

Welcome



Environmental Advisory Board Meeting

**Robins Air Force Base
November 7, 2019**



Welcome and Program Introduction

**Dr. Linda Smyth
Community Co-Chair**



Acronyms and Abbreviations

- **AFB - Air Force Base**
- **AFCEC - Air Force Civil Engineer Center**
- **AFFF - Aqueous Film Forming Foam**
- **CAP - Corrective Action Plan**
- **CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act**
- **COC - Contaminant of Concern**
- **COPC - Constituent of Potential Concern**
- **DAF - Dilution Attenuation Factor**
- **EC - Electrical Conductivity**
- **FID - Flame Ionization Detector**
- **ft bgs - feet below ground surface**
- **GA EPD - Georgia Environmental Protection Division**



Acronyms and Abbreviations

- GC - Gas Chromatograph
- HA - Health Advisory
- HPT - Hydraulic Profiling Tool
- LS - Lift Station
- mg/kg - milligram per kilogram
- MiHpt - Membrane Interface Probe and Hydraulic Profiling Tool
- MIP - Membrane Interface Probe
- mL/min - milliliters per minute
- MSL - Mean Sea Level
- mV - millivolt
- ORC - Optimized Remediation Contract
- PA - Preliminary Assessment



Acronyms and Abbreviations

- PAH – Polycyclic Aromatic Hydrocarbon
- PBR – Performance-Based Remediation
- PFAS – Per- and Polyfluoroalkyl Substances
- PFC – Perfluorinated Chemical
- PFOA – Perfluorooctanoic Acid
- PFOS – Perfluorooctane Sulfonate
- PID – Photoionization Detector
- ppt – part per trillion
- psi – pounds per square inch
- RCRA – Resource Conservation and Recovery Act
- R&D – Research and Development



Acronyms and Abbreviations

- **RFI - RCRA Facility Investigation**
- **RL - Remediation Level**
- **RSL - Regional Screening Level**
- **SI - Site Inspection**
- **SSL - Soil Screening Level**
- **SVOC - Semi-Volatile Organic Compound**
- **TCE - Trichloroethene**
- **VOC - Volatile Organic Compound**
- **WWTP - Waste Water Treatment Plant**
- **US EPA - United States Environmental Protection Agency**



Environmental Advisory Board

Introduction to Per- and Polyfluoroalkyl Substances (PFAS)



Herwig Goldemund, Ph.D.
Senior Scientist
Geosyntec Consultants

Fred Otto
Restoration Program Manager
AFCEC/CZOE - Robins Installation
Support Section

November 7, 2019



Overview

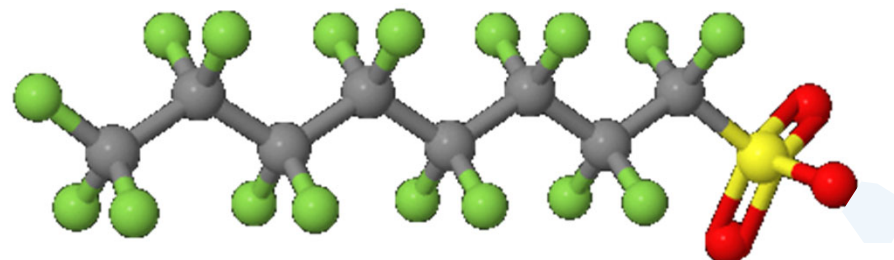
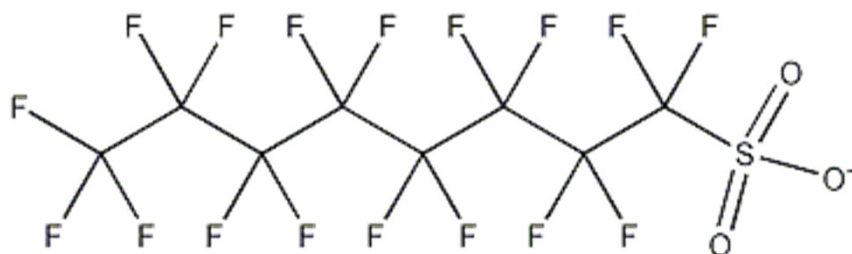
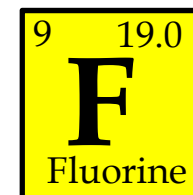
- **Background**
- **Regulatory status**
- **Treatment challenges**
- **Air Force response**
- **Robins Air Force Base (AFB) status**
- **Information sources**



Background - Characteristics

■ Per- and Polyfluoroalkyl Substances (PFAS)

- Family of synthetic organic compounds that contain multiple fluorine atoms



Conder et al. (2008)

Example molecular structures for perfluorooctane sulfonate (PFOS)

- Incorrectly referred to as perfluorinated chemicals or "PFCs"
 - Greenhouse gases regulated by Kyoto Protocol
 - PFCs are one of the families of PFAS (all PFCs are PFAS, not all PFAS are PFCs)



Background - Characteristics

■ PFAS

- Man-made group of chemicals
- Several thousand individual compounds
- Unique surface-active properties, non-reactive, and stable
- Best known and studied compounds are perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)
- At the Federal level, only PFOS and PFOA have established standards (Georgia follows federal standards)
 - Health Advisories (HAs) for drinking water only
 - United States Environmental Protection Agency (EPA) has initiated the process to establish maximum contaminant levels (MCLs)
- Air Force focus is on PFOA and PFOS



Background - Uses

■ Surface treatment/coatings

- Carpet and upholstery
- Apparel (waterproofing)
- Paper and packaging
- Non-stick cookware

■ Performance chemicals

- Chromium plating (mist suppression)
- Insecticides
- Lubricants
- Firefighting agent Aqueous Film-Forming Foam (AFFF) - Air Force began using AFFF in 1970



Oil and water repellency = Excellent surfactants



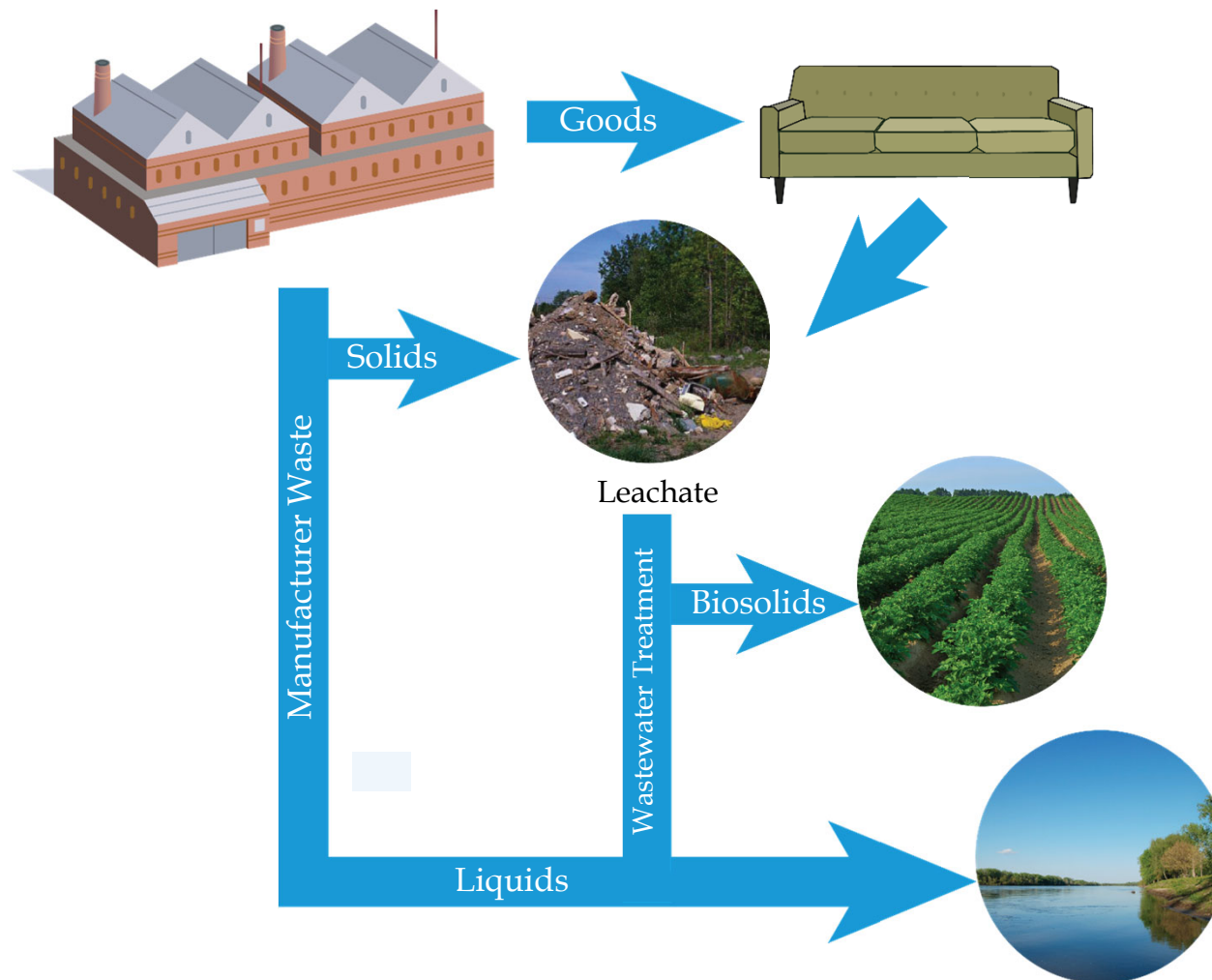
Background - Potential Sources

- Sites with very high probability of screening or risk-based criteria exceedances
 - Airports
 - Fire-fighting training areas
 - Petrochemical/chemical plants
 - Chrome plating facilities
 - Textile/carpet manufacturers
 - Waste Water Treatment Plants (WWTPs) and sewage sludge land application areas
 - Landfills
- Military proactive in site investigations; more than 600 sites investigated so far





Background - Environmental Inputs



Modified from Oliaei et al.; Environ Sci Pollut Res (2013) 20:1977-1992



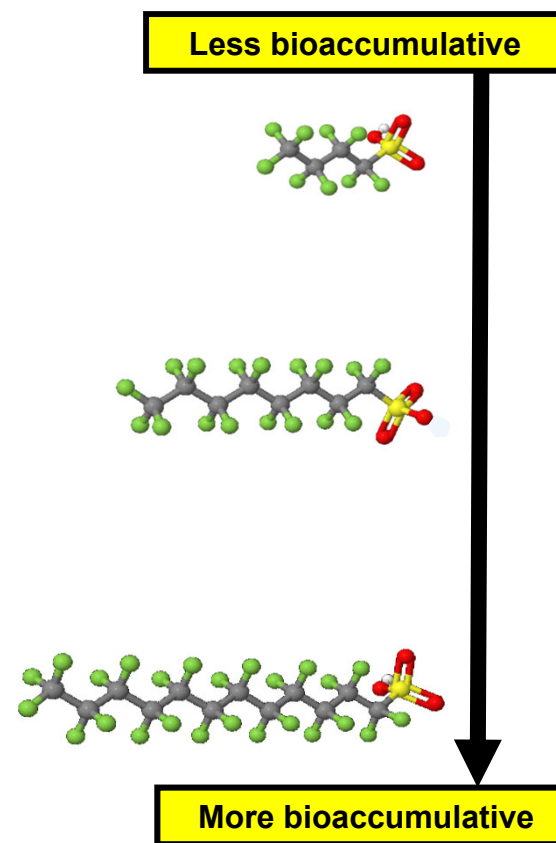
Background - Environmental Fate

- **Persistent in environment (or transformation to persistent compounds)**
- **Moderate-high water solubility/mobility**
- **Can also partition to soils and sediment**
- **Persistent at contaminated sites; compounds not volatile**



Background - Bioaccumulation

- Compounds detectable in nearly any biological tissue
- Many compounds bioaccumulate, especially longer-chain compounds like PFOS
- Partition to protein, not fat
 - Blood, liver, kidney, muscle are primary repositories
- Can also partition to soils and sediment
- Not metabolized, or metabolized to persistent compounds



Conder et al., 2008. Environ Sci Technol . 42:995-1003



Background - Human Exposure Pathways

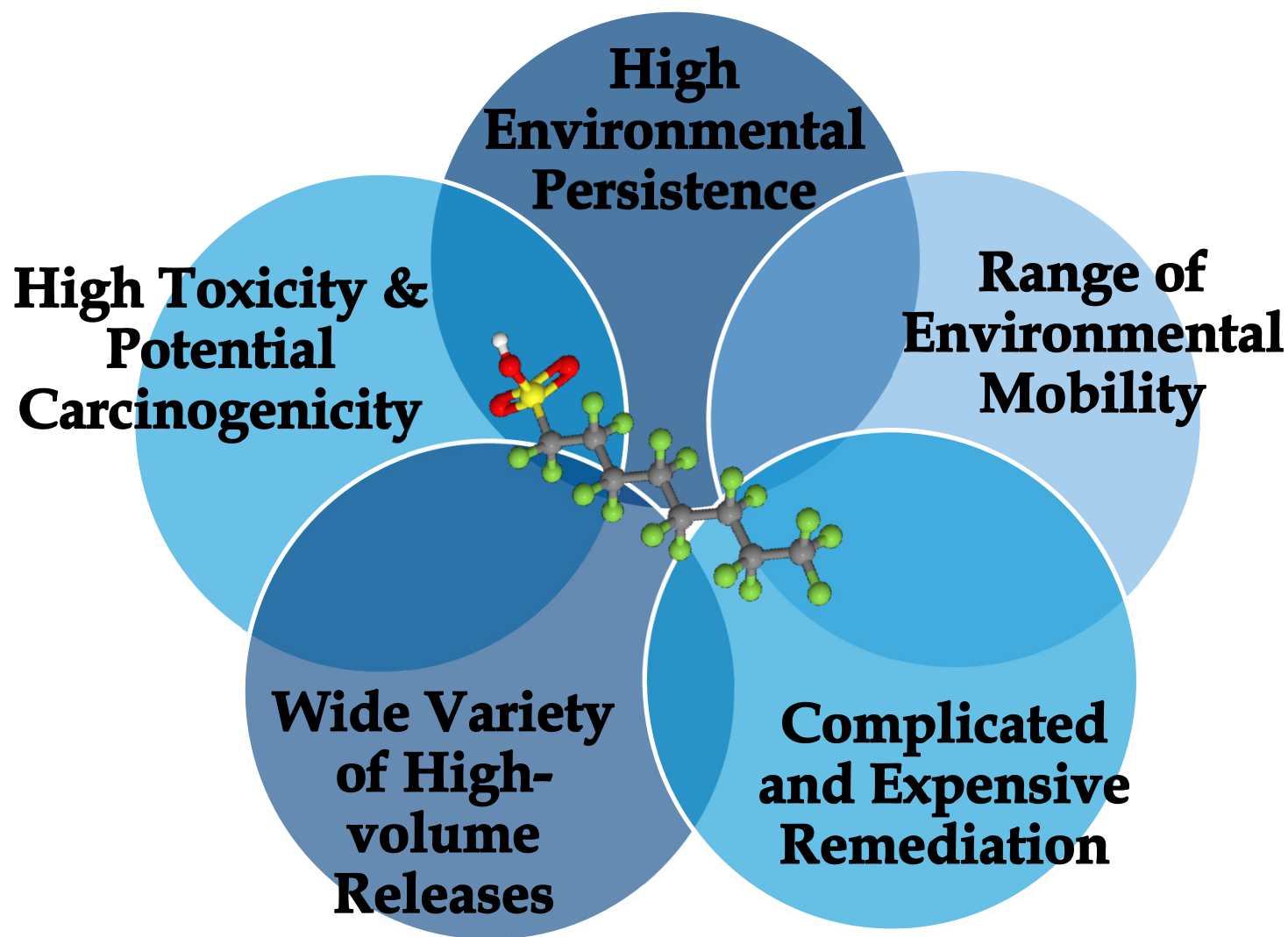
- **Major**
 - **Diet (bioaccumulation)**
 - Fish and seafood
 - Homegrown produce
 - **Drinking water**
 - **Incidental soil/dust ingestion**

- **Usually insignificant or minor**
 - **Dermal absorption**
 - **Inhalation**





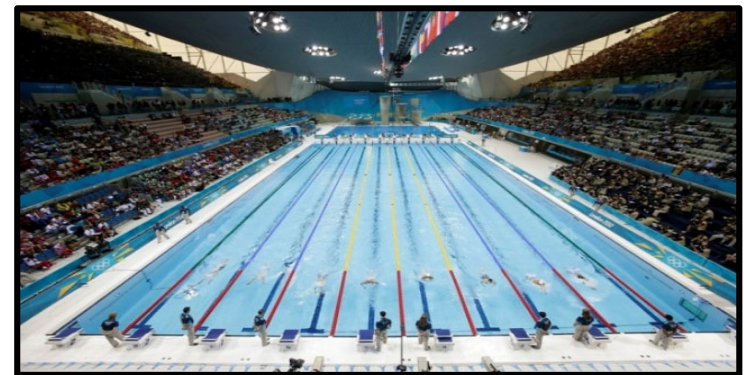
Background - Perfect Storm of Environmental Challenges





Regulatory Status

- In 2009, EPA established provisional HAs for PFOA at 400 parts per trillion (ppt) and for PFOS at 200 ppt
 - HAs are non-regulatory information for federal, state and local officials to consider when addressing drinking water contamination
- In May 2016, EPA released revised HAs for PFOA and PFOS
 - Revised HA for both PFOA and PFOS set at 70 ppt
 - HA for the sum of PFOA and PFOS also set at 70 ppt
 - 3.5 drops in an Olympic swimming pool



Volume: 660,000 gallons



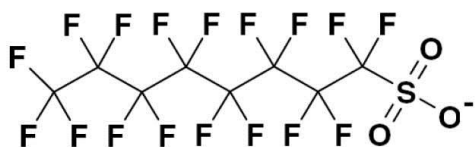
Regulatory Status

- **EPA released PFAS Action Plan in February 2019**
- **Ongoing EPA Research and Development (R&D) activities**
 - **Human health/toxicity**
 - Understand human health toxicity
 - Inform risk mitigation activities
 - Chemical library and high throughput toxicity testing
 - **Analytical methods**
 - Establish validated methods for measuring compounds in different environmental media
 - **Site characterization/exposure**
 - Develop sampling methods to characterize sources and contaminated sites
 - Identify and estimate human exposure from different sources
 - **Treatment/remediation**
 - Identify/evaluate methods to reduce exposures
 - Identify/evaluate methods to treat and remediate drinking water and contaminated sites



Treatment Challenges

- **Unique properties**
 - Hydrophobic and oleophobic
 - Persistent, bioaccumulative, and toxic
 - Moderate solubility; can be transported long distances
- **Chemically and biologically stable**
 - Resistant to typical environmental degradation processes
 - C-F bond is shortest and strongest in nature
- **Treatment approaches challenging and costly**





Air Force Response

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The Air Force's investigation work and mitigation actions are guided by CERCLA, applicable state laws and EPA drinking water **lifetime** HA of 70 ppt.

AFCEC is moving forward aggressively in accordance with the CERCLA process to identify, define, and mitigate potential contamination.



The CERCLA process:

- Ensures thorough investigation work
- Promotes accountability, community involvement, and long-term protectiveness



Air Force Response

The Air Force is using a three-step approach to assess the potential for PFOS/PFOA contamination of drinking water and respond appropriately.

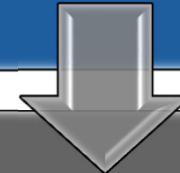
1. Identify

- Determine potential AFFF releases
- Verify releases through sampling
- Determine if contaminant pathways to drinking water exist



2. Respond

- PFOS/PFOA > HA, provide alternate drinking water supply
- If PFOS/PFOA < HA, establish monitoring schedule



3. Prevent

- Legacy AFFF disposal
- Transition to new AFFF
- Retrofit fire vehicles



Air Force Response Identify

IDENTIFY:

Preliminary Assessment (PA)

A base-wide records review identifies fire training areas, crash sites and other areas at installations where AFFF may have been released.

Site Inspection (SI)

Air Force Civil Engineer Center (AFCEC) conducts groundwater, surface water, soil, and sediment sampling to verify releases and map contamination and potential pathways to drinking water.

If SI sampling indicates potential pathways to drinking water supplies, AFCEC expands the SI footprint and may test public water systems and private wells.

Once SI is complete, AFCEC determines if investigation yielded adequate data to fully map contamination or if more investigation work is needed.



Robins AFB Drinking Water

- **August 2016 - Samples collected from all active Robins AFB drinking water wells (1, 5, 8, 16, 17, and 18)**
- **All results below EPA lifetime health advisory of 70 ppt**
- **All results below detection limits (< 2 ppt)**
- **No impacts to Robins AFB drinking water**



Robins AFB CERCLA Investigation

- **PA completed in May 2015**
- **SI**
 - **Fieldwork - March to April 2017**
 - **Soil and shallow groundwater sampled at 30 areas**
 - **Final Report - June 2018**
 - **Recommended further investigation at 29 areas**
- **Addition investigation timeline not yet determined**
 - **Low risk due to incomplete path to drinking water**



Information Sources

For more information, visit:

AFCEC

www.afcec.af.mil/

[http://www.afcec.af.mil/WhatWeDo/Environment/
Perfluorinated-Compounds](http://www.afcec.af.mil/WhatWeDo/Environment/Perfluorinated-Compounds)

EPA

www.epa.gov/

Agency for Toxic Substances and Disease Registry

www.atsdr.cdc.gov/

Interstate Technology & Regulatory Council

<https://pfas-1.itrcweb.org/fact-sheets/>



Environmental Advisory Board



Building 647 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)

Tamara E. Hebeler, P.E.
Principal
Geosyntec Consultants

November 7, 2019



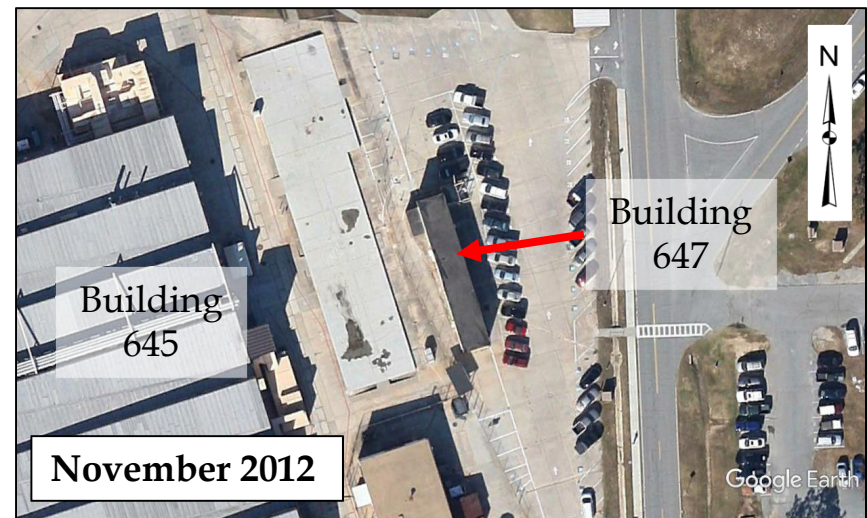
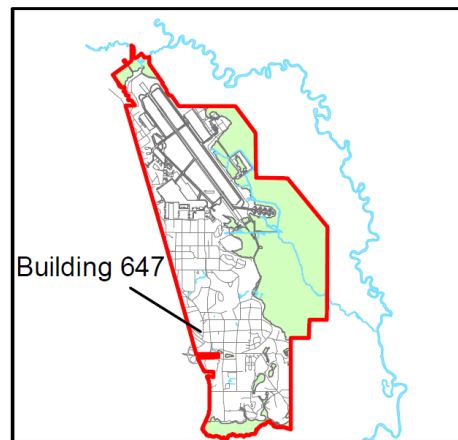
Outline

- **Project background**
- **Field investigation**
- **Human Health Risk Assessment**
- **Summary**
- **Path forward**



Project Background

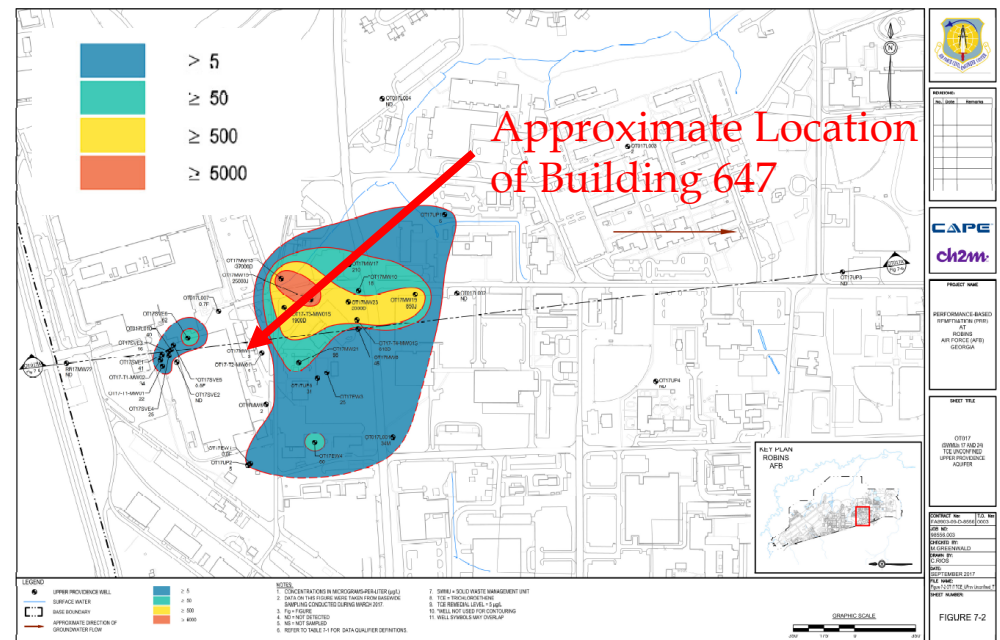
- Building 647 formerly located east of Building 645
 - Building demolished in 2013 to provide additional parking
- Reported historical use
 - Vehicle maintenance
 - Janitorial supply storage





Project Background

- Collocated with OT017 restoration site
 - Groundwater contamination
 - Remediation under Performance-Based Remediation (PBR) contract
 - Bioremediation
 - Soil Vapor Extraction
 - Trichloroethene (TCE) is historically primary contaminant of concern at OT017





Project Background

■ Timeline

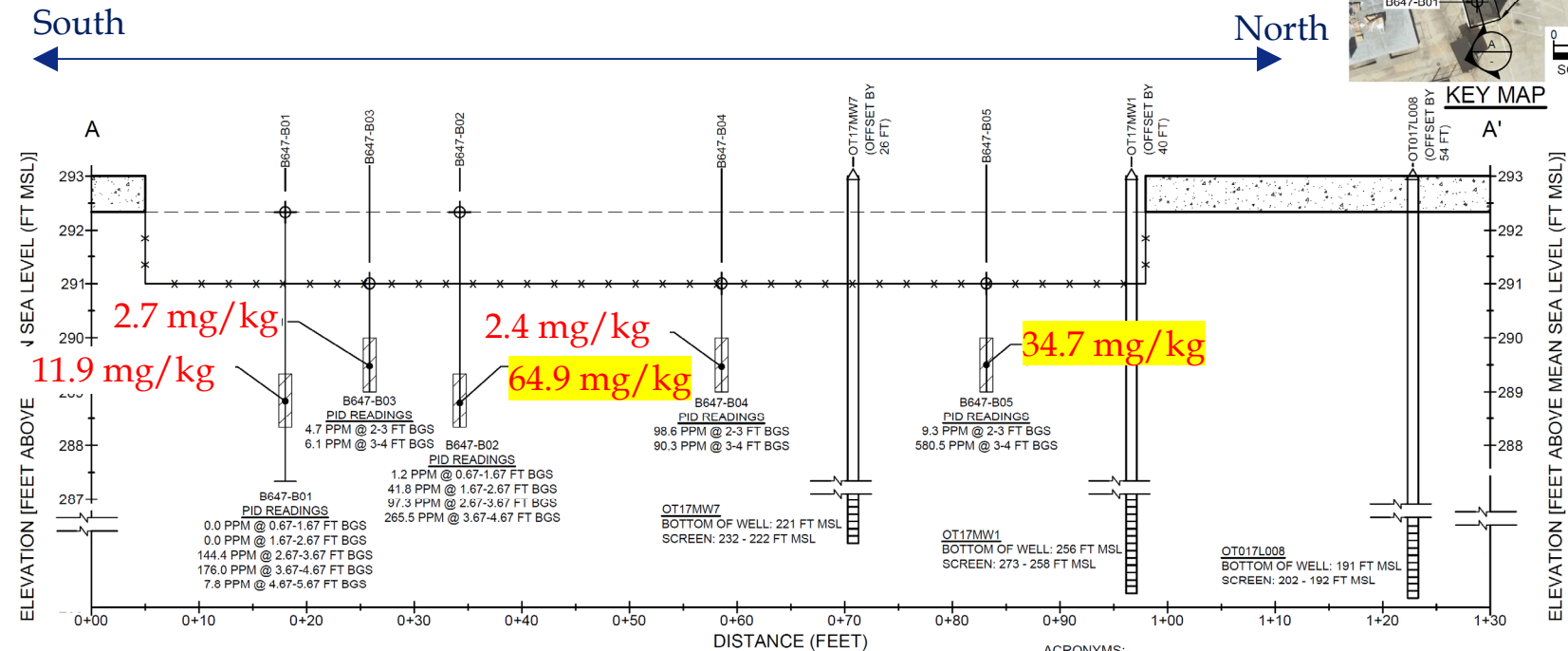
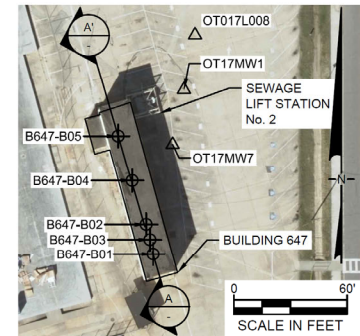
- **2013 - Robins AFB demolishes Building 647; odors noted**
- **May 2013 and February 2014 - Preliminary soil sampling conducted**
 - Volatile Organic Compounds (VOCs) (chlorobenzenes) and semi-volatile organic compounds (SVOCs) detected above regulatory screening levels
 - Chlorobenzene and SVOCs not historically associated with OT017; indication of separate release
- **November 2013 and February 2014 - Results submitted to Georgia Environmental Protection Division (GA EPD)**
 - GA EPD requested RFI for area in vicinity of Building 647



Project Background

Chlorobenzene Screening Levels:

- Industrial Regional Screening Level (RSL) = 130 milligrams per kilogram (mg/kg)
- Residential RSL = 28 mg/kg**
- Soil Screening Level (SSL) = 0.068 mg/kg**



LEGEND

| | | | | | |
|-----------|---------------------------|---|---------------------------------|---|-----------------------------------|
| ----- | ORIGINAL EXCAVATION DEPTH | ⊕ | SOIL BORING | △ | MONITORING WELL |
| -x-x-x-x- | FINAL EXCAVATION DEPTH | ▨ | SOIL SAMPLE COLLECTION INTERVAL | ▤ | MONITORING WELL SCREENED INTERVAL |
| ▨ | CONCRETE | | | | |

ACRONYMS:
 CB = CHLOROBENZENE
 PID = PHOTOIONIZATION DETECTOR
 PPM = PARTS PER MILLION
 µg/kg = MICROGRAMS PER KILOGRAM
 FT BGS = BELOW GROUND SURFACE

SCALE IN FEET (HORIZONTAL): 0, 10, 20
 SCALE IN FEET (VERTICAL): 0, 2



Project Background

- **Project Goal – Conduct an RFI**
 - **Investigate vertical and horizontal extent of soil/groundwater contamination in vicinity of Building 647**
 - Focus on chlorobenzenes and SVOCs (TCE and associated contamination is being addressed under PBR contract)
 - Evaluate presence of hexavalent chromium (not analyzed in 2013/2014 sampling events)
 - **Develop screening criteria for delineation of contaminants of potential concern (COPC)**
 - **Assess risk to human health**
 - **Identify contaminants of concern (COC) that may require corrective action**



Field Investigation

- **Membrane Interface Probe and Hydraulic Profiling Tool (MiHpt)**
- **Soil sampling**
- **Groundwater sampling, as necessary**

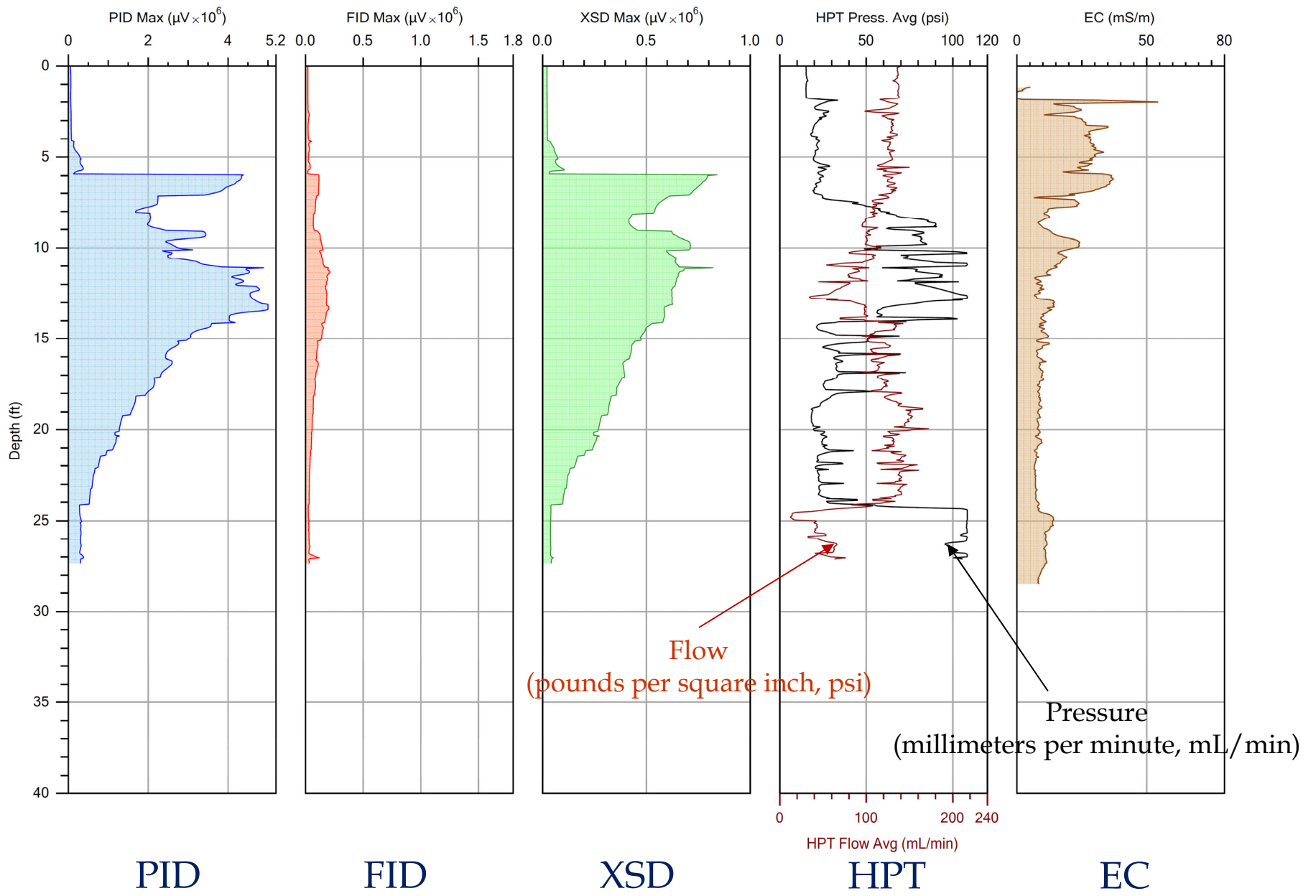


Field Investigation - MiHpt

■ MiHpt

- Screening tool for High Resolution Site Characterization
- Three Gas Chromatograph (GC) Detectors
 - Photoionization detector (PID)
 - Flame ionization detector (FID)
 - Halogen specific detector (XSD™)
- Hydraulic Profiling Tool (HPT) (permeability)
- Electrical conductivity (EC) (lithology)

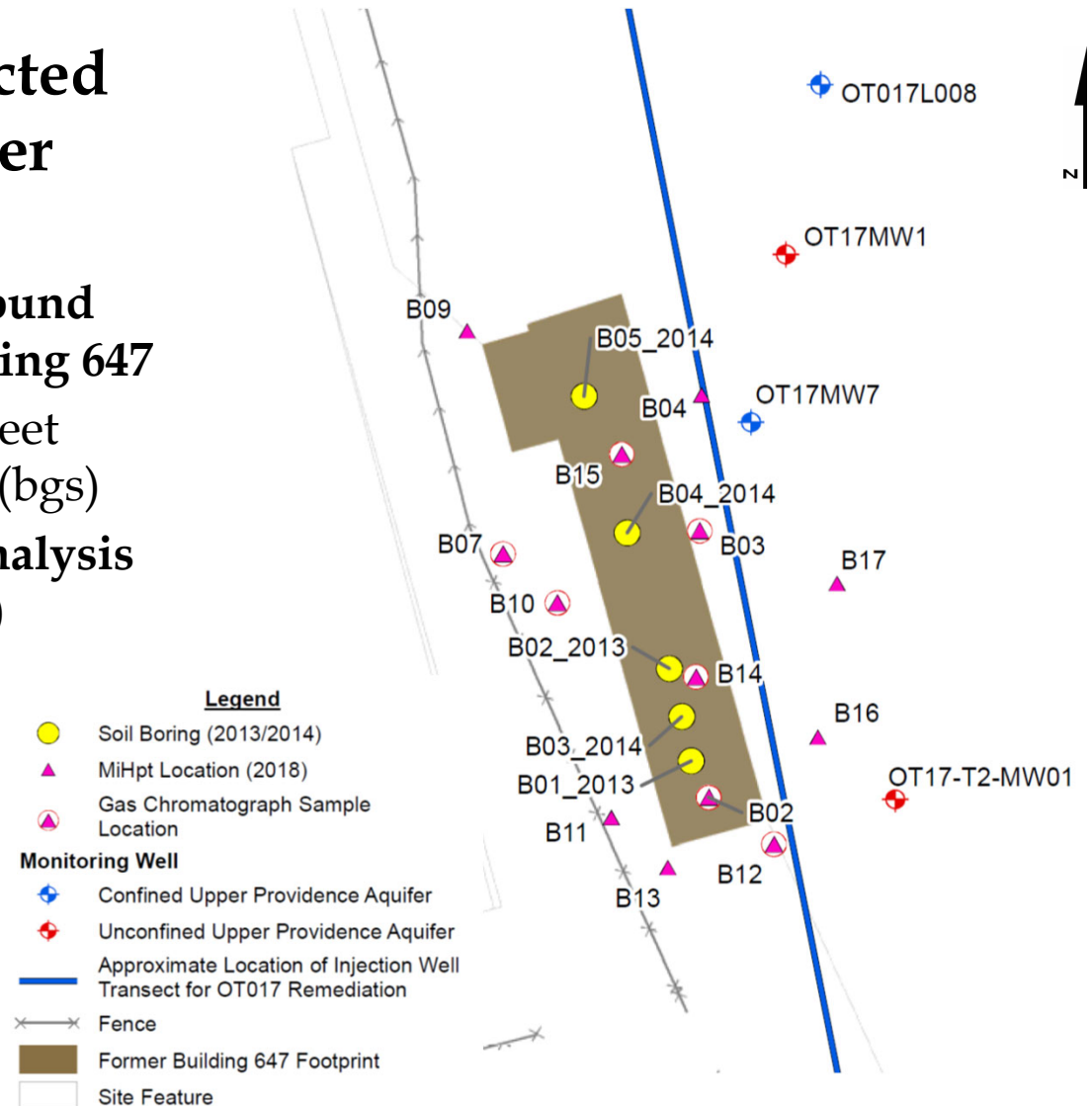






Field Investigation - MiHpt

- **Field activities conducted from 10 to 14 December 2018**
 - **16 MiHpt locations in/around footprint of former Building 647**
 - Total depths up to 37 feet below ground surface (bgs)
 - **Select intervals for GC analysis (chlorobenzene and TCE)**

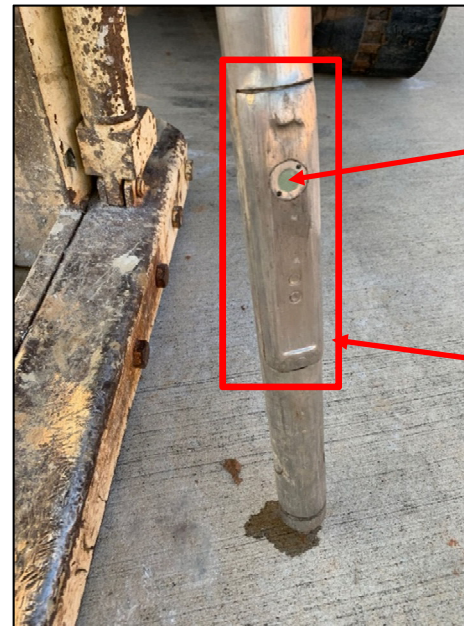




Field Investigation - MiHpt



Flow port for HPT

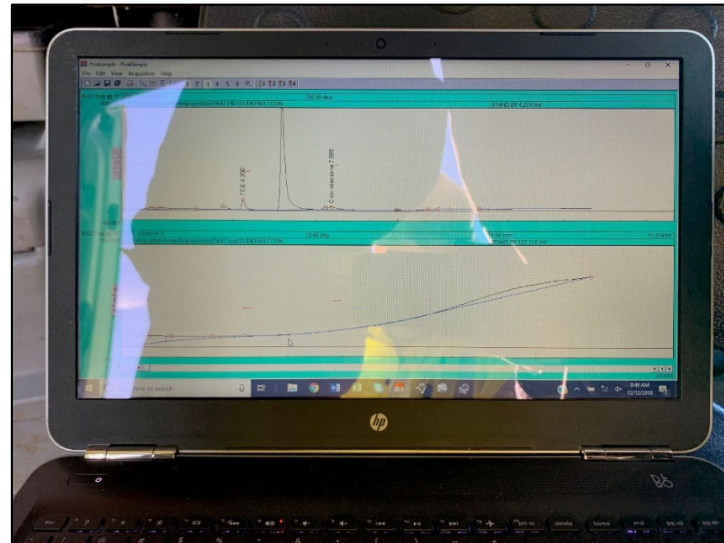


Membrane

Heater Block

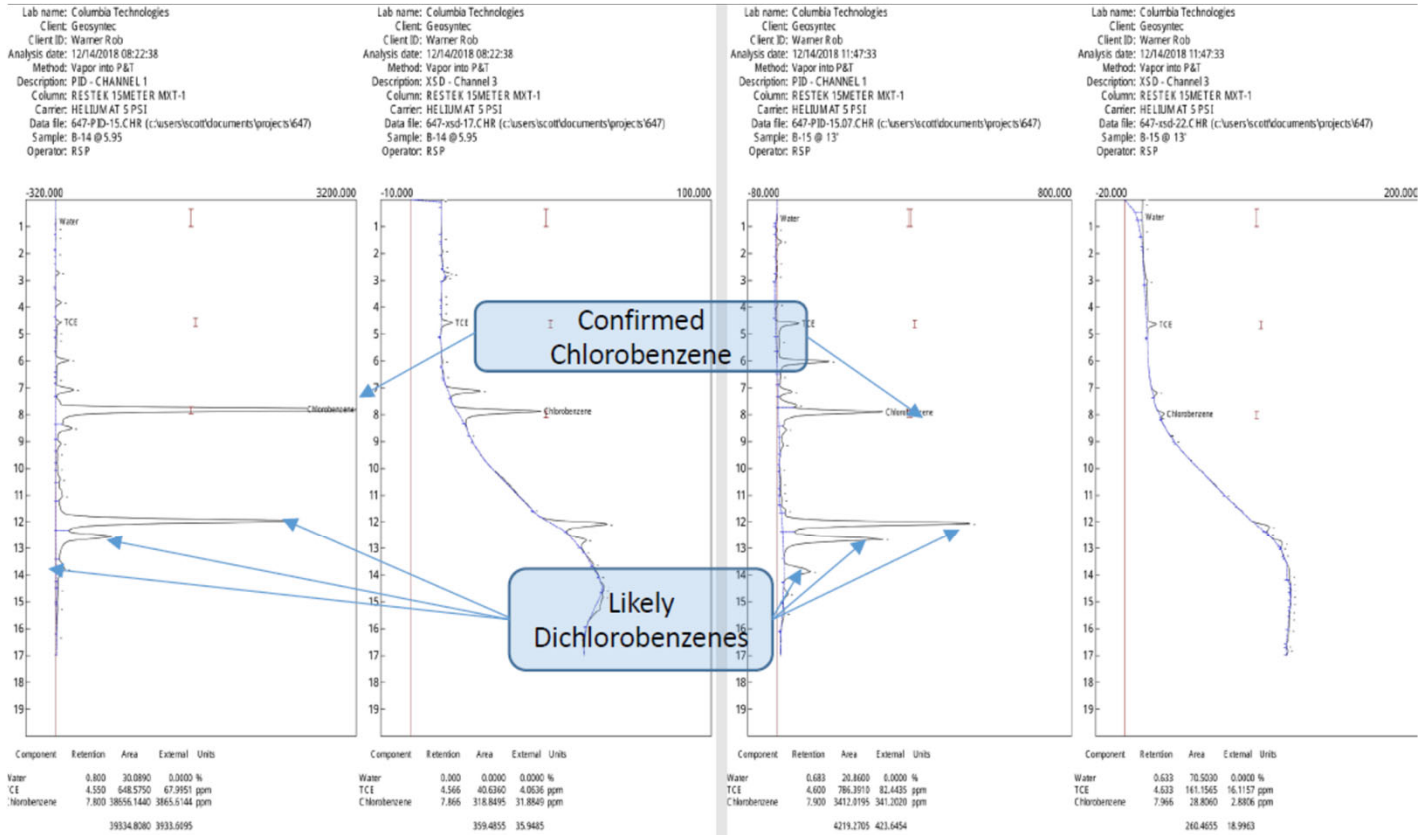


Field Investigation - MiHpt





Field Investigation - MiHpt

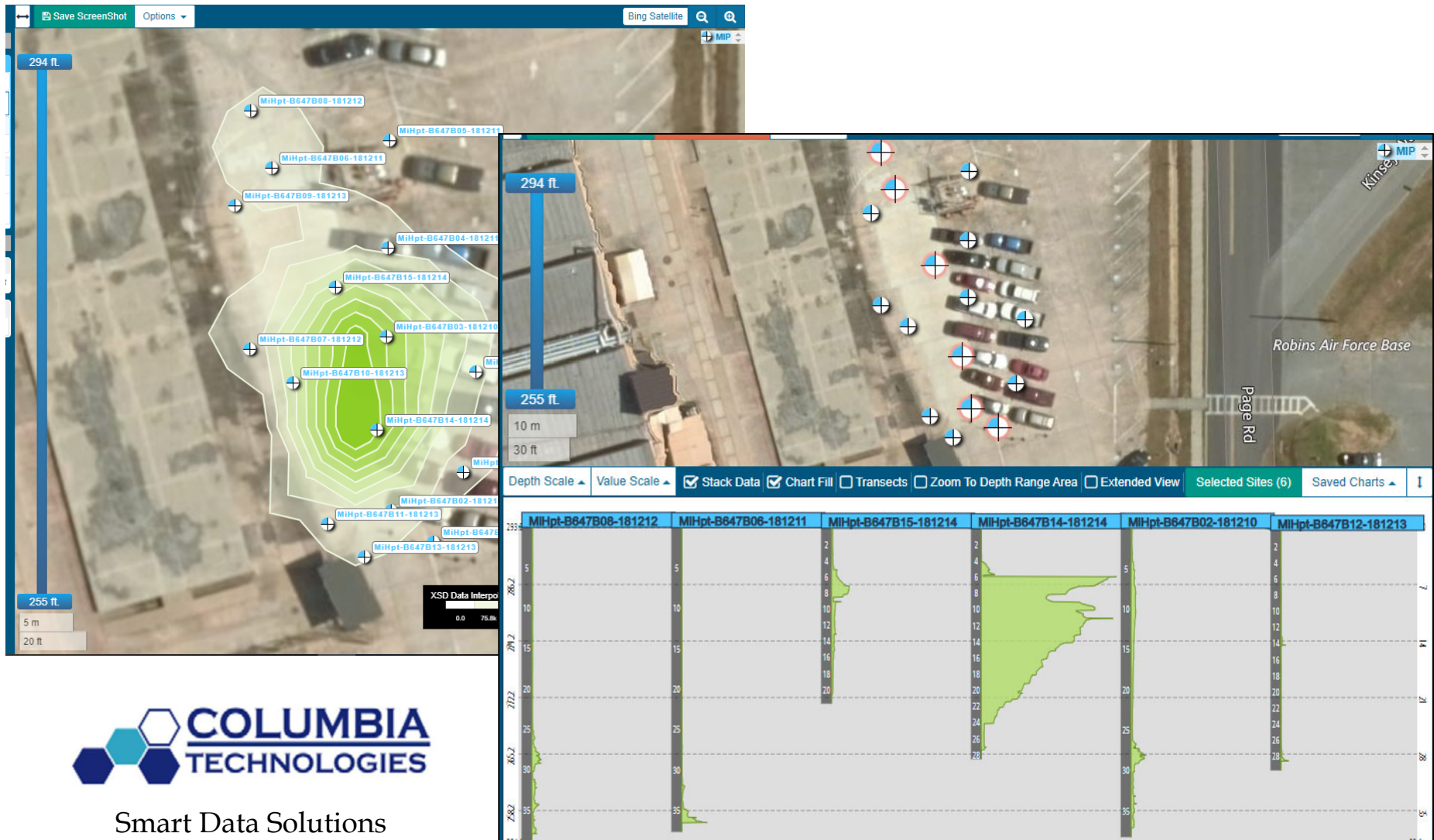


B-14 @ 6-ft

B-15 @ 13-ft



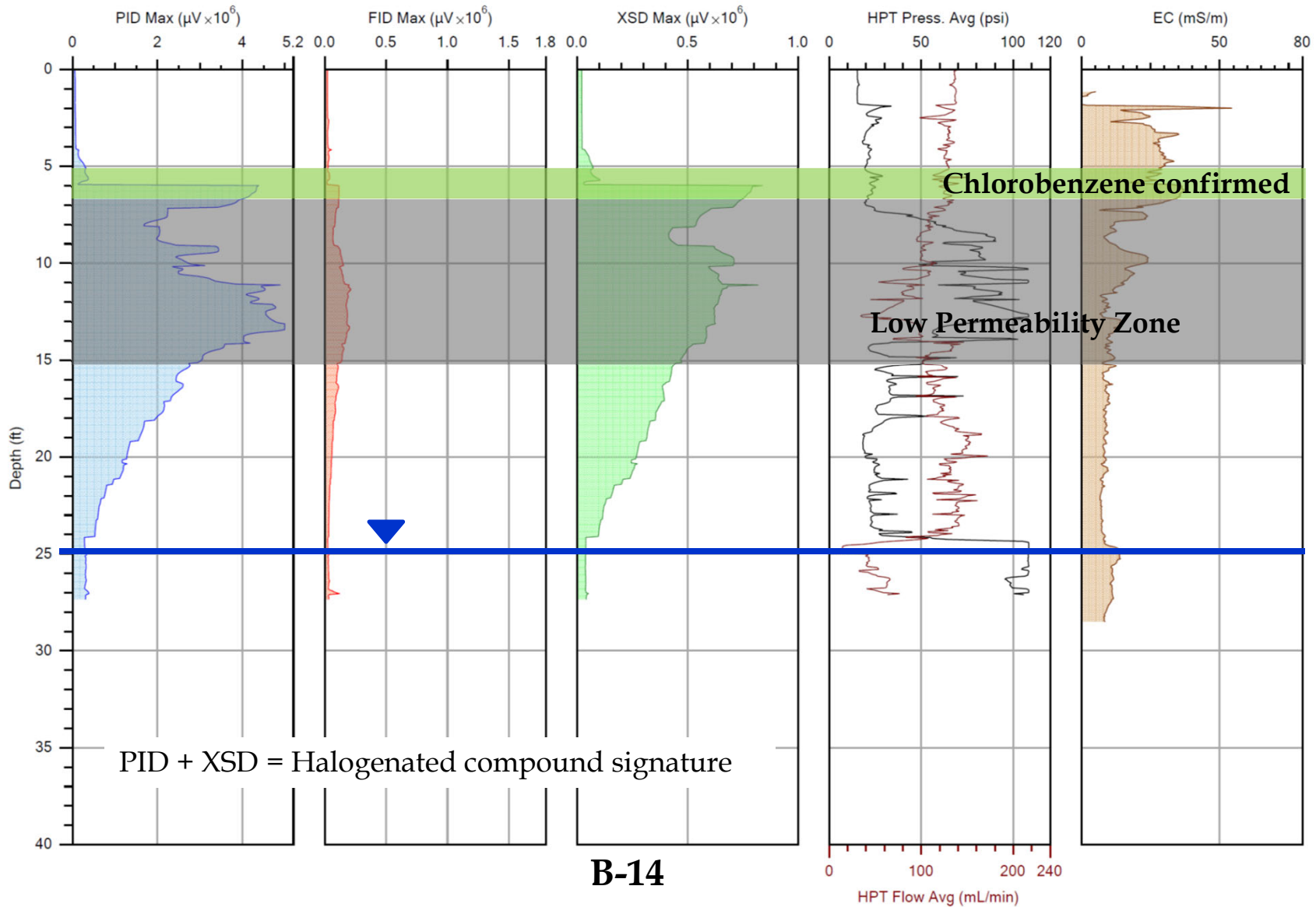
Field Investigation - MiHpt



Smart Data Solutions

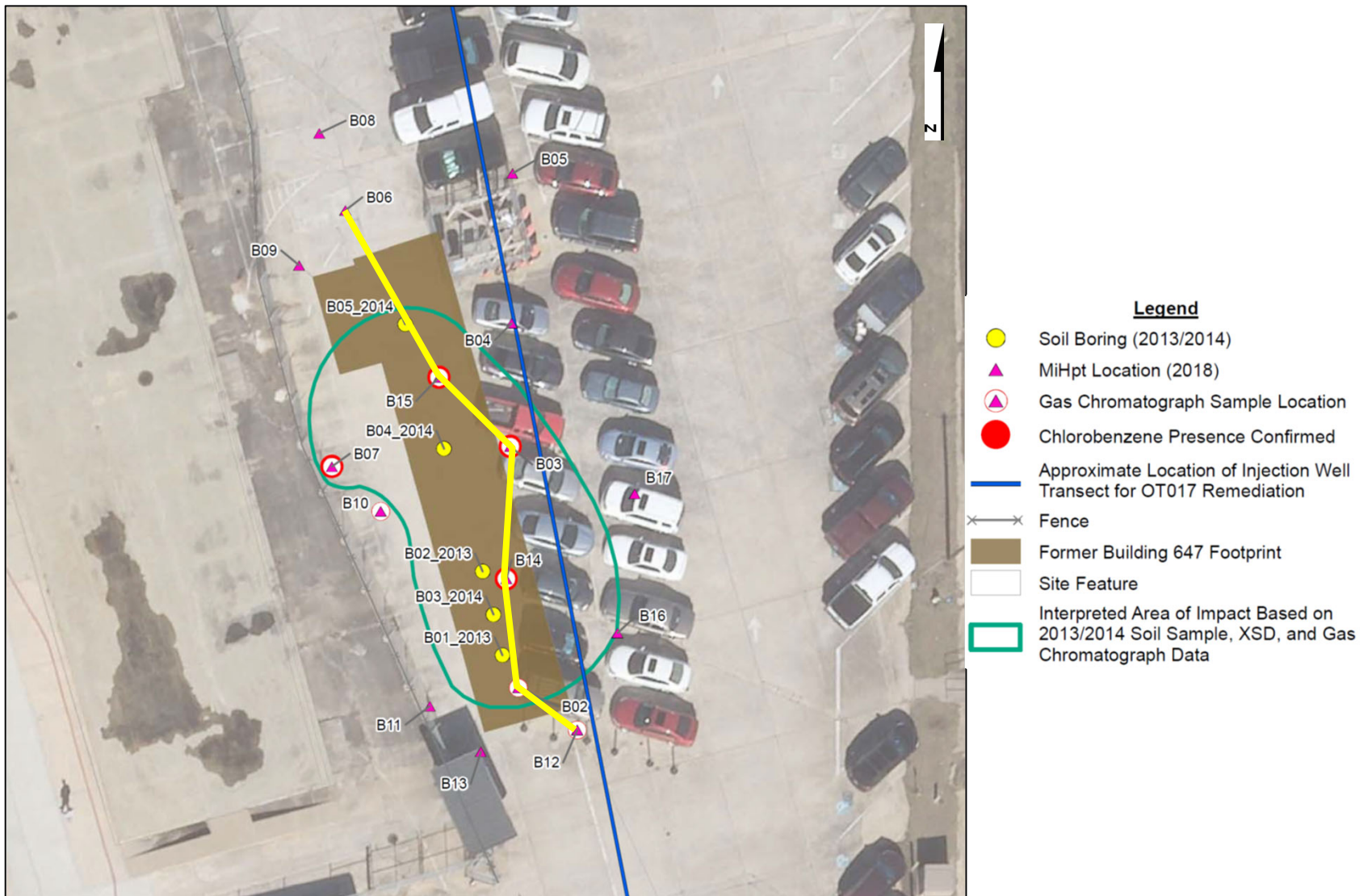


Field Investigation - MiHpt



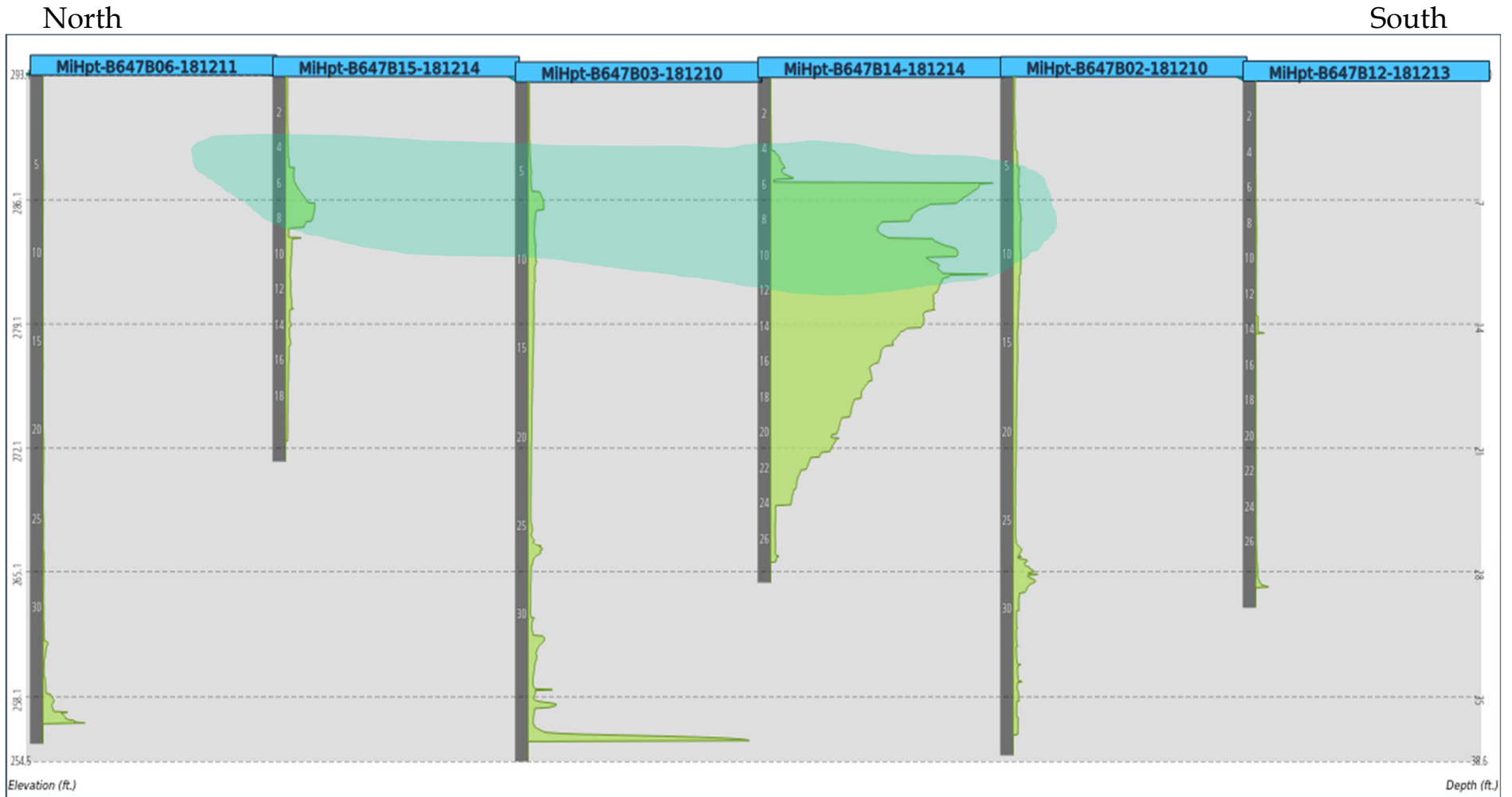


Field Investigation - MiHpt





Field Investigation - MiHpt





Field Investigation - MiHpt

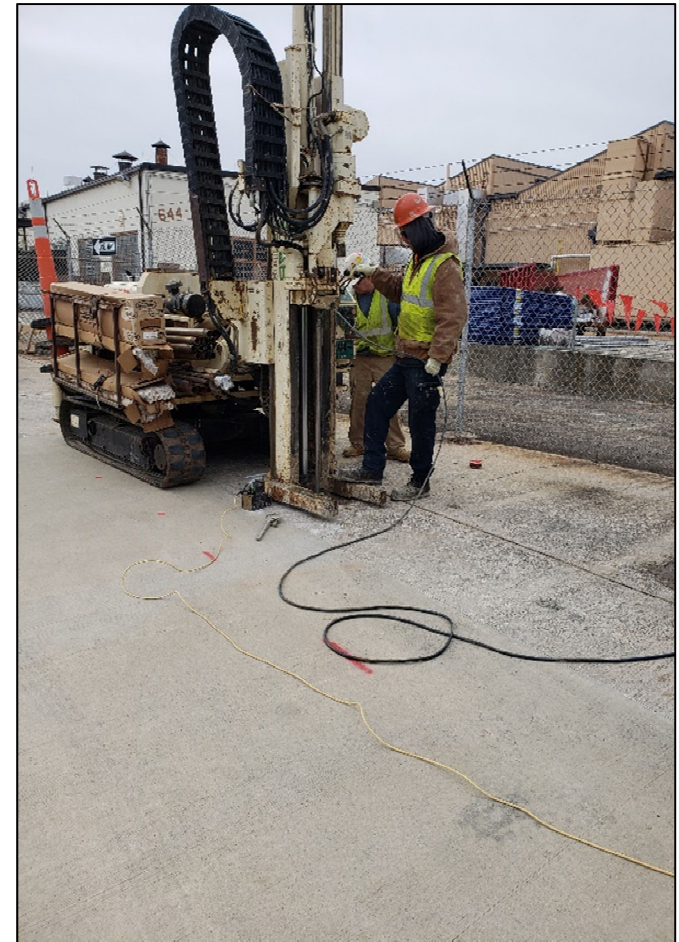
- **General observations from MiHPT investigation:**
 - **Chlorobenzene generally isolated to immediate vicinity of former building footprint**
 - **Chlorobenzene generally isolated to ~6 to 15 ft bgs**
 - **Low permeability zone ~7 to 16 ft bgs**
 - **Deep TCE responses in groundwater**



Field Investigation - Soil Investigation

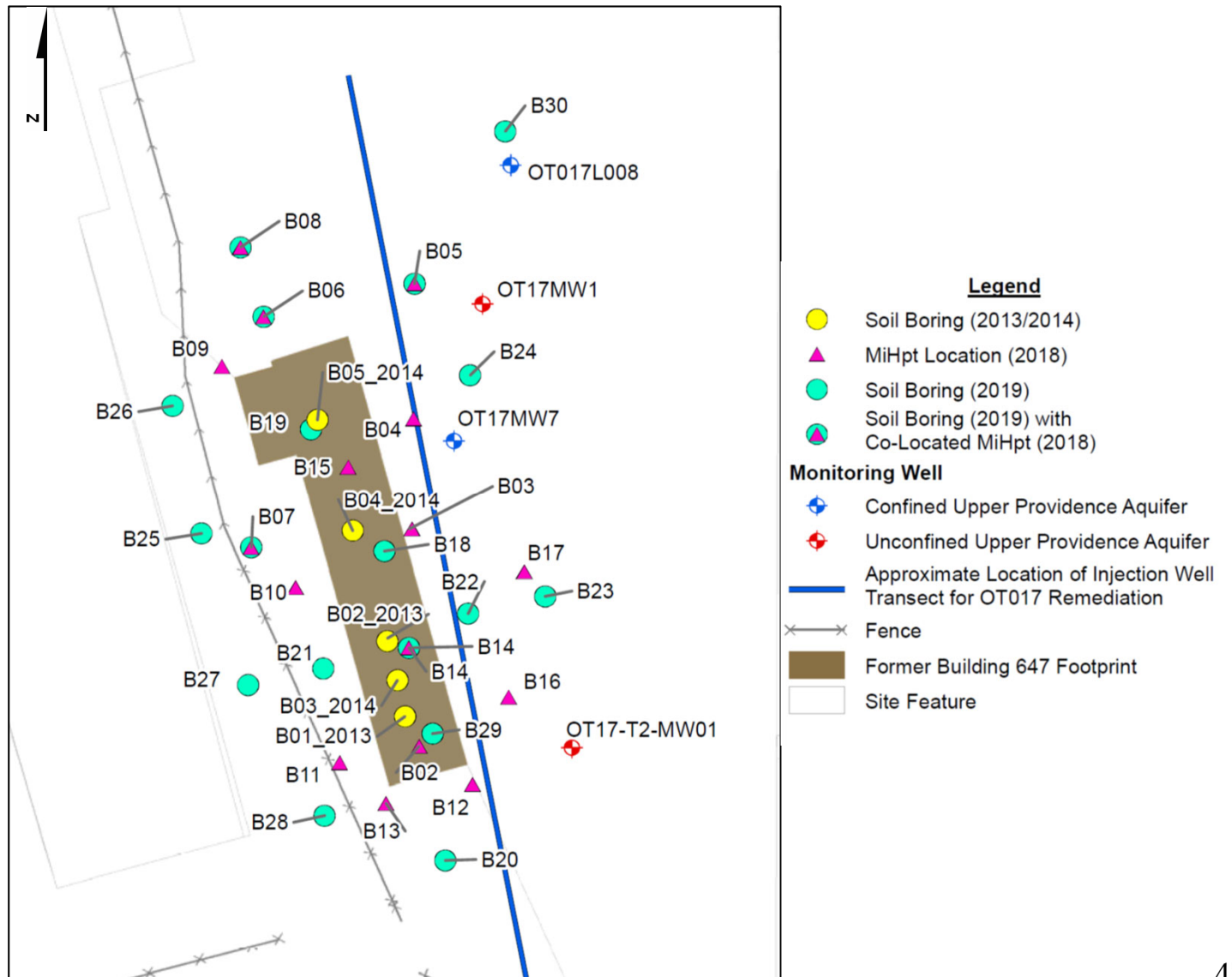
■ Analytes

- VOCs and SVOCs with low-level polycyclic aromatic hydrocarbons (PAHs)
- Speciated chromium (total and hexavalent chromium)
 - Results not above Robins AFB background concentrations





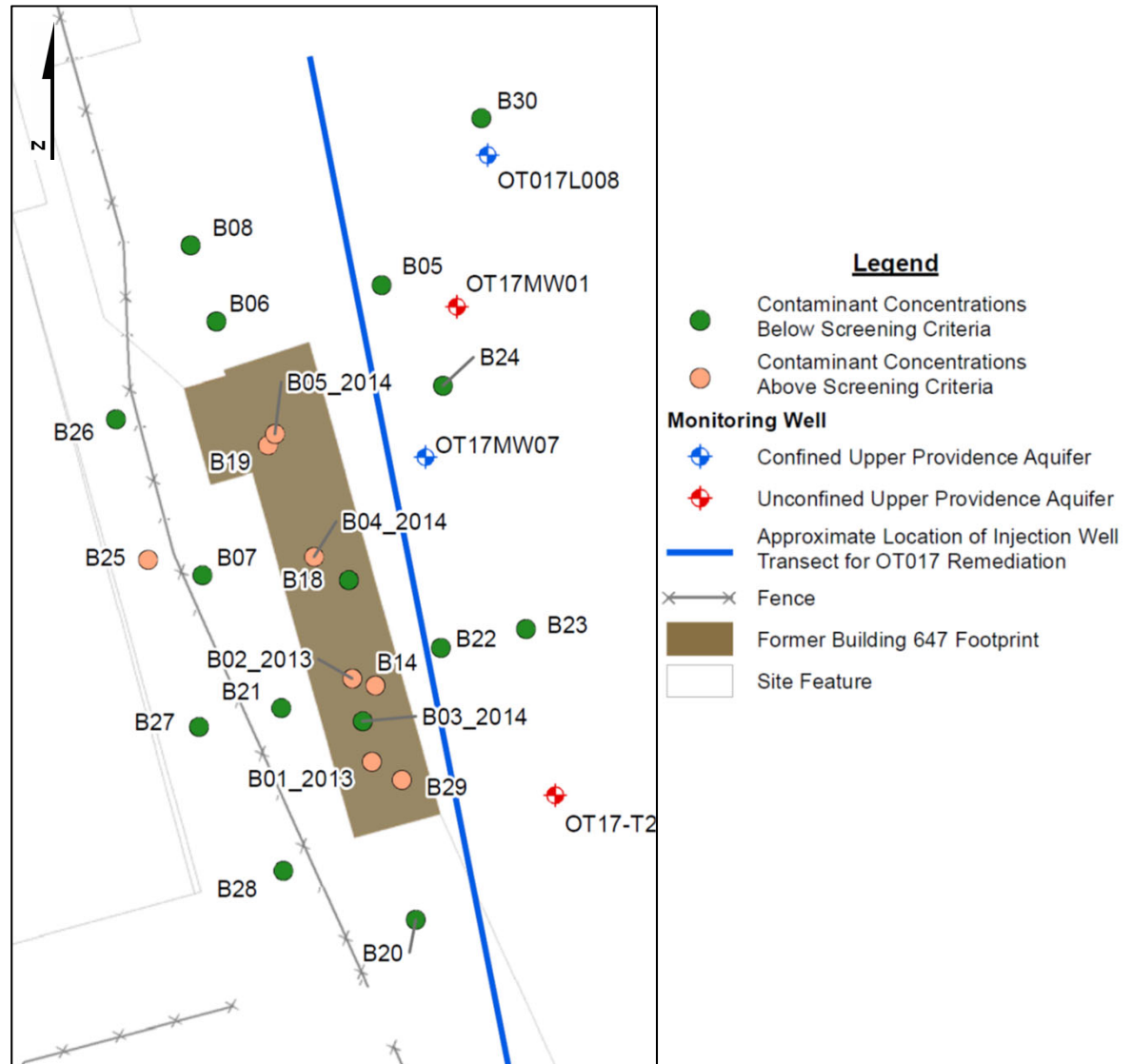
Field Investigation - Soil Investigation





Field Investigation – Soil Investigation

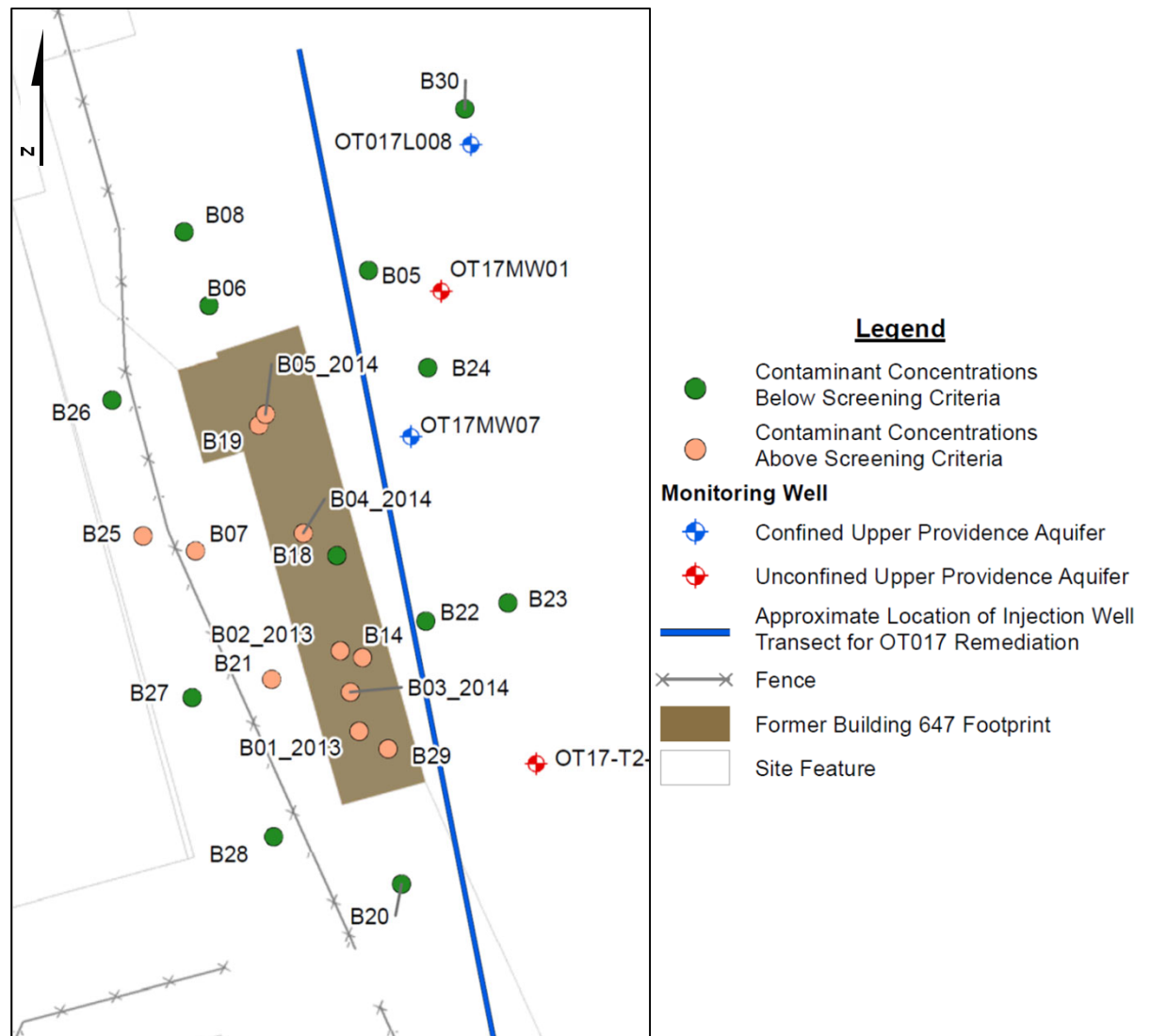
- VOC/SVOC data screened against residential RSLs
 - Deepest exceedance 11.5 to 12.5 ft bgs at B14





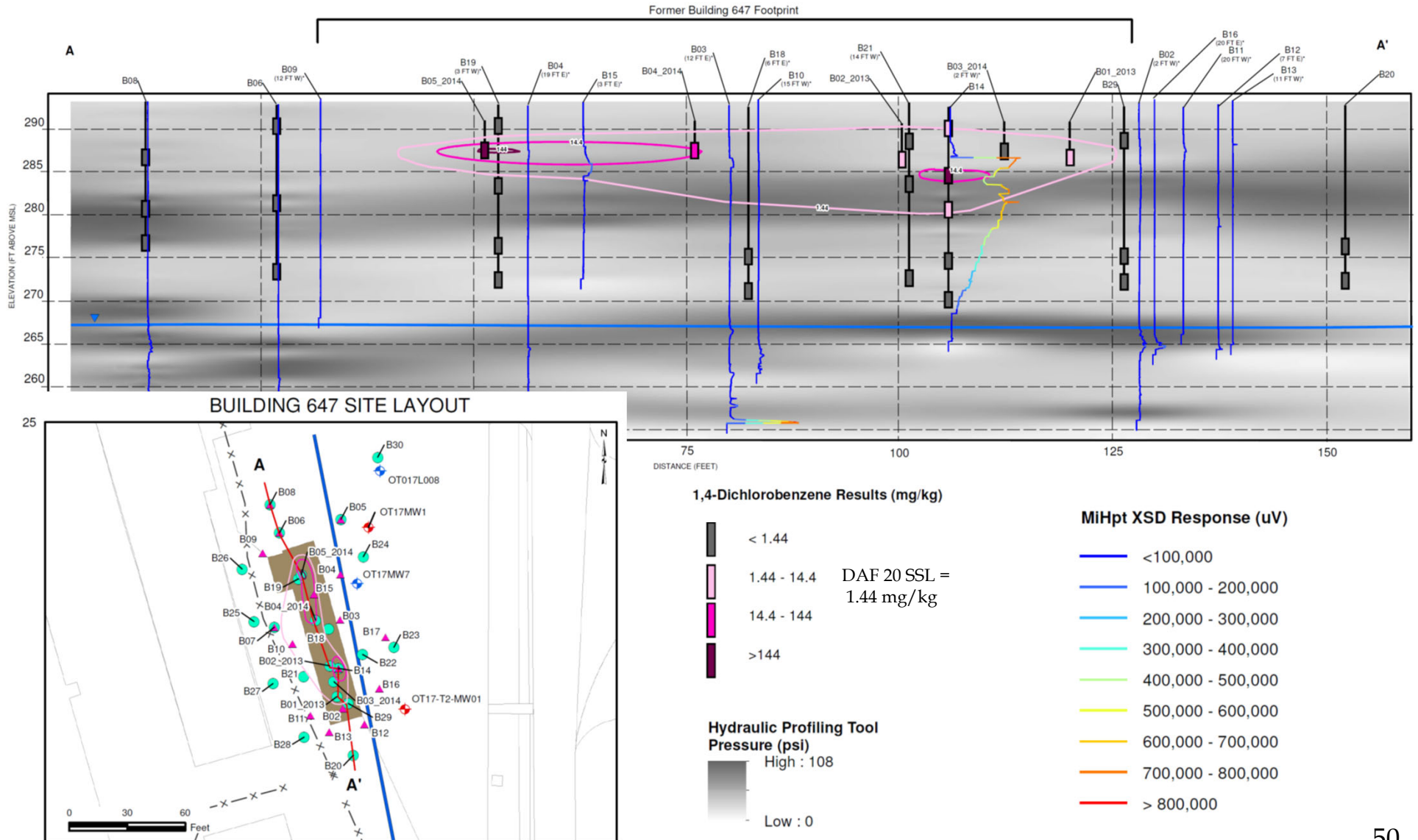
Field Investigation - Soil Investigation

- VOC/SVOC screened against SSL [Dilution Attenuation Factor (DAF) 20]
 - Deepest exceedance 12 to 13 ft bgs



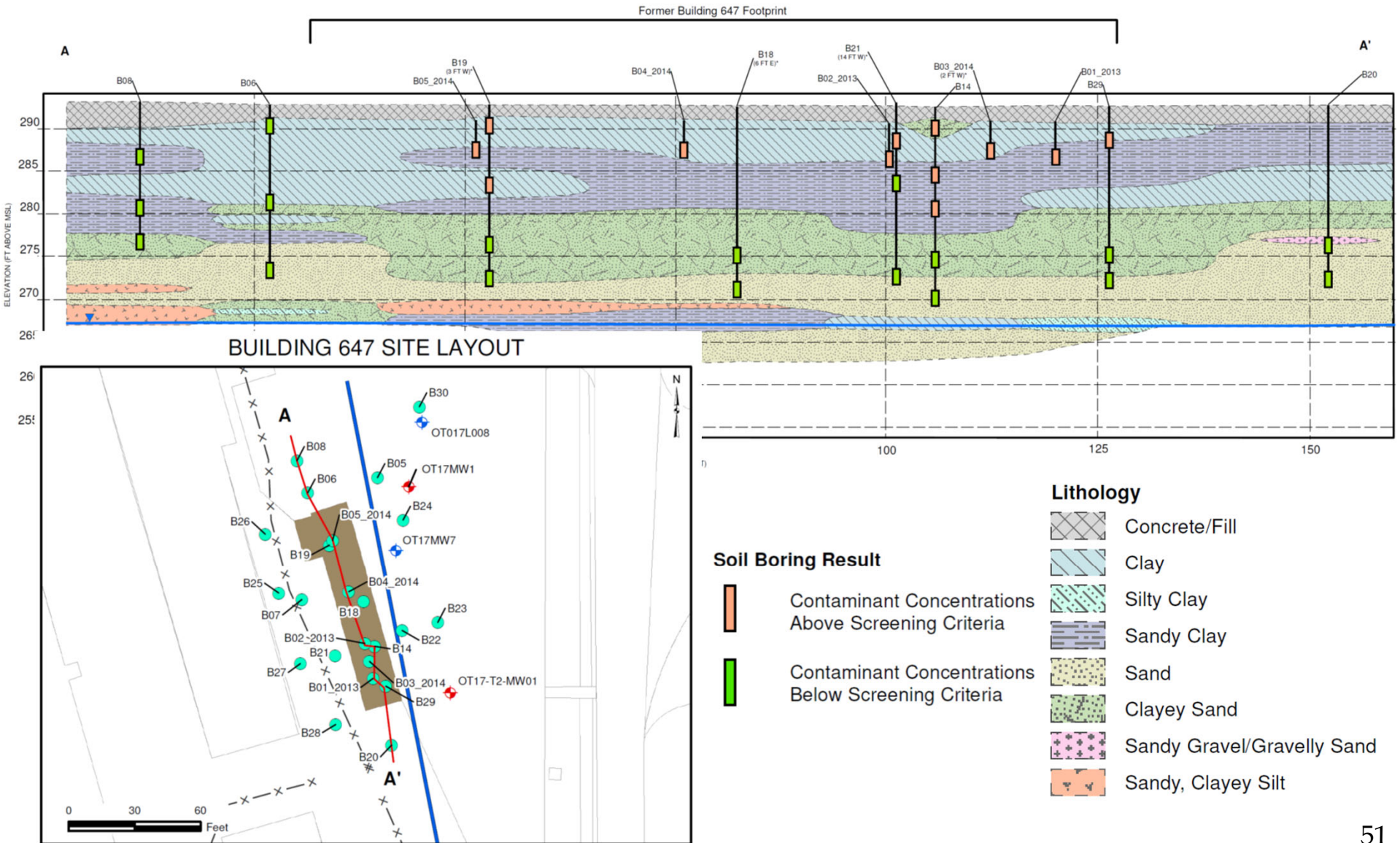


Field Investigation - Results





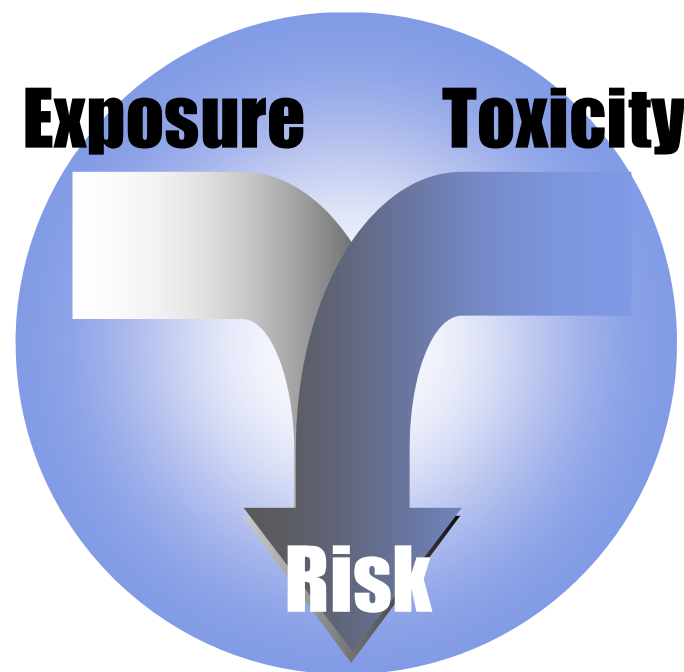
Field Investigation - Results





Human Health Risk Assessment

- Data evaluation and selection of COPCs
- Exposure assessment – Process of measuring or estimating intensity, frequency, and duration of human exposure to a chemical in environment
- Toxicity assessment – Provides a description of relationship between a dose of a chemical and potential likelihood of an adverse health effect
- Risk characterization to identify COCs
- Remediation Level (RL) calculation for COCs



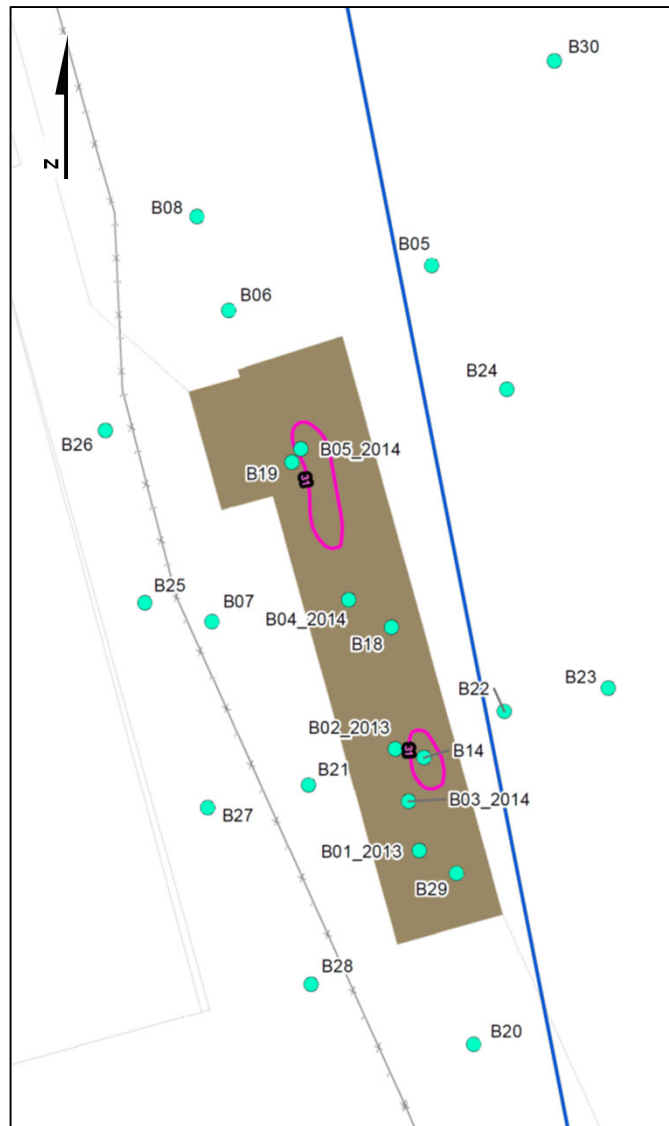


Human Health Risk Assessment

- **No current exposure scenarios**
 - **Future receptor-exposure scenarios**
 - **Commercial/industrial worker to soil**
 - **Maintenance worker to soil**
 - **Construction worker soil**
 - **Trespasser to soil**
 - **Hypothetical resident to soil**
 - 1,4-dichlorobenzene only COC; RL = 31 mg/kg
- } No COCs Identified



Human Health Risk Assessment



Legend

- Soil Boring
- Estimated Extent of 1,4-Dichlorobenzene Above Risk-Based Remediation Level of 31 mg/kg
- Approximate Location of Injection Well Transect for OT017 Remediation
- ×—× Fence
- Former Building 647 Footprint
- Site Feature



Summary

- **MiHpt provided real-time qualitative assessment of vertical and horizontal extent of chlorobenzenes in soil**
- **Detections in soil samples above screening levels generally isolated to vicinity of former Building 647 footprint**
- **Vertical delineation achieved in unsaturated soil – groundwater not impacted by Building 647 release**
- **RL of 31 mg/kg established for 1,4-dichlorobenzene under hypothetical residential use**



Path Forward

- **Prepare Corrective Action Plan (CAP)**
 - Evaluate remedial alternatives and select preferred alternative
 - CAP will be prepared under Optimized Remediation Contract (ORC)



New Business and Program Closing

**Dr. Linda Smyth
Community Co-Chair**



Next EAB Meeting

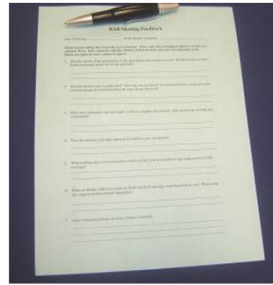
Thursday, February 6, 2020





Please...

Complete the meeting evaluation and feedback form and leave at your seat



Leave your name tag at the sign-in table for the next meeting



Thank you!