

It's Not Just a Spot! – Importance of Source Area Delineation & Remedial Characterization

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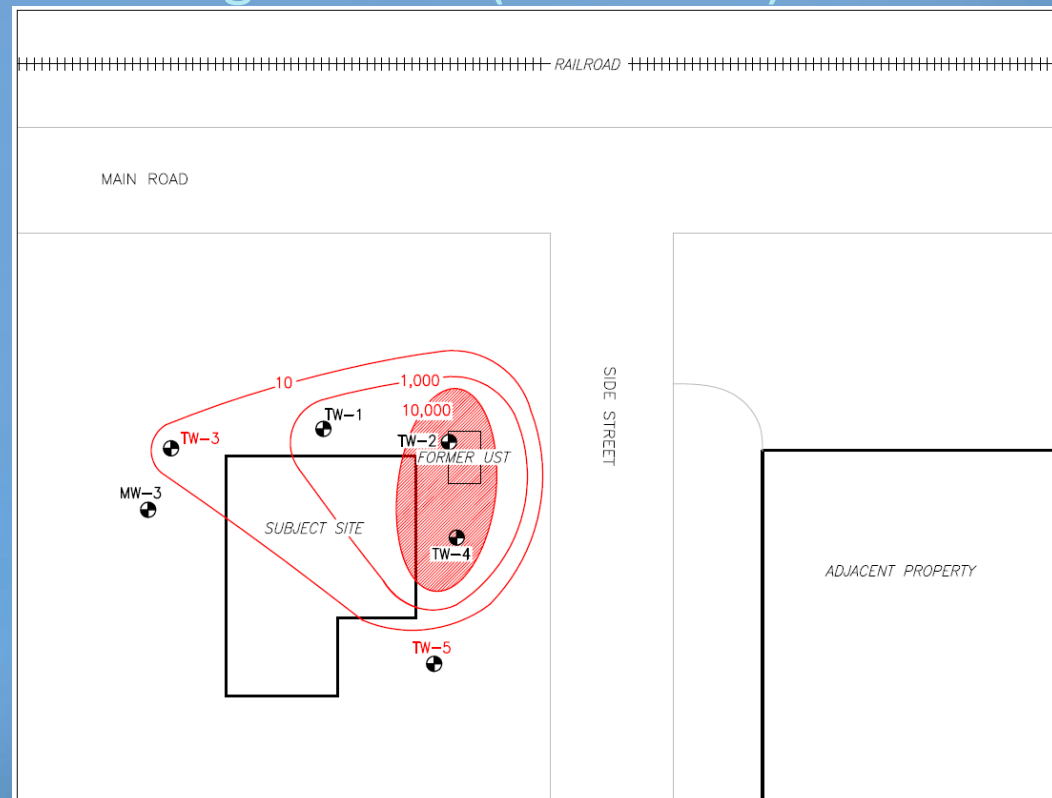
Prepared by Ken Summerour, P.G.



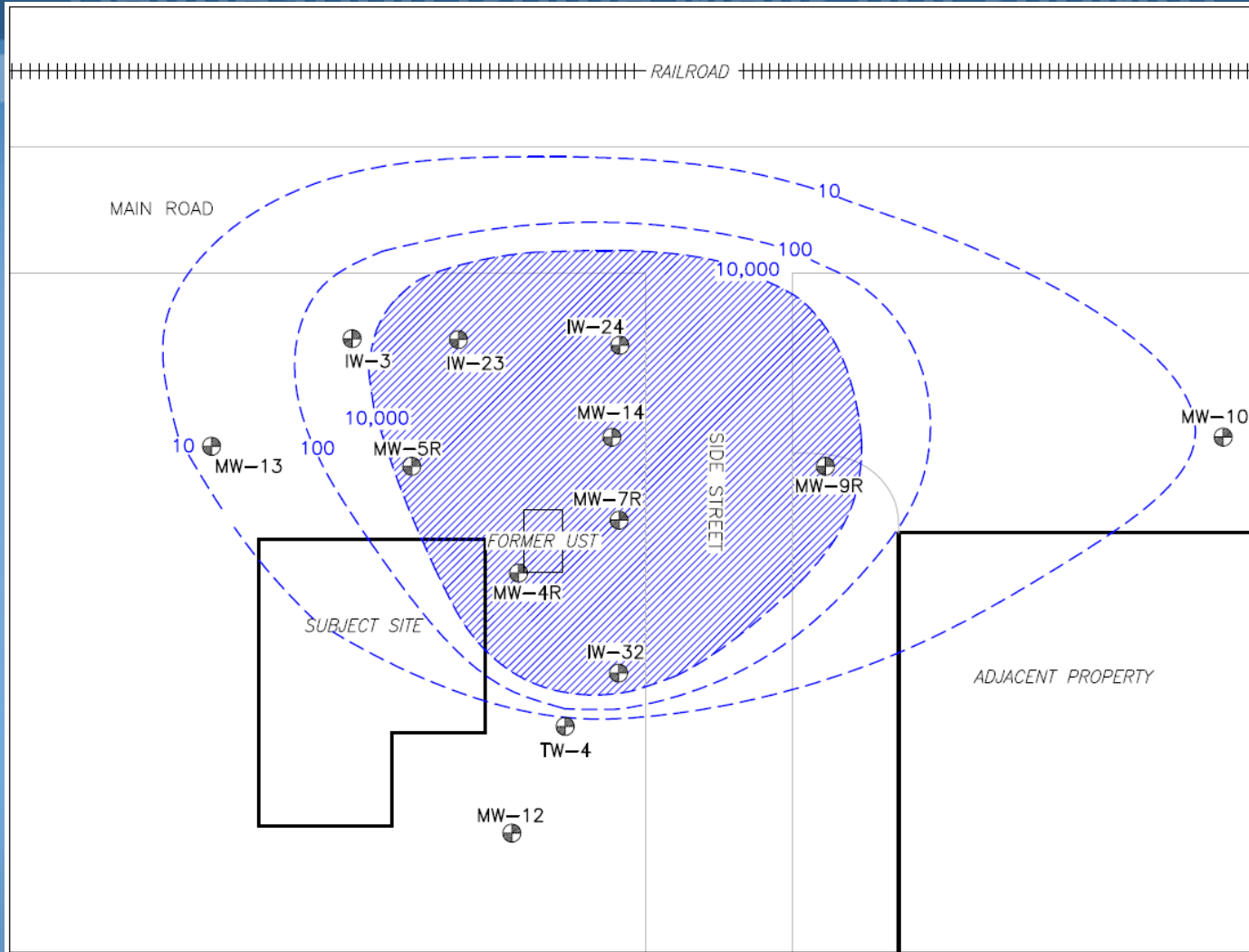
Importance of Source Area Delineation

- Size/magnitude of source area more so than plume extent often dictates remedial strategy.
- Most assessments focus on plume boundary delineation only with limited source area characterization.
- Many “spots” turn into larger areas (next slide).

Small Source Area Prior to Remedial Assessment



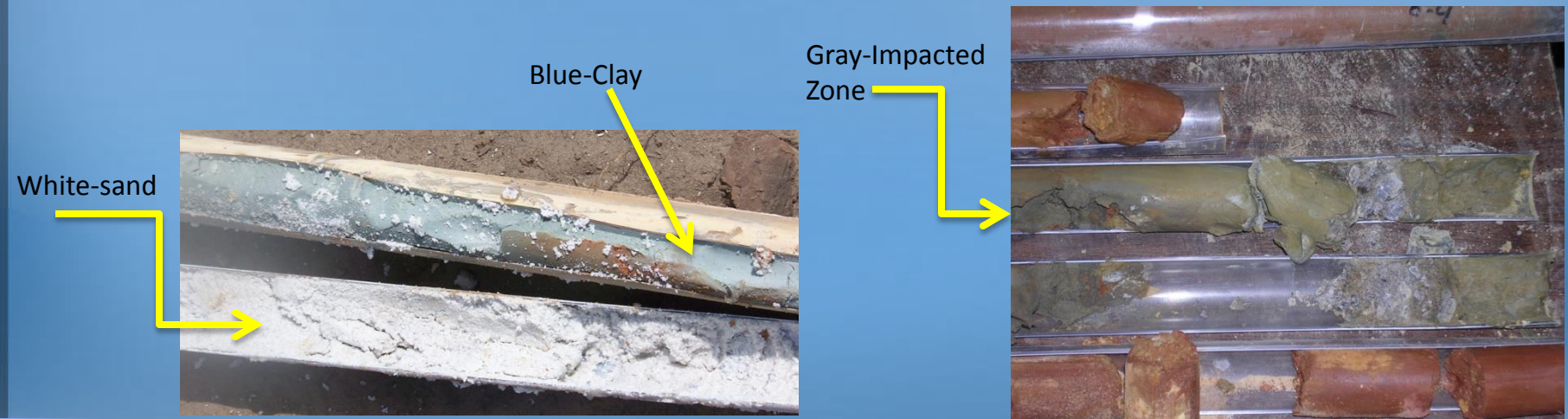
Same Site After Additional Source Area Delineation (some wells not shown)



Remedial Characterization Tools

Differences between remedial characterizations and standard contaminant assessments include:

- Soil delineation should include sampling above & below the water table and/or in different aquifer units to assess the “smear zone”
- Vertical delineation of dissolved contaminants in shallow water bearing zones at different depths (usually 10-15 foot intervals)
- Vertical delineation at different depths in deeper aquifer units
- Detailed vertical evaluation of NAPL including type, consistency, volume, etc.
- Plume maps, cross-sections, detailed boring logs depicting source zones



Drilling Tools for Remedial Characterization

- Hollow Stem Auger (HSA) Rig
 - Soil Sampling via split spoons
 - Groundwater sampling -temporary or permanent wells, or discrete zone samples (using packers, Hydropunch, etc.)
- Direct Push Technology (DPT)
 - Continuous soil sampling
 - Groundwater sampling using drive point screen sampler
- Mud/Air Rotary Drilling
 - Limited soil or rock sampling capabilities
 - Groundwater sampling options similar to HSA



Air Rotary Drill

Drilling Tools for Remedial Characterization (cont.)

- Rock Coring
 - Continuous rock sampling/characterization
 - Discrete sampling of groundwater using packers limited due to borehole size
- Sonic Drilling
 - Deep core sampling into rock/unconsolidated
 - Groundwater sampling options similar to HSA
- Cone Penetrometer Testing (CPT)
 - Non-intrusive soil testing (ASTM D5778 – 07)
 - No soil or groundwater sampling capabilities



Mud Rotary Drill

Remedial Screening Tools

SOIL ONLY

- Headspace screening (PID/FID)
- Immunoassay Kits
- X-Ray Fluorescence (XRF)
- Color-indicator/reagent test kits
- NAPL color indicator kits

SOIL & GROUNDWATER

- DPT or HSA plus mobile lab
- DPT plus MIP/EC logger
- CPT-ROST (Rapid Optical Screening Tool)
- DPT plus UVOST/Tar GOST™

ADVANTAGES:

- Provides more rapid data collection limiting additional mobilization
- Qualitative field level determination of clean-up boundaries/source zones
- Cost and time savings-avoid delays waiting on laboratory analysis
- Screening data generally does not have to be reported to regulatory agencies

DISADVANTAGES:

- Data is generally qualitative only
- Compound specific testing is not acquired (with exception of mobile lab)
- Screenable compounds limited to instrument/kit ranges

Remedial Screening Tools for Soil

- Head space screening for volatile organics (PID-10.6 eV or 11.8 eV lamp or FID)
- Immunoassay kits- TPH, BTEX, PAHs, PCBs, etc.- use antibodies to generate color changes – <http://www.clu-in.org/char/technologies/immunoassay.cfm>
- XRF screening for metals-Niton (www.niton.com), Innovex (www.innovx.com)
- Compound specific test kits for metals (www.leadcheck.com)& TPH (www.hanbytest.com)
- NAPL color indicator kits (www.cheiron-resources.com)



XRF



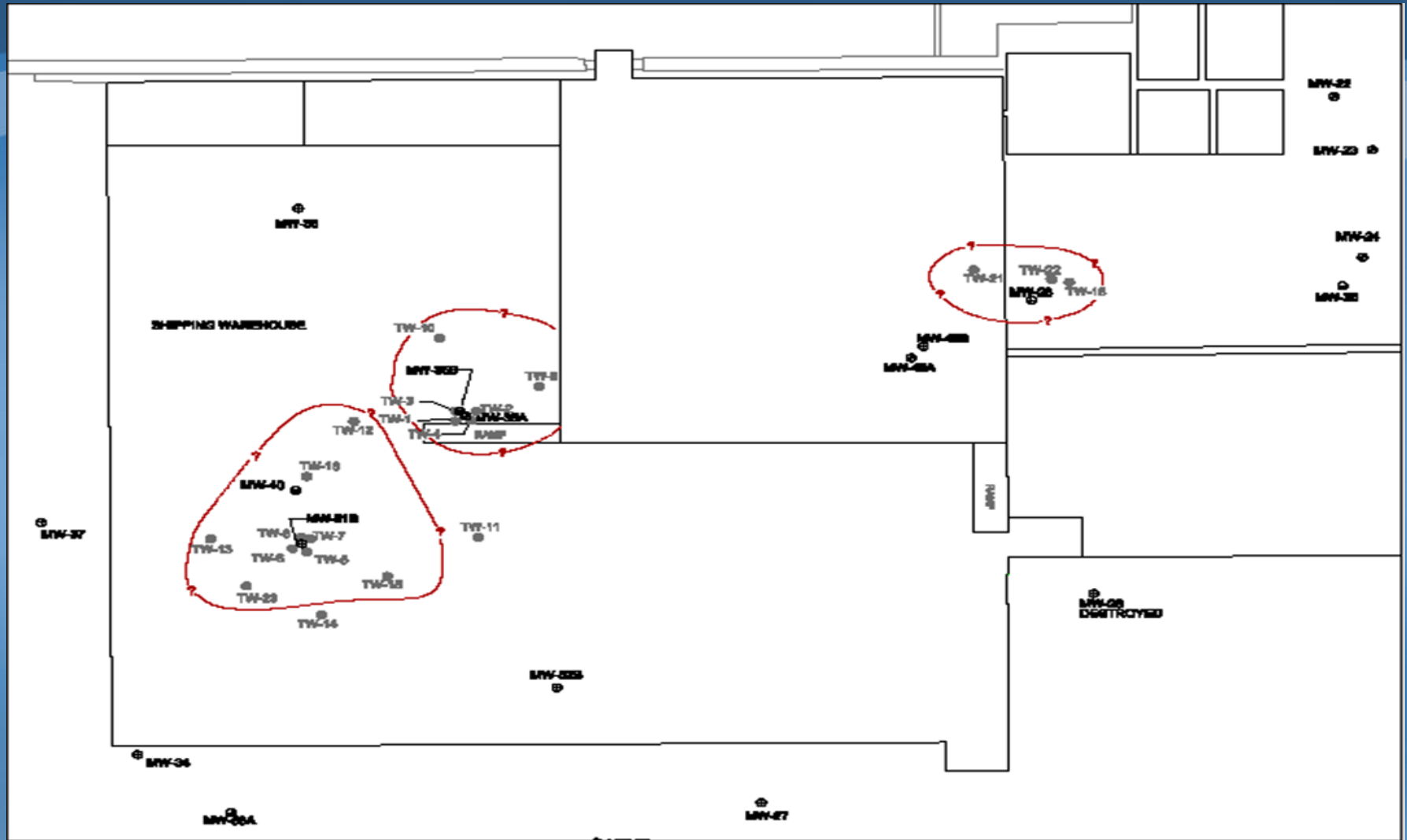
PID

Remedial Screening Tools for Soil and Groundwater

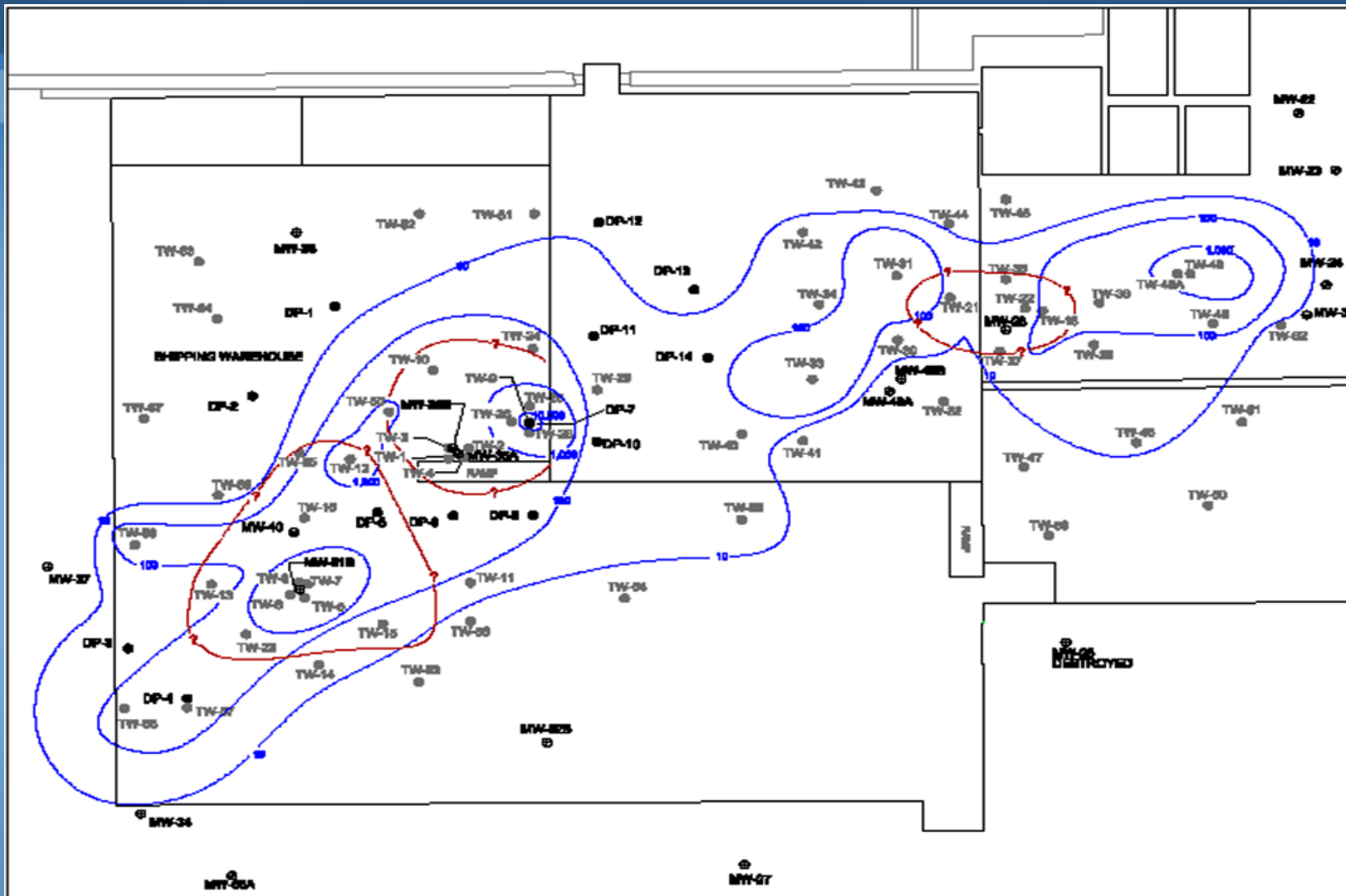
DPT/HSA with Mobile lab

- Use DPT or HSA sample tools to collect samples for on-site analysis
- Best applied to TPH or VOC analysis (can be NELAC certified data)
- Use real time data to “track” horizontal plume extent
- Vertical profiling can be performed in source zone
- Cost for DPT rig plus mobile lab ranges from \$3,000-\$3,500/day
- Track plume from outside in to increase daily samples lab can run

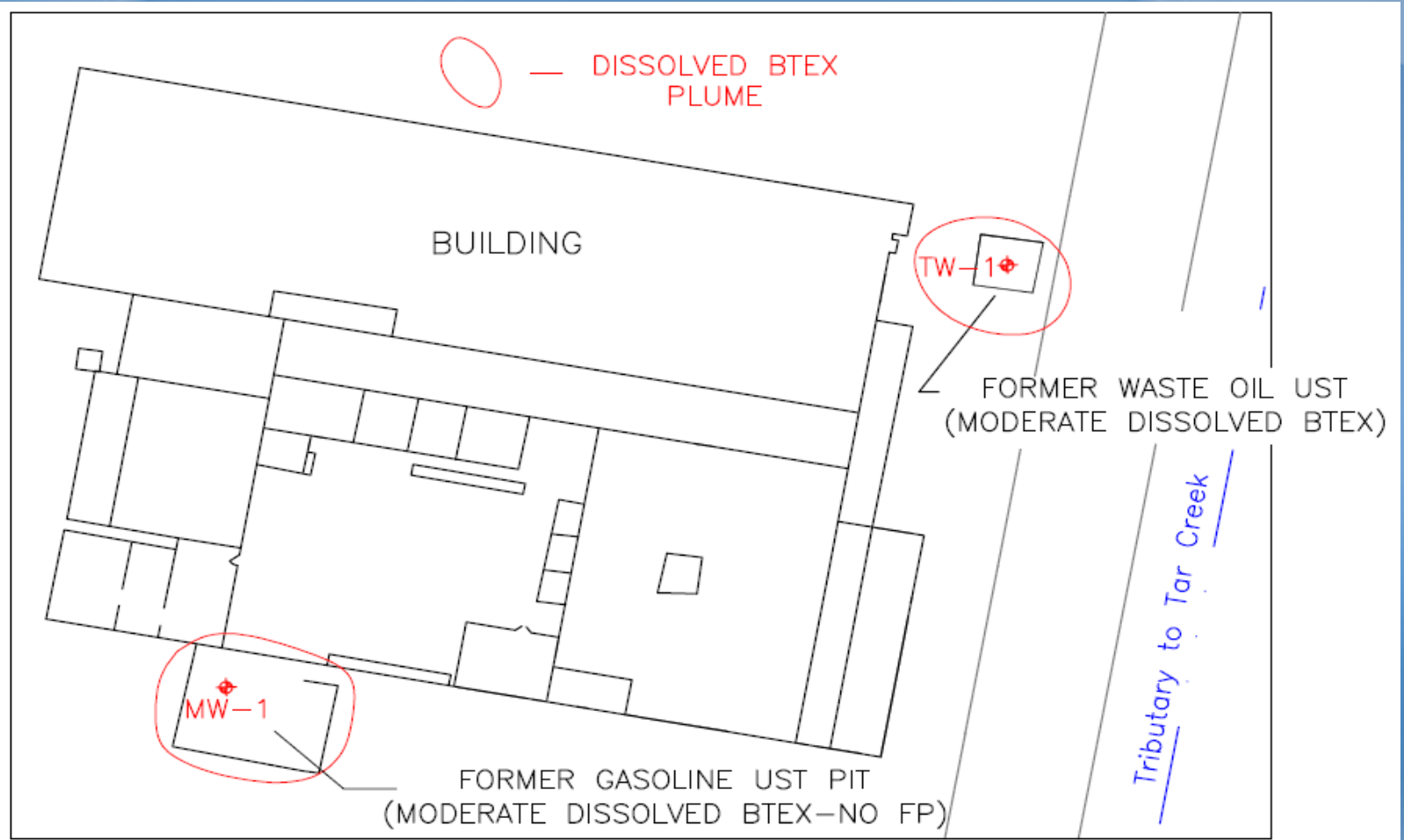
Dissolved VOC Plume Prior to Plume Tracking



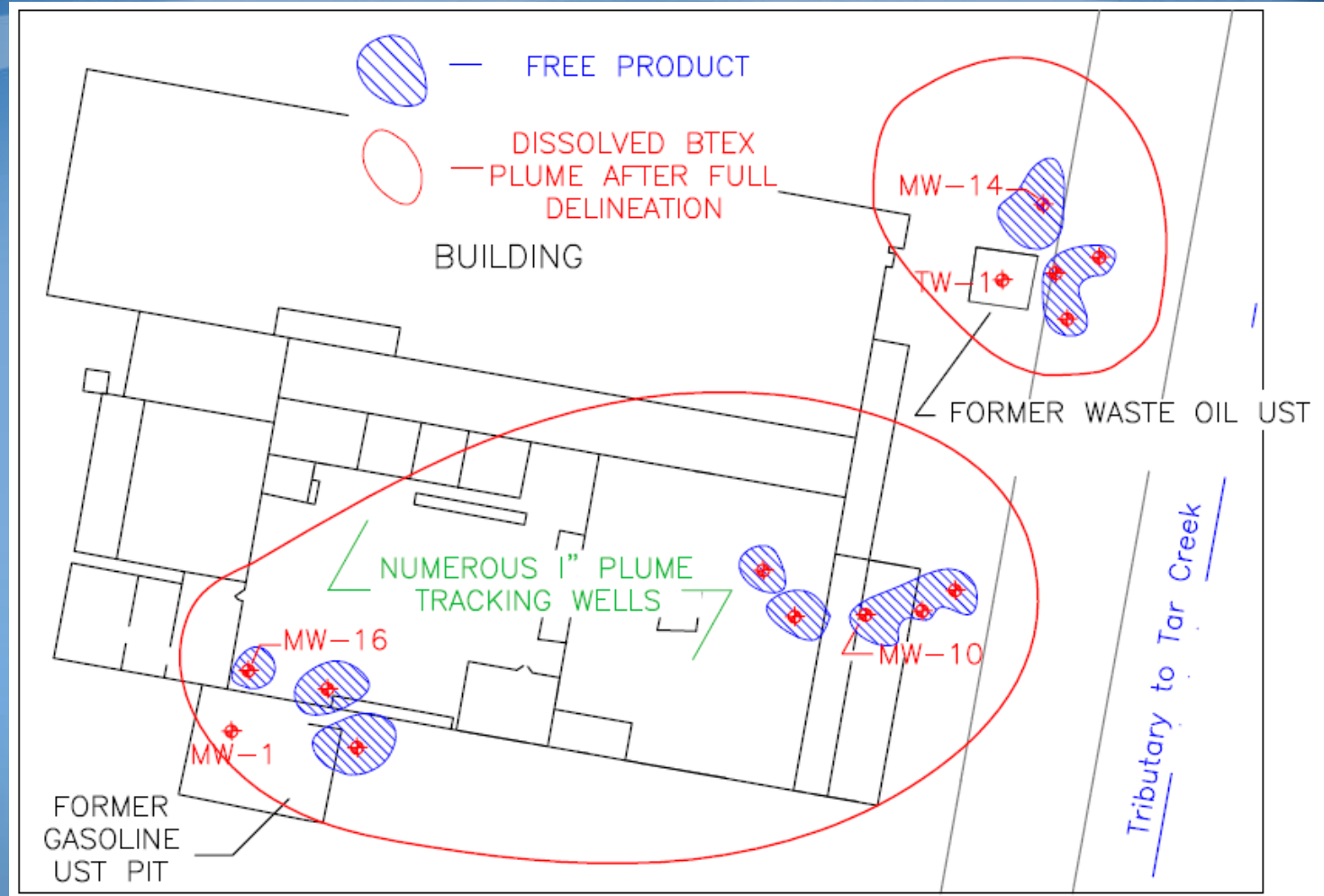
Dissolved Plume After Tracking



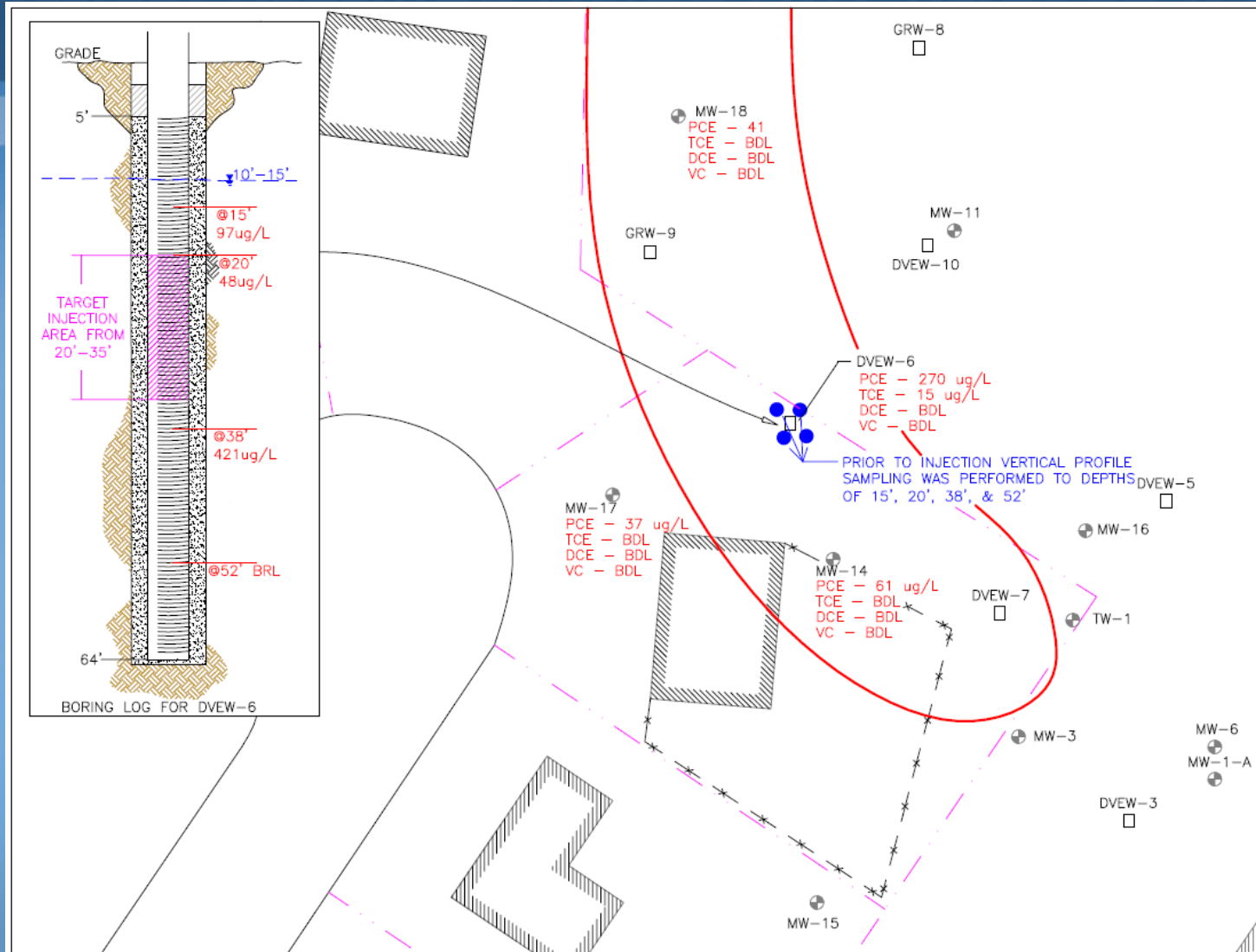
NW GA Site After Initial Assessment



Following Plume Tracking (converted some DPT wells to Injection Wells)



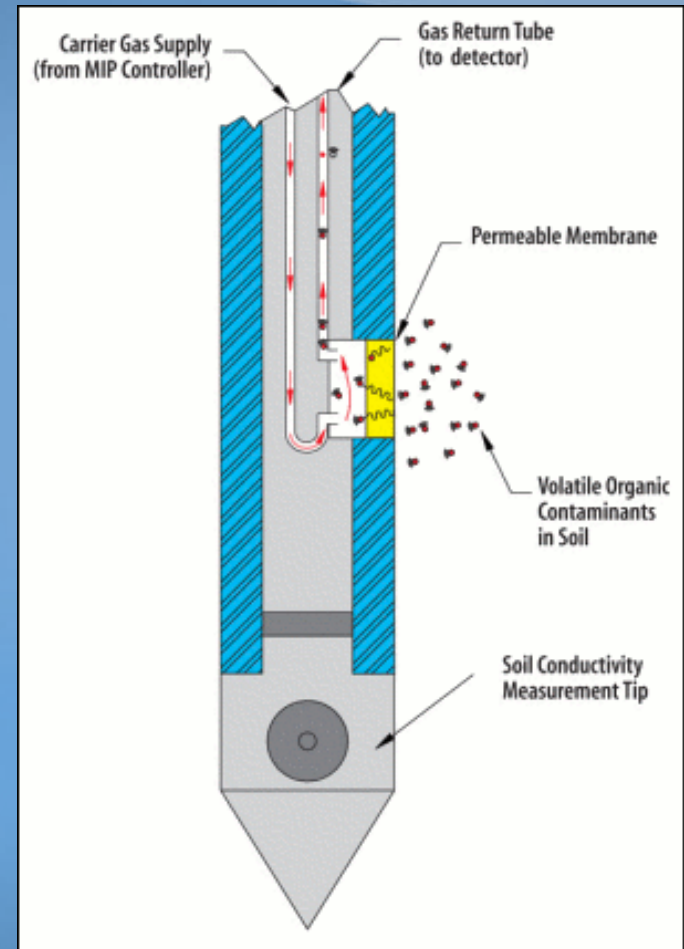
Vertical Profiling Using DPT Prior to ISCO



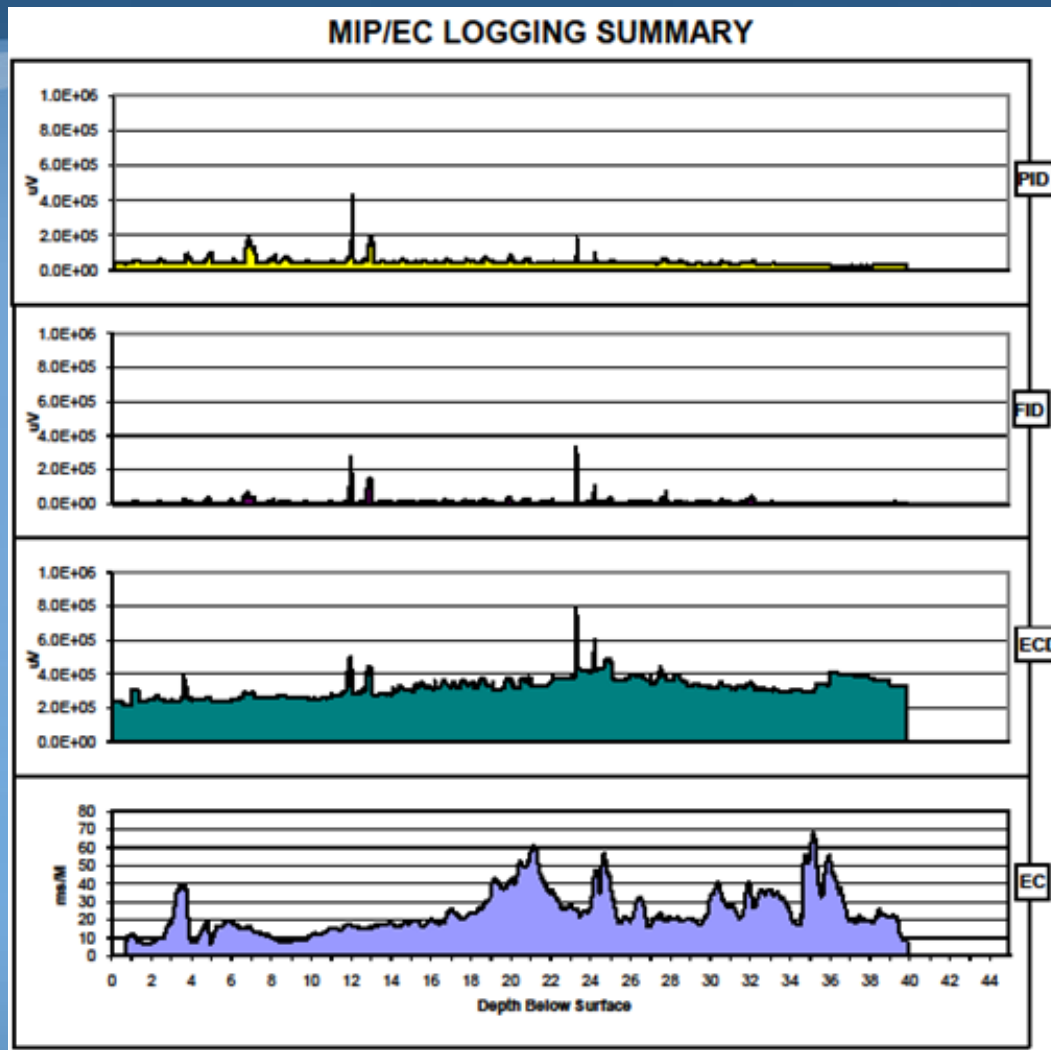
Remedial Screening Tools Soil & Groundwater

DPT-MIP/EC Logger™

- MIP uses a specially designed probe that threads to DPT rods
- VOC data is obtained at 1 foot advancements and analyzed as a gas stream using three detectors (PID, FID, ECD)
- EC Logger measures electrical conductivity variances (similar concept to CPT)
- Combined use of MIP detector and EC Logger allows correlation between high/low permeability zones vs. VOC detection
- Also useful for qualitative DNAPL detection
- Cost ranges from \$2,000-\$2,500 per day for probe plus rig charges



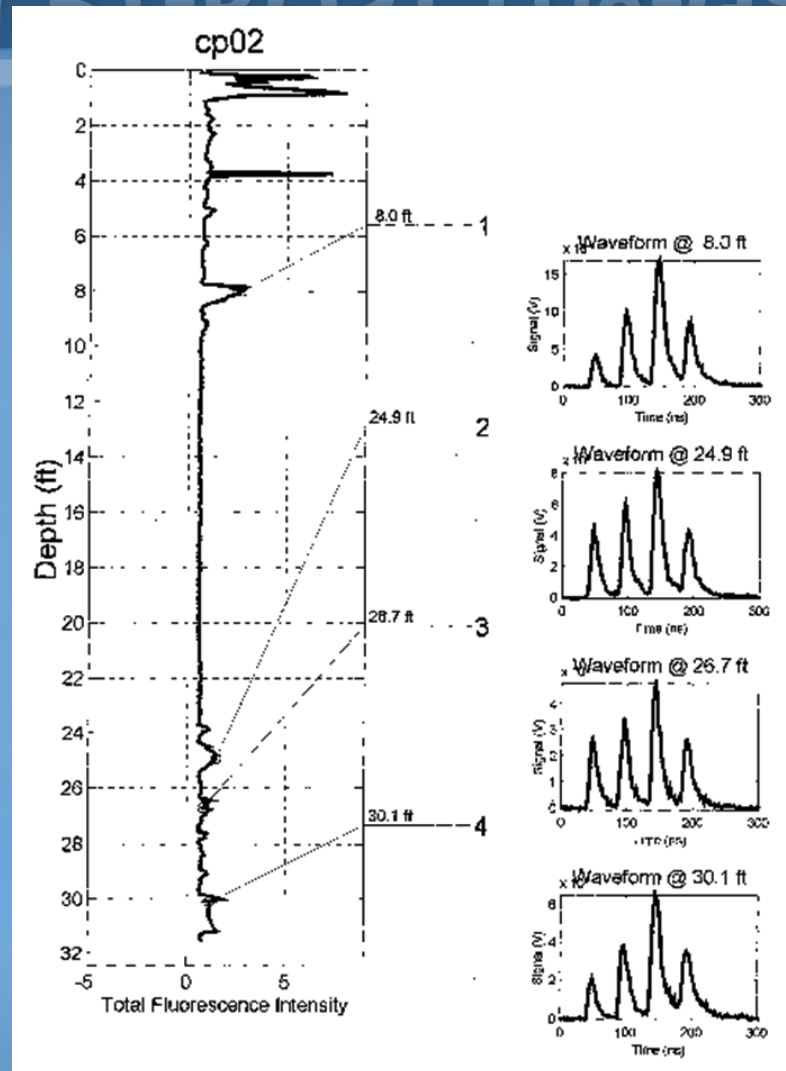
MIP/EC Log Example



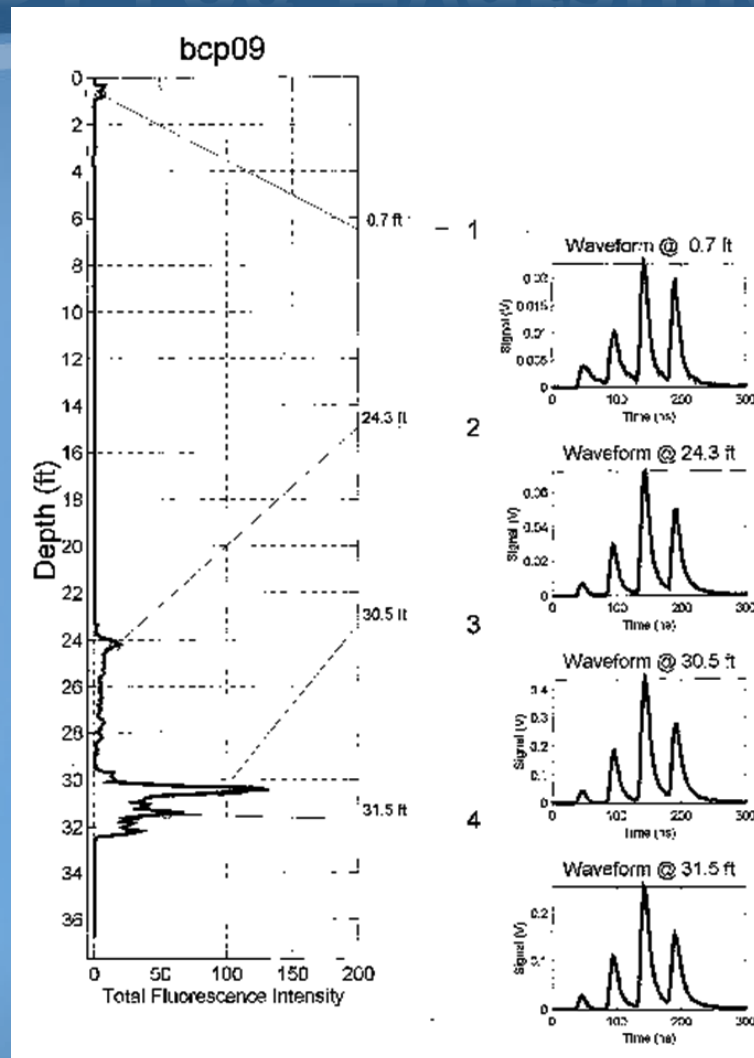
CPT-ROST Method

- ROST- Rapid Optical Screen Tool- developed by Fugro Geosciences (<http://www.geo.fugro.com/services/Geosciences/ROST.asp>) using laser induced fluorescence
- Tool advanced with large CPT trailer rig
- Probe advanced by weight of vehicle, no hammering-limited use in saprolite or hard formations
- Laser emitted from small diameter sapphire window mounted in CPT probe. The laser light is absorbed by petroleum hydrocarbons producing fluorescence wave patterns compares to standards
- Combined use of CPT & ROST process allows correlation between soil permeability and petroleum hydrocarbon detection
- Cost- \$5,000 per day or higher

Example CPT-ROST Log-Gasoline Site

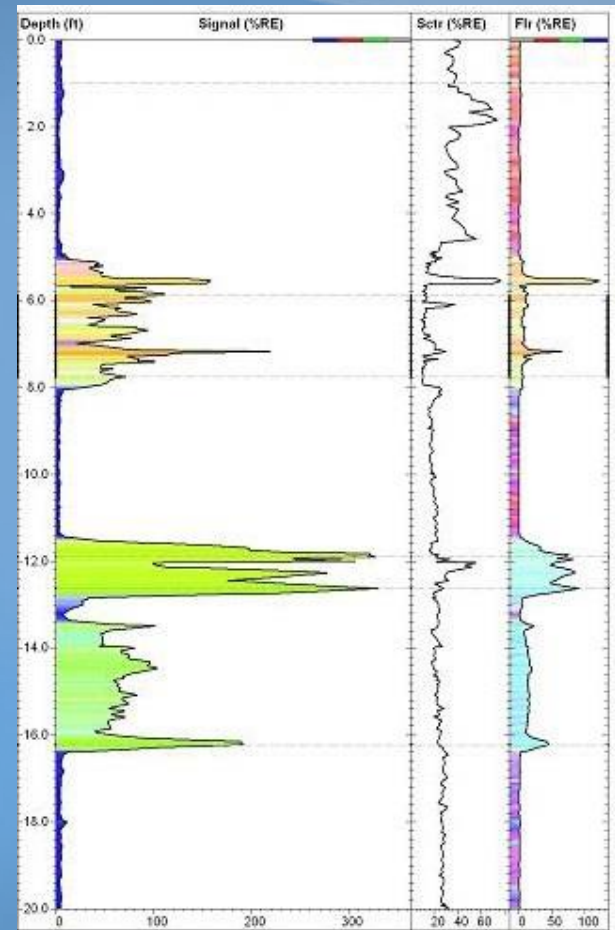


CPT-ROST Log-Hydraulic Oil Site



DPT plus UVOST® & TarGOST®

- Developed by Dakota Technologies (www.dakotatechnologies.com) using the LIF technology
- UVOST-developed for detection of NAPLs and high concentrations (10-500 ppm) of light to medium grade petroleum products
- TarGOST-specialized version of UVOST designed for coal tars, creosote, heavy crudes
- Can be advanced by DPT-advantage over ROST
- Cost- \$4,500-\$5,000 per day (TarGOST) excluding DPT cost



Conclusions

- Any successful remediation program requires a proper remedial characterization
- Since most assessments focus on plume boundary delineation only, source area characterization is usually required
- Remedial screening tools can provide a rapid cost effective means of targeting cleanup areas
- The proper application will result in more efficient cleanup at reduced overall project cost

