

Innovative Bioremediation Approach Implemented in Complex Karst Geology to Treat LNAPL Releasing from Seeps to a Creek and Residential Properties in Gallatin, Tennessee

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AST Environmental, Inc.



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- Hawkston Drilling, LLC, Cory Walker



Then and Now

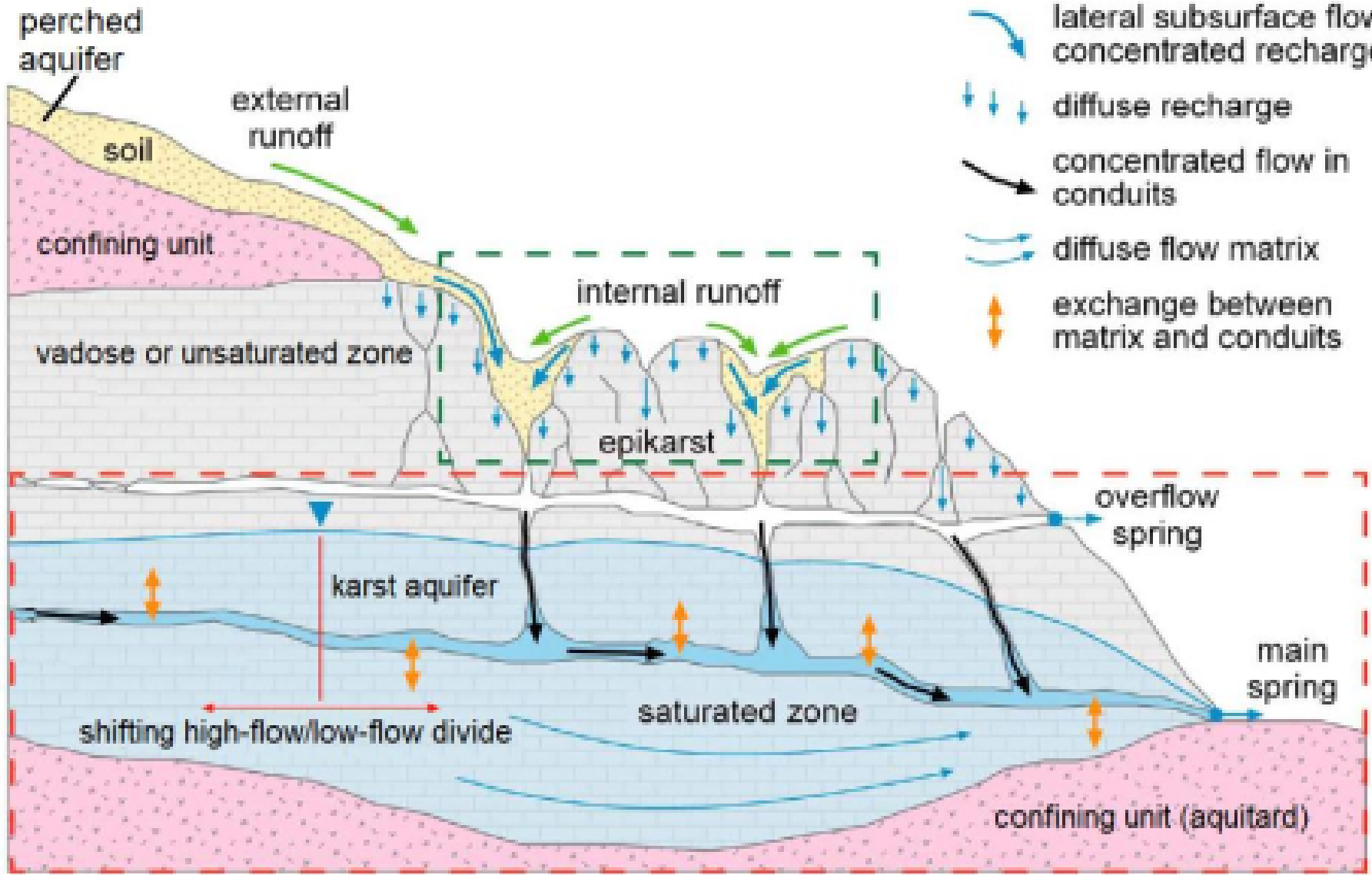


August 2019



May 2023

a)



- lateral surface flow
- lateral subsurface flow / concentrated recharge
- diffuse recharge
- concentrated flow in conduits
- diffuse flow matrix
- exchange between matrix and conduits

Soil/Epikarst Subsystem

Main Karst Subsystem

(modified from Hartmann et al., 2014)



- LEGEND**
- Seep
 - Spring
 - Submerged Spring
 - Surface Stream
 - Town Creek
 - Approximate Subject Property
 - Parcel Boundary

SOURCE: MODIFIED FROM DIM ADVISORS, 2019, CRAWFORD HYDROLOGY LAB 2019, GALLATIN GIS 2019, AND BING MAPS HYBRID AERIAL IMAGERY.

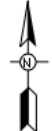


FIGURE 1

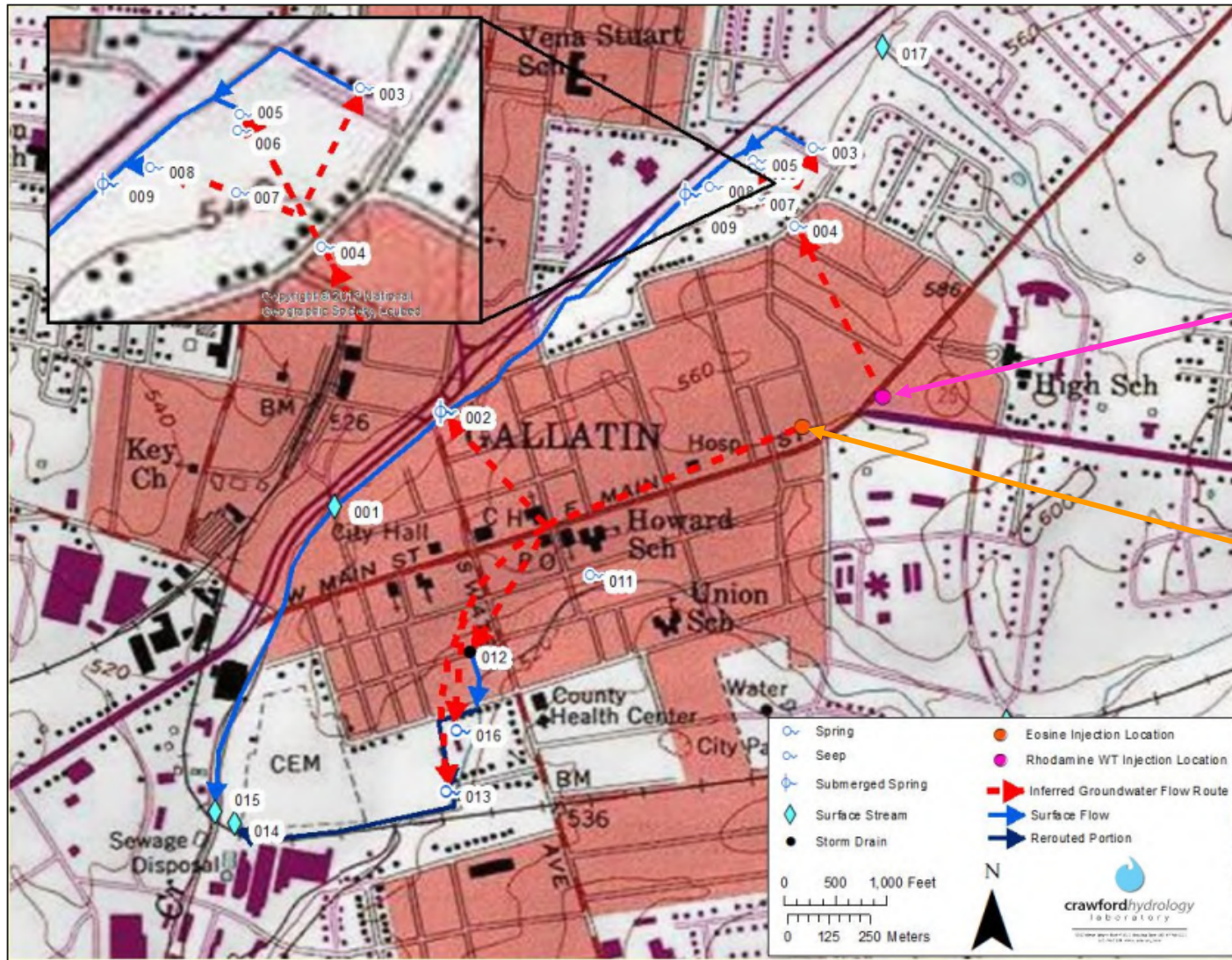
SITE VICINITY MAP

CONCEPTUAL SITE MODEL REPORT
 GALLATIN RELEASE
 GALLATIN, TN
 FACILITY ID# 5-R30123 & 5-R30173

DESIGNED BY TERRILL	DRAWN BY JP	DATE 11/22/2020
CHECKED BY GS	SCALE 1" = 500'	
FILENAME 09_550_0_01_303		

IF NOT 1" ON THIS SHEET, REFER TO SCALE ACCORDINGLY

Competent Bedrock Dye Trace – June 2019



Rhodamine WT injected at Gallatin Market at depth ~550' (elevation)

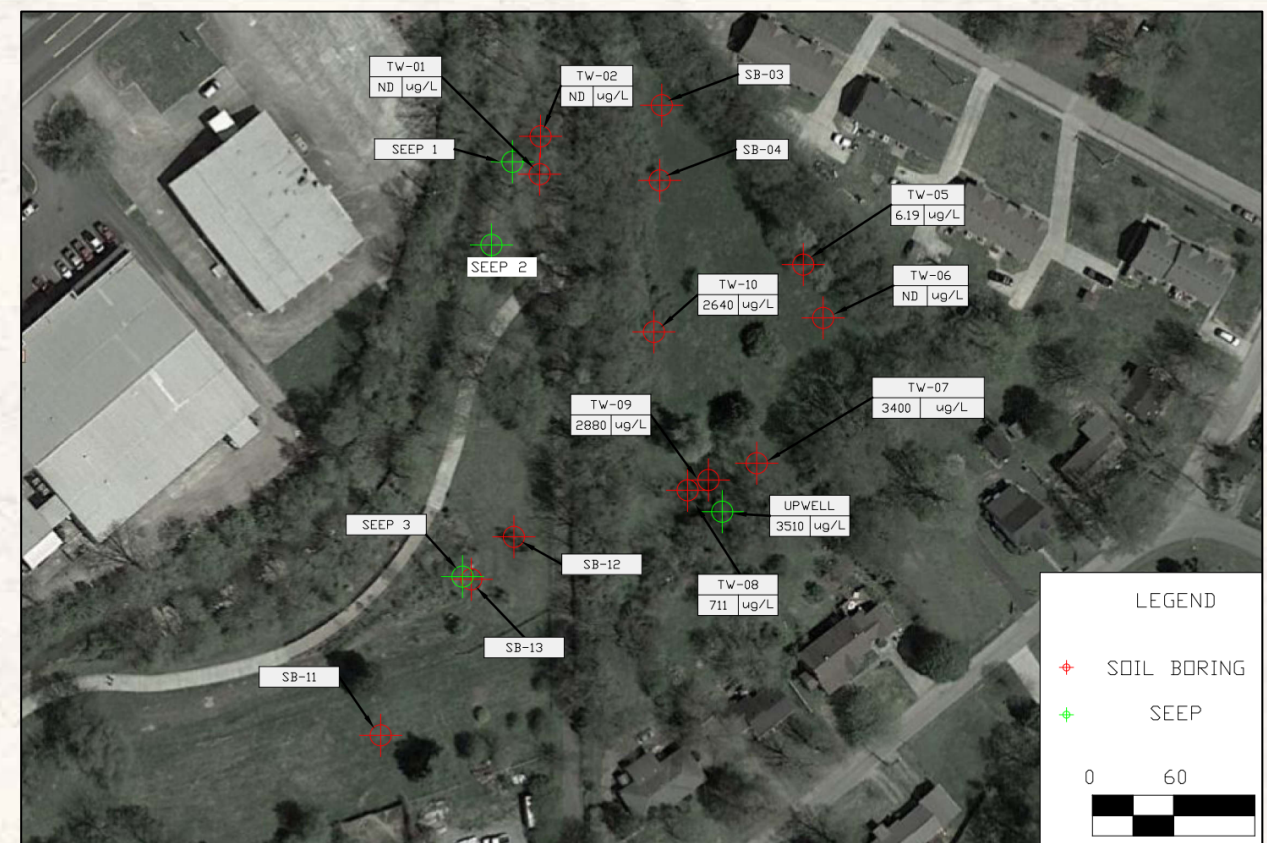
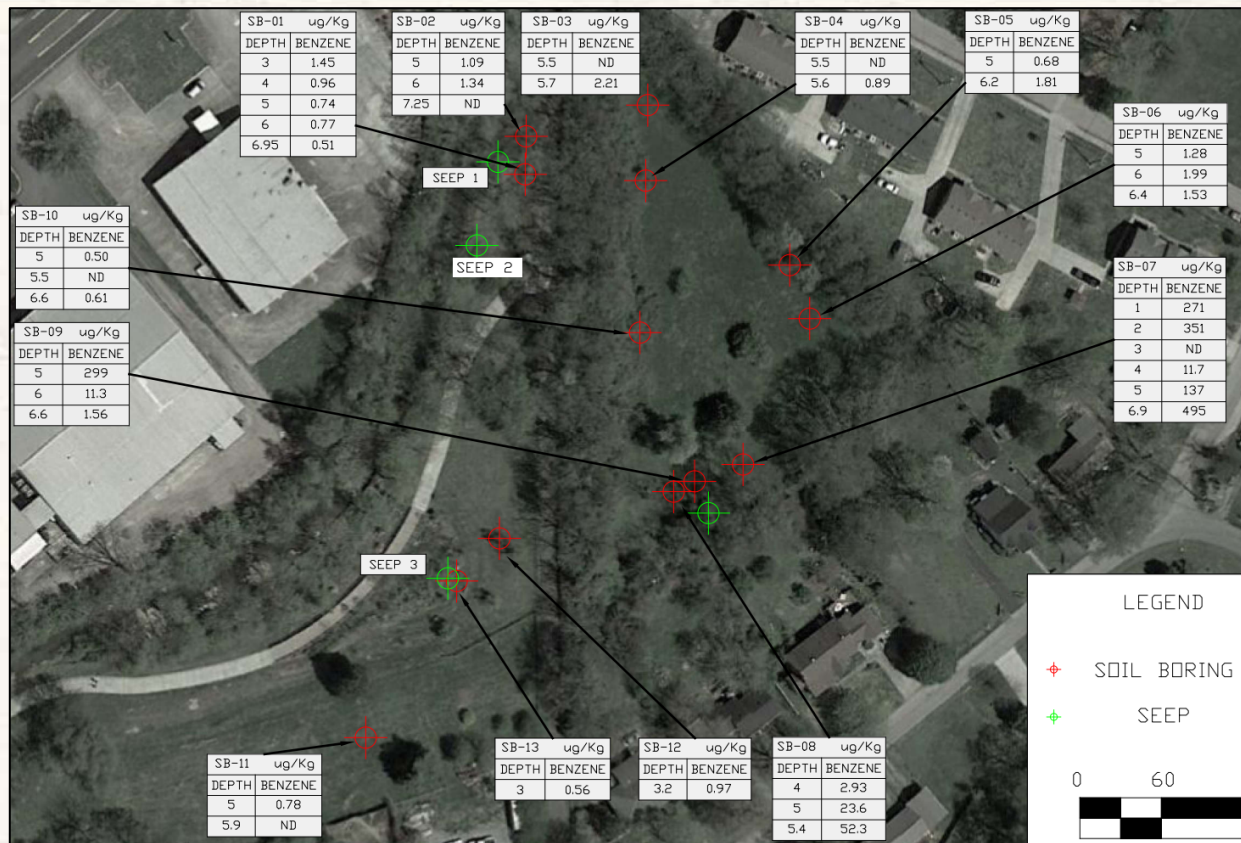
- Flow NW
- Shallow karst flow
- Sporadic (low to no) discharge
- >19-day travel time

Eosine injected at Petro Plus at depth ~515' (elevation)

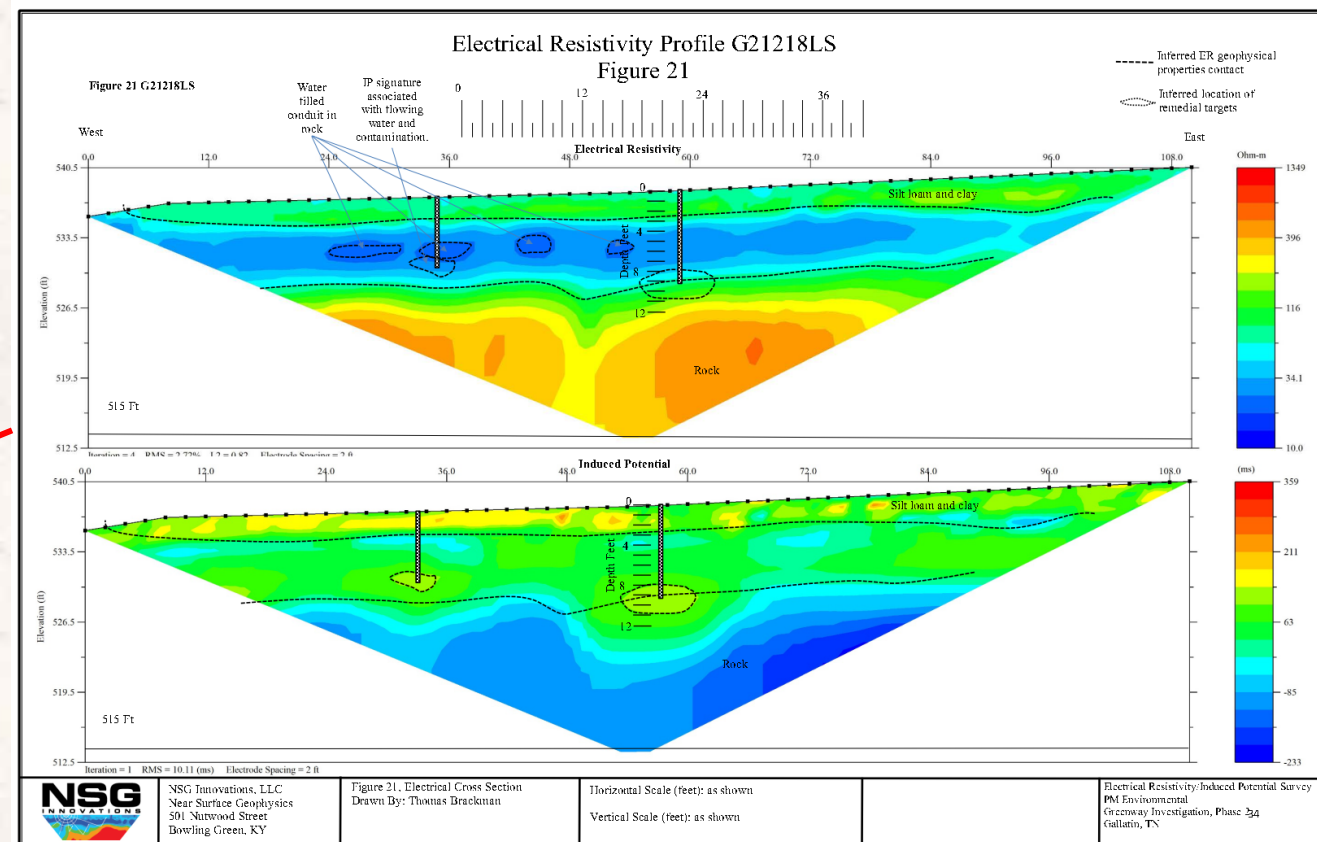
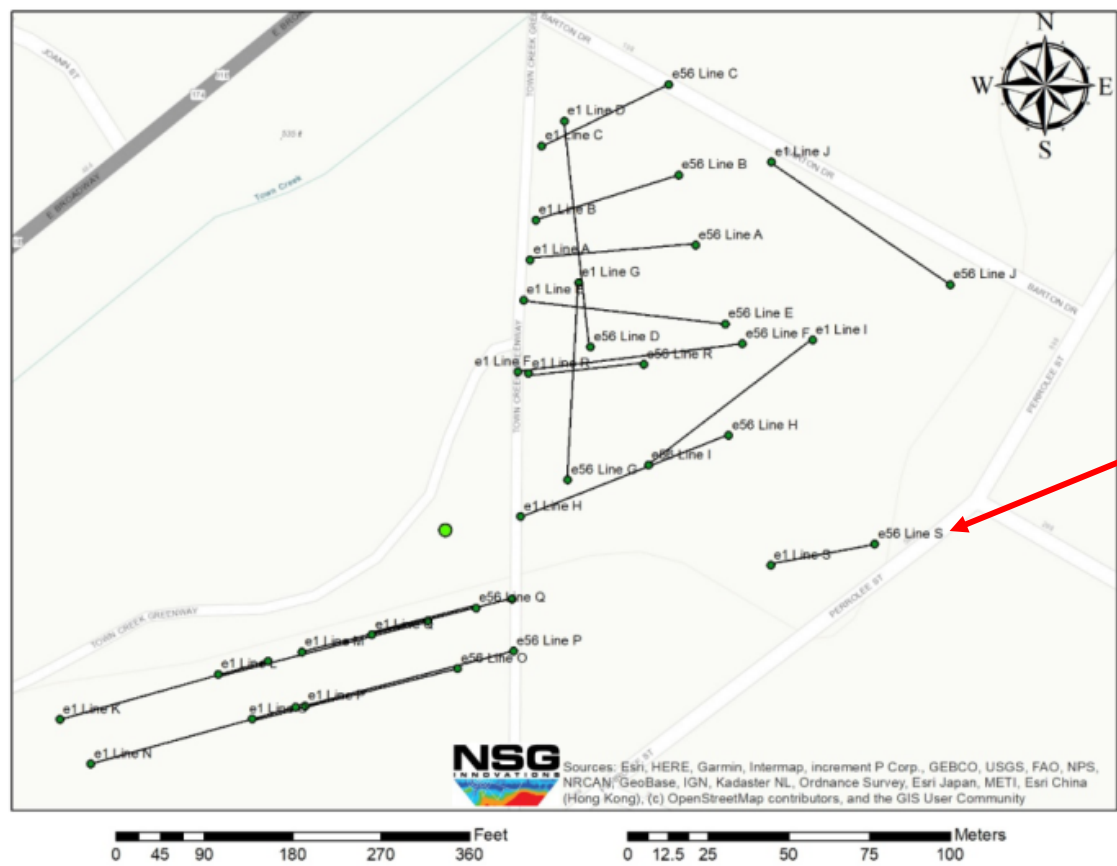
- Flow SW
- Mature karst flow
- Higher and continuous discharge
- ~6-day travel time

Figure 19. Inferred Groundwater Flow Path Map.

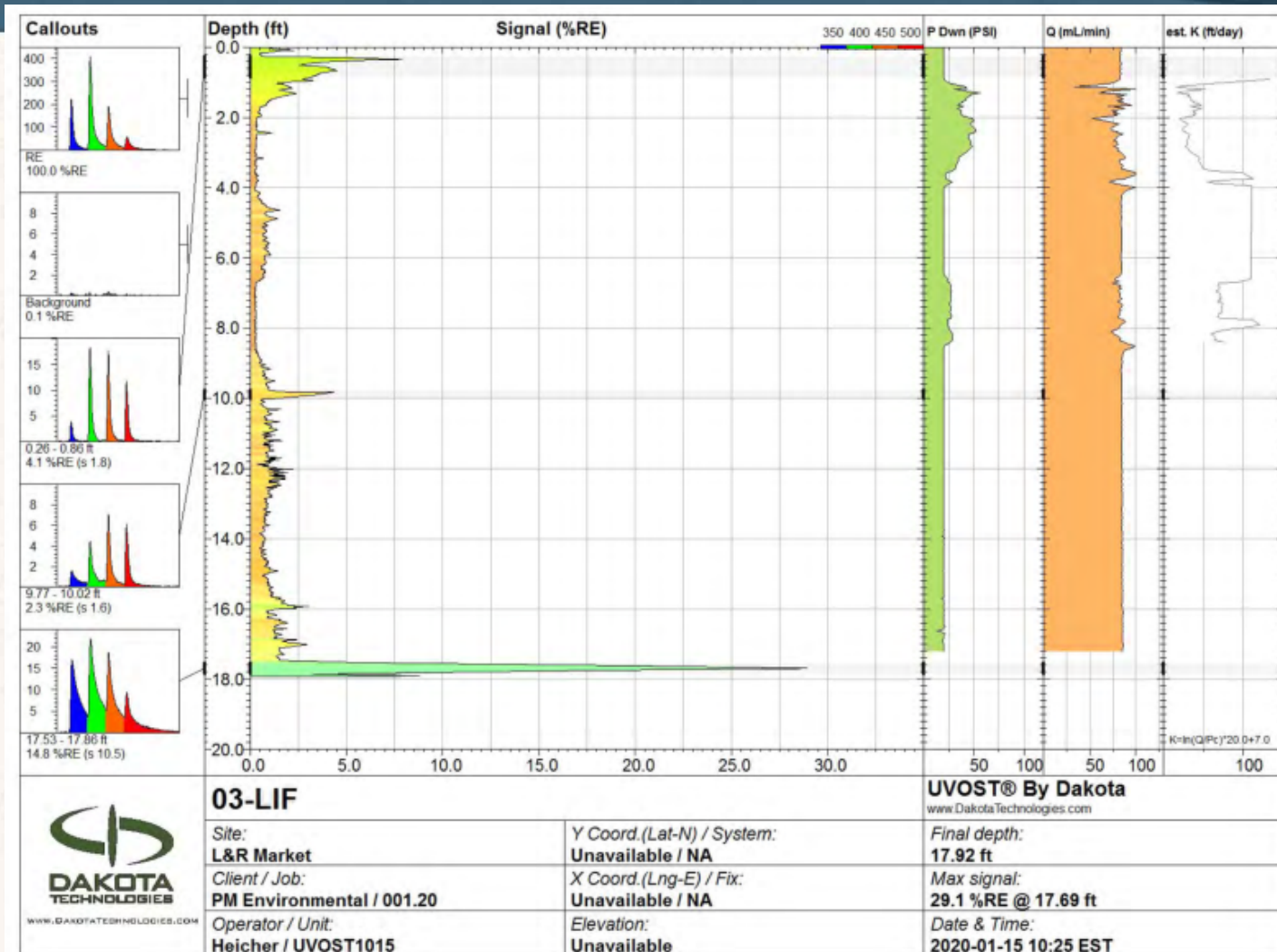
Interim RDC Between Δ Field and Town Creek – Dec 2019



Surface Geophysics – November 2019 to January 2020

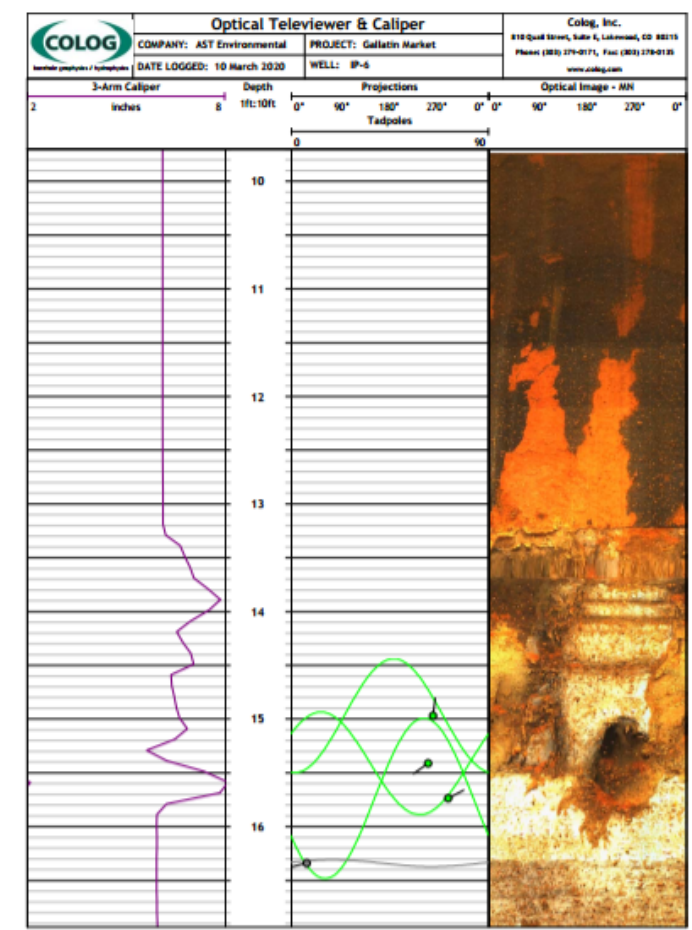


HRSC Survey and Confirmatory Soil Sampling at Eight (8) UST Facilities – January 2020



Based on the data collected, no significant pathways could be identified with the use of the LIF/UVOST and MiHpT technology or confirmatory laboratory analytical sampling in the overburden.

Rock Cores and Open Hole Bedrock Wells, Downhole Geophysics, Discrete Interval Groundwater Sampling – 1Q2020



2nd Dye Trace – March 2020



Figure 8. Inferred Groundwater Flow Path Map – Remediation Efficacy Testing.

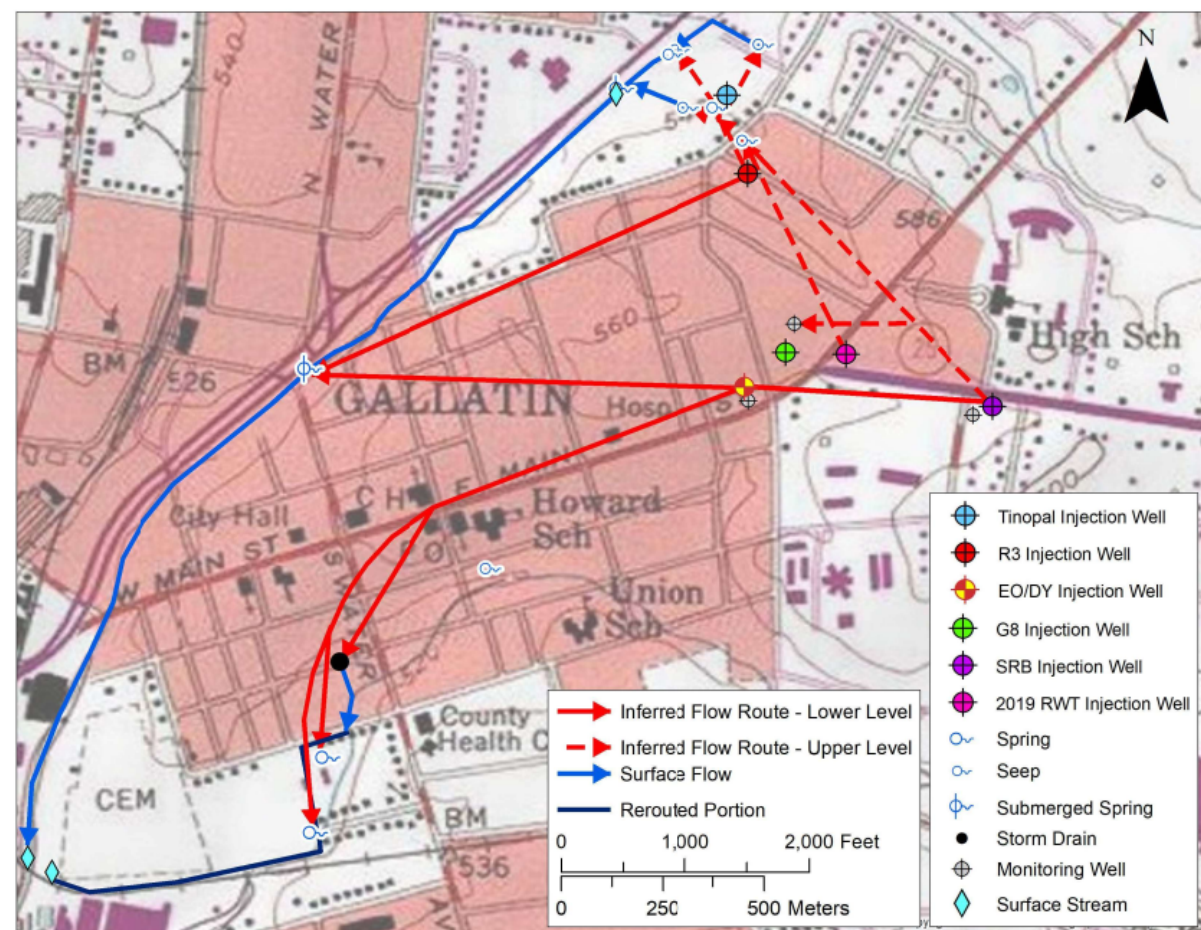


Figure 25. Inferred Groundwater Flow Path Map – Facility Testing

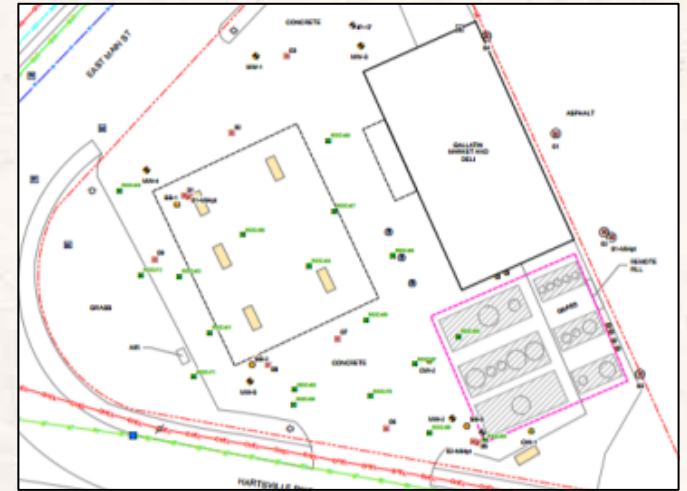
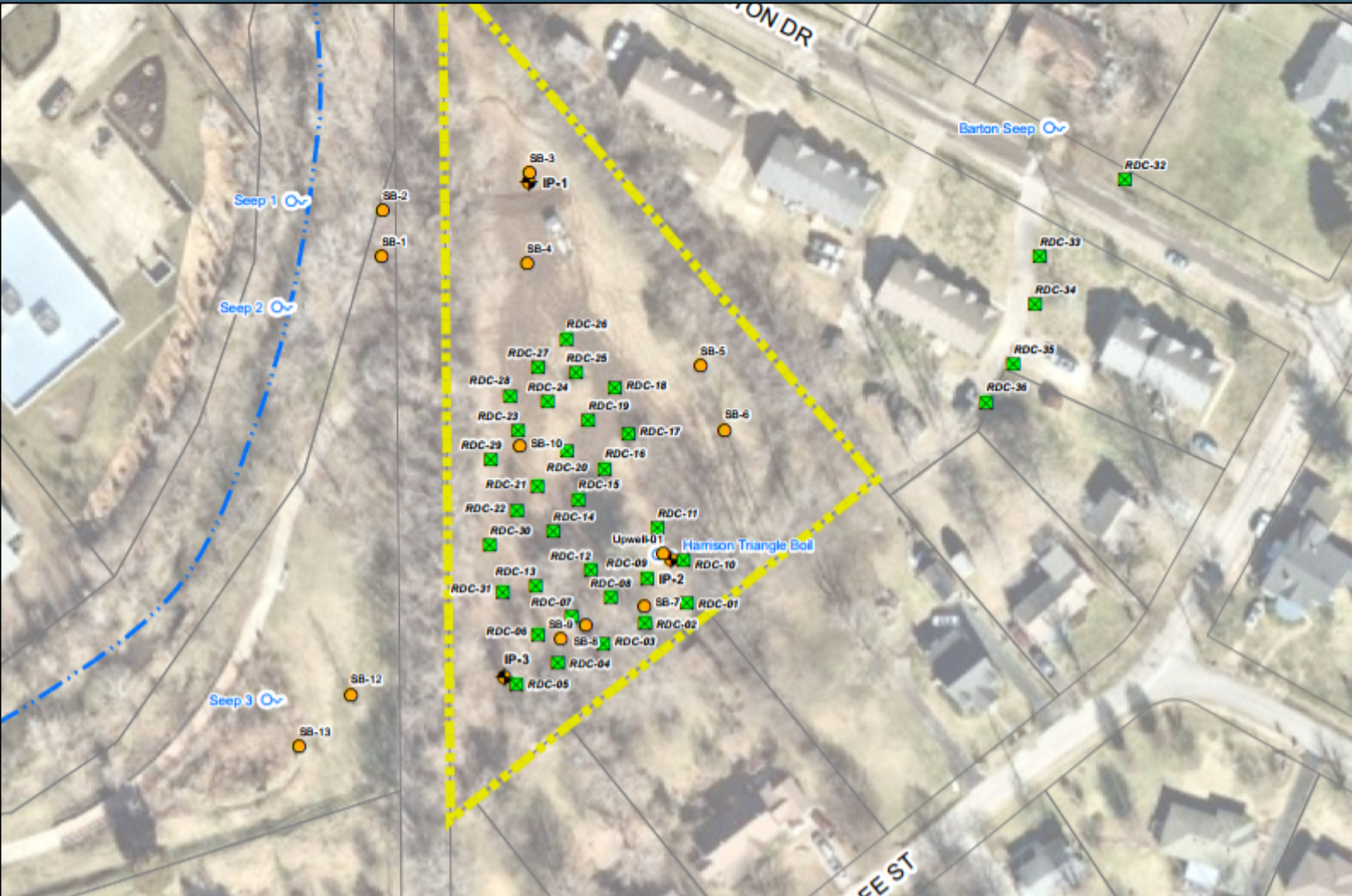
Interim Corrective Action Jent Seep Vault – July 2020



Interim Corrective Action Bedrock BOS 200[®] Injection – July 2020



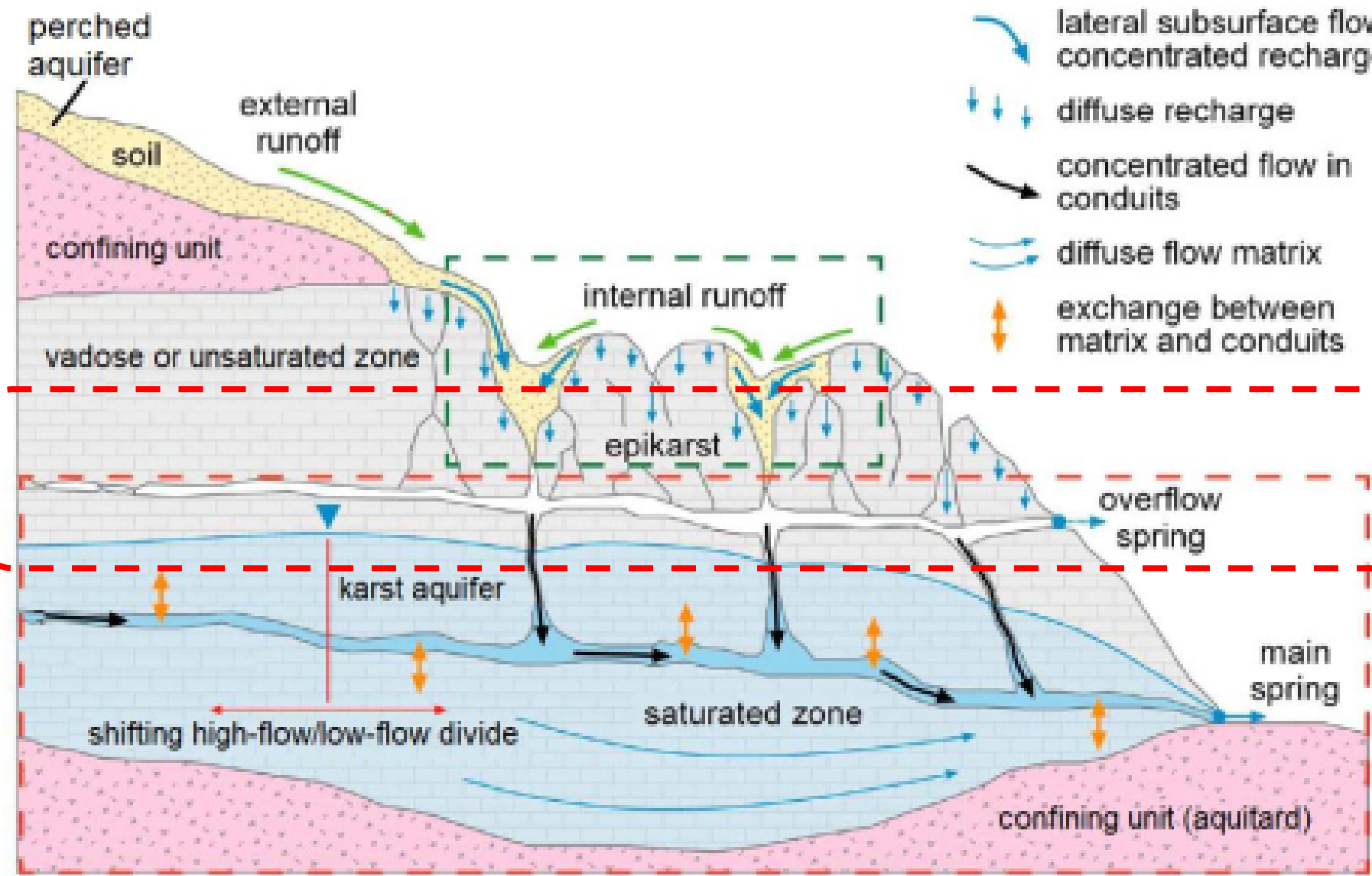
Remedial Design Characterization (RDC) – August 2021



Greenway/ Δ Field Overburden and Morton Avenue Epikarst GeoTAP™ BOS 200® Injection



a)



(modified from Hartmann et al., 2014)

Epikarst



Introducing RPI Group's **GeoTAP™** Pre-Drill Process

*Advancing the Science of
Optimized Injections*



Morton Ave Pilot-Scale Injection

300' Section Road Centerline
30 Points Installed, 10' Spacing
18 Points Intersected Epikarst
Channels and Were Injected

**GEOLOGICAL
TARGETED
ACCESS
POINT**



Direct-Push Refusal

**PACKER
REQUIRED**

Competent Bedrock,
Fractured Rock

**DIRECT
PUSH
FRIENDLY**

Cobble, Sandstone,
Caliche, Course Gravel,
Construction Debris

Silt, Sand, Clay

Gallatin Market BOS 200[®] Overburden Injections – March 2023



GeoTAP™ Barrier Installation – April and May 2023



GeoTAP™ Full-Scale Barrier Installation – April and May 2023



The Numbers

Bedrock Injection – July 2020

- IP Wells (4): 8,000 lbs. BOS 200®
- Jent Vault/Carbon Bed: 4,500 lbs. BOS 200®

Triangle Field Overburden Injections – March thru April 2022

- 555 Injection Points, 13, 875 ft², 5' Δ Grid
- 16,650 lbs. BOS 200®, 11,100 lbs. gypsum

Morton Avenue GeoTAP™ Pilot Scale Injection – May 2022

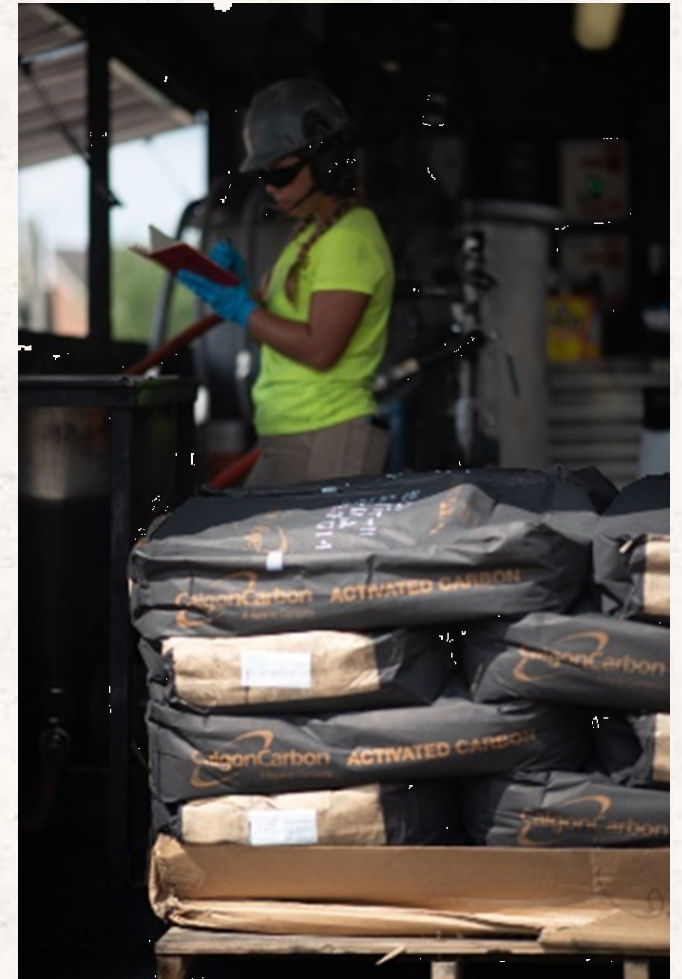
- 30 GeoTAP™ Points Installed at 10' Spacing
- 18 Points Injected (Accessed Epikarst Channels)
- 12,000 lbs. of BOS 200®, 6,000 lbs. Gypsum

Gallatin Market Overburden Injections – April 2023

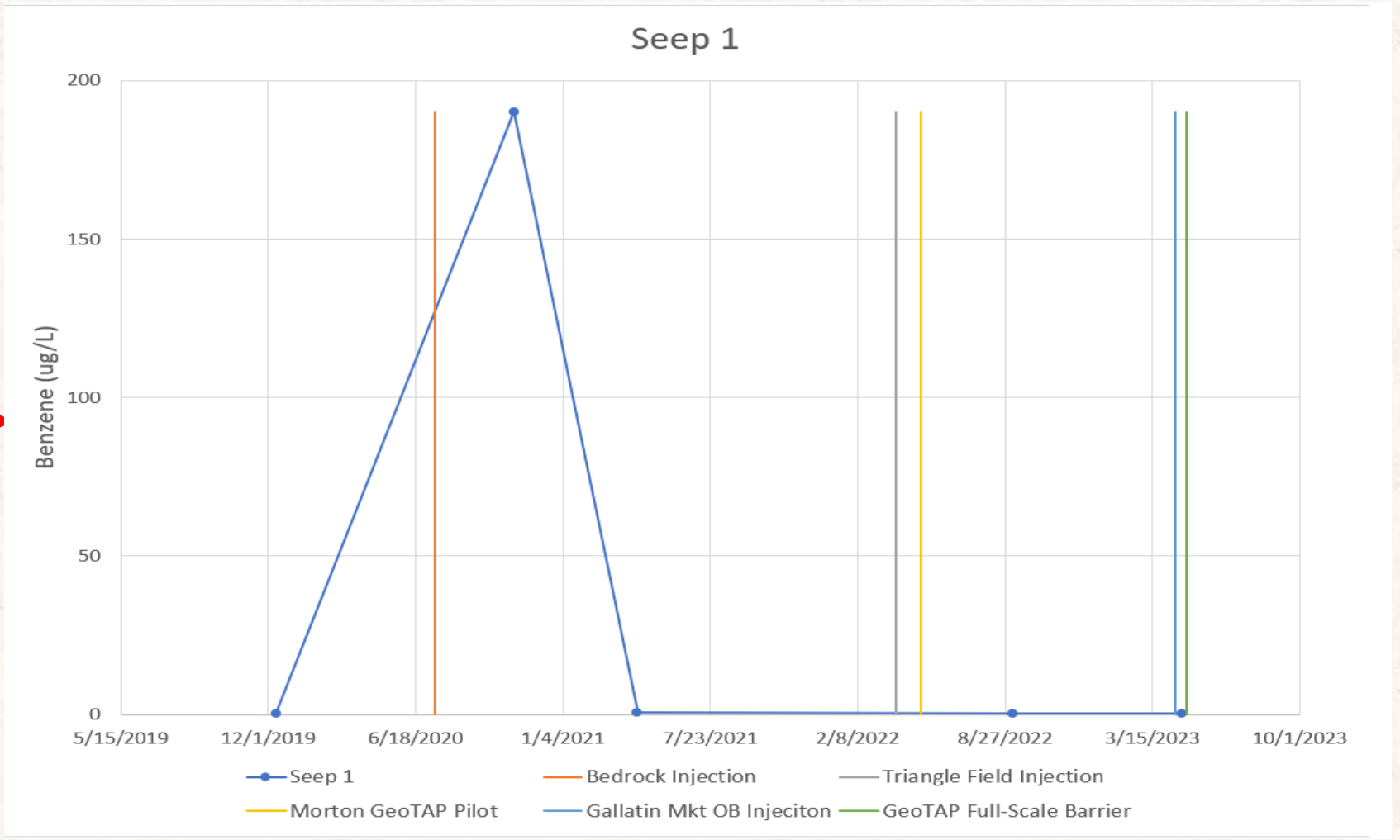
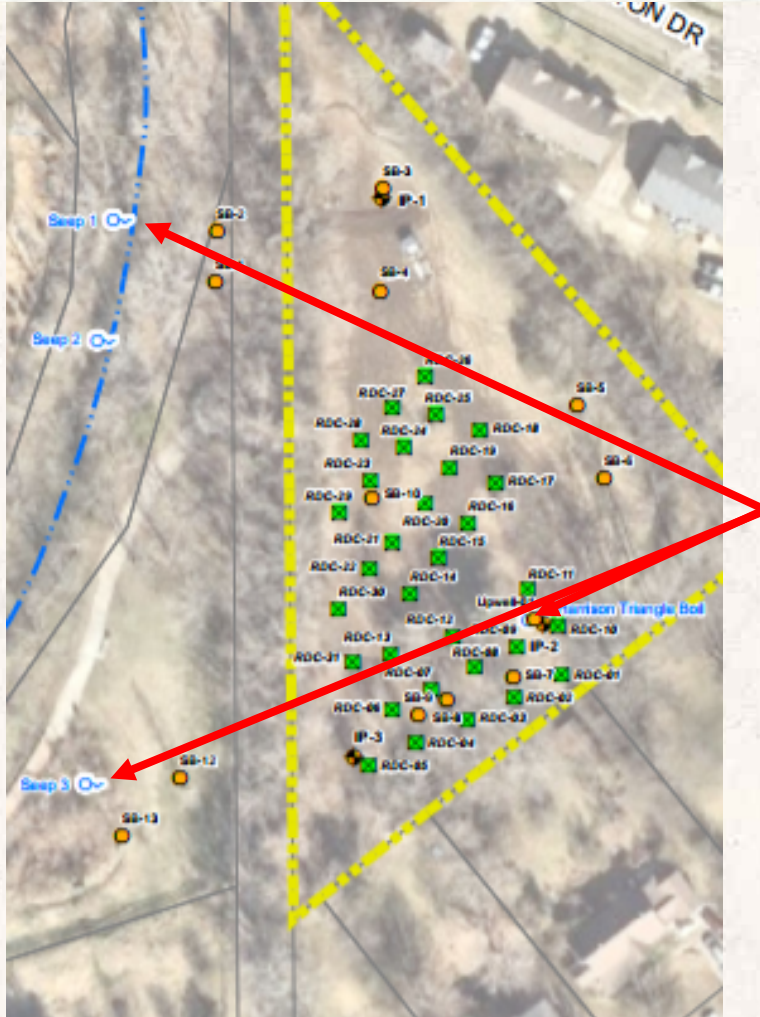
- 205 Injection Points, ~5,100 ft² Area, 5' Δ Grid
- 13,600 lbs. BOS 200®, 8,750 lbs. Gypsum

GeoTAP™ Barrier Full-Scale Injection – April and May 2023

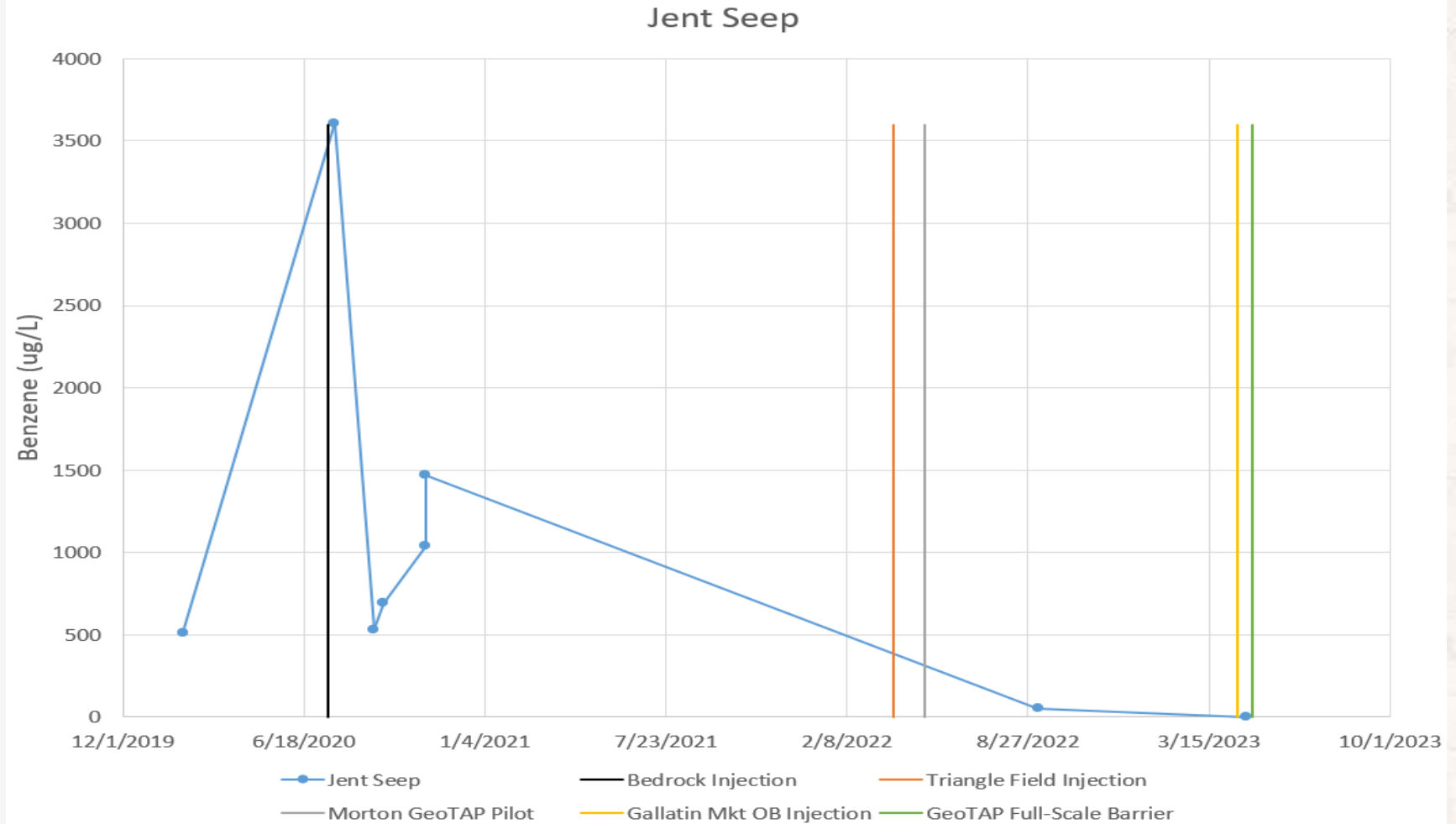
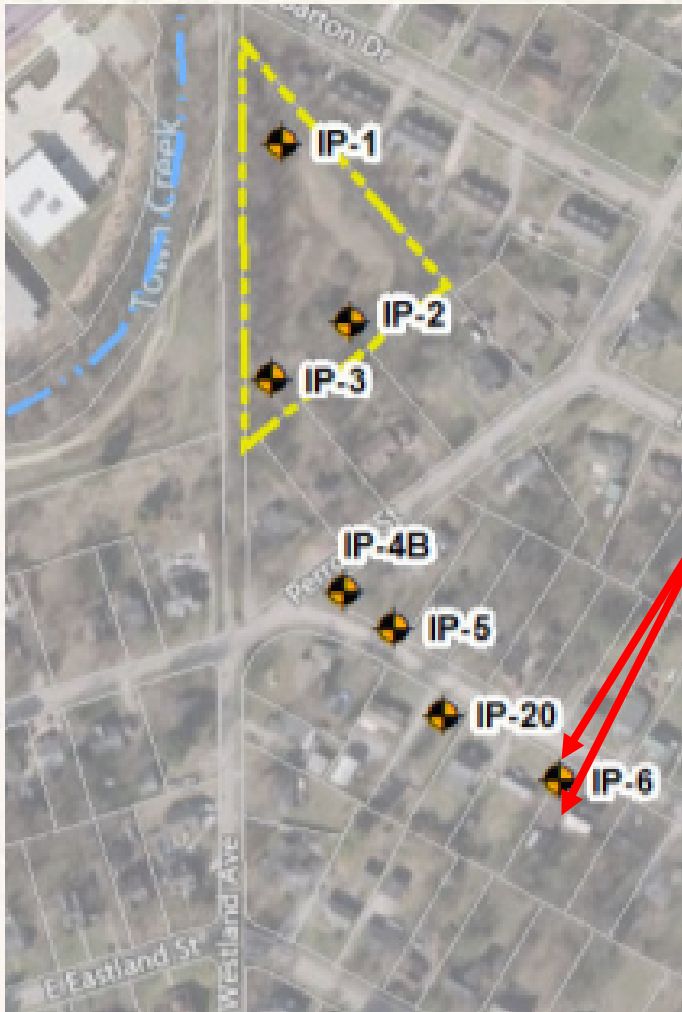
- 43 GeoTAP™ Points Installed at 10' Spacing
- 48,000 lbs. BOS 200®, 24,000 lbs. Gypsum



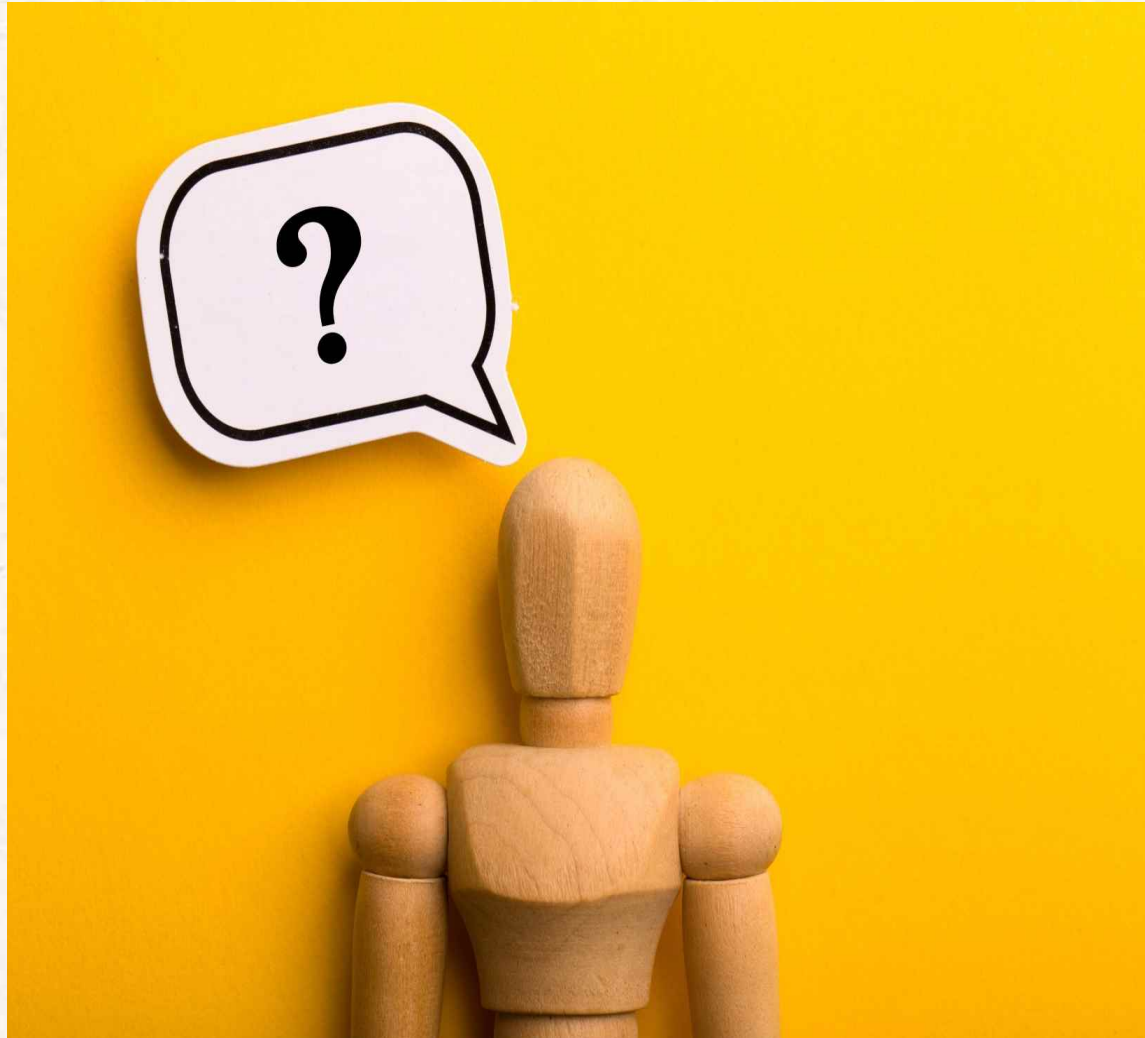
Performance as of today (May 2023)



Performance as of today (May 2023)



Final Actions



Thank You For Joining Me

AST Webinars: <https://astenv.com/webinars/>

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