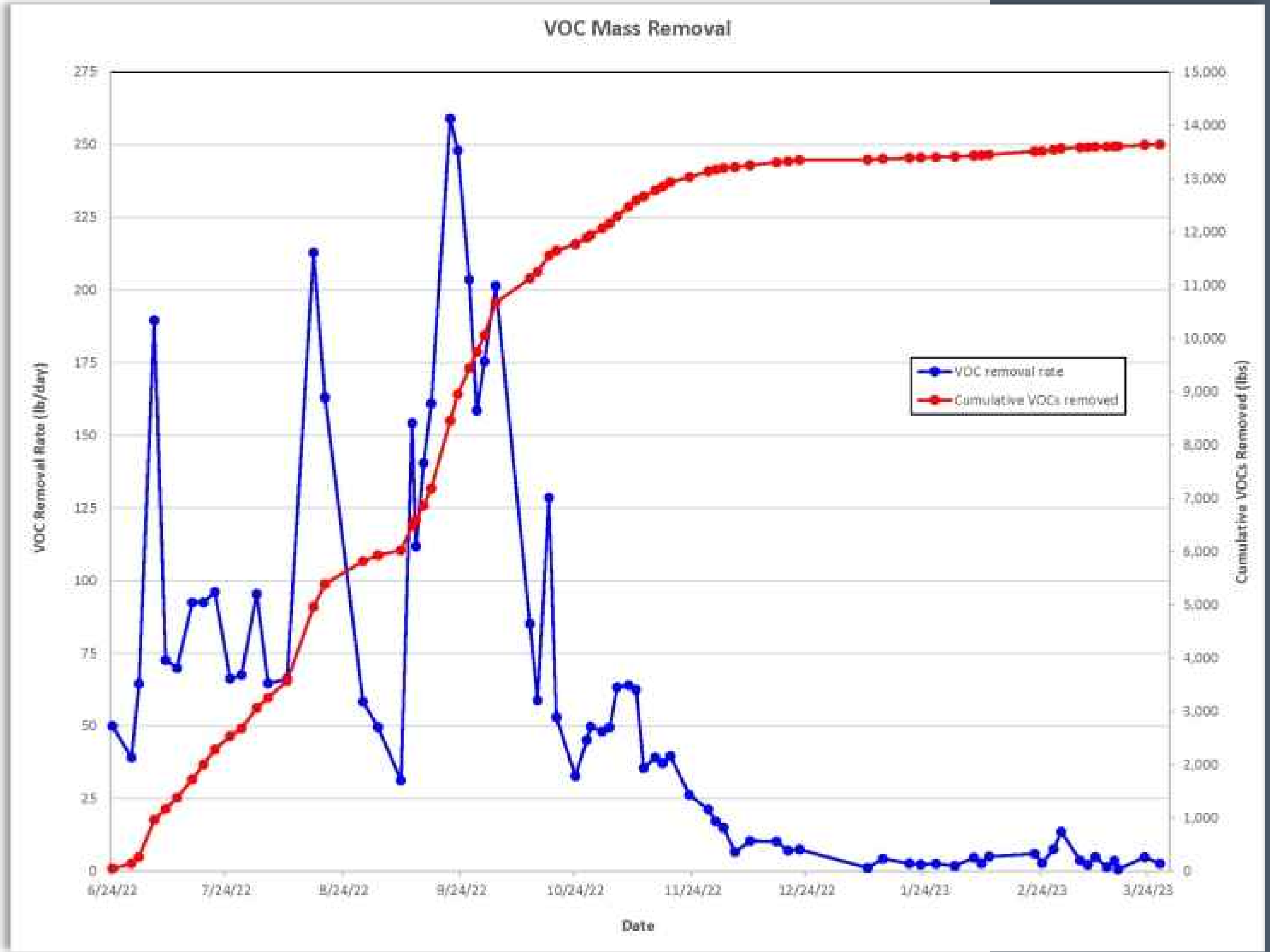
- Multiple utility surveys performed
- Pre-clearing at each location prior to installation
- Lowered shallow extent of treatment
- Cooling loop installation
- Supplemental vapor recovery screens
- Utility temperature monitoring points distributed across all utilities
- Interlock system alarms

Below Grade Installation

Field Installation

Conclusions and Site Future

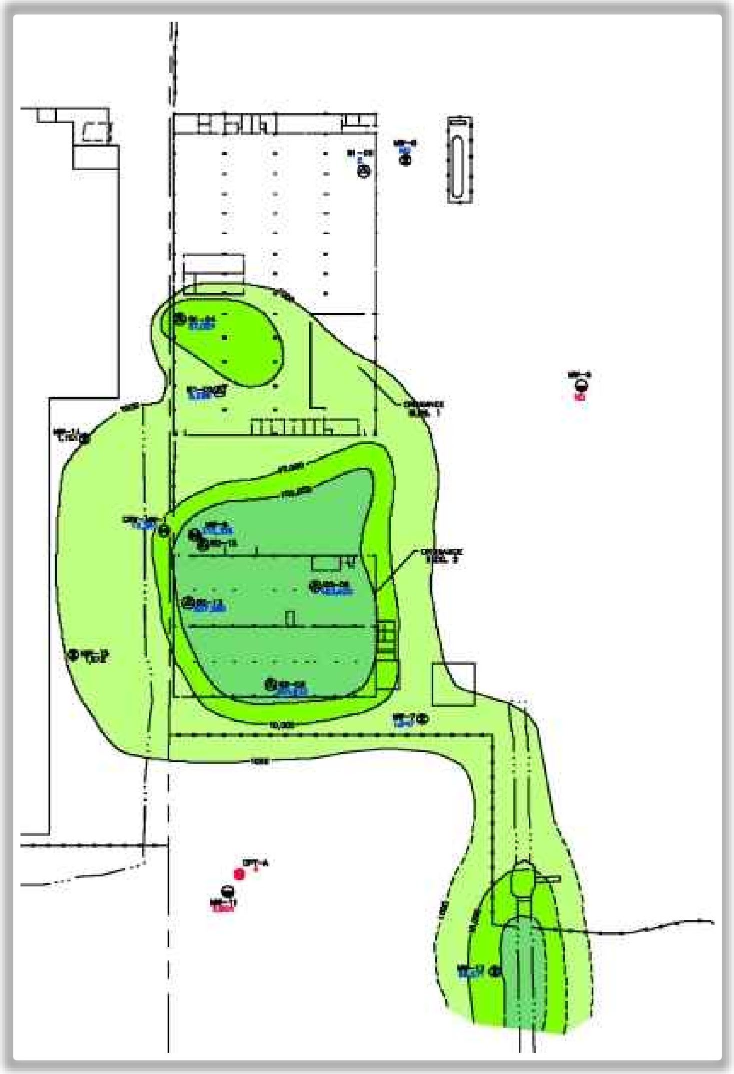
- 7 tons! of TCE removed in 10 months
- Thermal treatment feasible near utilities
- Detailed utility surveys essential
- Pre-clearing critical when drilling near utilities
- Utility temperature monitoring paramount
- Cooling mechanisms effective
- Groundwater still cooling down
- Future GW monitoring still needed



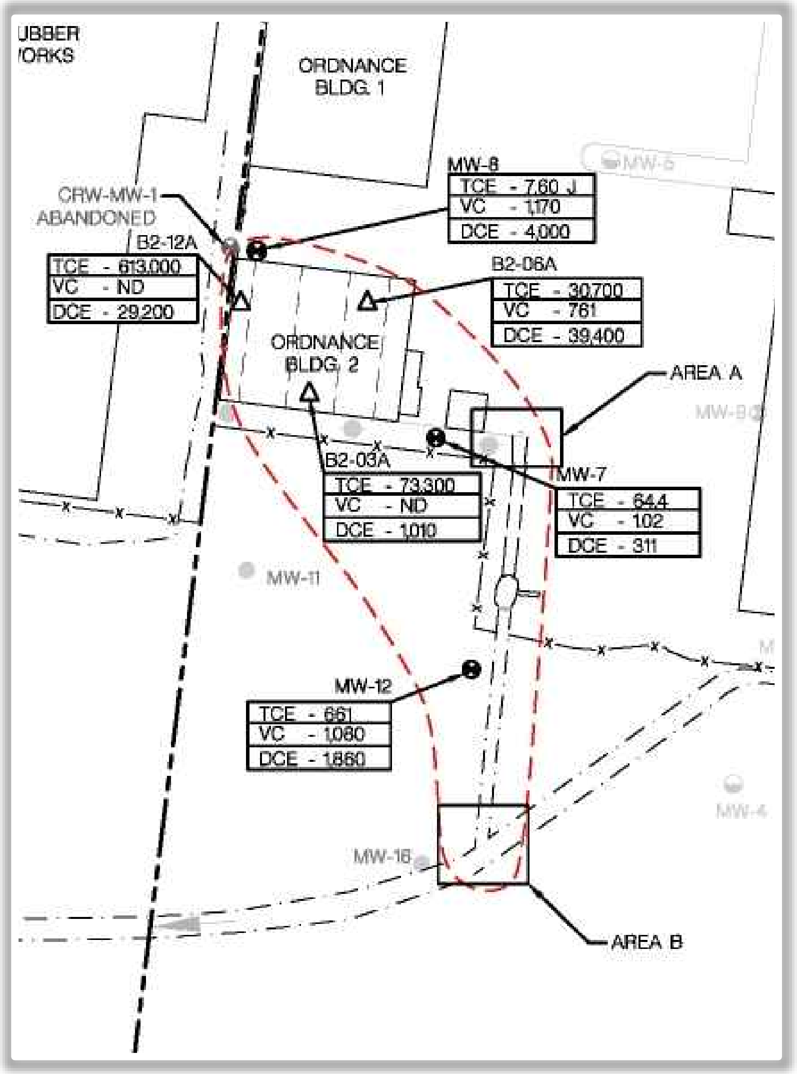
Backup Slides

GW Data Demonstrating Containment

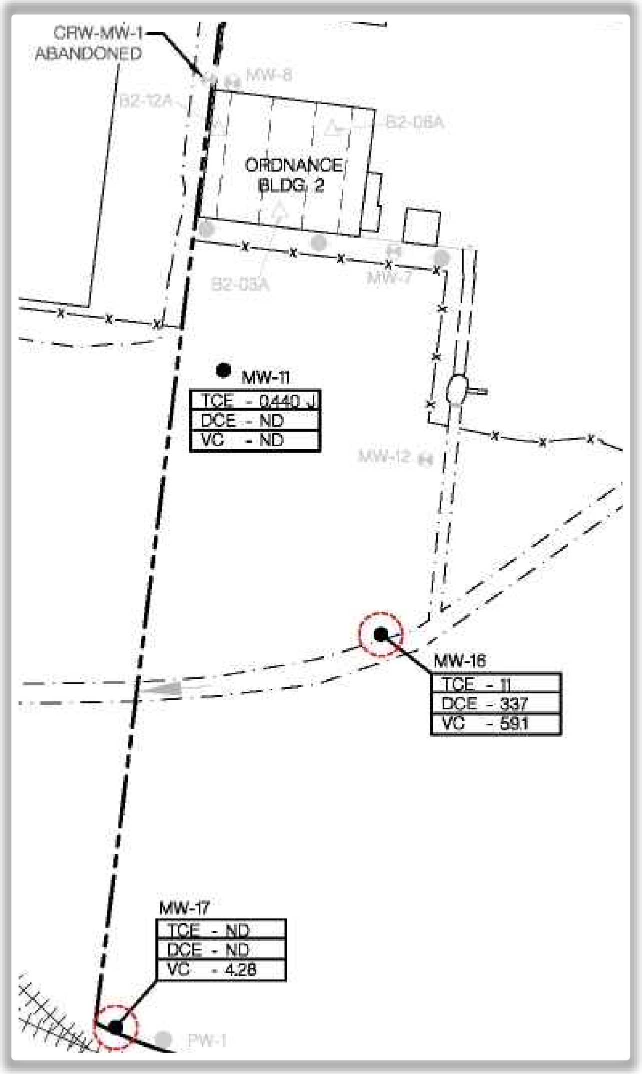
Pre-DPE System



Shallow



Fluvial



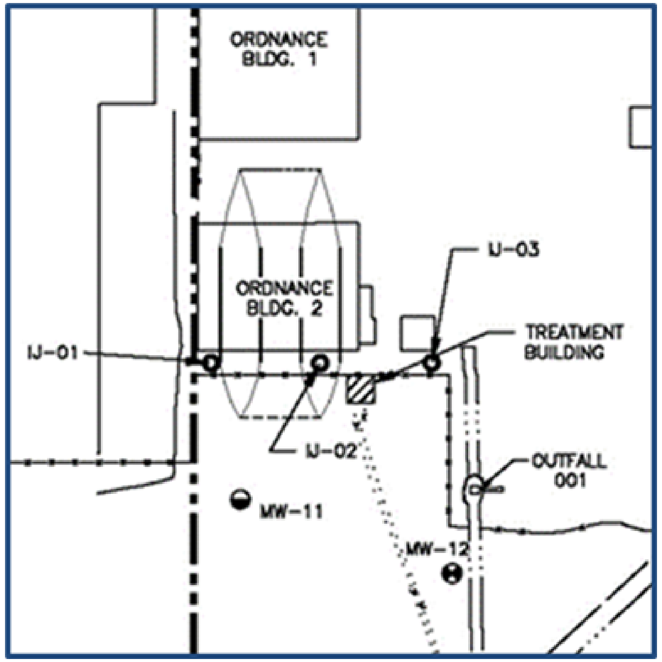
Cost Evaluation

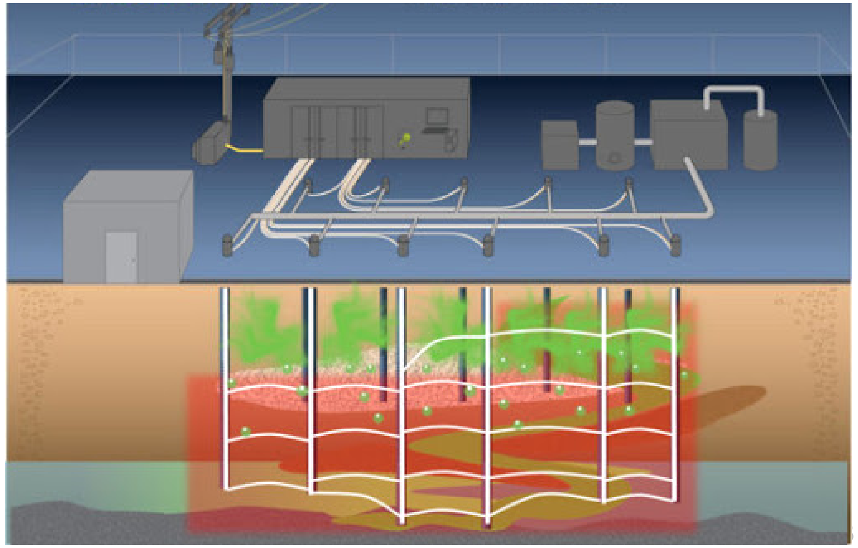
- 2000 – Projected 20-year cost = $1.85M (included inflation estimates)
- 2018 – Actual costs to date = $1.99M + projected $369K to replace DPE system

Result: Site stable but no reduction in risk
Estimate for next 20 years = $3.0M due to inflation

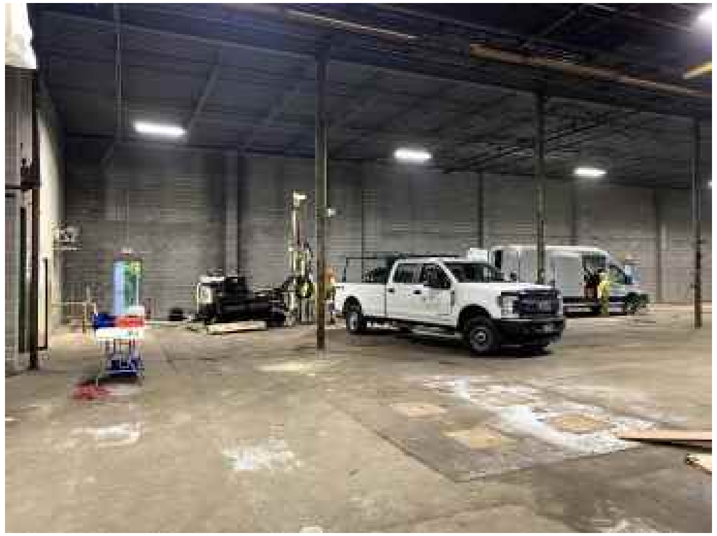
- Estimate for enhanced characterization and remediation to residential soil risk = $6M

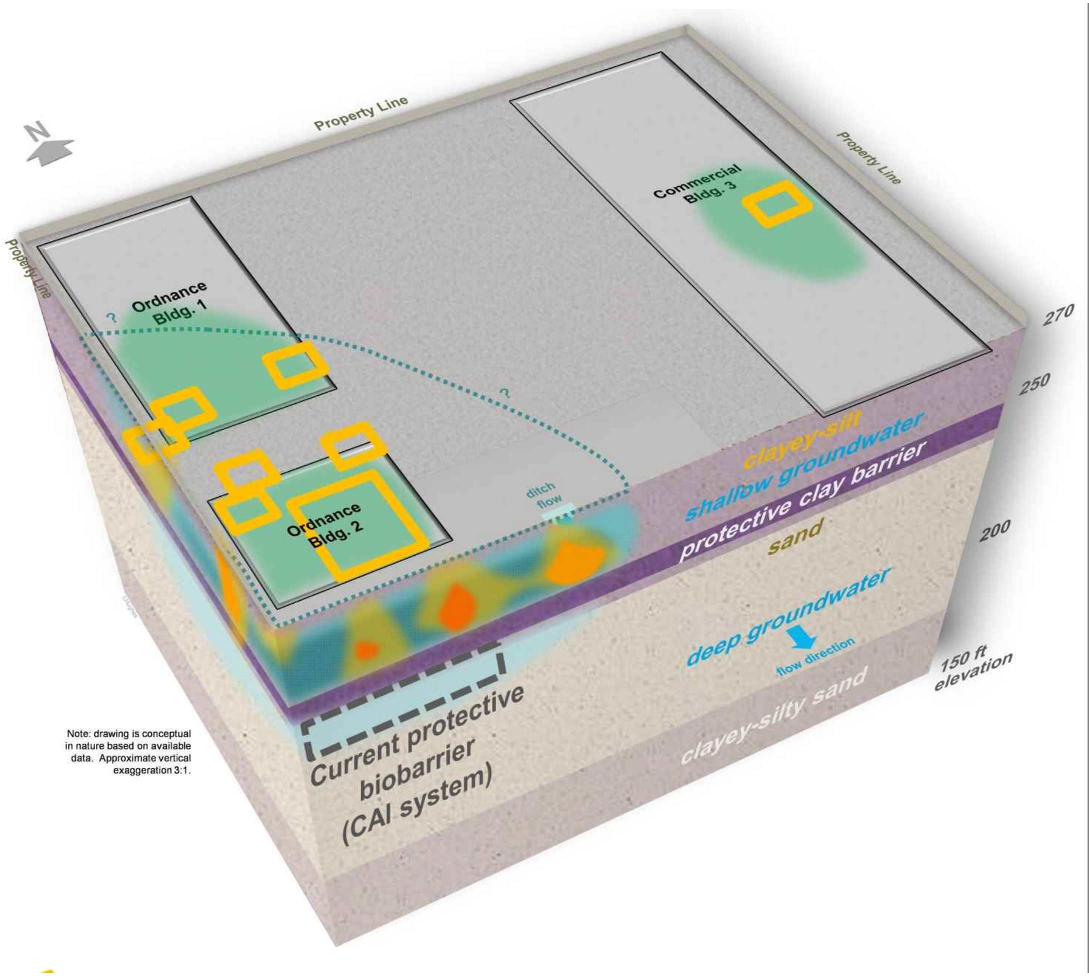
Result: Site land use essentially unconstrained with estimated $8.4M income over next 20 years



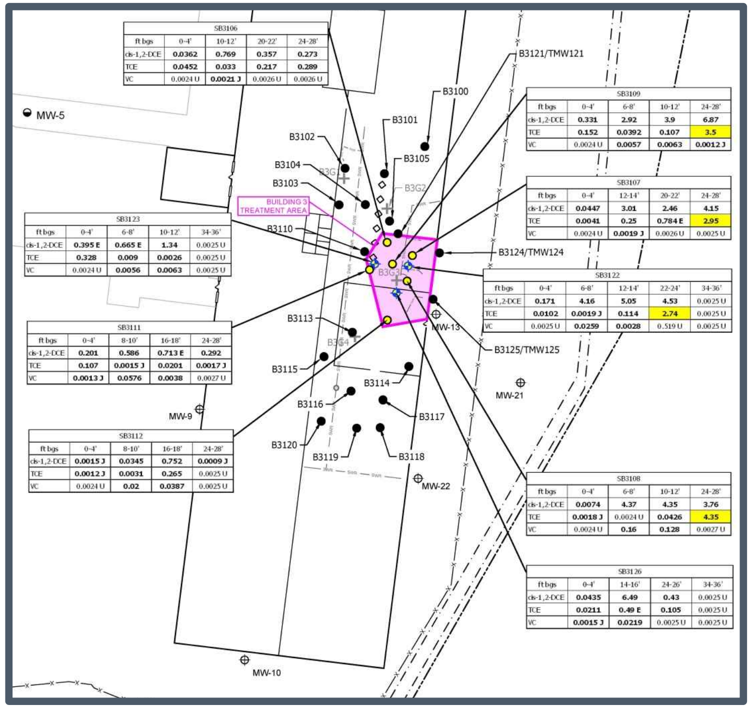


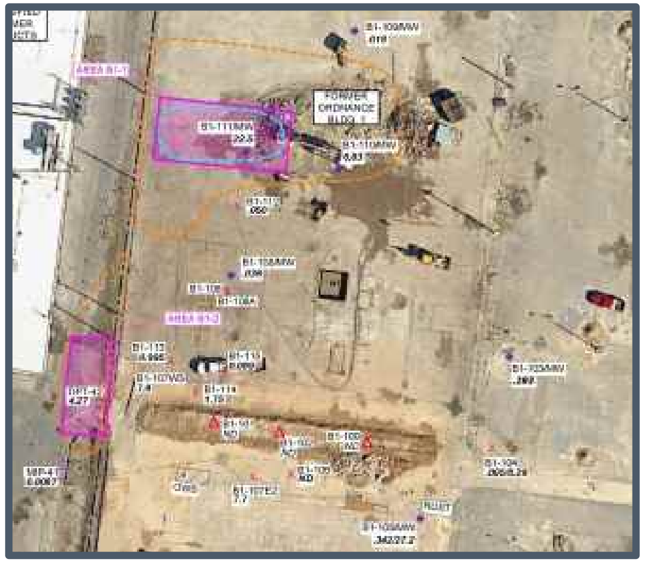
Extent of Contamination Study Needed

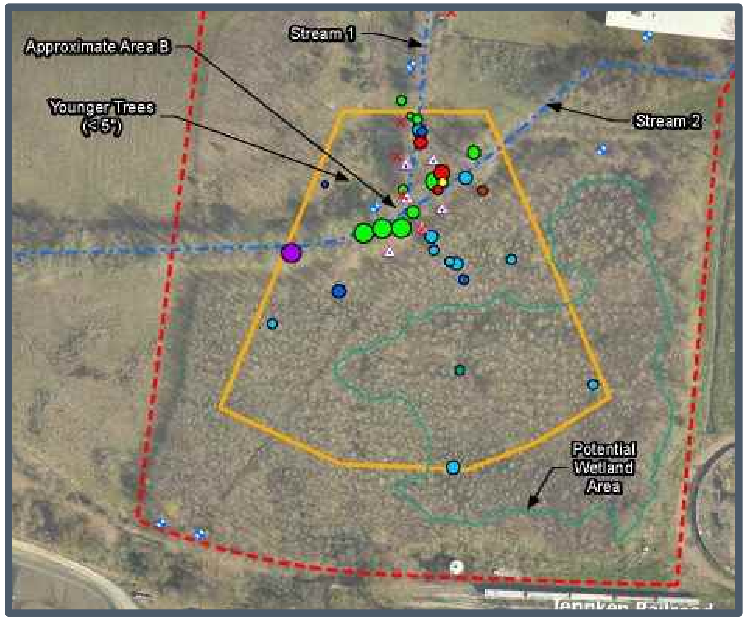




Substantial New Site Study







ISTR Installed Multiple Locations