



South Carolina Department of Health and Environmental Control

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# UST Site Rehabilitation Contractors Day

October 9, 2019

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# Welcome!



# Program Goals

- Evaluate processes for operational efficiencies
- Increase site rehabilitation activities
- Integrate innovative approaches & technologies
- Collaborate with Stakeholders

# Results for 2018

- Amount of SUPERB Monies Committed = \$30 million
- Amount of SUPERB Monies Spent = \$22 million
- Increase in Assessment Activities and Technology, AFVR directives, PFP awards, and site closures



# Continuous Improvement

- Additional Resources
- On-boarding Project Management Training
- Overtime Work
- Stakeholder Engagement
- Flexibility in State Lead Contracts
- MNA Approach
- New Technology

# Updates

- UST Tank Fees revert back to \$100 beginning January 1, 2020.
- Continue to enhance assessment activities and technology, AFVR directives, PFP awards, and site closures.

# Reminders

- Pre-Approval of all Site Rehabilitation Work
- Communication
  - Site updates with Project Managers
  - Field Work Notification
  - Request for Extension
- UST Control Regulations were amended on May 26, 2017 with full compliance by May 26, 2020.



# AFVR Evaluation Process





# Aggressive Fluid Vapor Recovery (AFVR)

- Aggressive – High Vacuum (>25 inches Hg) and High Air Flow (>250 CFM)
- Fluid – Remove as much water as possible
  - So air enters the soil pores to enhance volatilization of petroleum.
- Petroleum can be moved through the ground easier as a VAPOR to maximize recovery of the LNAPL.



# Objectives

- Remove LNAPL
- Remove LNAPL that exceeds residual saturation/solubility limits
- Mitigate migration/dissolved plume generation
- Remove highly soluble chemicals (oxygenates, ethanol)

# Overall Success – Since 2013\*



- 2,446 AFVR events completed
- 113,642 estimated gallons petroleum removed

\*Cumulative through 6/19



# Factors to consider for an AFVR event

- Product Type
- Chemical Properties
- Soil Types
- Quantity/Size of Release/Plume
- Groundwater depth



# Product Comparison

Type of Product	Relative Volatility	Relative Viscosity	Relative Recovery Efficiency
Gasoline	High	Low	Good
Diesel/Kerosene	Moderate	Medium	Poor
Waste Oil	Low	High	Very poor

# Chemical Recoverability

Chemicals	Recoverable	In what phase?
BTEX	Yes	Liquid & Vapor
Oxygenates & Ethanol	Yes	Liquid
Naphthalenes	Poor	Liquid
PAHs	Poor	Liquid

# Soil Types

Soil Type	Relative Pore Size	K Values	Radius of Influence	Water Generation
Sand	Large	$\sim 10e-2$	15-30 feet	High
Silt	Medium	$\sim 10e-5$	10-20 feet	Medium
Clay	Small	$\sim 10e-7$	<10 feet	Low

# Determination/Strategies of recovery points

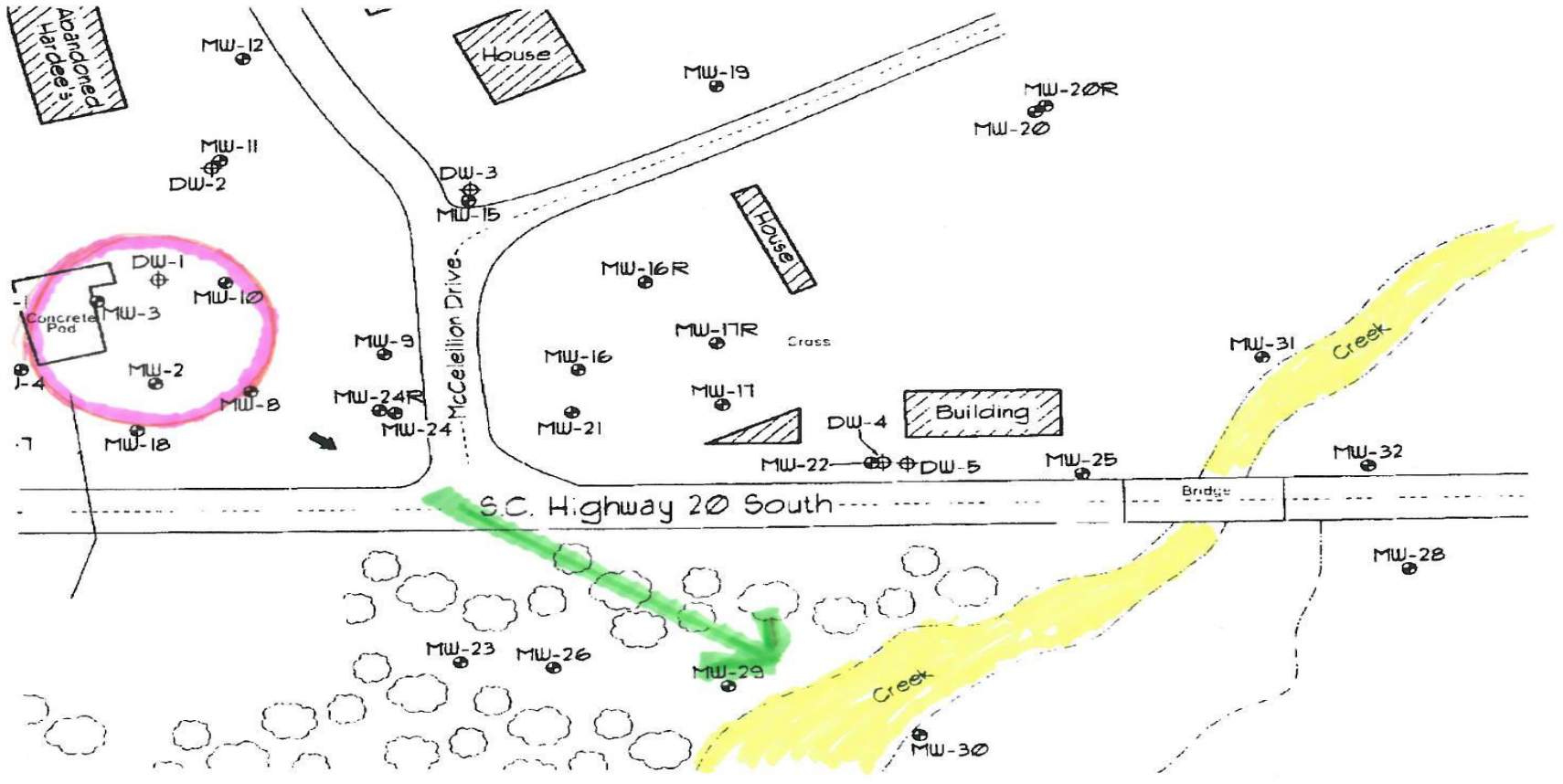
- Small plumes or new releases
  - Fewer recovery points are needed
- Large plumes or old releases
  - Large number of recovery points are needed

# Factors to consider when evaluating an AFVR event

- Recovery of equivalent gallons petroleum removed
- Effective radius of influence
  - Water drawdown and vacuum influence
- Is LNAPL decreasing?
- Are concentrations decreasing?
- Does data suggest that continued AFVR events will remove LNAPL and residual petroleum?

## Factors to consider when evaluating an AFVR event *continued...*

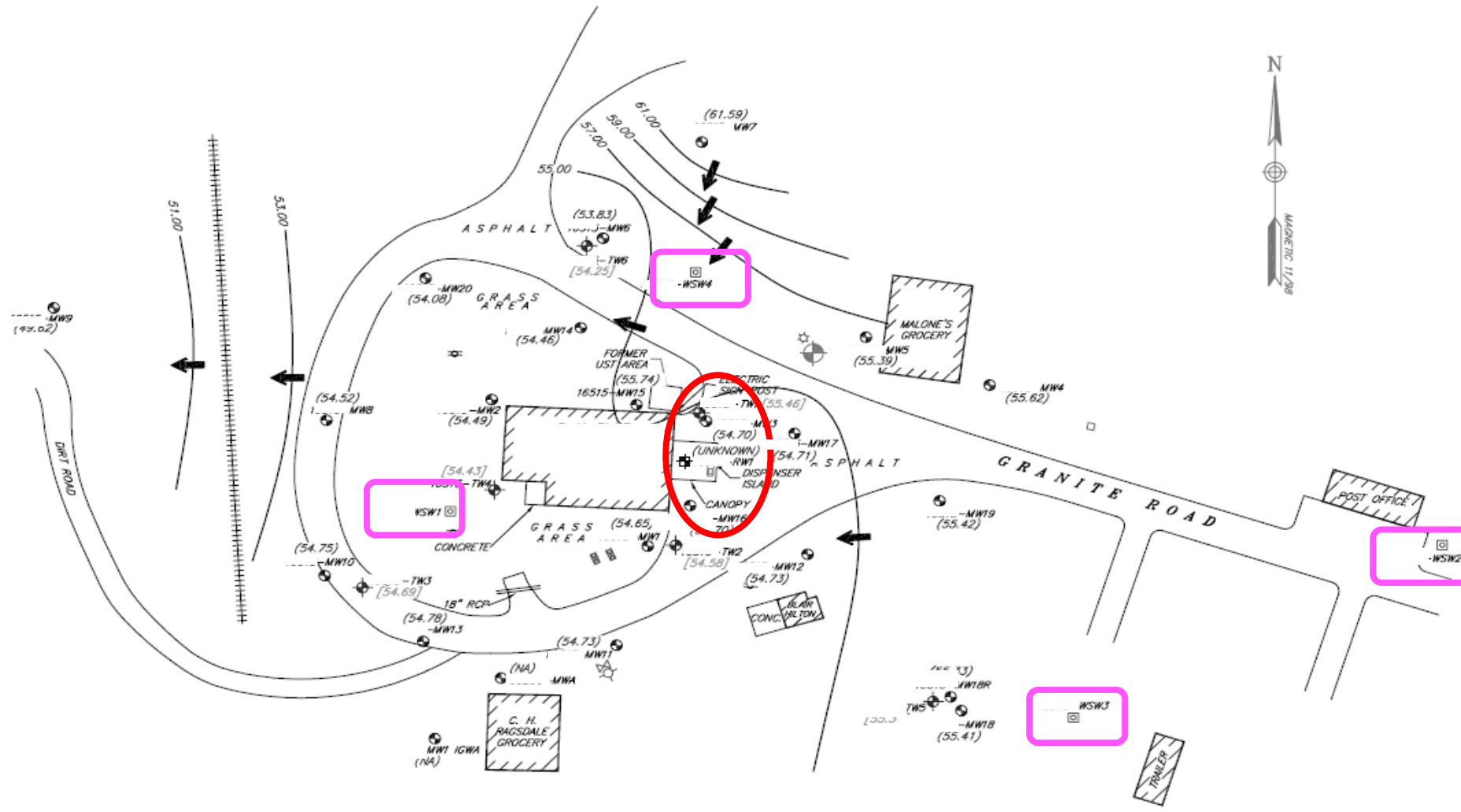
- If large quantities of water (30,000+ gallons) are generated
  - Is the formation successfully de-watered?
  - Is there sufficient petroleum recovery to warrant additional cost of water disposal?
- Recovery of Oxygenates, MTBE, or ethanol in water
- Other site specific conditions





# Case Study 1

Date	Benzene (ppb)	BTEX (ppb)	EDB (ppb)	AFVR Duration	Petroleum Recovered (gallons)	Water Recovered (gallons)
9/14/2011	10,000	73,100	770			
12/2/2013				96	24.76	11,404
2/24/2014				96	34.03	21,627
5/1/2014	1,700	17,200	77			
2/9/2015				96	27.23	8,059
5/6/2015	379	12,599	4.5			

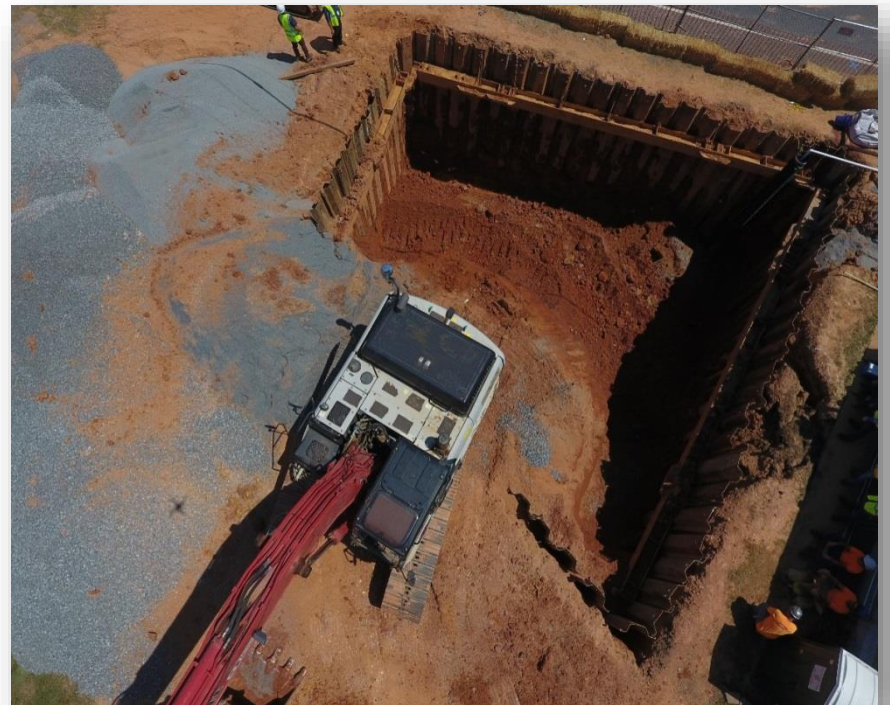


# Case Study 2

Date	Benzene (ppb)	BTEX (ppb)	EDB (ppb)	AFVR Duration	Petroleum Recovered (gallons)	Water Recovered (gallons)
3/3/14				96hr	6.92	1,638
9/15/14				96hr	8.44	5,085
2/17/15	22,100	90,320	1.5			
6/1/15				96hr	20.36	6,425
3/7/16				96hr	2.28	9,870
7/13/16	22,600	95,280	1.2			
12/15/16				96hr	2.5	2,776
4/2/17				96hr	0.58	2,667
10/25/17	17,600	86,380	0.88			
4/10/18				96hr	0.64	755
8/21/18	20,100	100,710	1.0			

# AFVR IS NOT THE BEST TOOL FOR EVERY SITE

- Excavation
- Chemical oxidation
- Bioremediation
- Surfactants
- Thermal
- Other



# 15 Minute Break





# UST QAPP 4.0 Revisions



# Background

- EPA Requirement as part of DHEC' Environmental Affairs' Quality Management Plan.
- DHEC Environmental Affairs policy is to create a Quality Assurance Project Plan for all activities that generate data used to make decisions.
- The UST Division developed a Quality Assurance **Program** Plan (QAPP) to cover all UST Assessment and Corrective Action activities regulated by the SUPERB Act.
- UST contractors who adopt DHEC's QAPP need to provide Annual Contractor Quality Assurance Plans that include their field Standard Operating Procedures or submit a QAPP Addendum for each scope of work.

# Purpose

- Document Quality Assurance / Quality Control processes to ensure data are complete, representative and comparable
- Document UST Division RBCA processes
- Set baseline standards for all UST data collection activities
- Provides a standard of accountability for UST site work





# QAPP Version 4.0



- Standardized formatting across the document
- Acronym List
- Updated org chart
- Eliminated (some) repetitive and redundant repetition
- New and Revised Sections

# Significant Changes

## Groundwater Sampling Section

- More emphasis on professional judgement & PM communication
- Dry purging should be avoided – wells given much more time to equilibrate before sampling
- Drawdown measurements required before purging and during sampling
- No purge sampling discussion expanded – addition of SNAP samplers.

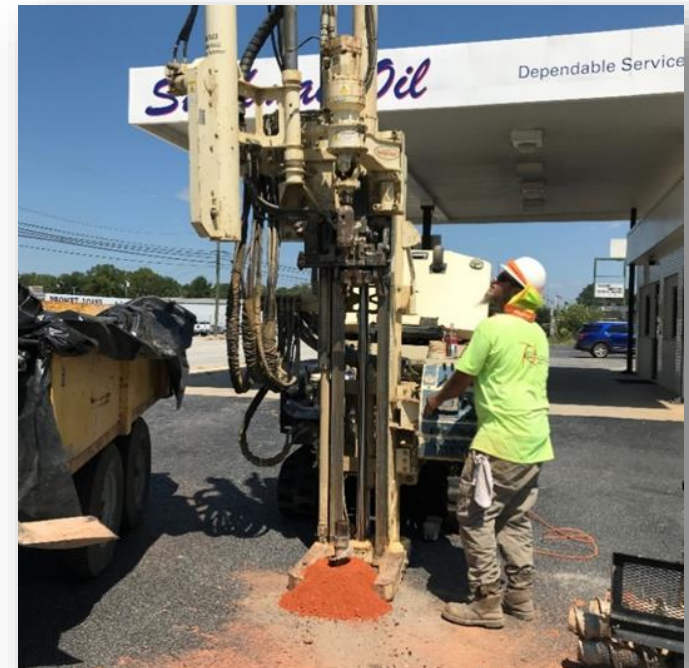
# Significant Changes

- Additional CASE Report Requirements
- New Surface Water Sampling Section
- Remedial Excavation Section Added
- Injection Section Updated
- Soil sample collection beneath water table
- Treated water discharge sampling requirements
- All submissions require digital copies, including unsecured pdfs, .xlsx tables, and .dxf figures



# Minor Changes

- Table order adjusted
- Documentation of sampling locations
- Equipment Blanks
- Recovery Well Specifications
- RBSLs < DLs Corrected
- Additional Metals Analytical SOPs
- Modified AFVR Requirements
- Monitoring Well Abandonment Requirements







**Reach out if you  
have any  
questions.**

Ray Holberger  
Quality Assurance Coordinator  
Office: (803) 898-0634  
Cell: (803) 608-0875  
[holberrr@dhec.sc.gov](mailto:holberrr@dhec.sc.gov)



# Field Work Observations



# Communication

## Field Work Notifications

- 4 days prior to work
  - 7-14 days for Verification/Confirmation Sampling
- 24 hours notice of any schedule changes





# Well Abandonment

## R 61-71 Well Standards

- “The well shall be filled with either neat cement, bentonite-cement, or 20% solids sodium bentonite grout, from the bottom of the well to **land surface.**”

## SC DHEC QAPP 3.1

- “In paved areas, the vault will be filled with aggregate reinforced concrete or asphalt. In **unpaved areas**, the pad, vault, and cover will be removed and the space filled with soil to level with surrounding land surface.”







# Well Tags

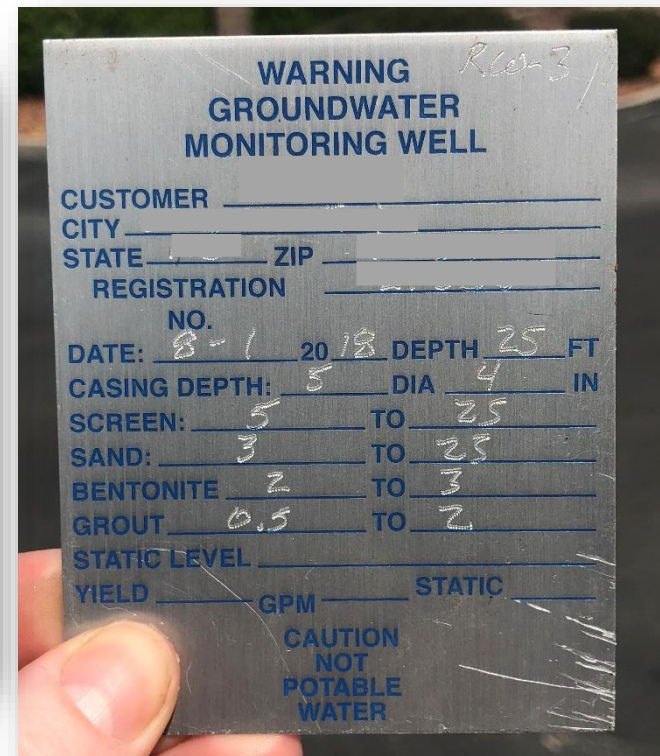
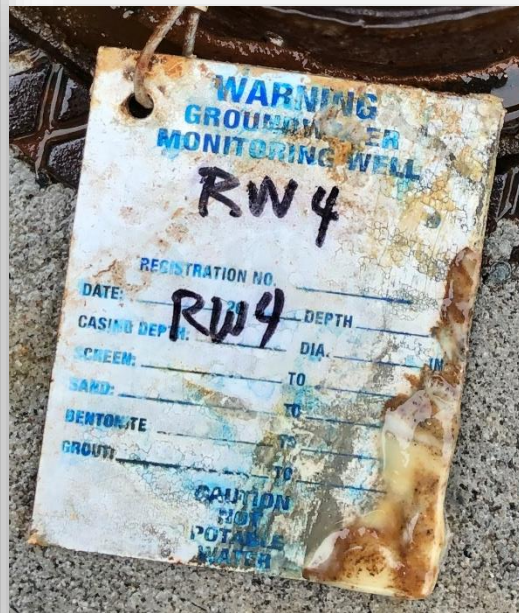
## R 61-71 Well Standards

- “The identification plate shall be permanently marked to show:
  - Company Name and certification # of driller who installed well
  - Date Completed
  - Total Depth (in ft)
  - Casing Depth (in ft)
  - Screened Interval
  - Designator and/or ID #



## SC DHEC QAPP 3.1

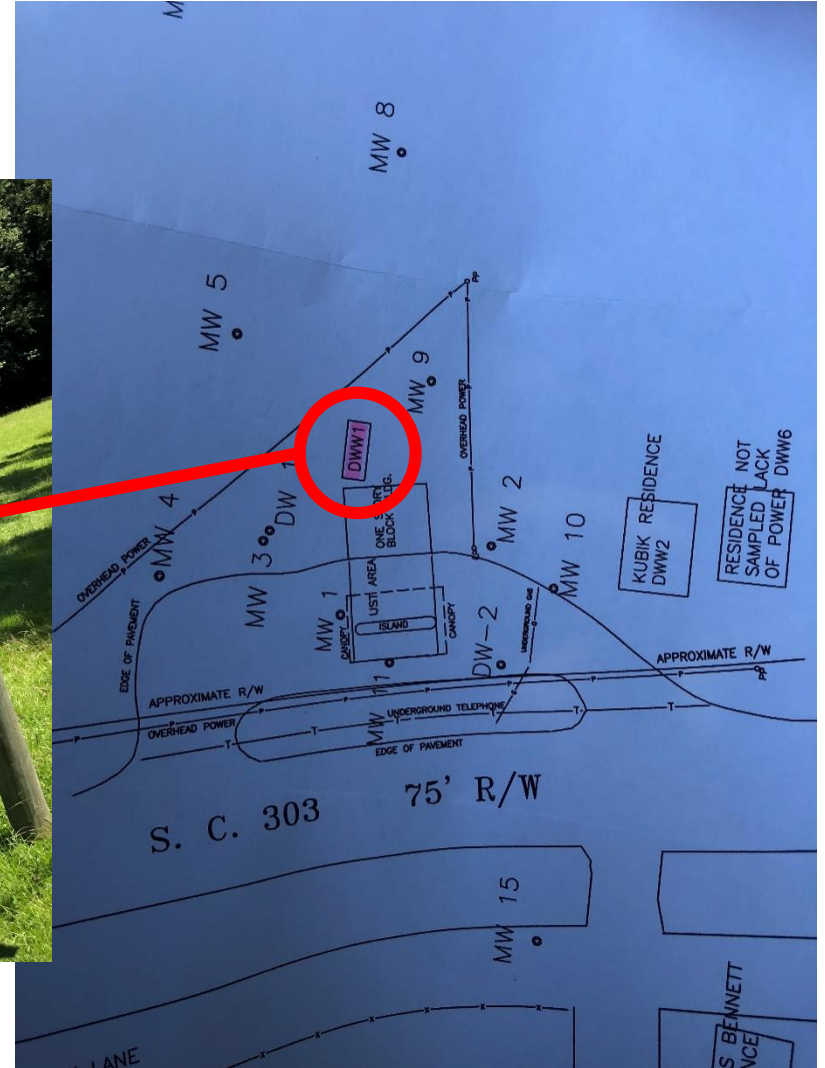
“Information on the well identification plate will be stamped, etched, or engraved in legible text. Use of ink markers (e.g. “Sharpie®”) is not allowed.”



# Site Maps

- Check the location of monitoring wells
- Ensure monitoring wells are correctly labelled
- Verify water supply wells and surface water locations





# Locating Monitoring Wells

- It all begins with an accurate site map
  - Use fixed objects (e.g.) light poles, buildings, fences, etc.
- Indicators: PVC pipes, bollards, square grass patches, marking flags, etc.
- Metal detectors!





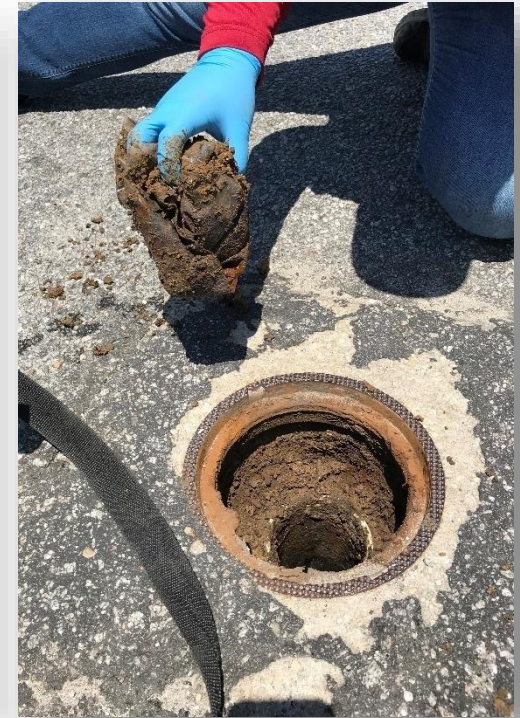






# Well Condition

- Document:
  - Well Pad
  - Well Vault
  - Vault Lid
  - Well Cap
  - Bolts
- Check
  - Total Depth
  - Screened Interval





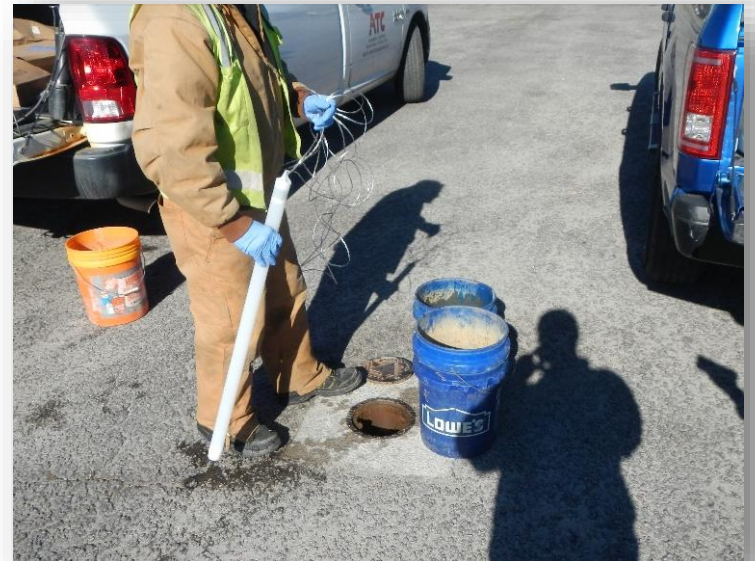




# Sampling Events

- Documentation
- Calibration
- Decontamination
- Plastic is required in ALL sampling events
- Place samples on **wet ice** within 15 mins
- Always wear nitrile gloves (non-powdered)
- Disposable Bailers are SINGLE USE ITEMS

- Protect the Vials
- Wells with free product must have prior approval before sampling
- Do Not Sample: from the flow through cell or from the flex tubing in a peristaltic pump
- Stability Criteria:
  - pH  $\pm$  0.1 S.U.
  - DO  $\pm$  0.2 mg/L
  - Conductivity  $\pm$  5%
  - Temperature  $\pm$  5%
  - Turbidity  $\pm$  5%



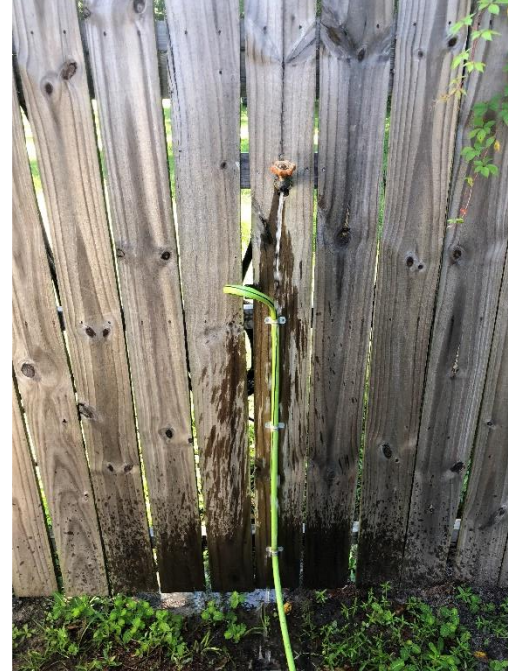






# Documentation

- Water Supply Wells
  - Where were the samples taken?
  - How was the sample collected?
  - How long did it run before it was collected?
- Surface Water
  - GPS coordinates
  - Photos of the location
  - Marking flags







# Pay For Performance (PFP) Process

- Regulatory Requirements for Corrective Action
  - R.61-92: UST Control Regulations
  - R.61-98: SUPERB Site Rehabilitation & Fund Access Regulations
- Statute & Regulatory Requirements for Establishing Costs
  - SUPERB Act
  - R.61-98: SUPERB Site Rehabilitation & Fund Access Regulations

# Pay for Performance

Statelead  
or  
Owner/Operator

# Pay For Performance (PFP) Process – Statelead

1. Solicitation advertised on SCBO for 30 days
2. SCDHEC receives sealed bids
3. SCDHEC determines lowest responsive and responsible bid
4. SCDHEC issues statement of award to contractor with lowest responsive and responsible bid
5. SCDHEC notifies O/O of contractor selected on their behalf for required work
6. SCDHEC works with the contractor to ensure that corrective action is completed as required



# Pay For Performance (PFP) Process – Owner/Operator

1. Solicitation Sent to O/O & advertised on SCBO for 30 days
2. O/O to obtain price quotes from 3 qualified contractors and submit to SCDHEC
3. SCDHEC receives price quotes & determines lowest responsive reasonable cost
4. SCDHEC sends O/O letter with the established reasonable cost and asks O/O to select contractor of choice
5. SCDHEC works with O/O to ensure that required work is being completed

# Pay For Performance (PFP) Process

## Owner/Operator

- Advertised on SCBO
- Not legally binding document
- Lowest responsive cost is established
- Contractor selected by O/O

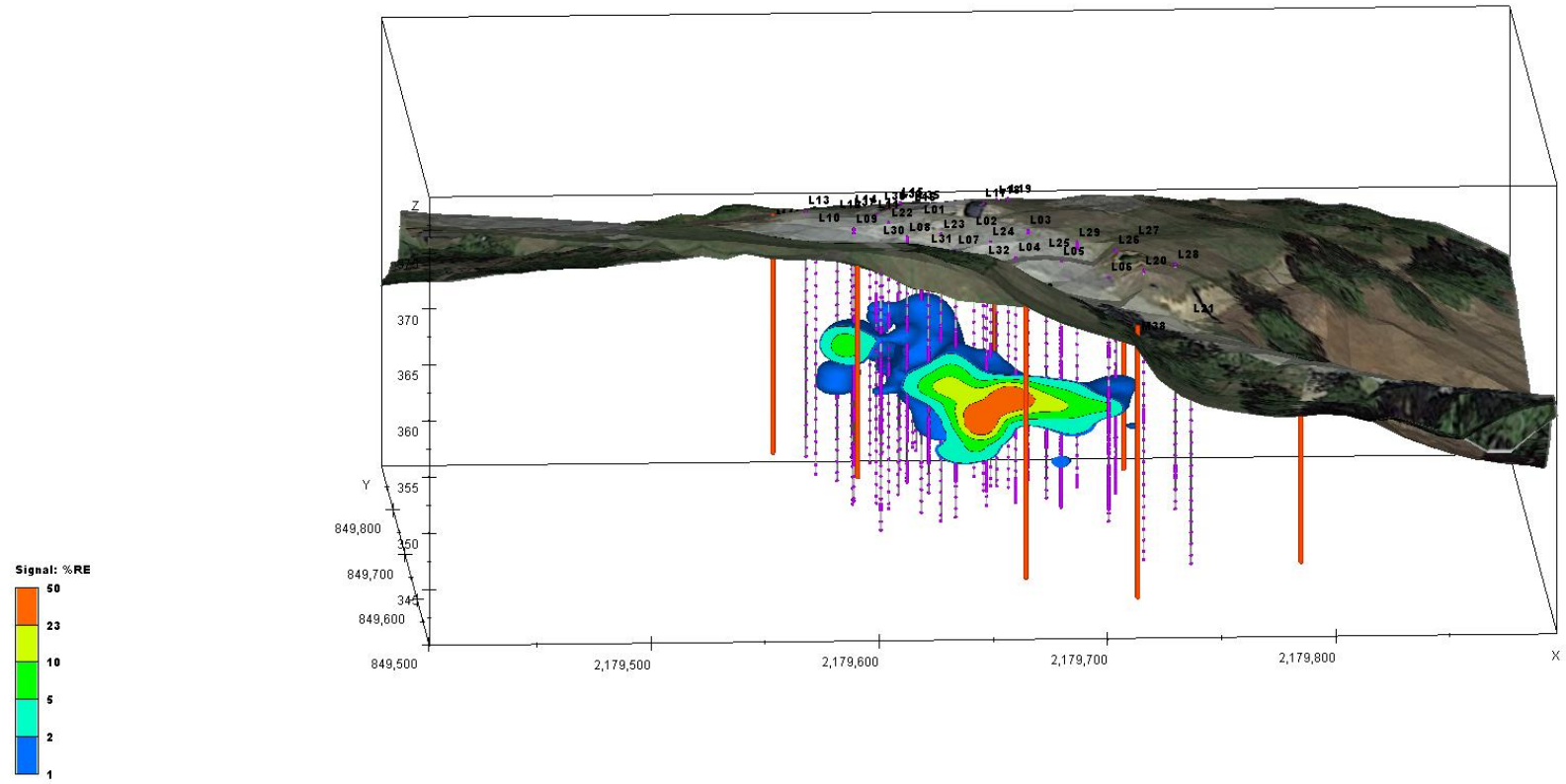
## Statelead

- Advertised on SCBO
- Legally binding document
- Low-cost responsive bidder selected
- Contract overseen by SCDHEC

# LUNCH



# High Resolution Site Characterization (HRSC) Project



# Why HRSC?



- Continuous improvement
- Input from contractor community
- Utilization of newer technologies
  - Data gaps?
- Improve Site Conceptual Models (SCM)
  - Optimize clean-up

# Research and Training



- Met with contractors
- EPA training & guidance
- Internet Technology and Regulatory Counsel (ITRC)



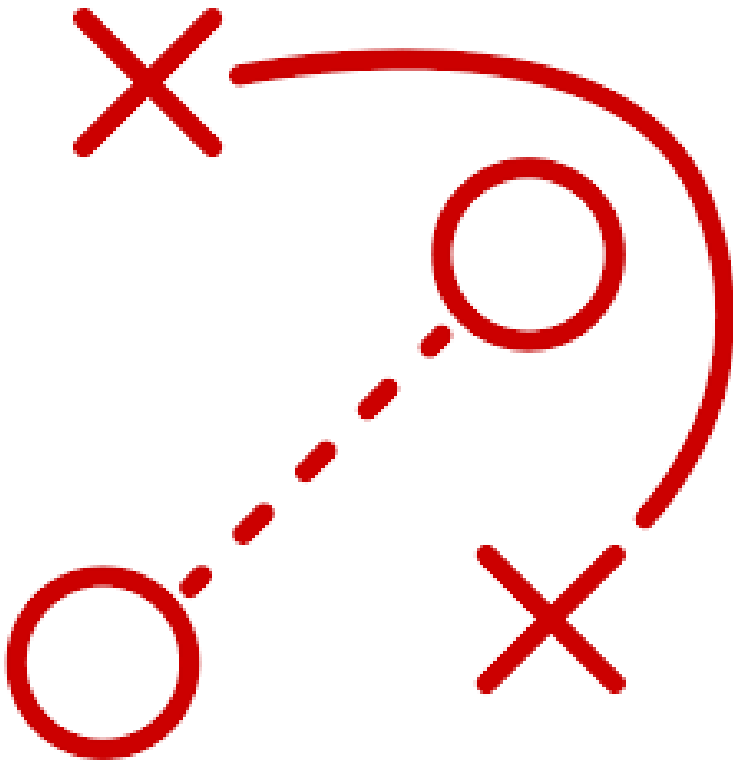


# Goals

- Explore cost vs. benefit
- Fill in data gaps
- Optimize clean-ups
- Determine limitations & best use



# Strategy



- Pilot study
- Solicitation of bids for a collection of sites
- Follow up with traditional methods

# Site Selection

- Good Direct Push Technology candidates
- Legacy sites
- Different stages of assessment/corrective action
- Corrective action did not succeed
- Varying geology



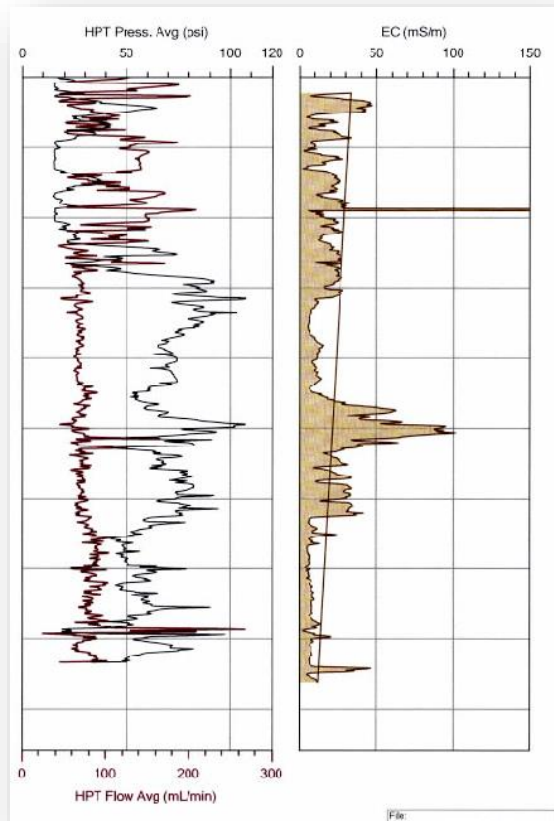


# The Tools



- Direct Push Technology
  - UVOST, MiHPT, OIPHPT
  - Traditional Field Screening
- Groundwater Sampling
- Soil Sampling
  - TPH
- Smartdata Solutions
- Rockworks, 4DIM

# Hydraulic Profiling Tool (HPT)



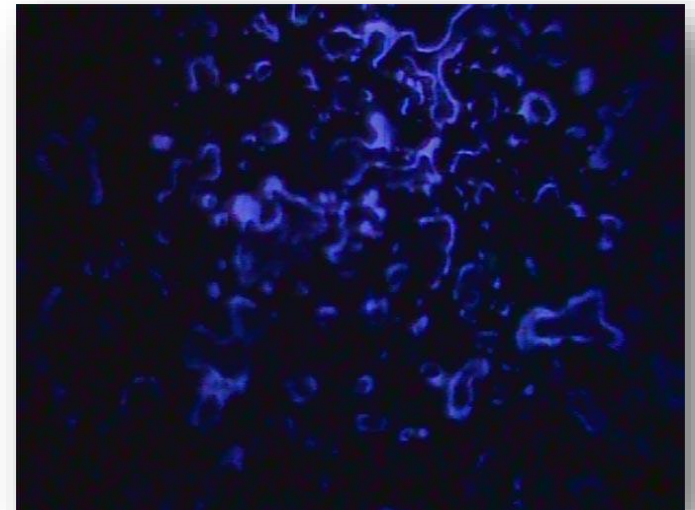
- Measures pressure
- Correlate permeability, depth, and contamination



# OIPHPT

## Optical Image Profiling tool & Hydraulic Profiling Tool

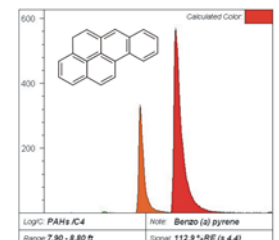
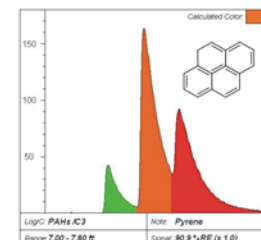
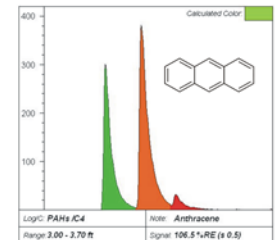
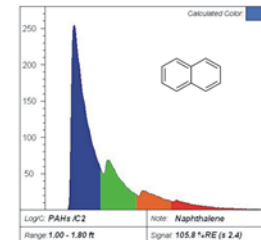
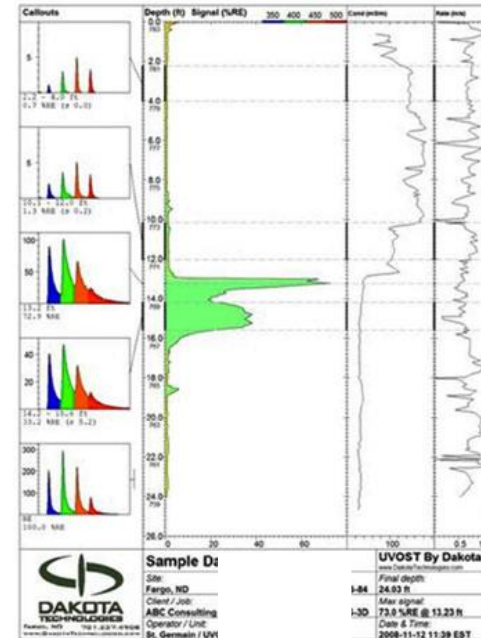
- Capture images of fluorescence in poly-aromatic hydrocarbons and subsurface lithology
- Electric Conductivity (EC)



# UVOSTHPT

## Ultra-Violet (UV) Optical Screening Tool and HPT

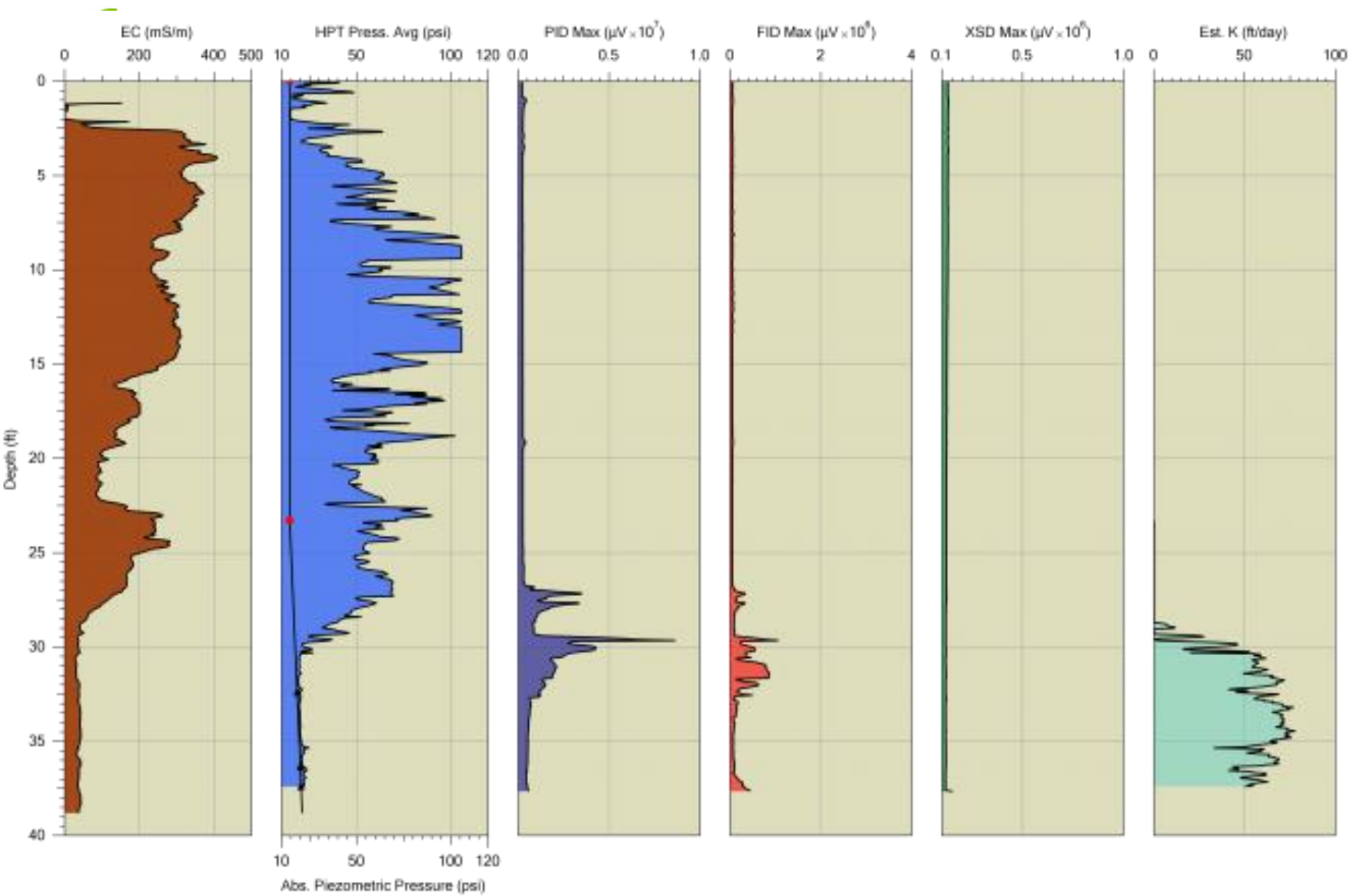
- Detects fluorescence in poly-aromatic hydrocarbons
- Allows for basic chemical composition fingerprinting.
- Gives Lithologic background in terms of the 4 waveforms
- Includes EC and HPT



# MiHPT

## Membrane Interface Probe and HPT

- Volatilizes organic compounds and carries those that diffuse across the membrane up the trunkline to the PID, and FID.
- HPT
- EC
- Takes longer than LIF
- Can see shorter chain hydrocarbons and methanes





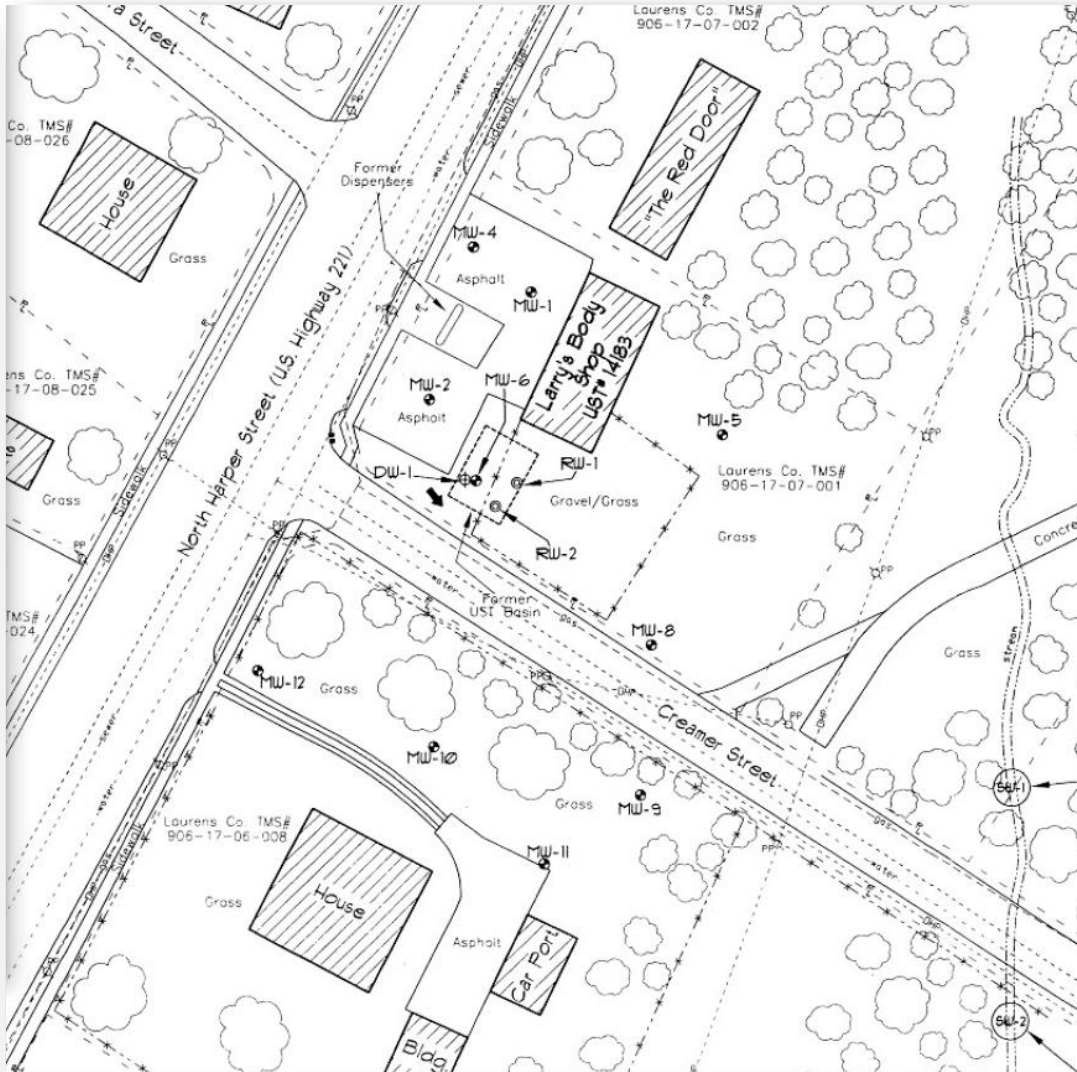
# Case Study 1 – Larry’s Body Shop



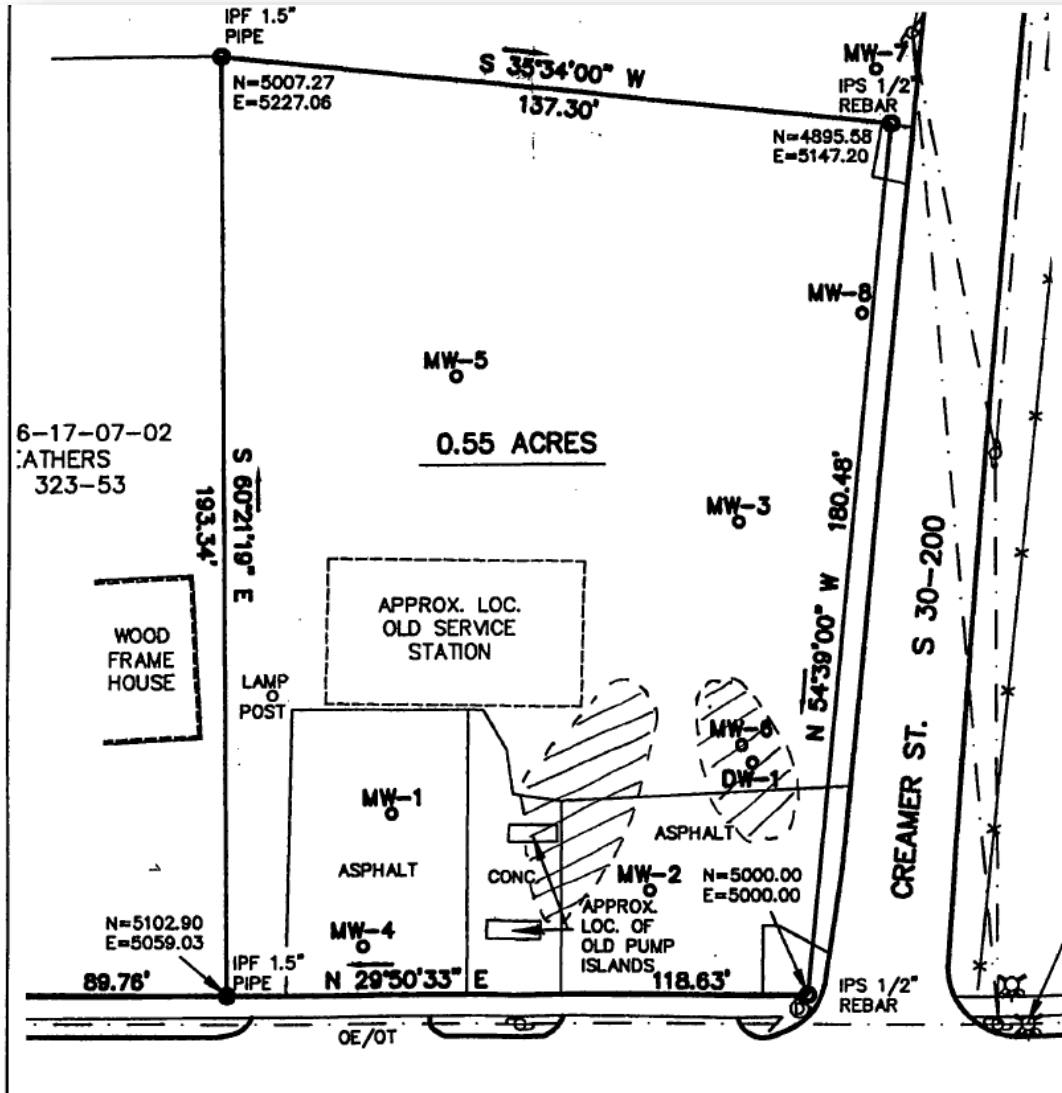
# Larry's Body Shop, UST #14183

- Release December 31, 1991 at tank closure
- 3 gasoline USTs abandoned by removal
- Laurens County
- Piedmont – igneous and metamorphic rocks
- Saprolitic Sandy Silt (Limited Assessment)
- Sandy Clay (Boring Log)
- Excavation

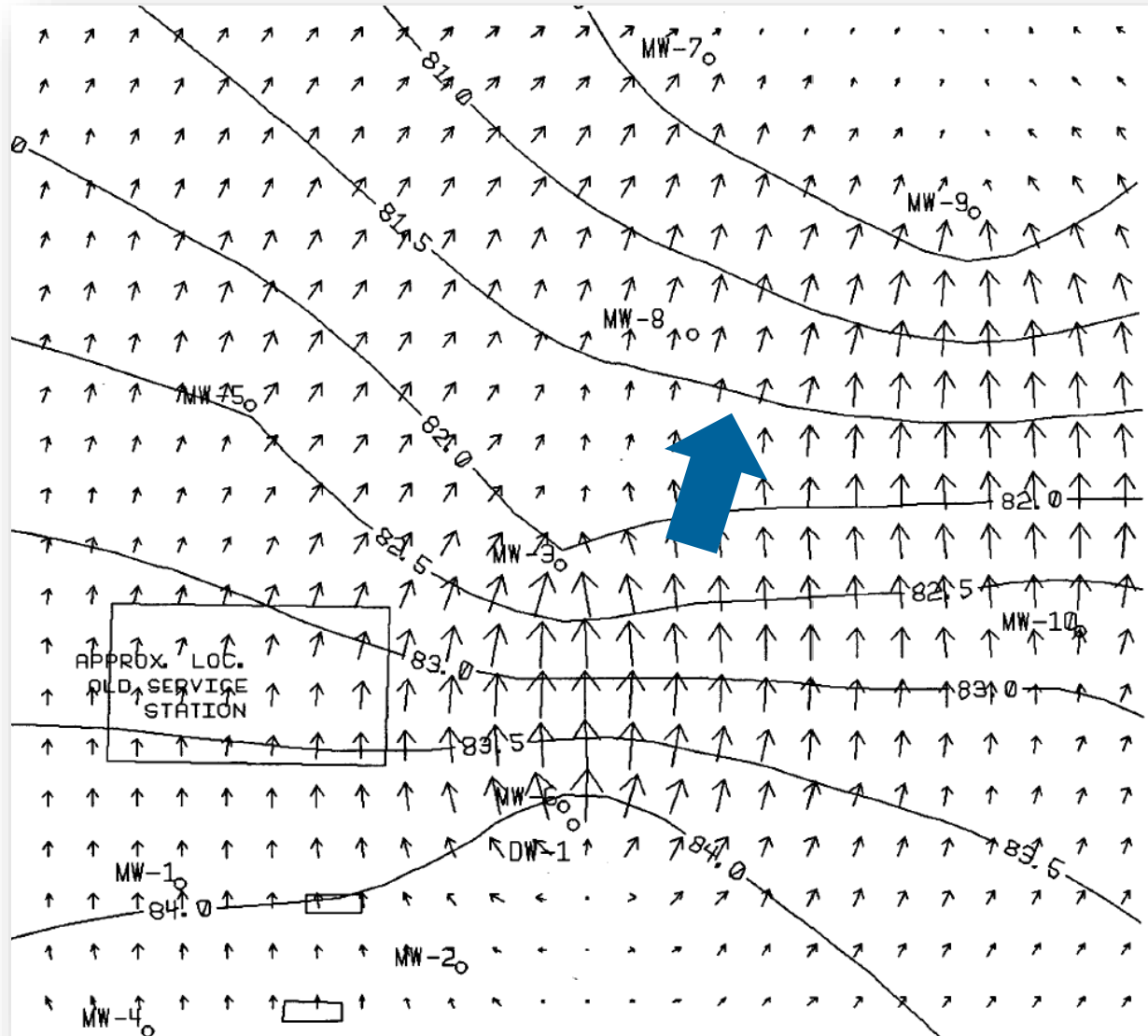


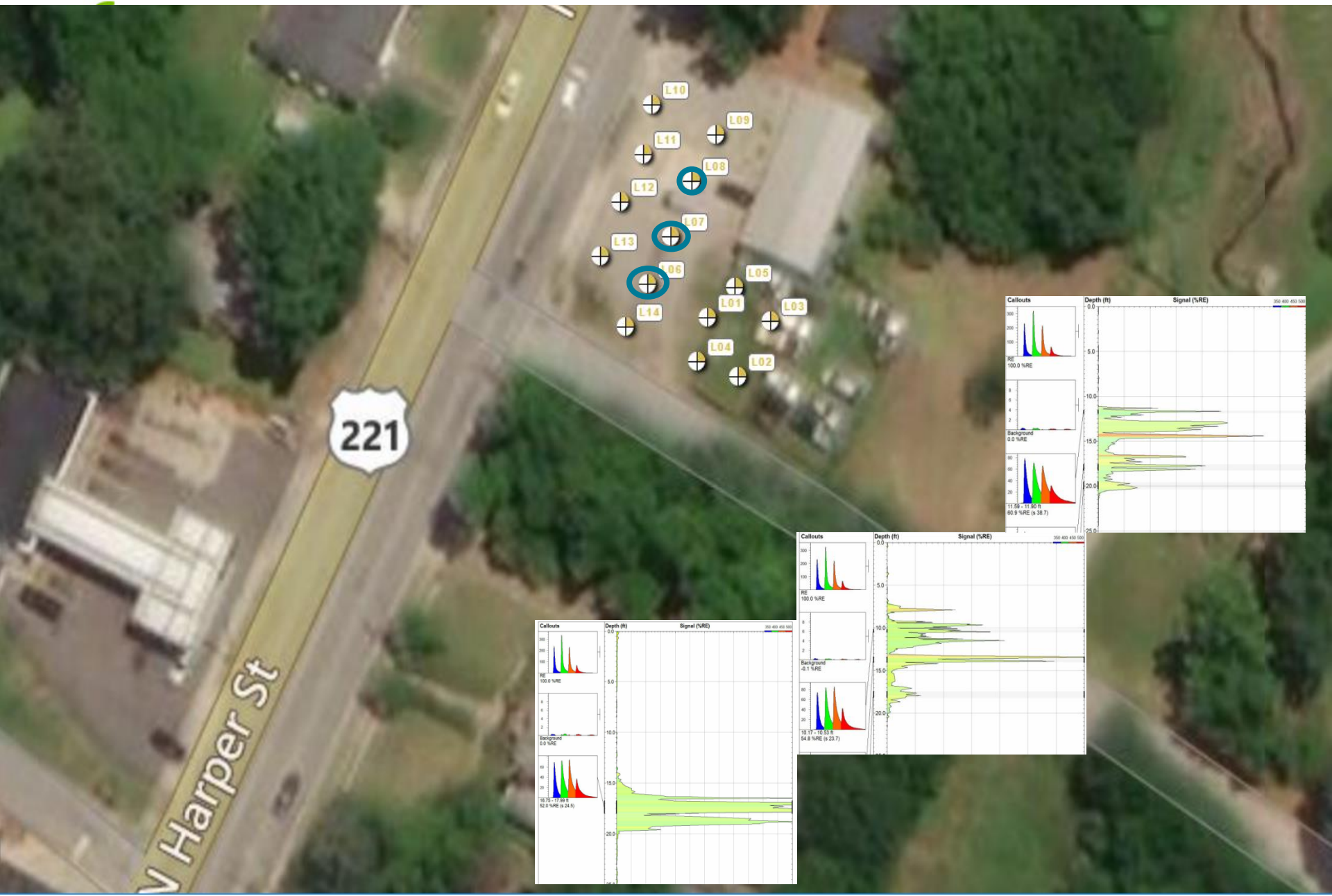


- Adjacent UST #10884
- MW1-12 screened approx. 10-22ft.
- RW1&2 10-25ft.
- DW-1 30-33ft.
- SW 1 & 2
- \*MW-2, 6, 10, 11, RW-1, 2



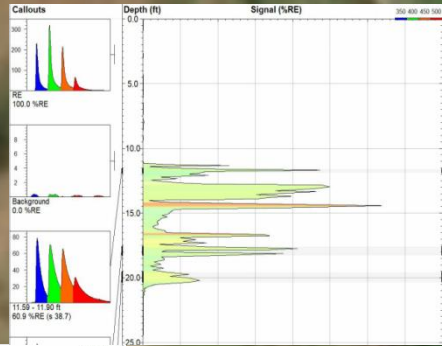
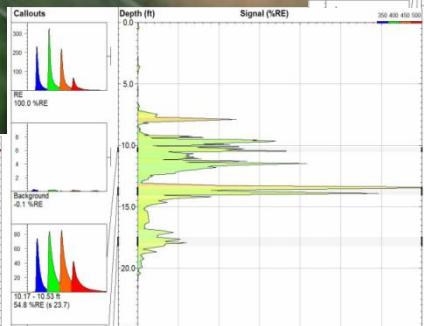
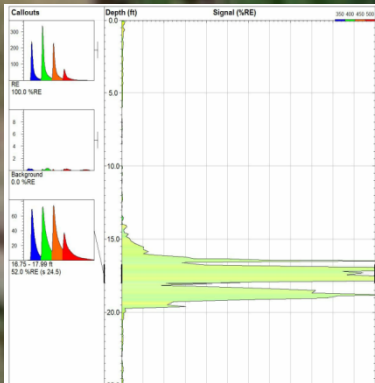
- Old MW network
- 20ft or less
- MW-1, 2, 3, 6, 9, & 10



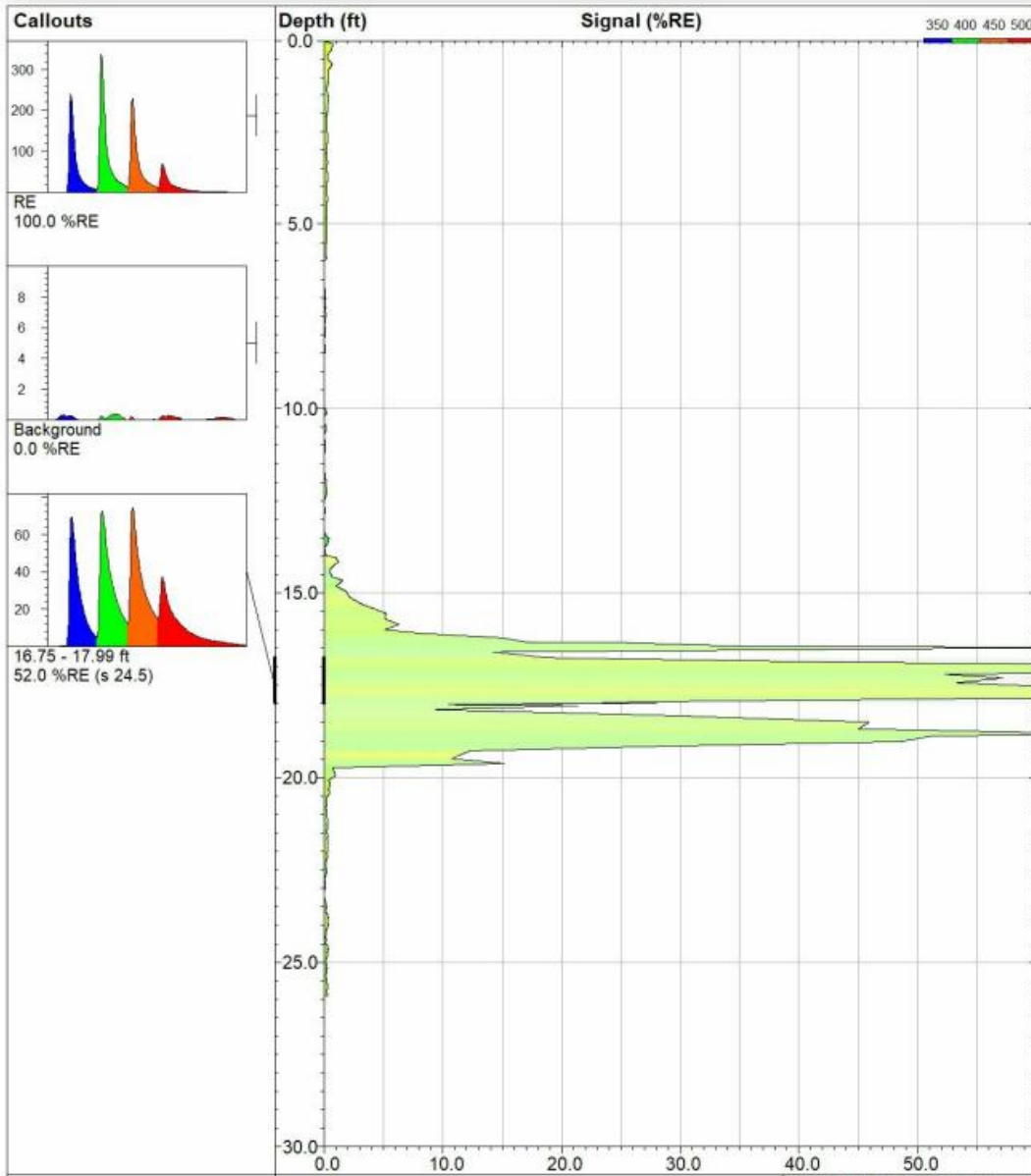


221

W Harper St

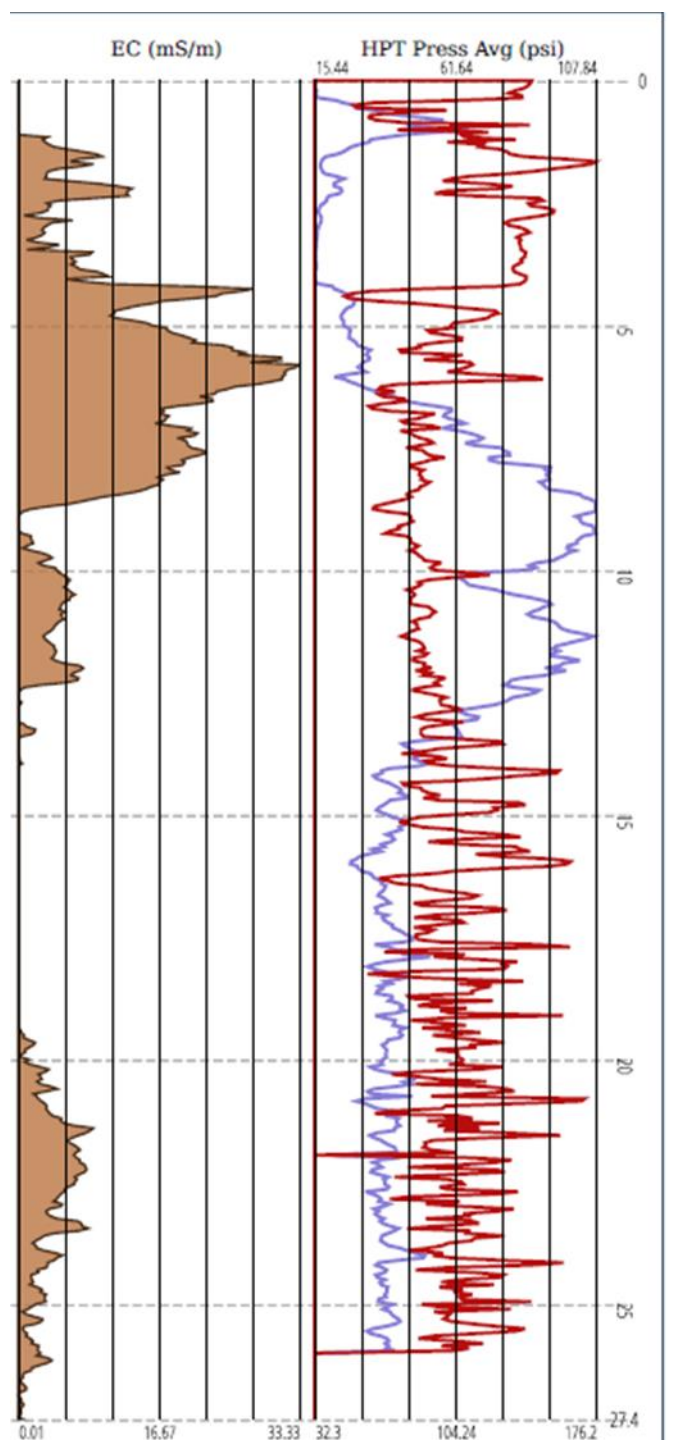
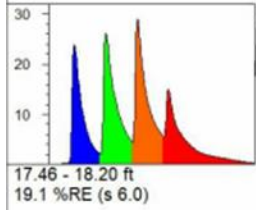
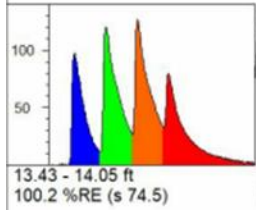
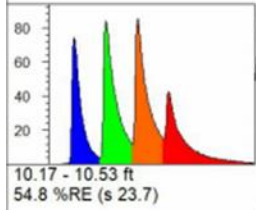
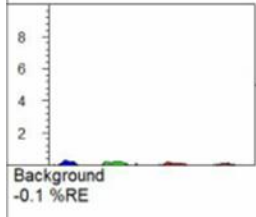
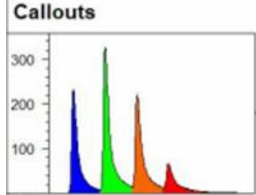
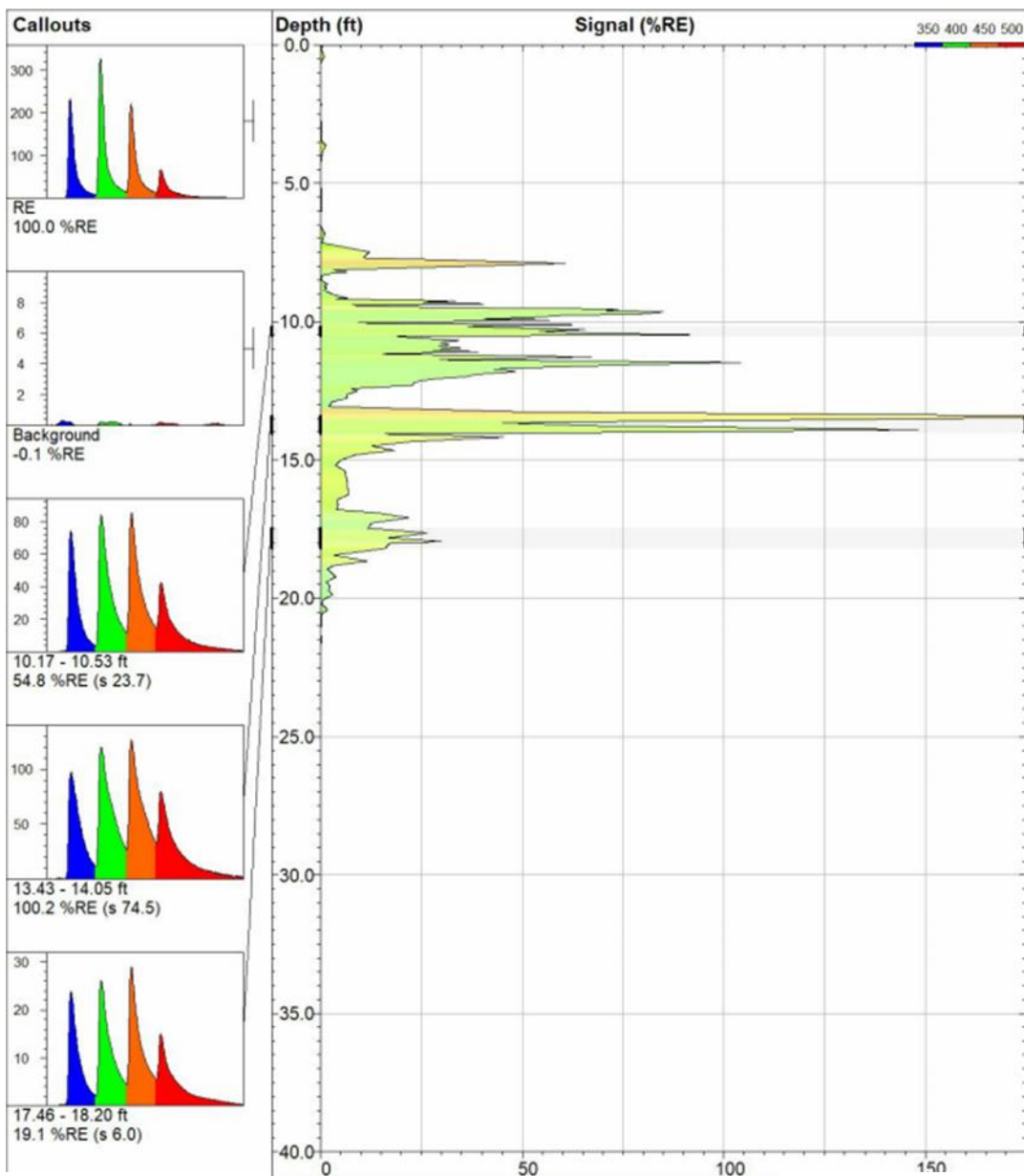




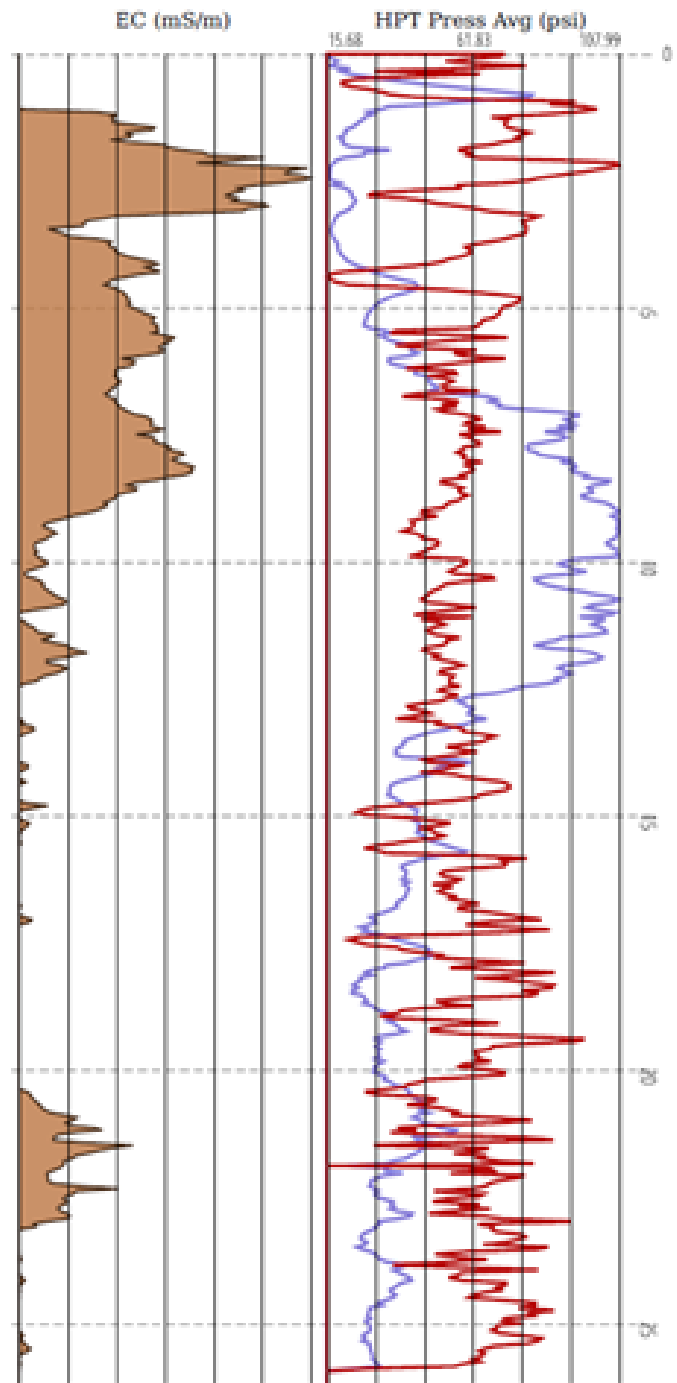
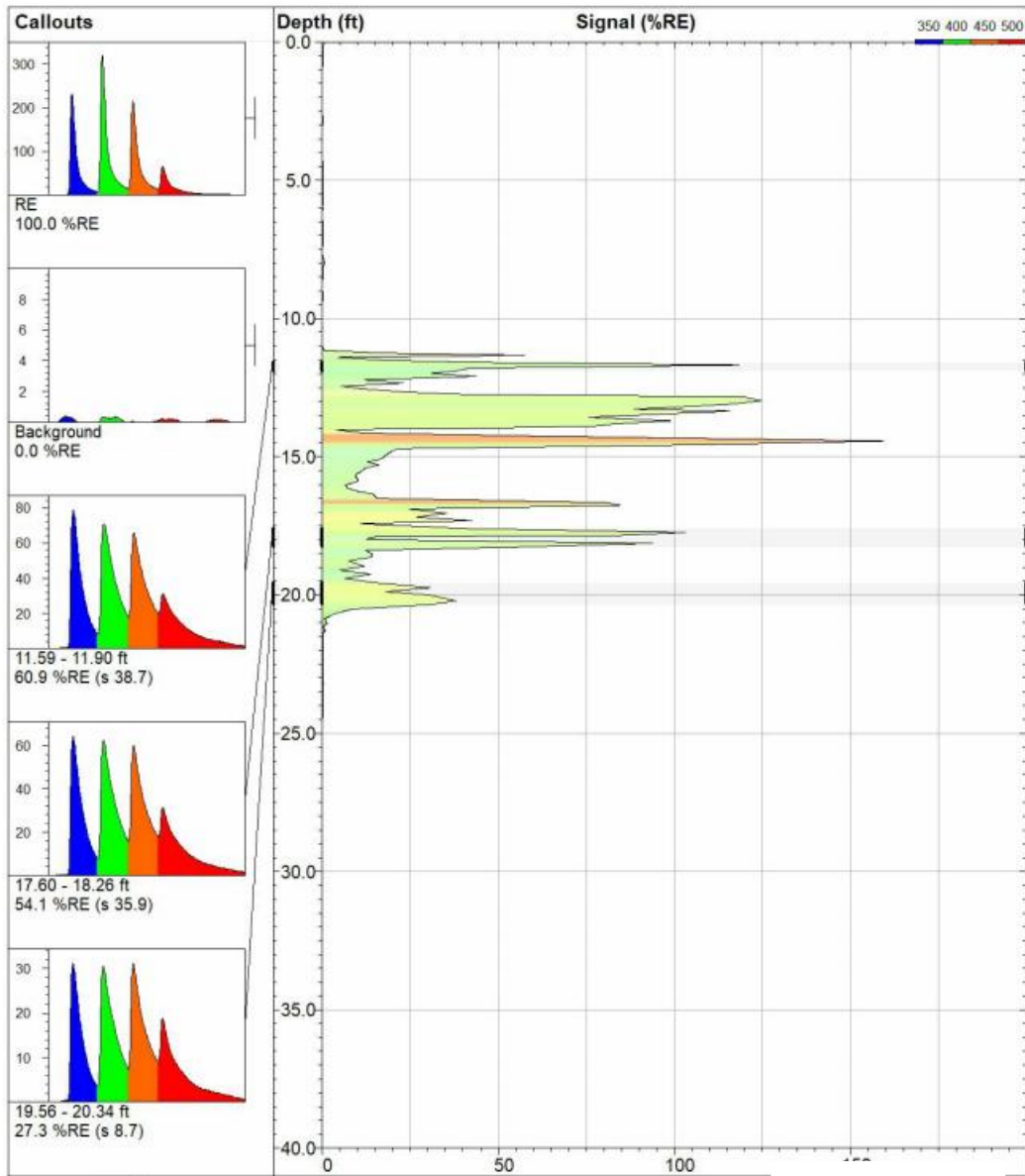


### L06

Site: <b>Larry Body Shop 14183</b>	Y Coord.(Lat-N) / System: <b>Unavailable / NA</b>	Final depth: <b>25.91 ft</b>
	X Coord.(Lng-E) / Fix: <b>Unavailable / NA</b>	Max signal: <b>102.3 %RE @ 17.02 ft</b>
Operator / Unit:	Elevation:	Date & Time:

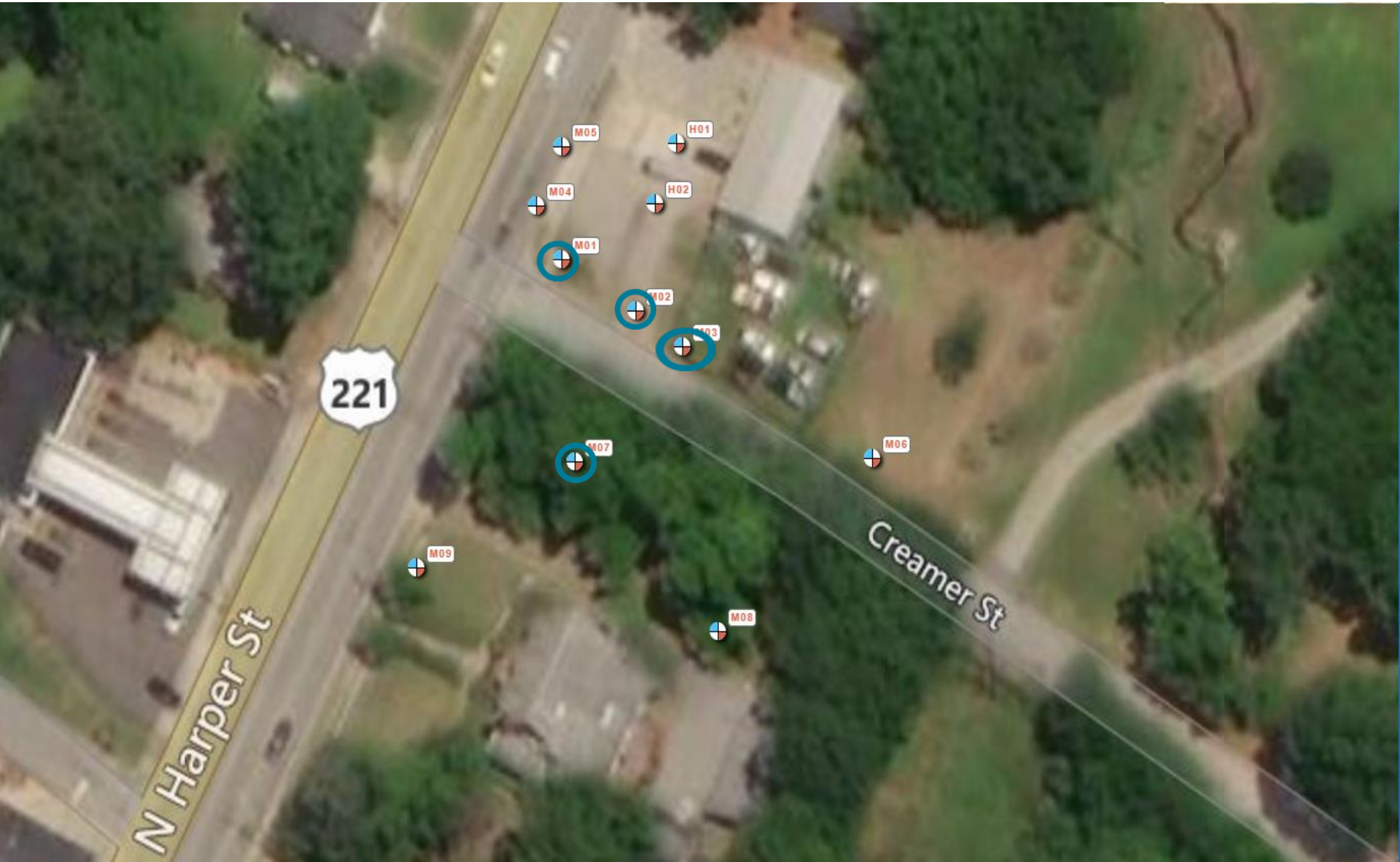


<b>L07</b>		
Site: <b>Larry Body Shop 14183</b>	Y Coord. (Lat-N) / System: <b>Unavailable / NA</b>	Final depth: <b>25.95 ft</b>
Client / Insh:	X Coord. (Lng-E) / Fix: <b>Unavailable / NA</b>	Max signal: <b>205.8 %RE @ 13.43 ft</b>
Op <b>MMA / UVOST1005</b>	Activation: <b>Unavailable</b>	Date & Time: <b>2019-08-07 08:01 EDT</b>

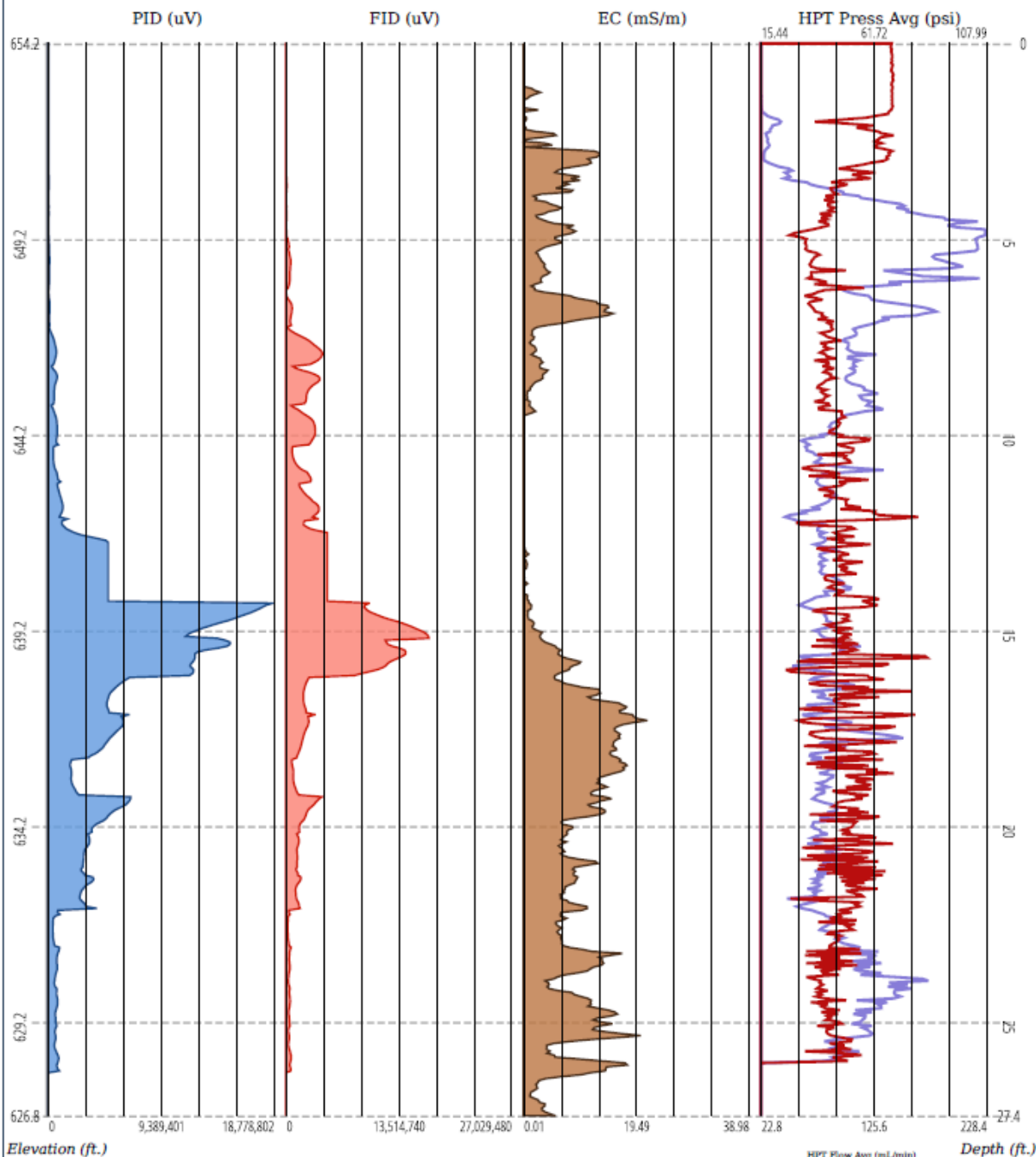


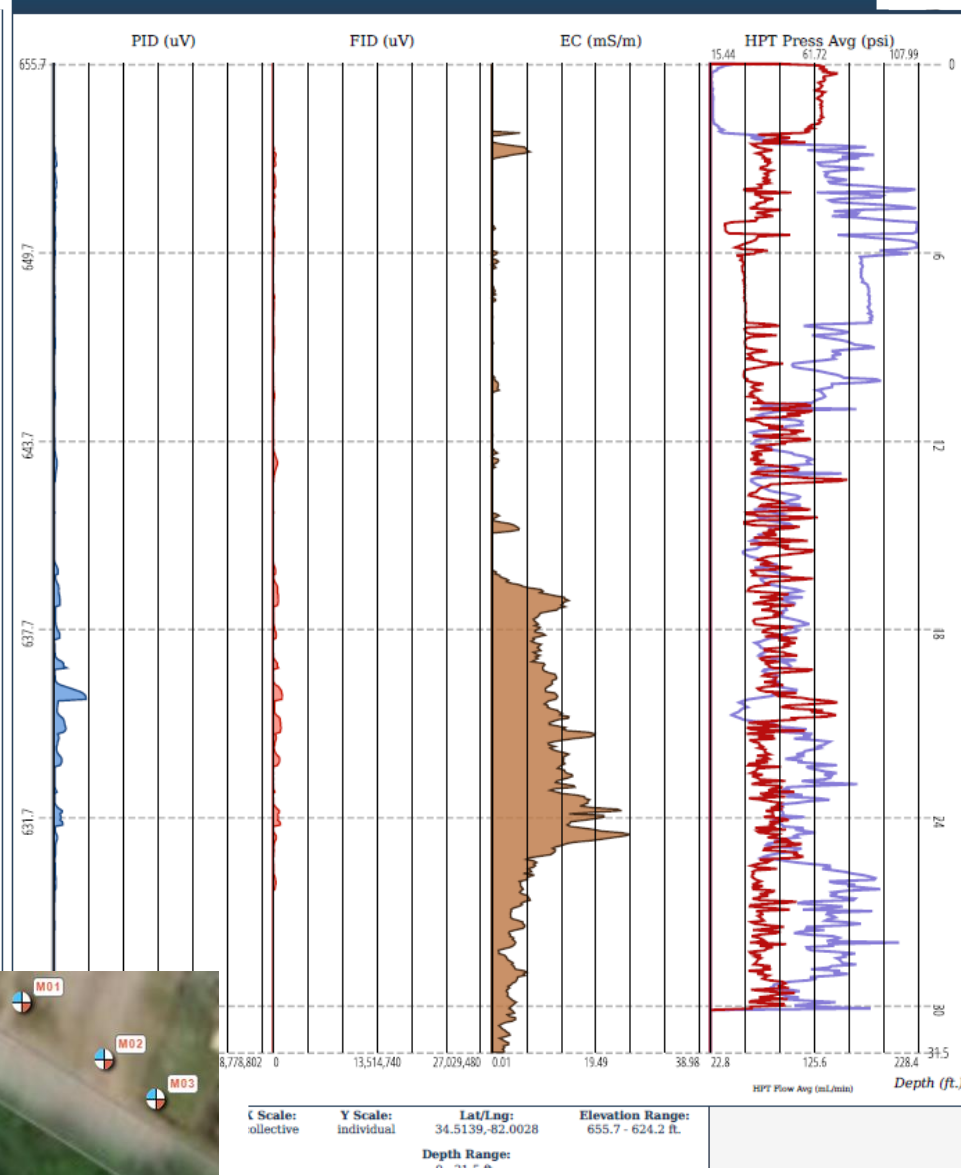
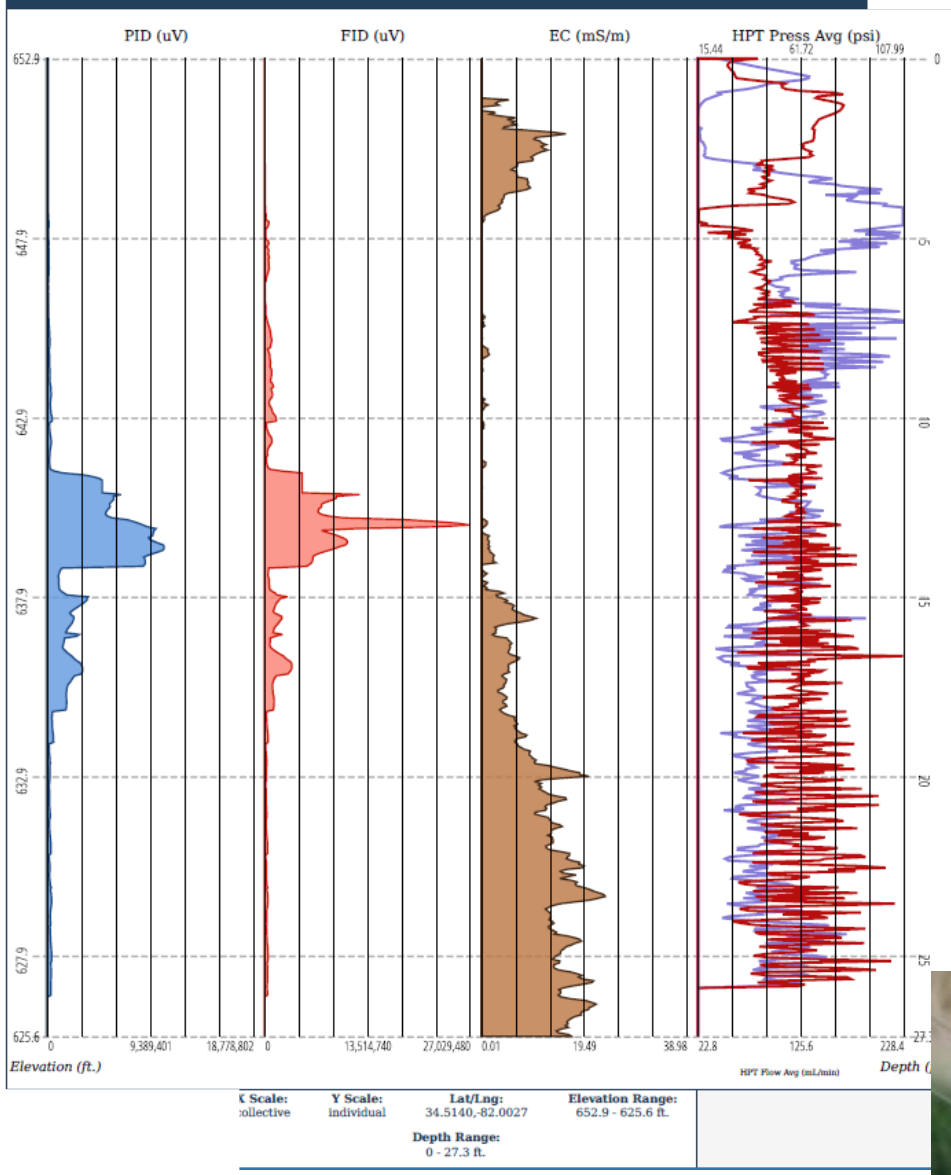
**L08**

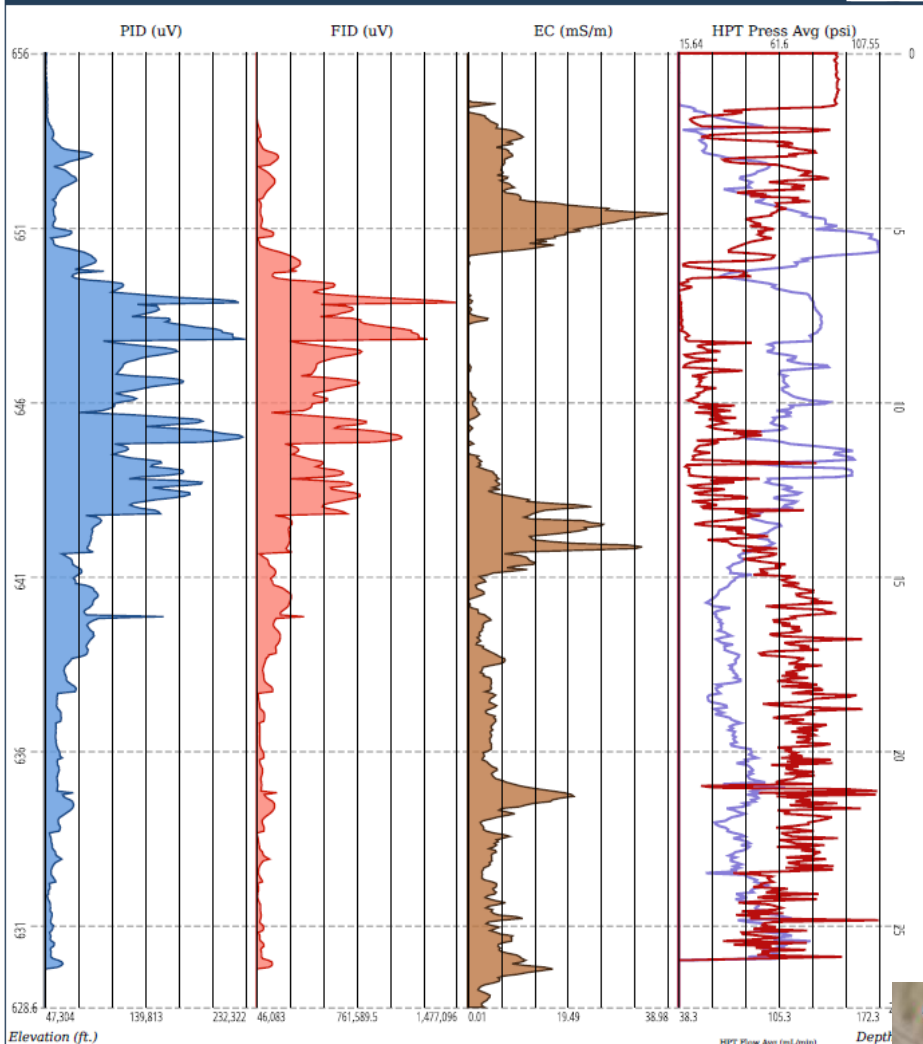
Site: Larrv Bodv Shop 14183	Y Coord.(Lat-N) / System: Unavailable / NA	Final depth: 25.90 ft
Operator / Unit: MMA / UVOST1005	X Coord.(Lng-E) / Fix: Unavailable / NA	Max signal: 160.0 %RE @ 14.43 ft
	Elevation: Unavailable	Date & Time: 2019-08-07 08:26 EDT



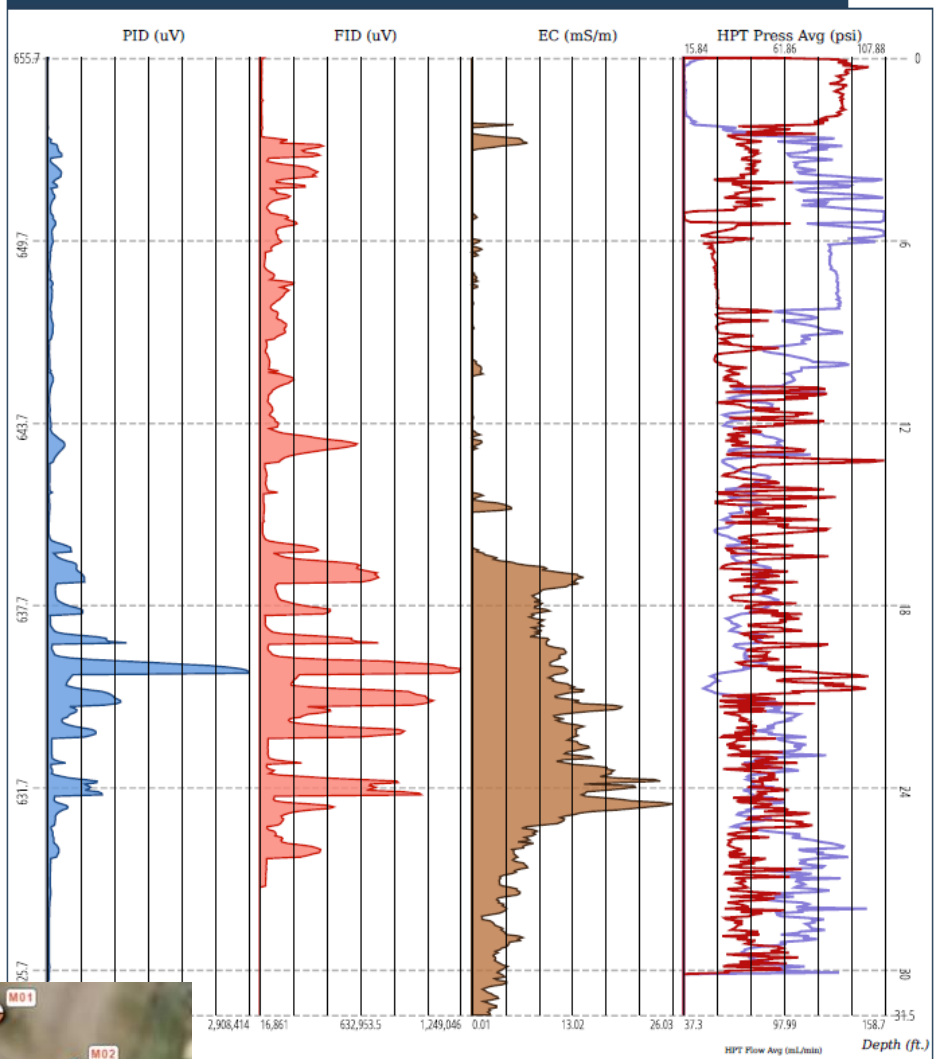








X Scale: individual  
 Y Scale: individual  
 Lat/Lng: 34.5141, -82.0028  
 Elevation Range: 656 - 628.6 ft.  
 Depth Range: 0 - 25 ft.



X Scale: individual  
 Y Scale: individual  
 Lat/Lng: 34.5139, -82.0028  
 Elevation Range: 655.7 - 624.2 ft.  
 Depth Range: 0 - 31.5 ft.



# Results

- Identified Residual LNAPL
- Better source area characterization
- Better idea of GW flow

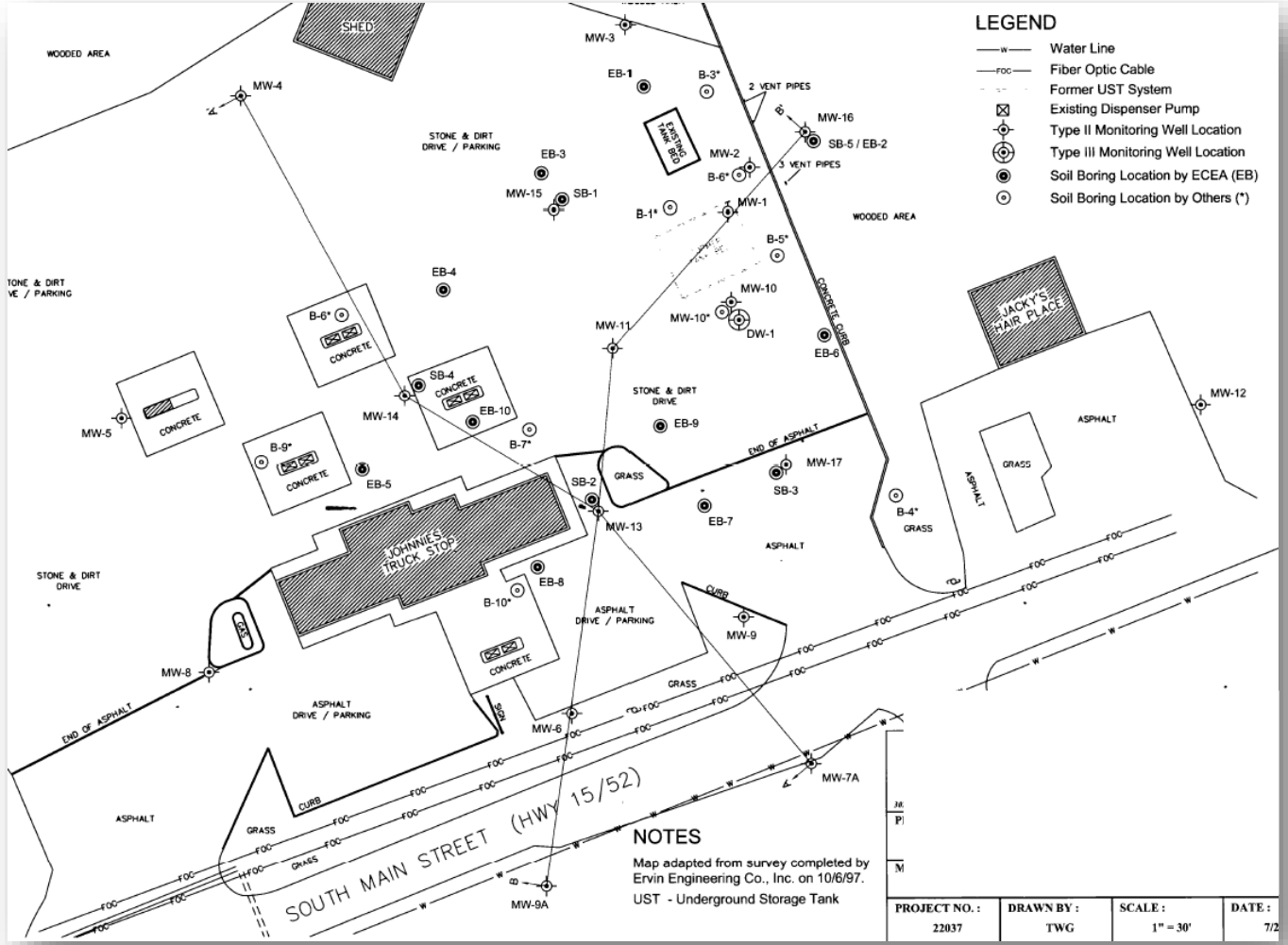


# Case Study 2 – Johnnies Truck Stop

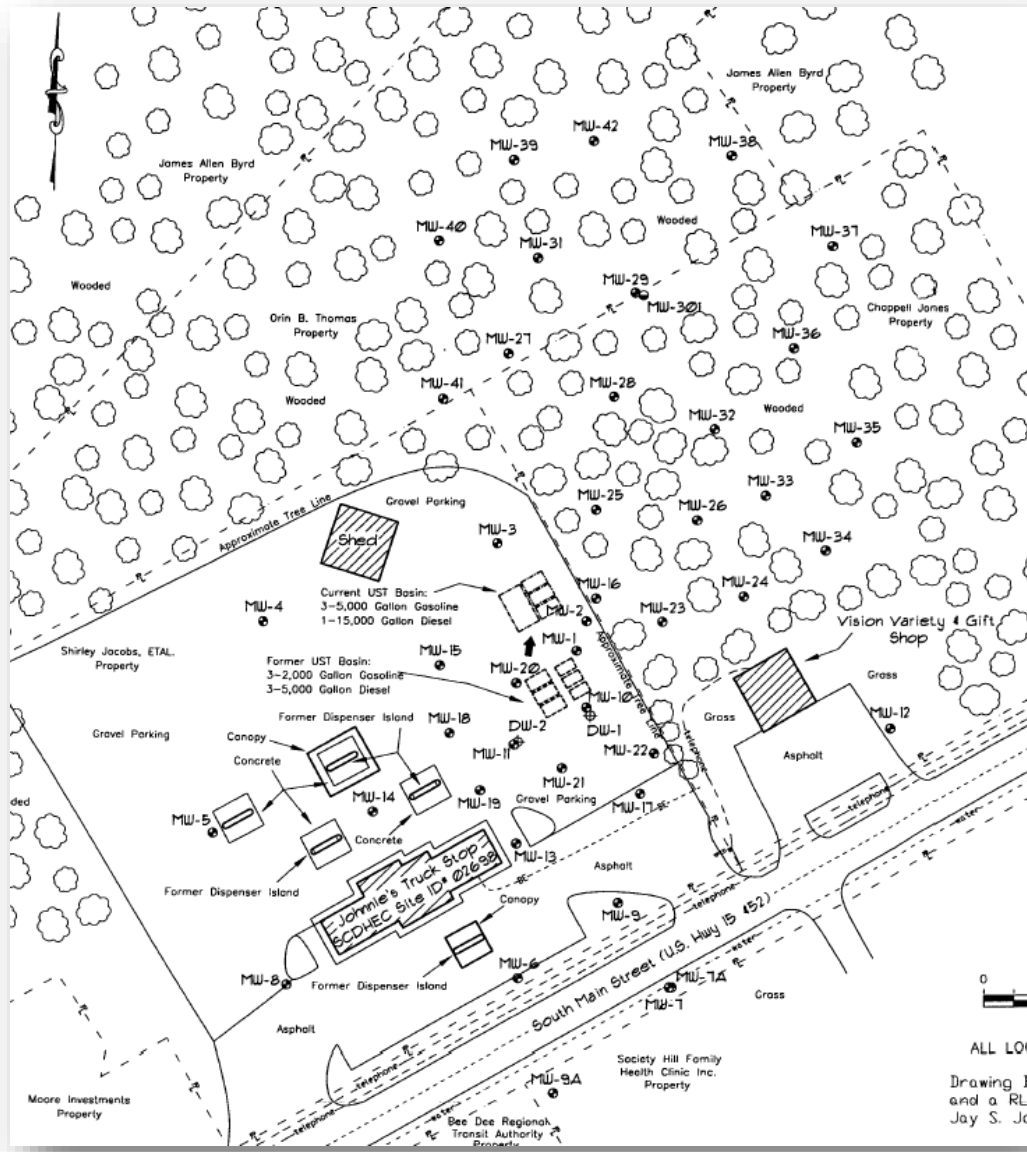


# Johnnies Truck Stop, UST #02698

- Release 1 January 27, 1989 (tank closure) and Release 2 April 12, 2001 (dispenser)
- 3 gasoline and 3 diesel USTs abandoned by removal
- Darlington County
- Coastal Plain – Sedimentary rocks
- Sands and Clays
- Corrective Action
- FPP, AFVRs
- Nearby Creek



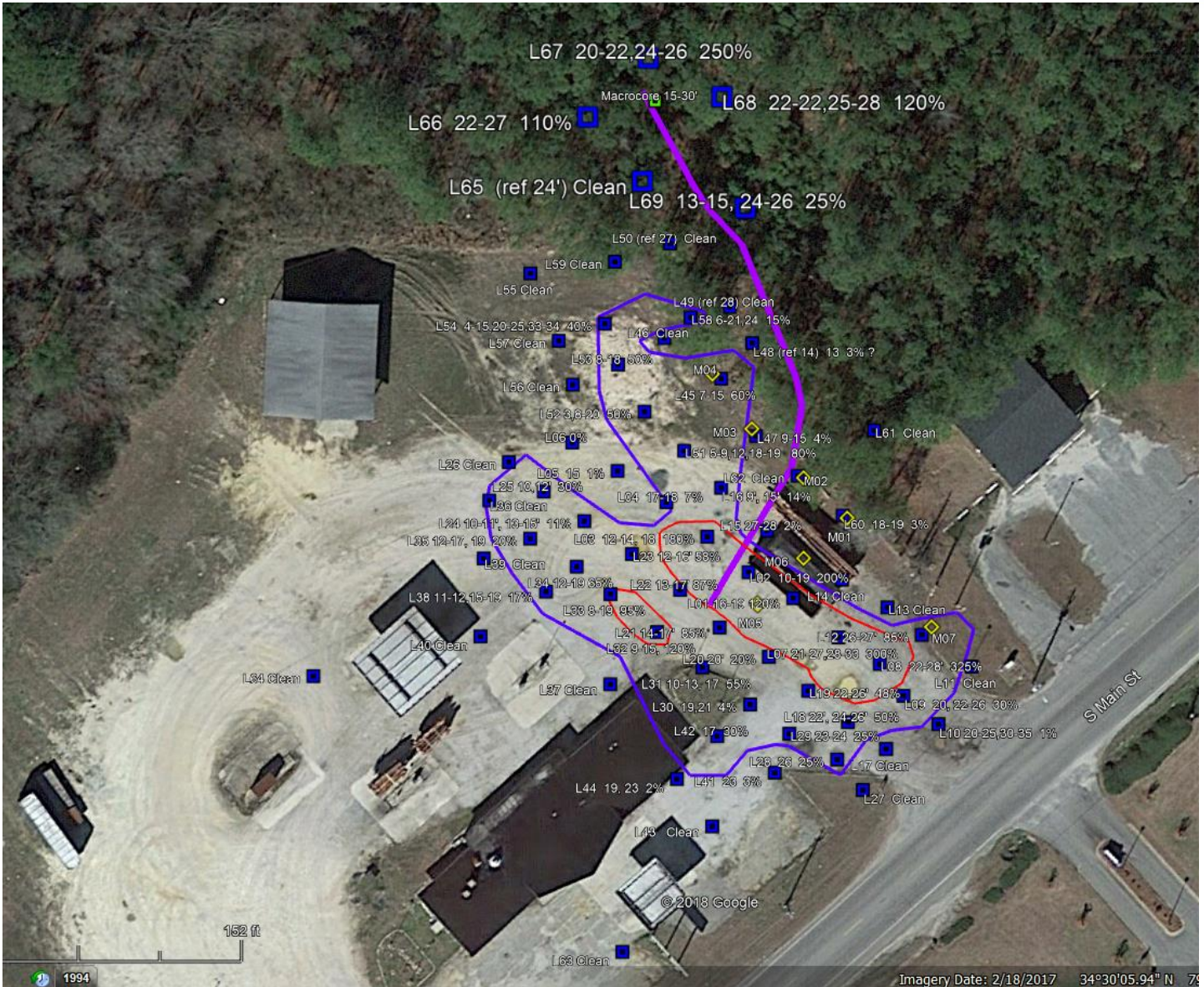
• MW-16, 10, 15, 18, 19, & 32



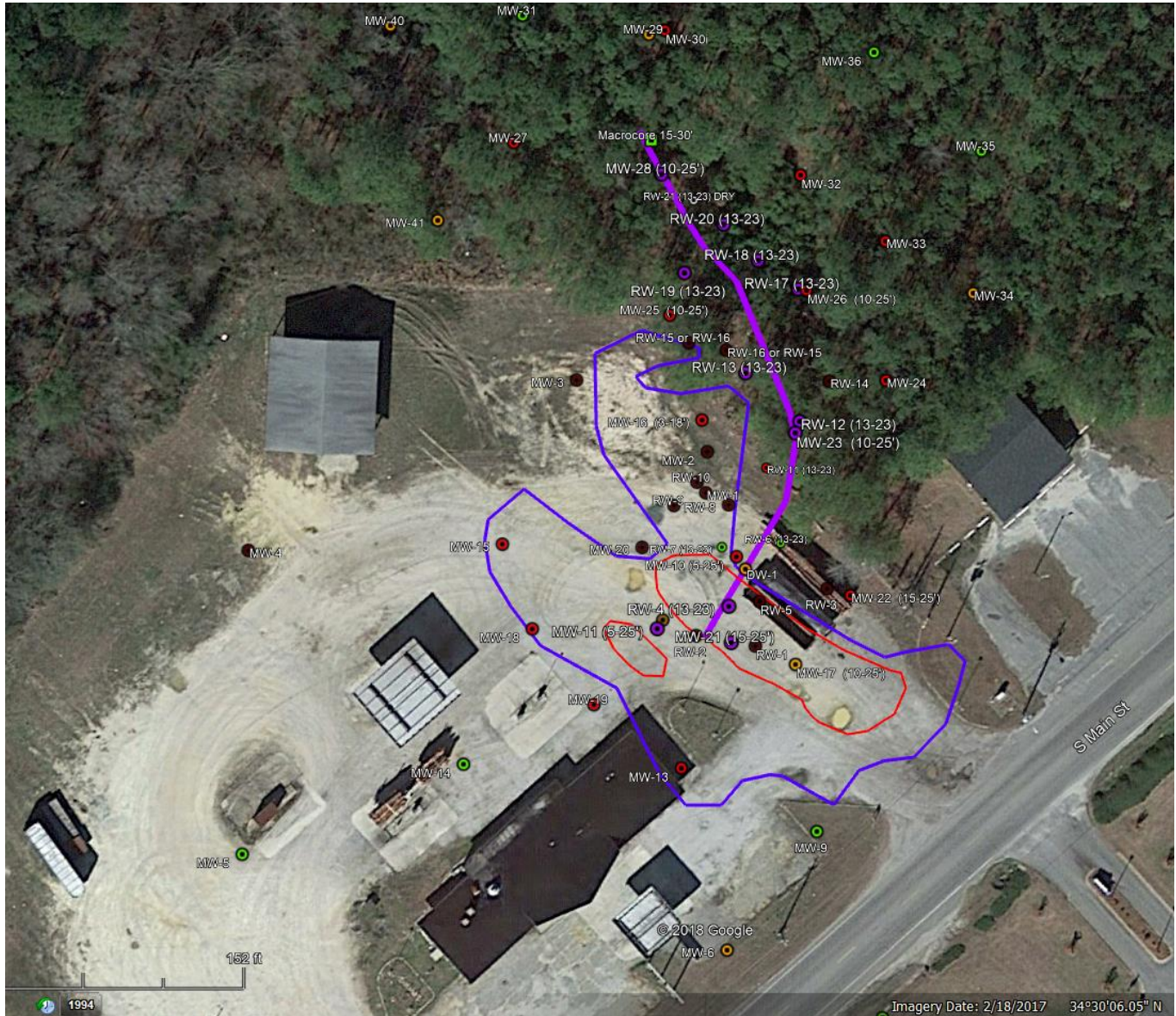
ALL LO  
 Drawing B  
 and a RL  
 Jay S. Jc

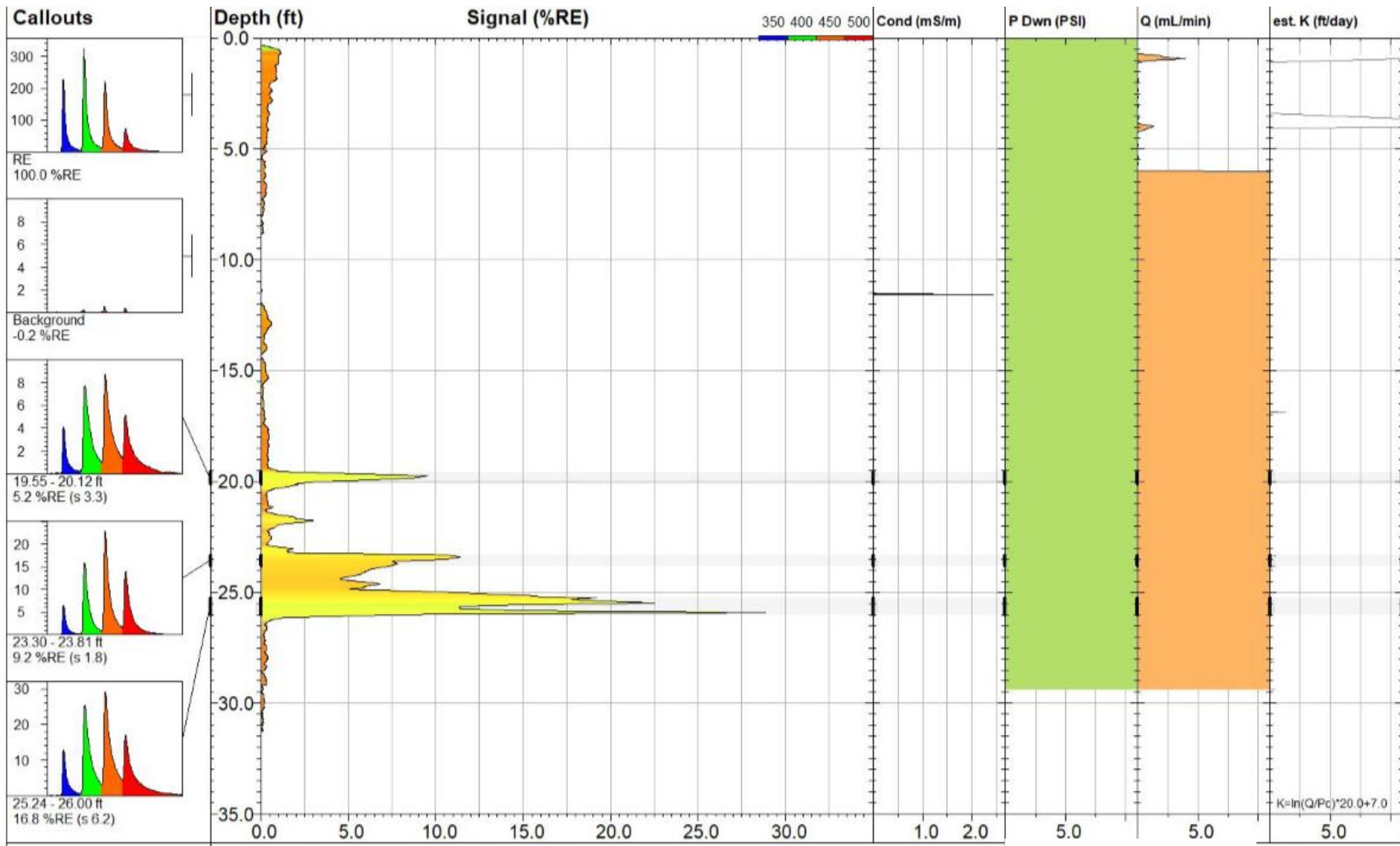












# L-009

Site:  
**Johnnies Truck Stop**

Y Coord. (Lat-N) / System:  
**Unavailable / NA**

Final depth:  
**31.27 ft**

X Coord. (Lng-E) / Fix:  
**Unavailable / NA**

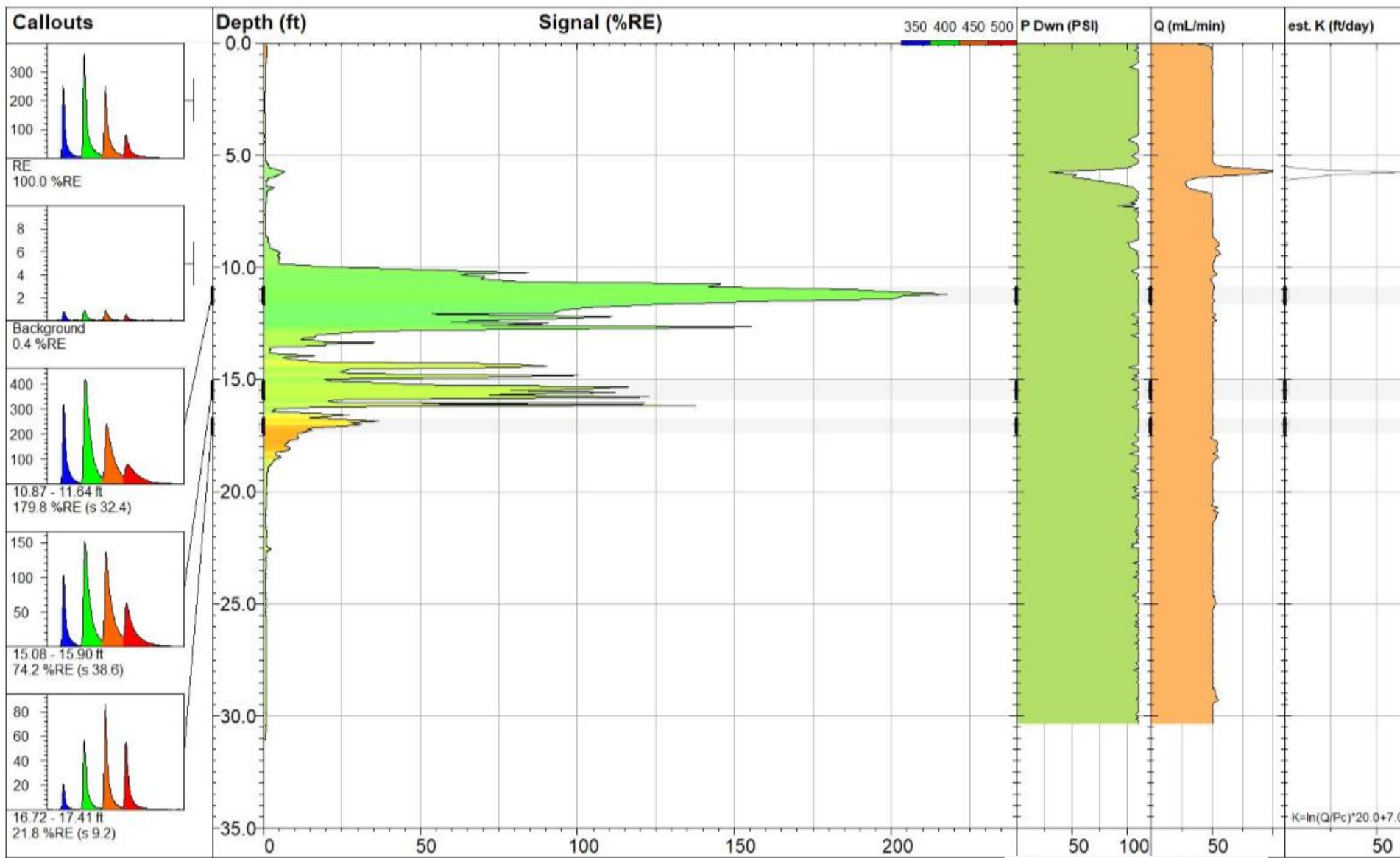
Max signal:  
**29.4 %RE @ 25.90 ft**

Operator / Unit:  
**J. Miller / UVOST1434**

Elevation:  
**Unavailable**

Date & Time:  
**2019-07-23 08:17 CDT**





## L-002

Site:  
**Johnnies Truck Stop**

Y Coord.(Lat-N) / System:  
**Unavailable / NA**

Final depth:  
**31.06 ft**

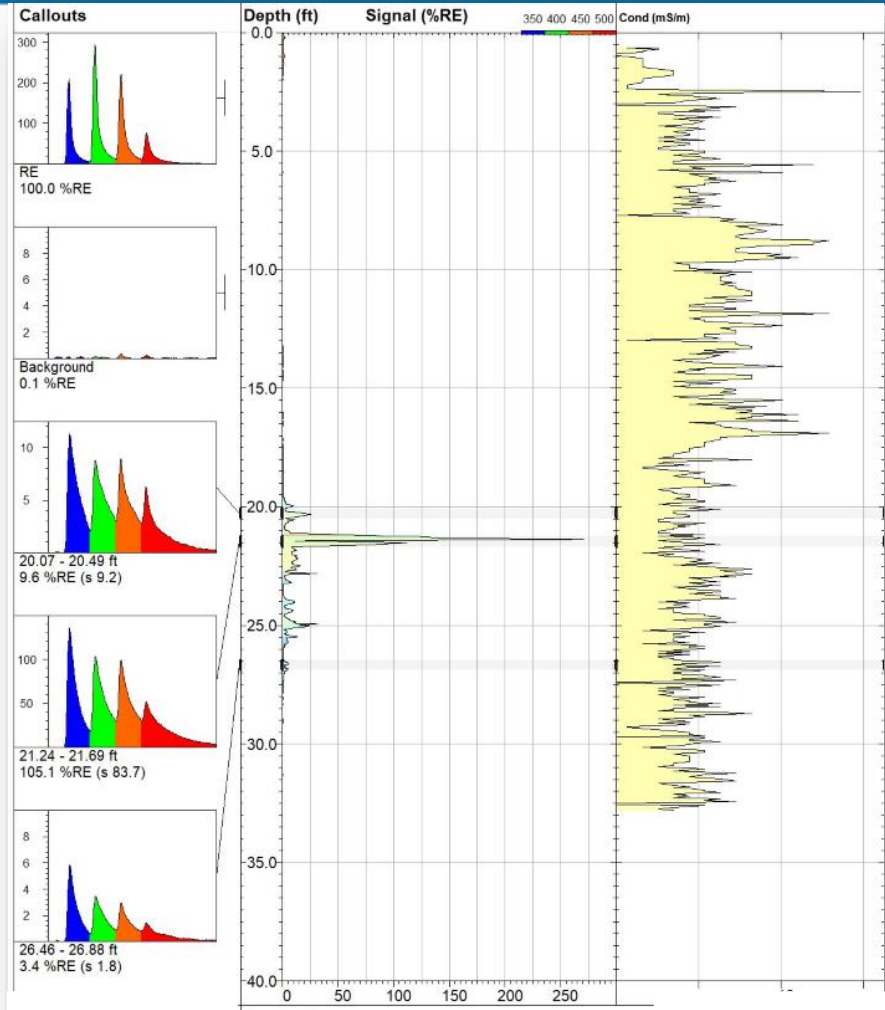
X Coord.(Lng-E) / Fix:  
**Unavailable / NA**

Max signal:  
**217.9 %RE @ 11.19 ft**

Operator / Unit:  
**J. Miller / UVOST1434**

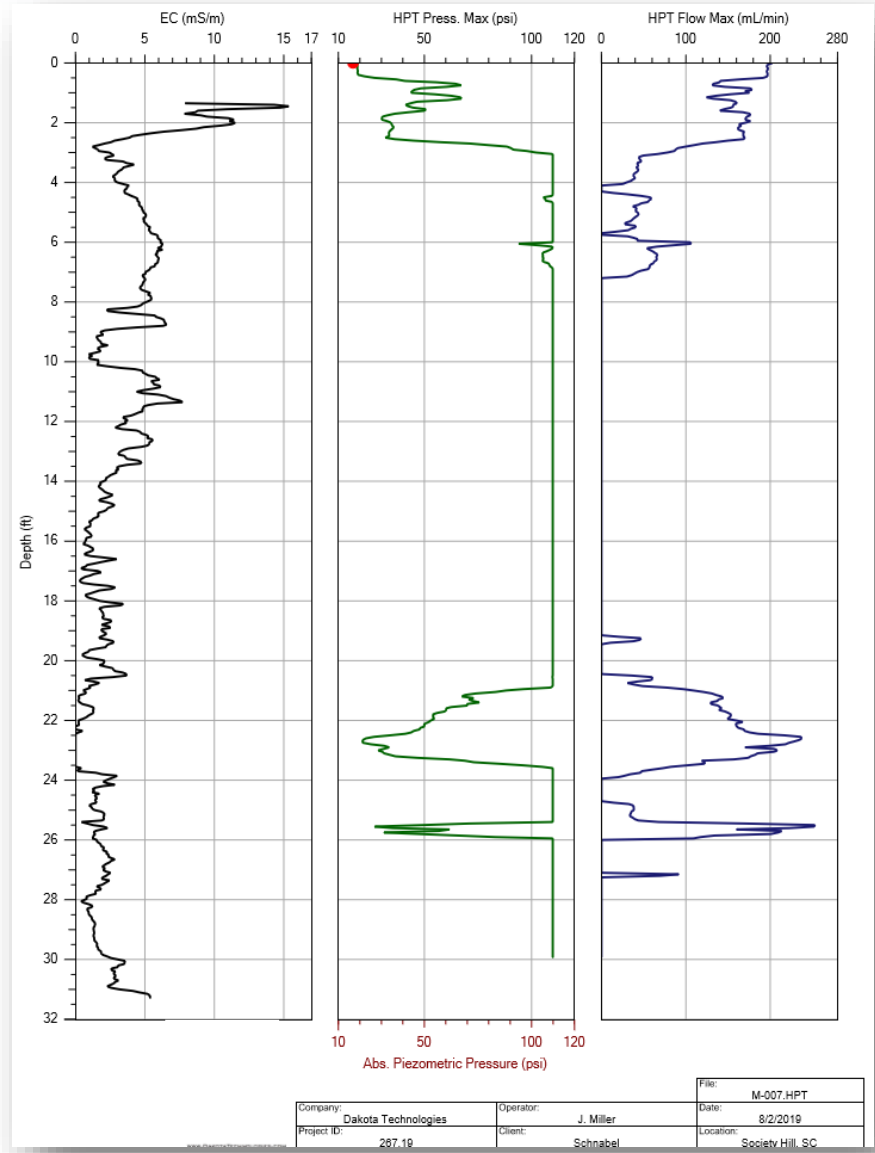
Elevation:  
**Unavailable**

Date & Time:  
**2019-07-22 10:02 CDT**



**L-067**

<small>www.loranusa.com/resources/</small>		
Site: <b>Johnnies Truck Stop</b>	Y Coord.(Lat-N) / System: <b>Unavailable / NA</b>	Final depth: <b>32.21 ft</b>
	X Coord.(Lng-E) / Fix: <b>Unavailable / NA</b>	Max signal: <b>272.7 %RE @ 21.37 ft</b>
Operator / Unit: <b>J. Miller / UVOST1434</b>	Elevation: <b>Unavailable</b>	Date & Time: <b>2019-08-06 12:13 CDT</b>







- Precisely defined FP
- Identified potential former pathway

Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L6678	28	1220	610	NA	NA	NA	NA

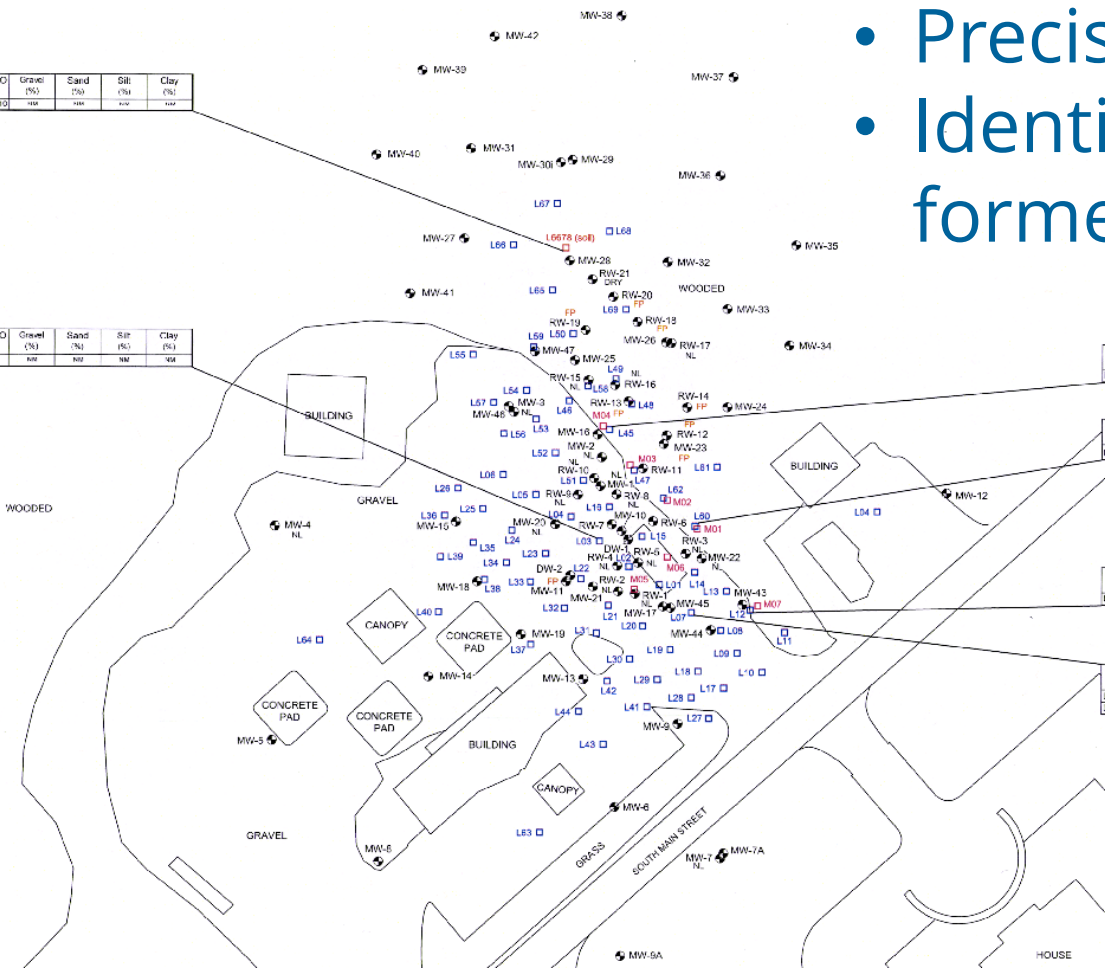
Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L03	14	596	NA	NA	NA	NA	NA

Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L45	13	191	NA	3.0	65.2	12.7	22.1

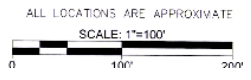
Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L60	15	NA	NA	0.0	69.9	15.4	14.7

Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L12	25	64	NA	0.0	79.6	11.9	8.5

Location	Depth (ft)	TPH-CRO (mg/kg)	TPH-ORD (mg/kg)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
L07	29	NA	5600	5.1	64.4	25.7	4.8
L07	28.5	1210	NA	NA	NA	NA	NA



**LEGEND**  
 □ LIF SCREENING POINT  
 □ HPT SCREENING POINT  
 ● MONITORING WELL  
 NL NOT LOCATED  
 FP FREE PRODUCT

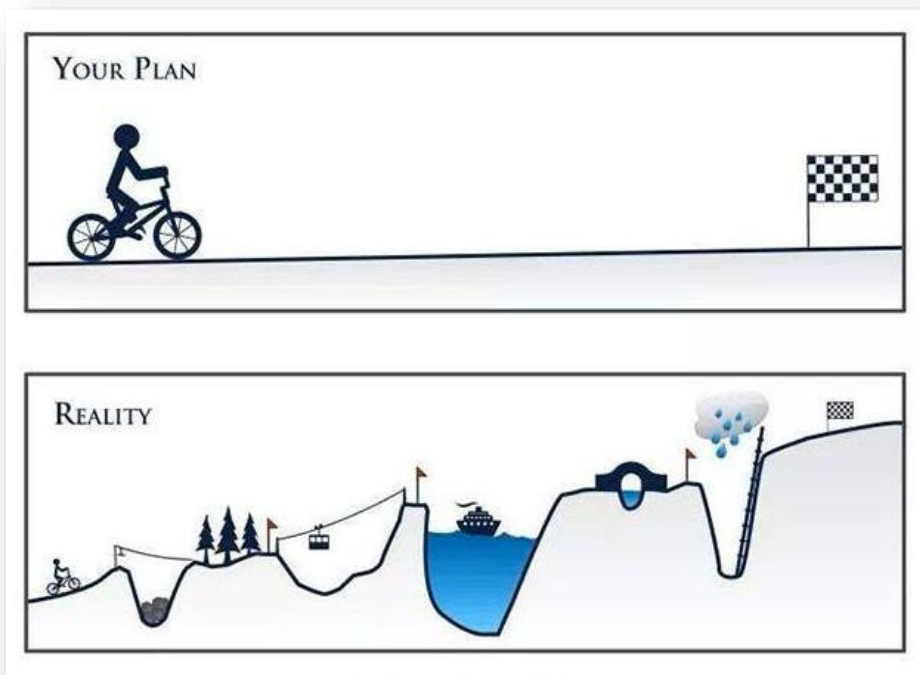


# 3D Modeling

Isolevels

Easting

# Lessons Learned



- Limitations/set backs
- Time commitment
- Actual Free-Phase Product (FPP) distribution
- Communication is KEY

# Benefits and Results

- More accurate SCM
- Knowledge/Experience
- Gain information necessary to choose appropriate cleanup strategies
- Targeted clean-up approaches for faster and more effective clean-up







# SUPERB Allowable Rates

- Existing Rates Proposed to Increase by 6.7 %
- In the Process of Establishing Rates for HRSC
- Public Notice the Proposed Rates with a target to make them effective for all directives issued on or after January 1, 2020.

A large graphic consisting of the letters "Q" and "A" in a bold, sans-serif font. The "Q" is blue and the "A" is green. A blue ampersand "&" is positioned between the two letters, overlapping both. The ampersand has a white outline and a small white dot at its top curve.

# CONTACT US

**UST Management Division**  
**803-898-2544 or 803-898-0589**

**Ryan Ariail, Customer Service Liaison**  
**803-898-9418 (office) • 803-608-0418 (cell)**  
**ariailrd@dhec.sc.gov**

**Stay Connected**

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