Memorandum

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Date: November 17, 2023

Re: Final Screening Evaluation Memorandum
GTAC 7-1-343 – Nockamixon TCE Site
Nockamixon Township, Bucks County, Pennsylvania

Groundwater & Environmental Services, Inc. (GES) has prepared this Screening Evaluation Memorandum on behalf of the Pennsylvania Department of Environmental Protection (DEP) for the Nockamixon TCE Site (Site), located in Nockamixon Township, Bucks County, Pennsylvania. The purpose of this Screening Evaluation Memorandum is to: discuss the components and results of additional remedial investigation activities; detail the remedial technology screening evaluation and rough cost estimating effort; and make recommendations for future work at the Site based on the new information obtained from these studies.

Background

The Site area is rural and comprises undeveloped land, farmland, residences, and businesses, including multiple residential and commercial properties located along Durham Road, Easton Road, Cord Way, Mountain View Drive, Tower Road, Brennan Road, and Park Drive West in Nockamixon Township, Bucks County, Pennsylvania. The source of the groundwater contaminant plume has been identified as a former 77.2-acre farm (Schulberger Farm) located on Brennan Road. A school is located on Durham Road and a quarry is located east of Easton Road. Nockamixon State Park is located to the west and southwest, and the Revere Chemical NPL Site is located northeast of the Site. A Site Location Map is included as **Figure 1** and a Site Map is included as **Figure 2**.

Groundwater contamination was initially discovered at the Site in 2002 when public water supply sampling was conducted at a restaurant located at the intersection of Durham Road and Easton Road by the Bucks County Health Department (BCHD). Laboratory data indicated that trichloroethene (TCE) was detected in the restaurant supply well. During subsequent potable well sampling conducted by DEP, additional contaminated wells were identified on Durham Road, Easton Road, Cord Way, Mountain View Drive, Tower Road, Brennan Road, and Park Drive

West. To date, more than 100 potable wells have been sampled, with 42 of those wells exceeding the Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L) for TCE. In addition to TCE, tetrachloroethene (PCE), 1,1-dichloroethene (1,1-DCE), and 1,4-dioxane (1,4D) have also been detected above their respective MCLs or PA Residential Used Aquifer MSCs in at least one potable well. DEP funded the installation of point-of-entry treatment (POET) systems for each of the residential private well water supplies with concentrations of contaminants which exceeded the MCLs.

Based upon groundwater sampling results, aerial photography analysis, and other investigations, the former Schulberger Farm has been identified as the source of contamination. The 77.2-acre Schulberger Farm, which was subdivided into nine parcels in 1978, housed drums of unknown contents which were removed from the Site in 1980. The source areas primarily include two drum storage areas: one in the north area of the former farm and one in the south. In addition to the drums, evidence suggests that other wastes may have been deposited or buried at the Site. Soil sampling, passive soil gas screening, and active soil gas screening investigations revealed elevated concentrations of chlorinated solvents in the areas where the former drums had been stored.

Site-Specific Geology and Hydrogeology

The local geologic and hydrogeologic conditions have been examined in a number of Site investigation activities and are described as follows.

Local Geologic Conditions

The work of previous consultants described the geology at the Site as comprising bedrock of the Triassic to Jurassic-aged Brunswick and Lockatong Formations overlain by unconsolidated soils. The unconsolidated overburden soils were identified as the Reaville channery silt loam, which is classified as farmland of statewide importance and is characterized as somewhat poorly drained with a very high potential for runoff.

Bedrock at the Site is relatively shallow, particularly in the vicinity of the former drum storage areas. Measured depths to bedrock (soil thicknesses) at the Site have been observed to range from one foot below ground surface (bgs) to 14.5 feet bgs, with an average of 5.8 feet bgs.

Based on a previous assessment completed by GES and included in the Conceptual Site Model (CSM) submitted with the Final Remedial Investigation Work Plan for the Site, the top of bedrock is observed to dip to the southwest in the northern project area in the vicinity of the suspected source areas and to the west further south in the project area. It should be noted that the northeast former drum storage area is located on the western edge of the bedrock high, and the southwest former drum storage area is located slightly down dip from the northeast drum storage area. A geologic map, published by the Pennsylvania Geological Survey was reviewed to assess bedrock structure in the area. Bedrock strike and dip measurements provided on this Pennsylvania Geological Survey map for the Site vicinity range from a north-south strike with a westerly dip direction to a northwest-southeast strike with a southwesterly dip direction, which are consistent

with the observed structure contours for the Site vicinity. This bedrock structure appears to strongly influence groundwater flow and contaminant plume distributions in groundwater.

Local Hydrogeologic Conditions

Unconsolidated overburden soils do not contain a water-bearing zone. At times of heavy recharge, these materials are wet, as water slowly percolates and recharges the bedrock aquifer; however, there is no true overburden aquifer present at the Site. The water table only begins at a significant depth within the bedrock unit.

The Brunswick and Lockatong Formation aquifers have been described by Morin et. al (2000) in a study conducted on seven wells in nearby Lansdale, Pennsylvania, as follows:

The Brunswick Group and the underlying Lockatong Formation are composed of lithified Mesozoic sediments that constitute part of the Newark Basin in southeastern Pennsylvania. These fractured rocks form an important regional aquifer that consists of gradational sequences of shale, siltstone, and sandstone, with fluid transport occurring primarily in fractures.

Additionally, Inners (1980) describes development of secondary porosity features in these rock units in nearby Nockamixon State Park, in the following:

Joints, or naturally occurring, mostly planar fractures, are extremely well developed in the rocks underlying Nockamixon Park. Several distinct groups, consisting of near-vertical fractures that repeat at regular intervals, are present at most outcrops….. Generally, they are spaced less than 12 inches apart in the sedimentary rocks and hornfels and 12 to 48 inches apart in the diabase.

From this information, it is expected that groundwater flow in the bedrock aquifer will be dominated by movement through well-developed and regularly-spaced secondary porosity features, including movement along bedding plane partitions and through joint development. Given that this secondary porosity is well developed and regularly spaced, it is assumed that plume movement in the aquifer will behave similarly to a homogenous aquifer, but with the possibility for some deflections of plume movement associated with the orientation of the secondary porosity features. Irregular plume movement and distribution like what would be associated with a karst environment is not expected here.

Groundwater in the vicinity of the Site has been investigated through the installation of a series of bedrock monitoring wells at 12 locations. A number of the locations include nested well pairs to separate the upper and lower portion of the aquifer. Monitoring wells completed in the shallower upper zone of the bedrock aquifer have depths ranging from 119-196 feet bgs, with an average depth of 149 feet bgs. Monitoring wells completed in the deeper portion of the bedrock aquifer or left as open holes have depths ranging from 187-300 feet bgs, with an average depth of 250 feet bgs.

Additional details related to Site hydrogeology are included in the CSM included in the Final Remedial Investigation Work Plan prepared by GES and submitted to DEP on April 28, 2021.

Additional Remedial Investigation Activities

Based on the evaluation of the data obtained from the fracture trace study and surficial geophysical investigation summarized in the Technical Memorandum dated January 7, 2022, GES recommended and completed a number of additional remedial investigation activities. Details related to specific methodologies and sampling requirements of these activities were included in the Final Remedial Investigation Work Plan and Sampling Analysis Plan that was submitted to DEP on April 28, 2021. The specific activities that were conducted and the results are summarized below.

Additional Site Inspection and Initial Surface Water Sampling

GES identified an additional potential surface water feature located on the property at 338 Park Drive West, which is northwest of the confirmed surface water feature previously identified and inspected by GES and DEP. DEP coordinated access to the property at 338 Park Drive West. This area was discussed in the Technical Memorandum dated January 7, 2022, and is identified on **Figure 2** as the Additional Site Visit Investigation Area.

DEP and GES conducted the site visit to identify any surface water or wetland features present on the property on March 17, 2022. The result of the site visit to 338 Park Drive West was relatively inconclusive due to heavy precipitation at the time; however, additional surface water drainage channels were identified. While on-site for the inspection, GES and DEP traveled to the previously identified wetland-type area and collected a surface water sample (SW-1) from an identified spring/seep. Based on field observations, it was believed that this spring/seep location was a direct discharge of groundwater to surface water. The surface water sample was collected directly into the necessary bottleware, and submitted to Eurofins Lancaster Laboratories Environmental (ELLE) of Lancaster, Pennsylvania for analysis of volatile organic compounds (VOCs), and 1,4D. The laboratory analytical results from the SW-1 sample indicated concentrations of TCE, PCE, and cis-1,2-dichloroethene above the applicable Chapter 93 Surface Water Quality Criteria (SWQC). All surface water analytical data are included in **Table 1**. The surface water sample locations are identified on **Figure 2**.

Surface Water Investigation and Sampling

Based on the results of the fracture trace study conducted in June 2021 and the results of a subsequent site visit/initial surface water sampling on March 17, 2022, GES recommended collection of surface water samples from the surface water features and wetland areas identified. The exact number and location of samples was not pre-determined and sample locations were selected in the field on June 22, 2022. A total of five (5) additional surface water samples were collected (SW-2 through SW-4, SW-6, and Hall Pond). The surface water sample locations are identified on **Figure 2**.

The surface water samples were collected directly into the necessary bottleware, and submitted to ELLE for analysis of VOCs via EPA Method 8260C, and 1,4D via 8260SIM. The laboratory analytical results from the SW-2 sample indicated concentrations of TCE, cis-1,2-dichloroethene, and vinyl chloride above the applicable Chapter 93 SWQC. It should be noted that other VOCs

were detected at concentrations below the applicable Chapter 93 SWQC and several laboratory detection limits exceeded the applicable Chapter 93 SWQC. All surface water analytical data are included in **Table 1**.

Soil/Rock Core Boring Locations

GES subcontracted Eichelbergers, Inc. (Eichelbergers) of Mechanicsburg, Pennsylvania to complete the installation of two (2) soil boring/rock cores to assess soil and bedrock for the presence of source impacts. The soil boring/rock coring activities were completed between October 25 and November 14, 2022. The soil/rock core boring locations (RC-1 and RC-2) were strategically placed based on the findings of the surficial geophysical investigation completed in June 2021 and reported in the January 2022 Technical Memo. The rock core locations are identified on **Figure 2**. Soil boring/rock core locations RC-1 and RC-2 were advanced to a depth of 150 feet below ground surface (bgs) and 250 feet bgs, respectively. Please note that RC-1 was intentionally installed within the known source area to identify the presence of free product, if any, in overburden or bedrock.

The soil boring/rock core locations were installed via hollow stem auger drilling methodologies. The overburden material was logged and sampled utilizing split-spoon sampling methods, and PQ™ wireline tooling (3.375" diameter) was utilized to advance the rock core boring to the terminal depth.

The composition, color, texture, and moisture content of the soil was monitored during advancement of the soil boring and recorded on a boring/coring log. The soil/rock boring locations were sampled within the overburden at the interval of the highest and/or elevated PID readings, visual observation of impacts, and at the soil/bedrock interface. A total of four (4) soil samples were collected from both RC-1 and RC-2. The soil samples were submitted to ELLE for analysis of VOCs via EPA Method 8260C. The soil sample results are included in **Table 2**. A copy of the subsurface soil boring/rock core logs are included as **Attachment A**.

Rock coring was initiated upon encountering competent bedrock to define the rock surface and stratigraphy to the depths indicated above. Competent rock was encountered at 9 feet bgs in both RC-1 and RC-2. Following extraction of the core, the following information was documented by GES field personnel:

- Total recovery
- Solid recovery
- Rock core descriptions
- Core photographs
- Presence of fractured zones
- Saturation
- Presence/absence of NAPL

Select rock core samples were crushed and submitted to ELLE for laboratory analysis of VOCs via EPA Method 8260C. The rock sample depths are included in **Table 2**. GES field personnel

also visually inspected and scanned each rock core with an ultra-violet light (blacklight) for the presence of any free product or non-aqueous phase liquid (NAPL). During the rock coring activities, no free product or NAPL were identified. Copies of the subsurface soil boring/rock core logs are included as **Attachment A**.

Additionally, rock core samples were submitted to GeoStructures, Inc. (GeoStructures) in King of Prussia, Pennsylvania for physical property analysis to determine rippability of the shallow/weathered bedrock zone. The first ~10 feet of rock core extracted from RC-1 and RC-2 were submitted for this analysis. GeoStructures determined that the shallow/weathered rock was not conducive to excavation via tradition means and classified the two weathered rock zones as 'hard ripping' or 'extremely hard ripping & blasting'. These results indicate that pneumatic hammering and/or blasting would be required to excavate weathered rock in the area of investigation. A copy of GeoStrucutres report is included as **Attachment B**.

At the completion of each soil/rock core boring, the rock cores were contained in core boxes and properly labeled. Additionally, the boreholes were marked accordingly for future downhole geophysical investigation and horizontal/vertical data were collected via handheld global positioning system (GPS) device. All cores were transported to the Rutgers University Geological Core Repository in Piscataway, NJ.

Investigation derived waste (IDW) generated during the soil/rock core boring installation activities was containerized in 55-gallon drums, transported, disposed of off-site at a DEP-approved facility. Lewis Environmental Group (Lewis) of Royersford, Pennsylvania completed the IDW disposal activities, and all drums were disposed of at VLS Lancaster, LLC in Lancaster, Pennsylvania. Copies of the waste manifests are included in **Attachment C**.

Downhole Geophysics

GES subcontracted Advanced Geological Services, Inc. (AGS) of Malvern, Pennsylvania to conducted a downhole geophysical investigation at RC-1 and RC-2 following the completion of the soil/rock core boring installation to: evaluate the bedrock characteristics in the drilled locations to identify potential water-bearing fracture zones; confirm structural orientation of joints and fractures in the rock; describe lithology; and characterize borehole water flow directions. The downhole geophysical logging utilized the following tools:

- Three-Arm Caliper measuring variations in borehole diameter as a function of depth;
- Heat Pulse Flow Meter measuring vertical flow within the borehole;
- Fluid Temperature measuring changes in fluid temperature as a function of depth;
- Optical Televiewer providing an undistorted 360-degree view of the borehole;
- Acoustical Televiewer providing a 360-degree acoustical image of the borehole;
- Gamma Ray measuring radioactivity from geologic units encountered in the borehole;
- Fluid Resistivity providing fluid column dissolved solids data;

- Short and Long Normal Resistivity measuring electrical resistivity of current passing through bedrock material; and
- Single Point Resistivity used to detect fractures in the borehole following variations in the resistivity of the bedrock.

Geophysical logging results were evaluated to determine bedrock characteristics that will assist remedial option evaluation for source area groundwater. Additionally, GES and DEP reviewed the downhole geophysical logs and proposed discreet groundwater sampling intervals in each of the two rock core locations. These intervals were selected based on the identified water bearing fractures and will be used to determine vertical dispersion of the bedrock aquifer impacts and if any downward migration from the source area overburden may be occurring. A copy of the downhole geophysical results report prepared by AGS is included as **Attachment D**.

Rock Core Groundwater Sampling

Based on the evaluation of the downhole geophysical investigation and field observations, GES and DEP determined appropriate groundwater sampling intervals in RC-1 and RC-2. DEP deployed PDB samplers at the selected intervals for vertical characterization within the open rock core boreholes. DEP conducted two (2) rounds of groundwater sampling from the rock core locations on January 17 and April 27, 2023.

The groundwater samples were submitted to ELLE for analysis of VOCs via EPA Method 8260C. The laboratory analytical results from the rock core locations and previous annual monitoring well sampling activities are included on **Table 3**. Please note that only the VOC parameters that had detections above the laboratory method detection limits (MDLs) were tabulated and evaluated. Overall, the groundwater analytical results were relatively consistent between the two sampling events, and indicated that the highest concentrations above the applicable DEP SHS for the COCs occurred within the shallower water bearing zones (RC-1 @ 103’ and 117’ and RC-2 @ 112’ and 142’). However, the samples collected from the deeper water bearing zones within RC-2 exhibited concentrations above the applicable DEP SHS, which indicates a likely downward migration of contamination with the fractured bedrock.

Rock Core Downhole Camera Inspection

GES mobilized to the site on May 16, 2023 to conduct a downhole camera inspection of the rock core boreholes. This effort was completed to determine if any cascading or seeping water was entering the borehole from the unsaturated portion of the overburden, weathered rock, or shallow water bearing fractures. Given the known shallow impacts to soil and the potential for infiltration through the unsaturated overburden, there exists the possibility for transport of COCs into the boreholes from the unsaturated overburden and entering deeper zones. The results of the downhole camera inspection did indicate seeping water from the soil-bedrock interface, from within the weather bedrock zones, and from some fractures within competent bedrock. Rock core location RC-1 had seeping water present at approximately 11.65 feet and 51.71 feet below top-of-casing (TOC), and rock core location RC-2 had pooling water observed at 15.65 feet below TOC and seeping water from 33.5-38.2 feet below TOC. Based on these observations, there is

potential downward migration within the boreholes from the overburden and shallow bedrock zone (above the static water table).

Recommendations for Additional Remedial Investigation Activities

Based on the evaluation of the data obtained from the additional remedial investigation, GES has prepared the following recommendations for additional data collection and monitoring at the Site as part of the continued remedial investigation and recommended remedial approach.

Soil/Rock Core Boring Permanent Well Construction

Based on the findings of the additional RI activities described above, GES recommends installation of permanent monitoring wells within the open rock boreholes at RC-1 and RC-2. It is proposed to install 2-inch diameter PVC monitoring wells screen across the higher impacted target zones (RC-1: 116' and RC-2: 141.5' and 145'). These monitoring wells will allow for continued groundwater monitoring and post-remediation monitoring, and may also be utilized for injection purposes during remedial activities (dependent on the recommended/selected remedy).

The following specific construction is recommended for the RC-1 and RC-2:

RC-1 (Target zone ~116')

- Flush Mount Construction
- Steel casing sealed into competent bedrock (already in place
- Seal 2" PVC from ground surface to 101'
- Bentonite plug 101' – 103'
- Sand/Filter Pack 103' – 125'
- PVC well screen 105' – 125'
- #00 Sand 125' – 130'
- Grout seal 130' – Bottom (150')

RC-2 (Target zones ~141.5' & 145')

- Flush Mount Construction
- Steel casing sealed into competent bedrock
- Seal 2" PVC from ground surface to 131'
- Bentonite plug 131' – 133'
- Sand/Filter Pack 133' – 155'
- PVC well screen 135' – 155'
- #00 Sand 155' – 160'
- Grout seal 160' – Bottom (250')

Technology Screening

As outlined in the Remedial Investigation Work Plan (GES, April 2021), technologies were screened for three different areas of concern at the site: source area overburden soils, source area bedrock groundwater, and non-source area bedrock groundwater. GES developed the following preliminary list of remedies which were included in the initial screening.

Potential Remedies for Each Area

Source Area Overburden Soils	Source Area Bedrock Groundwater	Non-Source Area Bedrock Groundwater
Soil Excavation – Off-site Disposal Soil Excavation – On-site Treatment Soil Vapor Extraction In-situ Thermal Treatment Soil Mixing *Engineering Controls* *Vapor mitigation, Surface Barrier* *Institutional Controls* No Action	Groundwater Recovery In-situ Thermal Treatment In-situ Chemical Reduction In-situ Chemical Oxidation Carbon Injection Enhanced biodegradation Monitored Natural Attenuation Engineering Controls *POET and vapor mitigation systems* Hydraulic control *Institutional Controls* No Action	Monitored Natural Attenuation *Engineering Controls* *POET and vapor mitigation systems* *Institutional Controls* No Action

Notes:
Items that are italicized are likely not appropriate as stand-alone solutions; however, may be necessary during and/or after the selected remedy.

The preliminary remedial action objectives (RAOs) which were identified for the purpose of this technology screening are as follows:

- Remediate the source area soils on-site to eliminate the continuing source from impacting bedrock groundwater.
- Reduce or eliminate surface water contact with source area soils which may be further contributing to bedrock groundwater.
- Prevent or eliminate pathway for direct contact with source area soils.
- Reduce potential vapor intrusion from source area soils.
- Reduce bedrock groundwater concentrations on-site to prevent further off-site migration.

Additional preliminary remediation goals (PRGs) and RAOs, as well as identification of the Applicable or Relevant and Appropriate Requirements (ARARs) will be outlined in more detail in the Remedial Alternatives Analysis, under separate cover. The following sections include a brief description of each technology, the likelihood that it will achieve the preliminary RAOs, if it is being retained for further evaluation as part of the Remedial Alternatives Analysis, and a preliminary cost estimate for implementation.

Source Area Overburden Soils

The soil isoconcentration map for PCE was used to estimate the extent of the highest areas for soil concentrations as a target for source area overburden soil remediation. The current assumed estimated areas are shown on **Figure 3**. These areas, along with the average depth to bedrock (6.5 ft bgs) were used to estimate the volume of soil to be remediated for the purpose of estimated ballpark costs for each of the options below. Additional soil delineation may be completed as part of pre-design investigation for each of the options outlined below, to confirm exact dimensions of the source area overburden soils

No Action

Under the "no action" remedial alternative, no further action would be taken to mitigate the threat of site-related contamination. Contaminants would remain in place in subsurface soils, and continue to act as a source to bedrock groundwater VOC concentrations and impacts to downgradient potable wells; therefore, this alternative is not protective of human health and the environment.

This alternative will serve as a baseline to compare against other alternatives in the Remedial Alternatives Analysis.

Engineering Controls and Institutional Controls

As stated in the table above, one or more engineering controls and/or institutional controls may be needed as part of the selected remedy for the source zone soils on-site; however, they would not be used as a stand-alone remedy, as no engineering control or institutional control can achieve all of the RAOs listed above. One engineering control that would reduce or remove the adsorbed-phase source from contacting surface water, and would eliminate the open pathway to direct contact is surface capping. However, surface capping would require routine long-term inspection/maintenance and would not eliminate or reduce the potential for vapor intrusion. Use of impervious caps is more typical in a commercial or industrial setting, where a cap may be incorporated into large foundations or asphalt parking areas. For these reasons, surface capping is not being considered further for the subject property.

In addition, an institutional control, such as an environmental covenant, could prohibit soil disturbance and prevent direct contact with contaminated soil; however, it would not remove or reduce the adsorbed-phase source which is acting as a continuing source for bedrock groundwater impacts.

Soil Excavation – Off-site Disposal

Excavation of contaminated unsaturated soil is a feasible remedial alternative for the site, as it would result in the removal of the adsorbed-phase concentrations, thereby, removing the ongoing source from further distribution into bedrock groundwater. Soil excavation with offsite disposal could be executed in a fashion that results in the elimination of unsaturated soil contaminant mass.

It is assumed that areal extent of the excavation would be consistent with the general areas of PCE and TCE concentrations above SHS in soil; therefore, two excavation areas would be required. To implement excavation in the identified areas, clearing and grubbing of the areas would first be required. Excavation would be completed down to the depth to bedrock (ranging from 3.5 to 9.5 feet below ground surface). The rippability analysis determined that neither the highly to moderately weathered nor the fresh to slightly weathered bedrock is able to be excavated using conventional machinery. Following the completion of excavation activities, the excavated soil would be transported off-site for disposal, and certified clean fill material would be utilized as backfill to match existing surface grades.

The estimated cost for the removal of source area soil for off-site disposal (assumed to be approximately 13,500 cubic yards), **$3.7 to $4.6 million**. The largest impact on the cost for this alternative is the off-site disposal fee.

Soil Excavation – On-site Treatment (Ex-situ Soil Stabilization)

As stated in the previous section, excavation of the unsaturated soils in the source areas is a feasible technology; would result in the removal of the adsorbed-phase concentrations; thereby removing the ongoing source from continuing distribution into bedrock groundwater. Similarly, soil excavation with on-site treatment will result in the elimination of unsaturated soil contaminant mass. Therefore, this alternative is considered to be protective of human health and the environment.

The difference between excavation with off-site disposal versus excavation with treatment on-site is that the on-site treatment process will take up a larger footprint of the site, and the timeframe to implement the remedy will be longer. The process utilizes mechanical mixing of soils with cementitious binding reagents, to create a solid structure of increased unconfined compressive strength and reduced permeability. This reduces the leaching of unsaturated source zone contaminants by limiting contact between infiltrated surface water and impacted soils. As soil stabilization will result in expansion of the original soil volume, a portion of the excavated soil will still need to be disposed of off-site. In addition, the stabilized soil must be reinstalled below the frost line to protect it from freeze/thaw cycles.

Additional soil delineation may be completed as part of pre-design investigation to confirm exact dimensions of the areas to be excavated. The current assumed estimated areas are shown on **Figure 3**. Initial ballpark cost estimates for on-site treatment via soil stabilization, based on an estimated 13,500 cubic yards of unsaturated soils is **$3.3 to $4.2 million**. The cost of design is higher for this option; however, the cost of treatment on-site is slightly lower than the cost for off-site disposal, making it more cost effective to treat on-site based on the volume of soil.

Soil Vapor Extraction

SVE is a commonly utilized remediation technique for the treatment of contaminated soil in the vadose zone. SVE systems utilize blowers to apply vacuum at extraction wells

(either vertical or horizontal), allowing for the recovery of soil vapors from unsaturated soils. As air moves through contaminated soils in the vadose zone, VOCs, including adsorbed-phase organic compounds, are transferred into the vapor stream for recovery.

At the subject site, the depth of the impacted soil is shallow, and the depth to bedrock in the affected areas varies between 3.5 and 9.5 feet below ground surface; therefore, implementing SVE at the site may be challenging. Shallow impacts will require the SVE wells (either vertical or horizontal) to be screened relatively shallow within the soil, which will result in the SVE wells being prone to short-circuiting to the surface. Additional topsoil or other cover could be added to the surface to reduce short-circuiting. In addition, although installing horizontal wells is likely to be a more efficient approach than vertical wells, due to the size of the impacted areas, this would be difficult due to the presence of shallow bedrock in some areas. In addition, the site is known to have poor soil drainage and is high in clay content, both which could contribute further to the challenges of recovering soil vapors effectively from the impacted areas.

As there are two separate areas with soil impacts, each area would require a separate SVE system to be pilot tested, designed, and installed, increasing the cost. Although an SVE approach may face challenges described above, the estimated cost for implementing SVE in the soil source areas, assuming horizontal wells, and 3 years of operation is approximately **$3.3 to $4.1 million**. If remediation is required after 3 years, then the cost per year is approximately $125,000.

In-Situ Thermal Treatment (ISTT)

Implementation of ISTT of soils in the unconsolidated zone and the upper bedrock zone would serve as a viable remedial alternative for the Property. ISTT consists of heating the subsurface to facilitate volatilization followed by contaminant extraction and treatment. For the given site conditions, a Thermal Conductive Heating (TCH) approach would be effective at remediating VOC impacts in unsaturated soil. To complete this, TCH wells would be drilled, and electric heaters would be installed to heat the soil to the required temperature to volatize the contaminants. During the TCH process, vapors would be captured from the vadose zone utilizing an SVE system. The extracted vapors will be moisture-laden due to the temperature of the vapors; therefore, a vapor-liquid separator will be used to separate condensate from the vapor stream prior to treatment. Condensate would either be treated on-site for discharge, or disposed of off-site. Although groundwater recovery (later section) was not retained due in part to the limited options for discharging treated groundwater on-site, it is anticipated that obtaining a temporary discharge permit for discharge to the surface may be feasible for this technology, as it is only estimated to operate for a short period of time (approximately 23 weeks). If this technology is chosen as the final remedy, treatment versus disposal of the condensate will be further evaluated at that time. Additional topsoil would likely need to be imported to provide adequate capture of the volatized contaminants in order to overcome the limited vadose zone in some areas of the Property, and the challenges described in the previous section for SVE as a stand-alone treatment.

During the ISTT process, power to heat the soil would come from the local power grid; therefore, costs include the estimated power drop installation and associated electrical fees. The treatment system is not any louder than a typical SVE system; however, if noise is a concern with the nearby residences, sound attenuation can be built into the design of the system. The estimated cost for implementing ISTT for the source area soils (assumed to be 13,500 cubic yards), is **$4.15 to $5.1 million.**

Soil Mixing (In-situ soil stabilization)

In-situ soil mixing involves the use of mechanical mixing of in-situ soils with cementitious binding reagents, to create a solid structure of increased unconfined compressive strength and reduced permeability. This reduces the leaching of unsaturated source zone contaminants by limiting contact between infiltrated surface water and impacted soils.

As the depth to bedrock in the impacted source area soils is highly variable, this would result in the potential for some of the deeper source material to be missed during in-situ soil mixing. In addition, as the stabilized soils should not be exposed to freezing and thawing cycles, the top 3 feet of the soil would not be included in the in-situ stabilization, but would instead need to be excavated and backfilled with clean soil. As a result of these complications, in-situ soil stabilization may not be as viable of a solution as excavation (coupled with on-site treatment or off-site disposal) or ISTT. Therefore, this technology will not be further evaluated.

Source Area Bedrock Groundwater

No Action

Under the “no action” remedial alternative, no further action would be taken to mitigate the threat of site-related contamination. Contaminants would remain in place in bedrock groundwater, and continue to have the potential for off-site migration. This alternative serves as a baseline to compare against other alternatives, and will be further evaluated in the RAA.

Engineering Controls and Institutional Controls

As stated in the table above, engineering controls and/or institutional controls may be needed as part of the selected remedy for the source zone bedrock groundwater on-site; however, they would not be used as a stand-alone remedy, as they would not remove or reduce the dissolved-phase source.

Groundwater Recovery

Groundwater recovery of the bedrock groundwater under the on-site source area is considered to be a feasible remediation solution. Under this scenario, groundwater would be pumped from a series of recovery wells, treated via an on-site treatment system, and discharged to the closest surface water body. In order to further assess the viability of this technology, pump testing would be conducted to determine the groundwater extraction rates and radius of influence.

Groundwater recovery from bedrock is not likely to reduce contaminant concentrations in on-site groundwater in a short period of time. Based on GES' experience with other similar projects, groundwater extraction systems operate for a very long period of time (20-30 years) with minimal reduction in groundwater concentrations. Due to the property also containing a residential dwelling, installing a groundwater extraction and treatment system on the property may not be the most viable solution. The system would likely have components that are loud and would have increased cost to design with sound attenuation to meet residential noise ordinances. In addition, the system would require frequent maintenance by various contractors which would need ongoing access to the property over the life of operation.

Due to the fractured nature of bedrock, substantial additional analysis and testing would be required to determine the correct well locations and intervals from which to successfully extract the contaminated groundwater. Additionally, because the closest surface water body is Lake Nockamixon, which is within a State Park; obtaining authorization to discharge treated groundwater to this surface water may be difficult. Finally, reinjection of the large volume of treated groundwater into bedrock is likely not feasible due to the limited fractures available. For these reasons, this solution is not being further evaluated at this time.

In-Situ Thermal Treatment

Implementation of ISTT of bedrock groundwater would serve as a viable remedial alternative for the Property. ISTT consists of heating the subsurface to facilitate volatilization followed by contaminant extraction and treatment. For the given site conditions, a TCH approach would be very effective at remediating VOC impacts in bedrock groundwater, including CVOCs and 1-4-dioxane. To complete this, TCH wells would be drilled, and electric heaters would be installed to heat the saturated bedrock to the required temperature to volatize the contaminants. During the TCH process, vapors would be captured from the vadose zone utilizing an SVE system. The extracted vapors will be moisture-laden due to the temperature of the vapors; therefore, a vapor-liquid separator will be used to separate condensate from the vapor stream prior to treatment. Condensate would either be treated on-site for discharge, or disposed of off-site. Although groundwater recovery (per the previous section) was not retained due in part to the limited options for discharging treated groundwater on-site, it is anticipated that obtaining a temporary discharge permit for discharge to the surface may be feasible for this technology, as it is only estimated to operate for a short period of time (approximately 19 weeks). If this technology is chosen as the final remedy, treatment versus disposal of the condensate will be further evaluated at that time.

The estimated cost for implementing ISTT for the bedrock groundwater (assumed to be 277,000 cubic yards), is $**37.2 to 45.9 million**. The majority of this costs includes bedrock drilling to install the TCH wells, and the energy to heat and treat to the target treatment depths (estimated to be 90 to 250 ft bgs).

In-Situ Chemical Reduction

In-situ chemical reduction (ISCR) involves the injection of a reductive amendment to promote the reductive dechlorination reactions to reduce the CVOCs in the dissolved-phase; however, it should be noted that 1,4-dioxane is not amenable to reduction. There are various commercially available amendments; however, many of them include a carbon source and zero valent iron, in addition to other nutrients (such as sulfate). Some of these amendments also incorporate enhanced bioremediation; either by inducing reductive conditions that are amenable to support naturally occurring reductive dechlorinators, or by including the injection of bacterial colonies as part of the injection process.

Prior to selecting ISCR as the remedy for the bedrock groundwater, groundwater monitoring for existing groundwater chemistry parameters (e.g., DO, ORP, pH, conductivity, total iron, dissolved iron, sulfate, sulfide, total organic carbon) should be completed to assess the viability of ISCR. In addition, as this technology requires amendments (in the form of liquid solutions) to be injected into the subsurface, an injection feasibility test should be conducted prior to designing a full-scale ISCR program for the site.

During the ISCR process, there is the potential for the generation of daughter compounds (such as vinyl chloride); however, most ISCR products are designed to completely reduce the daughter products as well. However, as ISCR is an abiotic process, as opposed to enhanced reductive dichlorination (ERD), the production of daughter products should be minimal. There is also the risk for the production of methane due to undesirable colonies of methanogens proliferating in the subsurface. However, products also are available which are designed to reduce the production of methane. Based on the distance between the target treatment zone and the residences closest to the treatment zone (approximately 200 to 250 ft cross-gradient and down-gradient), it is not anticipated that the injection of ISCR amendments will have any adverse effects on the water quality. If injected reagents were to migrate to any of the residents, any organic carbon present in the amendments would be removed by the activated carbon in the POET system; however, unreacted sulfate would likely pass through. To alleviate concerns regarding this potential for migration, monitoring wells can be used to monitor for any changes in water chemistry between the treatment areas and the residences, to ensure that reagents are not migrating towards the residences. Additionally, if ISCR is the chosen technology for this site, further information from the pilot test and other site characteristics will be used to refine the design for the volume and rate of injections in order to ensure that the majority of the amendments are consumed prior to them migrating close to any of the site supply wells.

Although 1,4-dioxane is not amenable to ISCR, this technology is being retained for further evaluation, as 1,4-dioxane may be able to be addressed by another method in conjunction or following the completion of ISCR. Based on similar sites where ISCR has been conducted, the estimated cost for implementing this remedy, including contingency is approximately **$0.9 to $1.2 million**. This is based on the assumption that six injection wells would provide adequate distribution of the amendments into the subsurface, and

assumes that one 5 week-long injection event would be conducted, followed by monitoring for the completion of the reduction process.

In-Situ Chemical Oxidation

In-situ chemical oxidation (ISCO), similar to ISCR, uses an injection pump to dispense a known volume and concentration of oxidants into the subsurface through injection points. This advanced oxidation process breaks down chlorinated compounds including CVOCs and 1,4-dioxane in the groundwater into end-products of carbon dioxide and water.

Chemical oxidation is a potentially viable remedial alternative for the dissolved-phase site contaminants, including CVOCs and 1,4-dioxane. Various types of commercially available ISCO technologies, such as RegenOx® or PersulfOx® may be applicable for the site. As this approach requires the injection of oxidants in the form of a liquid into the subsurface, an injection feasibility test should be conducted prior to designing a full-scale ISCO program for the site. Based on the distance between the target treatment zone and the residences closest to the treatment zone (approximately 200 to 250 ft cross-gradient and down-gradient), it is not anticipated that the injection of ISCO amendments will have any adverse effects on the water quality. To alleviate concerns regarding this potential for migration, monitoring wells can be used to monitor for any changes in water chemistry between the treatment areas and the residences, to ensure that reagents are not migrating towards the residences. Additionally, if ISCO is the chosen technology for this site, further information from the pilot test and other site characteristics will be used to refine the design for the volume and rate of injections in order to ensure that the majority of the oxidants are consumed prior to them migrating close to any of the site supply wells.

Based on similar sites where ISCO has been conducted, the estimated costs for implementing this remedy, including contingency is approximately **$1.7 to 2.1 million**. This is based on the assumption that ten injection wells would provide adequate distribution of the amendments into the subsurface, and assumes that three week-long injection events would be conducted over a three-year period, followed by monitoring for the completion of the oxidation process.

Carbon Injection

Carbon injection is a potentially viable remedial option to reduce the dissolved-phase concentrations in bedrock groundwater. Various vendors have formulations of injectable activated carbon which are typically impregnated with ZVI and other compounds and nutrients. A mixture of the powdered carbon and nutrients is mixed with water and injected into the subsurface under pressure. Contaminants are sorbed onto the carbon and subsequently degraded by biological activity. A carbon-based injection approach may be a viable remedy for the bedrock groundwater at the subject site. Similar to the other in-situ approaches for groundwater discussed above, a feasibility test should be conducted to confirm that liquids can be injected into the bedrock at a sufficient rate for this approach to be effective.

Based on the distance between the target treatment zone and the residences closest to the treatment zone (approximately 200 to 250 ft cross-gradient and down-gradient), it is not anticipated that the injection of carbon-based amendments will have any adverse effects on the water quality. The injected amendments themselves will not migrate in groundwater, and monitoring wells between the injection area and the residences can be utilized to monitor for changes in groundwater chemistry.

Based on similar sites where carbon injection has been conducted, the estimated costs for implementing this remedy, including contingency is approximately **$4.7 to 6.0 million**.

Enhanced Biodegradation

Biodegradation is a process in which naturally occurring microorganisms are utilized to metabolize chlorinated compounds, ultimately breaking them down to ethene and ethane. Natural hydrocarbon biodegradation processes can be enhanced through the addition of electron donors or acceptors, hydrocarbon degrading bacteria, and/or nutrients. These enhancement products are typically liquids that are injected into the subsurface aquifer at low flow rates. As the solution is injected, it disperses through the aquifer, facilitating bacteria colony growth and enhancing natural hydrocarbon degradation.

Enhanced biodegradation (also referred to as enhanced reductive dechlorination [ERD]) is considered to be a potentially applicable technology for the remediation of CVOCs at the site; however, 1,4-dioxane degradation can be inhibited or slowed in the presence of chlorinated ethenes. Additional groundwater chemistry data is needed to determine the prevailing microbiological process and the appropriate enhancement. Modeling would also need to be completed to ensure the enhanced biodegradation capacity is adequate for the mass flux of the contaminants through the injection zone.

Additional sampling and modeling is needed prior to determining if this approach would be appropriate for the site, an accurate estimate of the cost for implementation cannot be provided. However, it should also be noted that enhanced biodegradation can also occur naturally in conjunction with ISCR, ISCO, and carbon injection technologies, as they will promote conditions for biotic reduction or oxidations to occur. However, an estimated cost for implementing enhanced biodegradation as a stand-alone remedy is approximately **$0.5 to $0.7 million**.

Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) is a method that relies on monitoring the natural processes for reduction in site contaminants over time, which occur from natural physical (dilution, evaporation, sorption), chemical (abiotic reactions), and biological (aerobic/anaerobic) processes. An MNA program typically includes monitoring for stable or decreasing trends in dissolved-phase concentrations, as well as monitoring for parameters that demonstrate natural attenuation processes are occurring. These additional parameters typically include dissolved oxygen (DO), pH, oxidation-reduction potential (ORP), sulfate, iron, manganese, nitrate, and methane.

MNA is a potentially applicable for the project site; however, as noted in the previous section, 1,4-dioxane is not as amenable to natural biodegradation. In addition, this option will require monitoring for multiple years; therefore, it is a longer timeframe option than other options evaluated (estimated 10 years minimum). However, an estimated cost for the MNA approach is approximately **$0.3 to 0.4 million**.

Non-Source Area Bedrock Groundwater

No Action

Under the "no action" remedial alternative, no further action would be taken to mitigate the threat of site-related contamination. Contaminants would remain in place in bedrock groundwater,and continue to have the potential for off-site migration. This alternative serves as a baseline to compare against other alternatives, and will be further evaluated in the RAA.

Engineering Controls and Institutional Controls

As stated in the table above, engineering controls and/or institutional controls are currently in place (i.e., POET systems and Environmental Covenants), and may also be needed as part of the selected remedy for the non-source area bedrock groundwater on-site; however, they would not be used as a stand-alone remedy, as they would not remove or reduce the dissolved-phase source.

Monitored Natural Attenuation

MNA is a method that relies on monitoring the natural processes for reduction in site contaminants over time, which occur from natural physical (dilution, evaporation, sorption), chemical (abiotic reactions), and biological (aerobic/anaerobic) processes. An MNA program typically includes monitoring for stable or decreasing trends in dissolved-phase concentrations, as well as monitoring for parameters that demonstrate natural attenuation processes are occurring. These additional parameters typically include DO, pH, ORP, sulfate, iron, manganese, nitrate, and methane.

MNA is a potentially applicable for the non-source area bedrock groundwater. This is under the assumption that a more effective technology will be selected to address the higher concentrations present in the source-area bedrock groundwater, which will reduce further migration of concentrations to the outer portions of the plume. As noted in the previous section, 1,4-dioxane is not as amenable to natural biodegradation; however, the concentrations outside the source area are lower than in the source area, and may be manageable with an MNA approach combined with engineering controls. An estimated cost for the MNA approach for non-source area groundwater is **$0.5 to $0.7 million**.

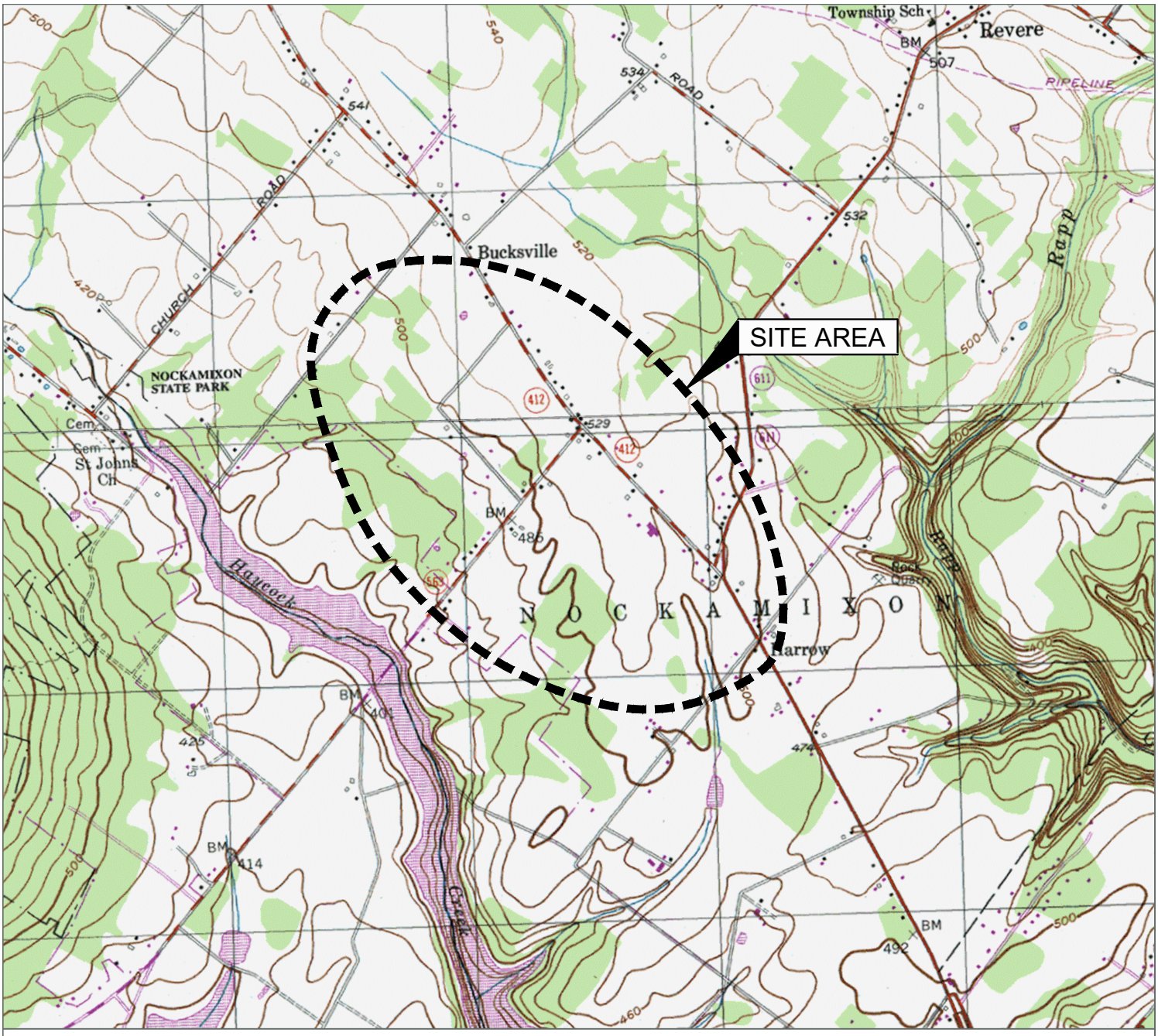
Summary

Pending review of this Screening Evaluation Memorandum and upon further discussion with DEP, GES will finalize a plan for preparation of the complete Remedial Alternatives Analysis (RAA) for the site, and move forward with completion of the well locations at rock core locations RC-1 and RC-2.

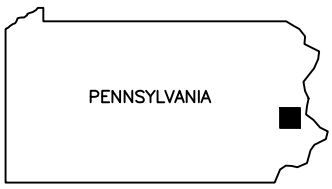
Please contact Tim Uhler at 610.458.1077 ext. 3071 or at TUhler@gesonline.com with any questions or comments regarding the information presented in this Technical Memorandum.

Figures

Figure 1 – Site Location Map



Source:
USGS 7.5 Minute Series
Topographic Quadrangle, 1997
Riegelsville, Pennsylvania
Bedminster, Pennsylvania
Contour Interval = 20'



QUADRANGLE LOCATION

Site Location Map

Pennsylvania Dept of Environmental Protection
Nockamixon TCE Site
84 Brennan Road, Nockamixon Township
Ottsville, Pennsylvania

Drawn
T.P.
Designed
M.E.T.
Approved
T.F.U.

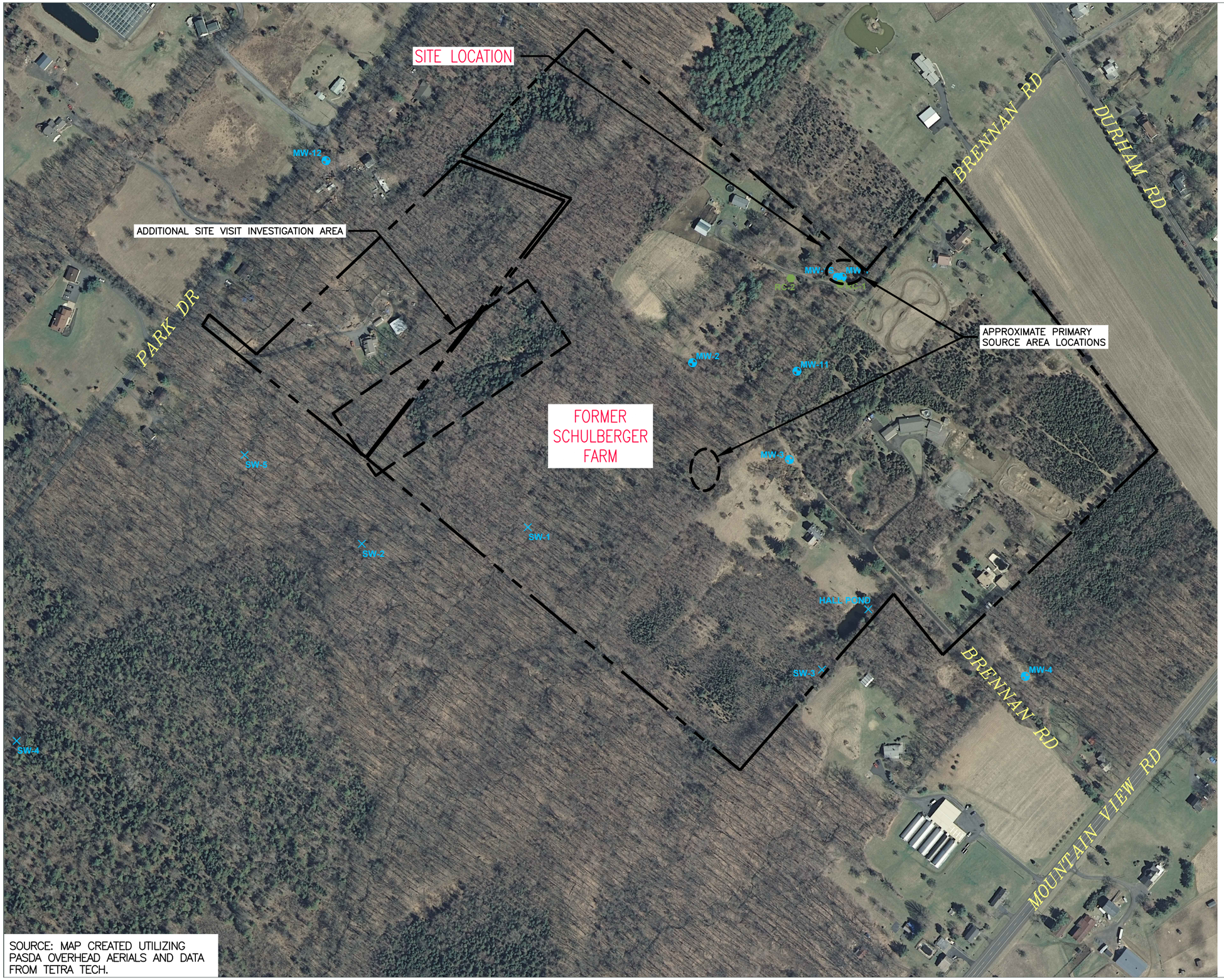
Date
08/27/21
Figure
1

Scale In Feet
0 2,000

Groundwater & Environmental Services, Inc.

N:_Corporate\Graphics-Exton\Exton\PADEP-GTAC-IRRSC\GTAC\GTAC Nockamixon TCE Site\Nockamixon SLM.dwg, SLM

Figure 2 – Site Map



SOURCE: MAP CREATED UTILIZING PASDA OVERHEAD AERIALS AND DATA FROM TETRA TECH.

LEGEND

- FORMER SCHULBERGER FARM PROPERTY
- MONITORING WELL
- SOIL/ROCK CORE BORING LOCATION
- SURFACE WATER SAMPLE

Site Map

Pennsylvania Dept of Environmental Protection
Nockamixon TCE Site
84 Brennan Road, Nockamixon Township
Ottsville, Pennsylvania

Drawn T.P.
Designed T.F.U.
Approved T.F.U.

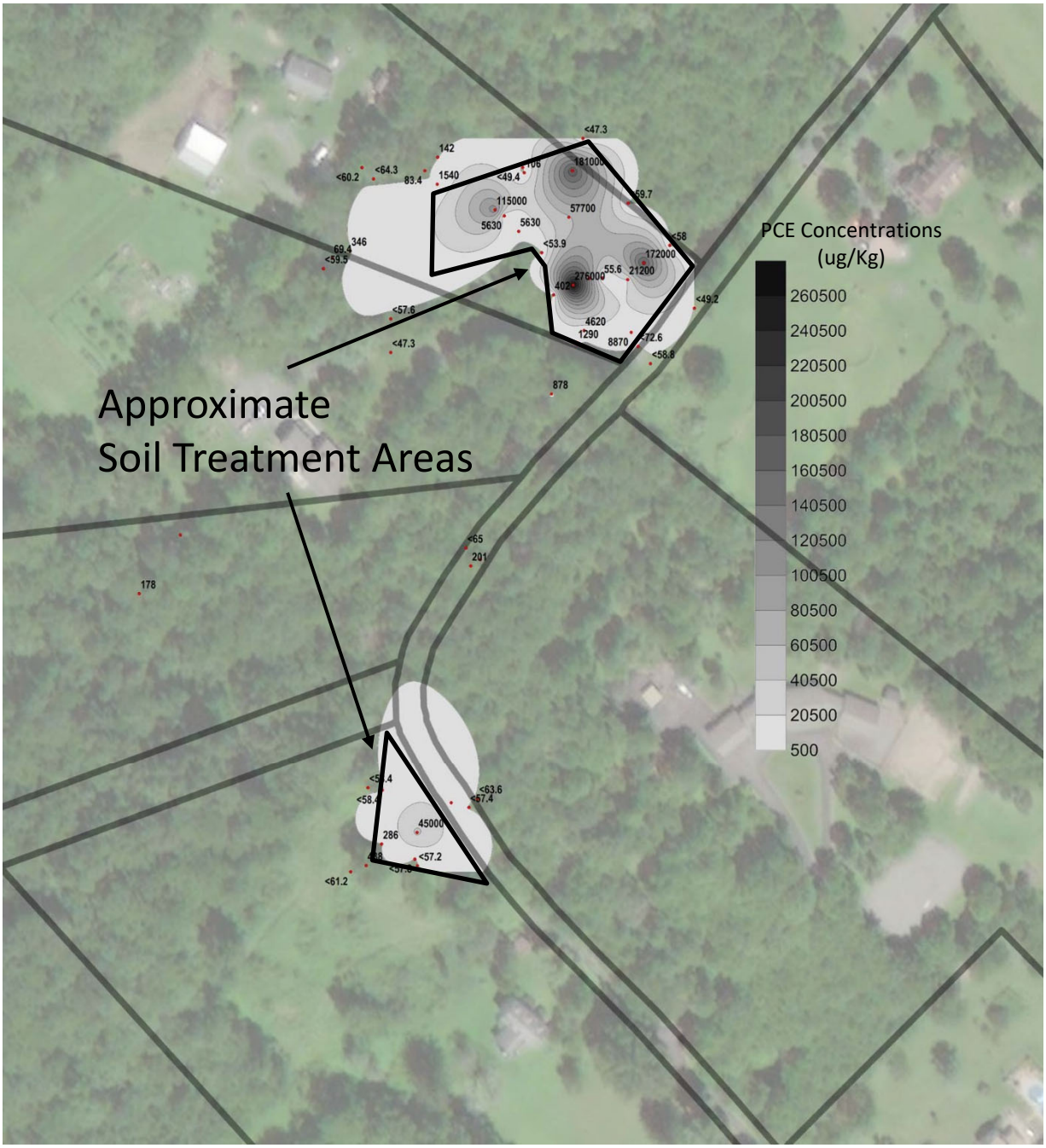
Date 11/13/23
Figure 2

Scale In Feet
0 300

Groundwater & Environmental Services, Inc.

N:_Corporate\Graphics-Exton\Exton\PADEP-GTAC-IRRSC\GTAC\GTAC Nockamixon TCE Site\Nockamixon SM.dwg, B(SM 300), TPeters

Figure 3 – Approximate Soil Treatment Areas



Total Estimated Volume of Soil Treatment
is 13,500 cubic yards

Approximate Soil Treatment Areas

PA Dept of Environmental Protection
Nockamixon TCE Site
84 Brennan Road, Nockamixon Township
Ottsville, Pennsylvania

Drawn
H.M.K.
Designed
H.M.K.
Approved
T.F.U.

Date
10/9/23
Figure
3

Scale In Feet
0 Approximate 4,000

Groundwater & Environmental Services, Inc.

Tables

Table 1 – Surface Water Analytical Data Summary

Table 1

Surface Water Analytical Data Summary

Sampling Event	Sample Location	Sample Date	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	1,2,4-Trichlorobenzene	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane	1,3-Dichlorobenzene	1,4-Dichlorobenzene (*p*-Dichlorobenzene)	1,4-Dioxane	2-Butanone (Ethyl methyl ketone)	2-Hexanone (Methyl *n*-butyl ketone)	4-Methyl-2-pentanone (Methyl isobutyl ketone)
			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria for Continuous Concentrations			**610**	**210**	**680**	**NS**	**1,500**	**26**	**NS**	**NS**	**160**	**3,100**	**2,200**	**69**	**150**	**NS**	**32,000**	**4,300**	**5,000**
DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria for Criteria Maximum Concentration			**3,000**	**1,000**	**3,400**	**NS**	**7,500**	**130**	**NS**	**NS**	**820**	**15,000**	**11,000**	**350**	**730**	**NS**	**230,000**	**21,000**	**26,000**
DEP Chapter 93 Surface Water Quality Standards for Human Health			**10,000**	**0.2**	**0.55**	**NS**	**33.0**	**0.07**	**NS**	**NS**	**1,000**	**9.9**	**0.90**	**7**	**300**	**NS**	**21,000**	**NS**	**NS**
DEP Groundwater SHS for a Used, Residential Aquifer			**200**	**0.84**	**5**	**31**	**7**	**70**	**0.2**	**0.05**	**600**	**5**	**5**	**600**	**75**	**6.4**	**4,000**	**63**	**2,800**
March 2022 Sampling Event	SW-1	03/17/22	16	ND<0.30	ND<0.30	1.2	4.0	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<29 ^c	ND<0.50	ND<0.40	ND<0.50
	Field Blank #1	03/17/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<29 ^c	ND<0.50	ND<0.40	ND<0.50
	Trip Blank #1	03/11/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<29 ^c	ND<0.50	ND<0.40	ND<0.50
June 2022 Sampling Event	SW-2	06/22/22	0.91	ND<0.30	ND<0.30	0.99 J	0.88 J	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	0.72	ND<0.50	ND<0.40	ND<0.50
	SW-3	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	SW-4	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	Duplicate (SW-4)	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	SW-6	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	Hall Pond	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	Field Blank	06/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50
	Trip Blank	06/10/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.17	ND<0.50	ND<0.40	ND<0.50

Notes:
DEP: Pennsylvania Department of Environmental Protection
SHS: Statewide Health Standard
N/A: Not applicable
NS: No standard
µg/L: micrograms per liter
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
^c: CCV Recovery is outside acceptance limits
ND<#: Indicates analysis was performed for the compound but it was not detected (# is the method detection limit)
Yellow Shaded: Indicates laboratory method detection limits exceed the DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health, or the DEP SHS (when there was no Chapter 93 Surface Water Quality Criteria)
Red Shaded: Indicates concentrations exceed the DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health.
Green Shaded: Indicates a concentration was detected.
Concentrations with no cooresponding Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health were compared to the DEP Groundwater SHS.
The standard for 1,3-dichloropropene was used for both *cis*-1,3-dichloropropene and *trans*-1,3-dichloropropene.

Table 1

Surface Water Analytical Data Summary

Sampling Event	Sample Location	Sample Date	Acetone	Benzene	Bromodichloromethane (Dichlorobromomethane)	Bromoform (Tribromomethane)	Bromomethane	Carbon disulfide	Carbon tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane (Methyl Chloride)	cis-1,2-Dichloroethene (cis-1,2-Dichloroethylene)	cis-1,3-Dichloropropene	Cyclohexane	Dibromochloromethane (Chlorodibromomethane)	Dichlorodifluoromethane (Freon 12)	Ethylbenzene	Freon 113	Isopropylbenzene (Cumene)	Methyl acetate	Methyl tert-butyl Ether (MTBE)	Methylcyclohexane	Methylene chloride	Styrene	Tetrachloroethene (Tetrachloroethylene (PCE))	Toluene	trans-1,2-Dichloroethene (trans-1,2-Dichloroethylene)	trans-1,3-Dichloropropene	Trichloroethene (Trichloroethylene (TCE))	Trichlorofluoromethane (Fluorotrichloromethane (Freon 11))	Vinyl chloride	Xylenes, Total
			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		(µg/L)	(µg/L)	(µg/L)		(µg/L)		(µg/L)		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria for Continuous Concentrations			86,000	130	NS	370	NS	NS	560	240	NS	390	5,500	NS	61	NS	NS	NS	580	NS	NS	NS	NS	NS	2,400	NS	140	330	1,400	61	450	NS	NS	210
DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria for Criteria Maximum Concentration			450,000	640	NS	1,800	NS	NS	2,800	1,200	NS	1,900	28,000	NS	310	NS	NS	NS	2,900	NS	NS	NS	NS	NS	12,000	NS	700	1,700	6,800	310	2,300	NS	NS	1,100
DEP Chapter 93 Surface Water Quality Standards for Human Health			3,500	0.58	0.95	7.0	NS	NS	0.4	100	NS	5.7	NS	12	0.27	NS	0.8	NS	68	NS	NS	NS	NS	NS	20	NS	10	57	100	0.27	0.6	NS	0.02	70,000
DEP Groundwater SHS for a Used, Residential Aquifer			31,000	5	80	80	10	1,500	5	100	21,000	80	30	70	6.5	13,000	80	1,000	700	11,000	840	35,000	20	NS	5	100	5	1,000	100	6.5	5	2,000	2	10,000
March 2022 Sampling Event	SW-1	03/17/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	110	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	140	ND<0.20	1.1	ND<0.20	100	ND<0.20	ND<0.20	ND<0.40
	Field Blank #1	03/17/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	3.2	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	Trip Blank #1	03/11/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
June 2022 Sampling Event	SW-2	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	25	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	5.5	0.78 J	ND<0.30	ND<0.20	11	ND<0.20	3.2	ND<0.40
	SW-3	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	SW-4	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	Duplicate (SW-4)	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	SW-6	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	Hall Pond	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	Field Blank	06/22/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	1.9	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40
	Trip Blank	06/10/22	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<1.0	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.50	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.30	ND<0.20	ND<0.20	ND<0.40

Notes:
DEP: Pennsylvania Department of Environmental Protection
SHS: Statewide Health Standard
N/A: Not applicable
NS: No standard
µg/L: micrograms per liter
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
^c: CCV Recovery is outside acceptance limits
ND<#: Indicates analysis was performed for the compound but it was not detected (# is the method detection limit)
Yellow Shaded: Indicates laboratory method detection limits exceed the DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health, or the DEP SHS (when there was no Chapter 93 Surface Water Quality Criteria)
Red Shaded: Indicates concentrations exceed the DEP Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health.
Green Shaded: Indicates a concentration was detected.
Concentrations with no cooresponding Chapter 93 Surface Water Quality Fish and Aquatic Life Criteria or Standard for Human Health were compared to the DEP Groundwater SHS.
The standard for 1,3-dichloropropene was used for both *cis*-1,3-dichloropropene and *trans*-1,3-dichloropropene.

Table 2 – Soil and Rock Core Analytical Data Summary

Table 2

Soil and Rock Coring Analytical Data Summary

Sampling Event	Sample ID	Depth (ft)	Sample Date	Soil Condition	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	1,2,4-Trichlorobenzene	1,2-Dibromo-3-chloropropane	1,2-Dibromoethane (Ethylene Dibromide)	1,2-Dichlorobenzene	1,2-Dichloroethane	1,2-Dichloropropane	1,3-Dichlorobenzene	1,4-Dichlorobenzene (p-Dichlorobenzene)	2-Butanone (Methyl ethyl ketone)	2-Hexanone (Methyl n-butyl ketone)	4-Methyl-2-Pentanone (Methyl isobutyl ketone)	Acetone	Benzene	Bromodichloromethane	Bromoform (Tribromomethane)	Bromomethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroethane	Chloroform
					(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
DEP Soil to Groundwater Values for Unsaturated/Saturated Soil in a Residential, Used Aquifer					**20,000**	**84**	**500**	**3,100**	**700**	**27,000/ 7,000**	**20**	**5**	**60,000**	**500**	**500**	**61,000/ 60,000**	**10,000/ 7,500**	**400,000**	**6,300**	**280,000**	**3,100,000**	**500**	**8,000**	**8,000**	**1,000**	**150,000**	**500**	**10,000**	**2,100,000**	**8,000**
DEP Soil to Groundwater Values for Unsaturated/Saturated Soil in a Non-Residential, Used Aquifer					**20,000**	**430**	**500**	**16,000**	**700**	**27,000/ 7,000**	**20**	**5**	**60,000**	**500**	**500**	**61,000/ 60,000**	**10,000/ 7,500**	**400,000**	**26,000**	**780,000**	**8,800,000**	**500**	**8,000**	**8,000**	**1,000**	**620,000**	**500**	**10,000**	**8,800,000**	**8,000**
DEP Residential Direct Contact Numeric Values (0-15 feet)					**10,000,000**	**7,600**	**3,800**	**280,000**	**3,800,000**	**39,000**	**29**	**740**	**3,800,000**	**17,000**	**120**	**10,000,000**	**40,000**	**10,000,000**	**570,000**	**10,000,000**	**10,000,000**	**57,000**	**12,000**	**400,000**	**95,000**	**10,000,000**	**75,000**	**950,000**	**10,000,000**	**19,000**
DEP Non-Residential Direct Contact Numeric Values Surface Soil (0-2 feet)					**10,000,000**	**38,000**	**16,000**	**1,400,000**	**10,000,000**	**160,000**	**370**	**3,700**	**10,000,000**	**85,000**	**600**	**10,000,000**	**200,000**	**10,000,000**	**2,400,000**	**10,000,000**	**10,000,000**	**280,000**	**60,000**	**2,000,000**	**400,000**	**10,000,000**	**370,000**	**3,900,000**	**10,000,000**	**96,000**
DEP Non-Residential Direct Contact Numeric Values Subsurface Soil (2-15 feet)					**10,000,000**	**44,000**	**18,000**	**1,600,000**	**10,000,000**	**190,000**	**420**	**4,200**	**10,000,000**	**98,000**	**690**	**10,000,000**	**230,000**	**10,000,000**	**2,700,000**	**10,000,000**	**10,000,000**	**330,000**	**69,000**	**2,300,000**	**460,000**	**10,000,000**	**430,000**	**45,000,000**	**10,000,000**	**110,000**
Soil Boring Investigation November 2022	RC-1 @ 4'-4.5'	4-4.5	10/26/22	Unsaturated	21	ND<0.46 ^c	ND<0.57	ND<0.57	0.67 J	ND<5.7	ND<0.57 ^c	ND<0.46	ND<0.57	ND<0.69	ND<0.57	ND<0.57	ND<0.46	ND<2.3	ND<1.1 ^c	ND<1.1	23	ND<0.57	ND<0.46	ND<5.7	ND<0.80	ND<0.69	ND<0.57	ND<0.57	ND<1.1	ND<0.69
	RC-1 @ 4'-4.5' (DUPLICATE)	4-4.5	10/26/22	Unsaturated	94	ND<0.44 ^c	ND<0.55	ND<0.55	ND<0.55	ND<5.5	ND<0.44	ND<0.44	ND<0.55	ND<0.66	ND<0.55	ND<0.55	ND<0.44	ND<2.2	ND<1.1 ^c	ND<1.1	18 J	ND<0.55	ND<0.44	ND<5.5	ND<0.77	ND<0.66	ND<0.55	ND<0.55	ND<1.1	ND<0.66
	RC-1 @ 4.75'-5.2'	4.75-5.2	10/26/22	Unsaturated	ND<0.59	ND<0.40 ^c	ND<0.49	ND<0.49	ND<0.49	ND<4.9	ND<0.49 ^c	ND<0.40	ND<0.49	ND<0.59	ND<0.49	ND<0.49	ND<0.40	ND<2.0	ND<0.99 ^c	ND<0.99	15 J	ND<0.49	ND<0.40	ND<4.9	ND<0.69	ND<0.59	ND<0.49	ND<0.49	ND<0.99	ND<0.59
	RC-1 @ 6'-6.5'	6-6.5	10/27/22	Unsaturated	ND<11,000	ND<100	ND<130	ND<130	ND<130	ND<1,30	ND<250	ND<100	ND<130	ND<150	ND<130	ND<130	ND<100	ND<510	ND<250	ND<250	ND<1,500	ND<130	ND<100	ND<1,300	ND<180 *+, ^c	ND<150	ND<510	ND<130	ND<250 ^c, *+	ND<150
	RC-1 @ 8.5'-9'	8.5-9	10/27/22	Unsaturated	71 J	ND<23	ND<29	ND<29	ND<29	ND<290	ND<58	ND<23	ND<29	ND<35	ND<29	ND<29	ND<23	ND<120	ND<58	ND<58	ND<350	ND<29	ND<23	ND<290	ND<41 *+, ^c	ND<35	ND<120	ND<29	ND<58 ^c, *+	ND<35
	RC-1 @ 88'-89'	88-89	11/01/22	Unsaturated	ND<0.53	ND<0.35	ND<0.44	ND<0.44	ND<0.44	ND<4.4	ND<0.44	ND<0.35	ND<0.44	ND<0.53	ND<0.44	ND<0.44	ND<0.35	3.1 J, ^c	ND<0.88 ^c	ND<0.88 ^c	65	ND<0.44	ND<0.35	ND<4.4	ND<0.62	ND<0.53	ND<0.44	ND<0.44	ND<0.88	ND<0.53
	RC-2 @ 1.5'-2'	1.5-2	11/03/22	Unsaturated	ND<0.69	ND<0.46 ^c, *+	ND<0.57	ND<0.57	ND<0.57	ND<5.7	ND<0.57 ^c	ND<0.46	ND<0.57	ND<0.69	ND<0.57	ND<0.57	ND<0.46	ND<2.3	ND<1.1 ^c	ND<1.1 ^c	38	ND<0.57	ND<0.46	ND<5.7	ND<0.80	ND<0.69	ND<0.57	ND<0.57	ND<1.1	ND<0.69
	RC-2 @ 4'-4.5'	4-4.5	11/03/22	Unsaturated	ND<0.69	ND<0.46 ^c, *+	ND<0.57	ND<0.57	ND<0.57	ND<5.7	ND<0.57 ^c	ND<0.46	ND<0.57	ND<0.69	ND<0.57	ND<0.57	ND<0.46	2.5 J	ND<1.1 ^c	ND<1.1 ^c	39	ND<0.57	ND<0.46	ND<5.7	ND<0.80	ND<0.69	ND<0.57	ND<0.57	ND<1.1	ND<0.69
	RC-2 @ 6'-6.5'	6-6.5	11/03/22	Unsaturated	0.75 J	ND<0.43 ^c, *+	ND<0.54	ND<0.54	ND<0.54	ND<5.4	ND<0.54 ^c	ND<0.43	ND<0.54	ND<0.65	ND<0.54	ND<0.54	ND<0.43	3.6 J	ND<1.1 ^c	ND<1.1 ^c	54	ND<0.54	ND<0.43	ND<5.4	ND<0.76	ND<0.65	ND<0.54	ND<0.54	ND<1.1	ND<0.65
	RC-2 @ 8.5'-9'	8.5-9	11/03/22	Unsaturated	ND<0.62	ND<0.41 ^c	ND<0.52	ND<0.52	ND<0.52	ND<5.2	ND<0.52 ^c	ND<0.41	ND<0.52	ND<0.62	ND<0.52	ND<0.52	ND<0.41	ND<2.1	ND<1.0 ^c	ND<1.1 ^c	28	ND<0.52	ND<0.41	ND<5.2	ND<0.72	ND<0.62	ND<0.52	ND<0.52	ND<1.0	ND<0.62
	RC-2 @ 102.5'-103'	102.5-103	11/09/22	Unsaturated	ND<0.56	ND<0.38	ND<0.47	ND<0.47	ND<0.47	ND<4.7	ND<0.47	ND<0.38	ND<0.47	ND<0.56	ND<0.47	ND<0.47	ND<0.38	2.6 J	ND<0.94 ^c	ND<0.94 ^c	22	ND<0.47	ND<0.38	ND<4.7	ND<0.66	ND<0.56	ND<0.47	ND<0.47	ND<0.94	ND<0.56
	RC-2 @ 169.5'-170'	169.5-170	11/16/22	Saturated	ND<0.53	ND<0.35	ND<0.44	ND<0.44	ND<0.44	ND<4.4	ND<0.44 ^c	ND<0.35	ND<0.44	ND<0.53	ND<0.44	ND<0.44	ND<0.35	ND<1.8	ND<0.88 ^c, B	ND<0.88 ^c	64	ND<0.44	ND<0.35	ND<4.4	ND<0.62	ND<0.53	ND<0.44	ND<0.44	ND<0.88	ND<0.53
	RC-2 @ 249.5'-250'	249.5-250	11/16/22	Saturated	ND<0.50	ND<0.34	ND<0.42	ND<0.42	ND<0.42	ND<4.2	ND<0.42 ^c	ND<0.34	ND<0.42	ND<0.50	ND<0.42	ND<0.42	ND<0.34	ND<1.7	ND<0.84 ^c, B	ND<0.84 ^c	5.8 J	ND<0.42	ND<0.34	ND<4.2	ND<0.59	ND<0.50	ND<0.42	ND<0.42	ND<0.84	ND<0.50
DEP Residential Used Aquifer Statewide Health Standards (SHS)					**200**	**0.84**	**5**	**31**	**7**	**70**	**0.2**	**0.05**	**600**	**5**	**5**	**600**	**75**	**4,000**	**63**	**2,800**	**31,000**	**5**	**80**	**80**	**10**	**1,500**	**5**	**100**	**21,000**	**80**
Aqueous QA/QC Samples (µg/L)	Field Blank	-	10/26/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	1.5 J, ^c	ND<0.30	ND<0.20	ND<1.0 ^c	ND<0.30	ND<0.30	ND<0.30 ^c	ND<0.30	ND<0.20	1.9
	Trip Blank	-	10/26/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	0.91 J, ^c	ND<0.30	ND<0.20	ND<1.0 ^c	ND<0.30	ND<0.30	ND<0.30 ^c	ND<0.30	ND<0.20	ND<0.30
	Trip Blank	-	11/01/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	ND<0.70 ^c	ND<0.30	ND<0.20	ND<1.0 ^c	ND<0.30	ND<0.30	ND<0.30 ^c	ND<0.30	ND<0.20	ND<0.30
	Trip Blank	-	11/03/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85 ^c	ND<0.50 ^c	ND<0.70	ND<0.30	ND<0.20	ND<1.0 ^c	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30
	Trip Blank	-	11/09/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30
	Equipment Blank	-	11/16/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30 ^c	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	2.8 J	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30
	Trip Blank	-	11/16/22	-	ND<0.30	ND<0.30	ND<0.30	ND<0.30 ^c	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.20	ND<0.30	ND<0.30	ND<0.68	ND<0.30	ND<0.50	ND<0.85	ND<0.50	ND<0.70	ND<0.30	ND<0.20	ND<1.0	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.20	ND<0.30

Notes:

DEP: Pennsylvania Department of Environmental Protection
SHS: Statewide Health Standard
ft: feet
mg/kg: milligrams per kilogram
µg/L: micrograms per liter
NS: No standard
ND< : Indicates analysis was performed for the test but it was not detected. The sample method detection limit is
B: Analyte was found in the blank.
E: Results exceed calibration range
H: Sample was prepped or analyzed beyond the specific holding time.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
*+: Laboratory Control Sample (LCS) and/or Laboratory Control Sample Duplicate (LCSD) is outside acceptance limits, high biased.
^c: Continuing calibration vertification (CCV) recovery is outside the acceptance limits
*3: Internal Standard response or retention time outside acceptable limits.
Indicates laboratory method detection limits exceed the applicable DEP Act 2 Standard.
Indicates concentrations exceed the applicable DEP Act 2 Standard.
Indicates a concentration was detected.
The standard for 1,3-dichloropropene was used for both *cis*-1,3-dichloropropene and *trans*-1,3-dichloropropene.

Table 2

Soil and Rock Coring Analytical Data Summary

Sampling Event	Sample ID	Depth (ft)	Sample Date	Soil Condition	Chloromethane (Methyl Chloride)	Cyclohexane	*cis*-1,2-Dichloroethene (*cis*-1,2-Dichloroethylene)	*cis*-1,3-Dichloropropene	Dibromochloromethane (Chlorodibromomethane)	Dichlorodifluoromethane (Freon 12)	Ethylbenzene	Freon 113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	Isopropylbenzene (Cumene)	Methyl acetate	Methylcyclohexane	Methylene Chloride (Dichloromethane)	Methyl *tert*-butyl ether (MTBE)	Styrene	Tetrachloroethene (Tetrachloroethylene (PCE))	Toluene	Total Xylenes	*trans*-1,2-Dichloroethene (*trans*-1,2-Dichloroethylene)	*trans*-1,3-Dichloropropene	Trichloroethene (Trichloroethylene (TCE))	Trichlorofluoromethane (Fluorotrichloromethane (Freon 11))	Vinyl Chloride
					(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
DEP Soil to Groundwater Values for Unsaturated/Saturated Soil in a Residential, Used Aquifer					**3,000**	**1,700,000/ 1,300,000**	**7,000**	**650**	**8,000**	**100,000**	**70,000**	**3,400,000/ 1,100,000**	**600,000/ 84,000**	**3,500,000**	**NS**	**500**	**2,000**	**24,000/ 10,000**	**500**	**100,000**	**1,000,000**	**10,000**	**650**	**500**	**200,000**	**200**
DEP Soil to Groundwater Values for Unsaturated/Saturated Soil in a Non-Residential, Used Aquifer					**3,000**	**6,900,000/ 5,300,000**	**7,000**	**2,700**	**8,000**	**100,000**	**70,000**	**10,000,000/ 4,400,000**	**2,500,000/ 350,000**	**9,700,000**	**NS**	**500**	**2,000**	**24,000/ 10,000**	**500**	**100,000**	**1,000,000**	**10,000**	**2,700**	**500**	**200,000**	**200**
DEP Residential Direct Contact Numeric Values (0-15 feet)					**250,000**	**10,000,000**	**440,000**	**110,000**	**220,000**	**1,900,000**	**180,000**	**10,000,000**	**7,600,000**	**10,000,000**	**NS**	**1,300,000**	**1,700,000**	**10,000,000**	**760,000**	**10,000,000**	**1,900,000**	**4,400,000**	**110,000**	**38,000**	**10,000,000**	**930**
DEP Non-Residential Direct Contact Numeric Values Surface Soil (0-2 feet)					**1,200,000**	**10,000,000**	**6,400,000**	**550,000**	**1,100,000**	**8,000,000**	**880,000**	**10,000,000**	**10,000,000**	**10,000,000**	**NS**	**10,000,000**	**8,500,000**	**10,000,000**	**3,200,000**	**10,000,000**	**7,900,000**	**10,000,000**	**550,000**	**160,000**	**10,000,000**	**61,000**
DEP Non-Residential Direct Contact Numeric Values Subsurface Soil (2-15 feet)					**1,400,000**	**10,000,000**	**10,000,00**	**640,000**	**10,000,000**	**9,100,000**	**1,000,000**	**10,000,000**	**10,000,000**	**10,000,000**	**NS**	**10,000,000**	**9,800,000**	**10,000,000**	**3,600,000**	**10,000,000**	**9,100,000**	**10,000,000**	**640,000**	**180,000**	**10,000,000**	**290,000**
Soil Boring Investigation November 2022	RC-1 @ 4'-4.5'	4-4.5	10/26/22	Unsaturated	ND<0.69	ND<0.57	6.2	ND<0.46	ND<0.57	ND<0.69	ND<0.46	ND<0.69	ND<0.46	ND<1.1 ^c	ND<0.69 ^c	ND<2.3	ND<0.57	ND<0.46	420	1.4 J	1.8 J	ND<0.57	ND<0.57	520 E	ND<0.80	ND<0.69
	RC-1 @ 4'-4.5' (DUPLICATE)	4-4.5	10/26/22	Unsaturated	ND<0.66	ND<0.55	4.4 J	ND<0.44	ND<0.55	ND<0.66	0.56 J	ND<0.66	ND<0.44	ND<1.1 ^c	ND<0.66	ND<2.2	ND<0.55	ND<0.44	2,300	1.3 J	2.3 J	ND<0.55	ND<0.55	120	ND<0.77	ND<0.66
	RC-1 @ 4.75'-5.2'	4.75-5.2	10/26/22	Unsaturated	ND<0.59	ND<0.49	8.0	ND<0.40	ND<0.49	ND<0.59	ND<0.40	ND<0.59	ND<0.40	ND<0.99 ^c	ND<0.59	ND<2.0	ND<0.49	ND<0.40	8.4	1.5 J	1.9 J	ND<0.49	ND<0.49	14	ND<0.69	ND<0.59
	RC-1 @ 6'-6.5'	6-6.5	10/27/22	Unsaturated	ND<150	ND<130	ND<1,900	ND<100	ND<510	ND<150 ^c	ND<4,600	ND<150 ^c	ND<7,200	ND<250	870 J	ND<510	ND<130	ND<100	95,000	ND<150	31,000	ND<130	ND<130	48,000	ND<180	ND<150
	RC-1 @ 8.5'-9'	8.5-9	10/27/22	Unsaturated	ND<35	ND<29	150 J	ND<23	ND<120	ND<35 ^c	ND<23	ND<35 ^c	ND<23	ND<58	ND<35	ND<120	ND<29	ND<23	220 J	ND<35	86 J	ND<29	ND<29	250 J	ND<41	ND<35
	RC-1 @ 88'-89'	88-89	11/01/22	Unsaturated	ND<0.53	ND<0.44	8.8	ND<0.35	ND<0.44	ND<0.53 ^c	ND<0.35	ND<0.53	ND<0.35	3.7 J	ND<0.53 ^c	ND<1.8	ND<0.44	ND<0.35	1.8 J	3.6 J	ND<1.2	ND<0.44	ND<0.44	63	ND<0.62	ND<0.53
	RC-2 @ 1.5'-2'	1.5-2	11/03/22	Unsaturated	ND<0.69	ND<0.57	ND<0.57	ND<0.46	ND<0.57	ND<0.69	ND<0.46	ND<0.69	ND<0.46	ND<1.1 *+	ND<0.69 ^c	ND<2.3	ND<0.57	ND<0.46	ND<0.57	1.8 J	ND<1.6	ND<0.57	ND<0.57	ND<0.57	ND<0.80	ND<0.69
	RC-2 @ 4'-4.5'	4-4.5	11/03/22	Unsaturated	ND<0.69	ND<0.57	1.1 J	ND<0.46	ND<0.57	ND<0.69	ND<0.46	ND<0.69	ND<0.46	ND<1.1 *+	ND<0.69 ^c	ND<2.3	ND<0.57	ND<0.46	ND<0.57	2.2 J	ND<1.6	ND<0.57	ND<0.57	ND<0.57	ND<0.80	ND<0.69
	RC-2 @ 6'-6.5'	6-6.5	11/03/22	Unsaturated	ND<0.65	ND<0.54	8.5	ND<0.43	ND<0.54	ND<0.65	ND<0.43	ND<0.65	ND<0.43	ND<1.1 *+	ND<0.65 ^c	ND<2.2	ND<0.54	ND<0.43	1.3 J	2.0 J	ND<1.5	ND<0.54	ND<0.54	4.3 J	ND<0.76	ND<0.65
	RC-2 @ 8.5'-9'	8.5-9	11/03/22	Unsaturated	ND<0.62	ND<0.52	1.2 J	ND<0.41	ND<0.52	ND<0.62	ND<0.41	ND<0.62	ND<0.41	ND<1.0 *+, ^c	ND<0.62	ND<2.1	ND<0.52	ND<0.41	ND<0.52	2.1 J	ND<1.4	ND<0.52	ND<0.52	0.68 J	ND<0.72	ND<0.62
	RC-2 @ 102.5'-103'	102.5-103	11/09/22	Unsaturated	ND<0.56	ND<0.47	ND<0.47	ND<0.38	ND<0.47	ND<0.56	ND<0.38	ND<0.56	ND<0.38	ND<0.94	ND<0.56	ND<1.9	ND<0.47	ND<0.38	ND<0.47	ND<0.56	ND<1.3	ND<0.47	ND<0.47	ND<0.47	ND<0.66	ND<0.56
	RC-2 @ 169.5'-170'	169.5-170	11/16/22	Saturated	ND<0.53	ND<0.44	ND<0.44	ND<0.35	ND<0.44	ND<0.53	ND<0.35	ND<0.53	ND<0.35	ND<0.88 ^c, *+	ND<0.53	ND<1.8	ND<0.44	ND<0.35	ND<0.44	2.7 J	ND<1.2	ND<0.44	ND<0.44	ND<0.44	ND<0.62	ND<0.53
	RC-2 @ 249.5'-250'	249.5-250	11/16/22	Saturated	ND<0.50	ND<0.42	ND<0.42	ND<0.34	ND<0.42	ND<0.50	ND<0.34	ND<0.50	ND<0.34	ND<0.84 ^c, *+	ND<0.50	ND<1.7	ND<0.42	ND<0.34	ND<0.42	ND<0.50	ND<1.2	ND<0.42	ND<0.42	ND<0.42	ND<0.59	ND<0.50
DEP Residential Used Aquifer Statewide Health Standards (SHS)					**30**	**13,000**	**70**	**6.5**	**80**	**1,000**	**700**	**11,000**	**840**	**35,000**	**NS**	**5**	**20**	**100**	**5**	**1,000**	**10,000**	**100**	**6.5**	**5**	**2,000**	**2**
Aqueous QA/QC Samples (µg/L)	Field Blank	-	10/26/22	-	ND<0.55	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.50	ND<0.30	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70	ND<0.20	ND<0.30	ND<0.20	ND<0.20
	Trip Blank	-	10/26/22	-	ND<0.55	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.50	ND<0.30	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70	ND<0.20	ND<0.30	ND<0.20	ND<0.20
	Trip Blank	-	11/01/22	-	ND<0.55	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.50	ND<0.30	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70	ND<0.20	ND<0.30	ND<0.20	ND<0.20
	Trip Blank	-	11/03/22	-	ND<0.55	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30 ^c	ND<0.50	ND<0.30	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70	ND<0.20	ND<0.30	ND<0.20	ND<0.20
	Trip Blank	-	11/09/22	-	ND<0.55	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30 ^c	ND<0.50	ND<0.30	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70	ND<0.20	ND<0.30	ND<0.20	ND<0.20
	Equipment Blank	-	11/16/22	-	ND<0.55 ^c	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.50 ^c	ND<0.30 *+, ^c	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70 ^c	ND<0.20	ND<0.30	ND<0.20 ^c	ND<0.20
	Trip Blank	-	11/16/22	-	ND<0.55 ^c	ND<1.0	ND<0.30	ND<0.20	ND<0.20	ND<0.20	ND<0.40	ND<0.30	ND<0.20	ND<0.30	ND<0.50 ^c	ND<0.30 *+, ^c	ND<0.20	ND<0.30	ND<0.30	ND<0.20	ND<0.40	ND<0.70 ^c	ND<0.20	ND<0.30	ND<0.20 ^c	ND<0.20

Notes:
DEP: Pennsylvania Department of Environmental Protection
SHS: Statewide Health Standard
ft: feet
mg/kg: milligrams per kilogram
µg/L: micrograms per liter
NS: No standard
ND< : Indicates analysis was performed for the test but it was not detected. The sample method detection limit is
B: Analyte was found in the blank.
E: Results exceed calibration range
H: Sample was prepped or analyzed beyond the specific holding time.
J: Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
*+: Laboratory Control Sample (LCS) and/or Laboratory Control Sample Duplicate (LCSD) is outside acceptance limits, high biased.
^c: Continuing calibration vertification (CCV) recovery is outside the acceptance limits
*3: Internal Standard response or retention time outside acceptable limits.
Indicates laboratory method detection limits exceed the applicable DEP Act 2 Standard.
Indicates concentrations exceed the applicable DEP Act 2 Standard.
Indicates a concentration was detected.
The standard for 1,3-dichloropropene was used for both *cis*-1,3-dichloropropene and *trans*-1,3-dichloropropene.

Table 3 – Groundwater Analytical Data Summary

Table 3
Groundwater Analytical Data Summary

Sample ID	Sample Date	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	*cis*-1,2-Dichloroethene (*cis*-1,2-Dichloroethylene)	Tetrachloroethene (Tetrachloroethylene (PCE))	*trans*-1,2-Dichloroethene (*trans*-1,2-Dichloroethylene)	Trichloroethene (Trichloroethylene (TCE))	1,4-Dioxane
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Groundwater SHS for a Used, Residential Aquifer		**200**	**5**	**31**	**7**	**70**	**5**	**100**	**5**	**6.5**
MW-1S Converted to multi - screened well MW-1Ss/1Sd December 2019	09/10/13 *	3.9	ND	ND	1.6	67.2	2.2	ND	295	NA
	12/11/13	0.53	ND	ND	ND	6.6	ND	ND	23.9	NA
	04/07/14	0.72	ND	ND	ND	9.6	ND	ND	34.2	NA
	09/09/15	63.4	5.8	ND	42.5	1,470	104	ND	9,020	NA
	07/06/16	36.4	ND	ND	23.7	704	50	2.4	4,280	NA
	08/30/17	53.4	ND	ND	ND	752	38.2	19.8	2,710	NA
	08/22/18	35.7	ND	ND	17.2	589	53.4	ND	3,190	NA
	10/03/18	NA	NA	NA	NA	NA	NA	NA	NA	37.1
	06/18/19	40.5	ND	ND	25.6	762	50.2	ND	3,820	46.2
MW-1Ss	01/30/20	7.4	ND	ND	ND	167	5.6	ND	561	16.4
	12/03/20	4.4	0.62	ND	2.3	68	2.7	ND	317	11
	11/08/21	4.6	ND	ND	2.2	58.7	2.6	ND	276	7.7
	10/24/22	2.4 J	ND<1.5	ND<1.5	ND<1.5	34	ND<1.5	ND<3.5	160	7.4
	04/27/23	26	0.90 J	1.3	2.5	230	19	1.7 J	570	11
MW-15d	01/30/20	ND	ND	ND	ND	51.7	5.6	ND	169	5.1
	12/03/20	0.73	ND	ND	ND	4.7	ND	ND	18.8	2.8
	11/08/21	1.6	ND	ND	0.8	20.1	0.85	ND	39.4	ND
	10/24/22	0.70 J	ND<0.30	ND<0.30	0.50 J	6.6	0.33 J	ND<0.70	18	1.1
	04/27/23	0.83 J	ND<0.30	ND<0.30	0.46 J	11	0.41 J	ND<0.70	32	1.7
MW-1L	01/14/13*	ND	ND	ND	ND	3.5	ND	ND	11.2	NA
	09/09/13*	ND	ND	ND	0.68	4	ND	ND	7	NA
	12/11/13	ND	ND	ND	ND	2.5	ND	ND	4.8	NA
	04/03/14	ND	ND	ND	ND	1.8	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	1.2	ND	ND	5.2	NA
	08/30/17	ND	ND	ND	ND	2.7	ND	ND	5.8	NA
	08/22/18	ND	ND	ND	ND	1.9	ND	ND	4.9	NA
	06/18/19	Not Sampled Due to Well Blockage								
MW-2U	01/16/13*	97.3	ND	3.5	112	518	105	3.8	2,110	NA
	09/12/13*	28.7	ND	0.96	26.8	114	33.1	1.4	562	NA
	12/11/13	36.9	ND	4.8	57.4	254	21	3	772	NA
	04/03/14	32.2	ND	4.9	52.2	333	25.2	3.1	1,040	NA
	09/09/15	53	ND	8.9	97.3	685	41.3	5.8	2,010	NA
	07/06/16	7.7	ND	ND	8.6	46.9	5.5	0.51	171	NA
	08/30/17	5.4	ND	ND	6	35.4	5	6.2	116	NA
	08/22/18	6	ND	ND	6.6	35.7	4.6	ND	140	NA
	06/18/19	ND	ND	ND	5.4	23.1	ND	ND	97.2	8.9
	12/03/20	5.5	ND	0.69	6.9	33.1	7.8	ND	102	3.9
	11/08/21	28.4	ND	5.9	74.5	613	75.7	4.5	1,860	3.6
	10/24/22	24	ND<3.0	6.5 J	62	590	70	ND<7.0	1,600	ND<1.7
	04/27/23	3.2 J	ND<3.0	ND<3.0	ND<3.0	14	7.0 J	ND<7.0	51	ND<1.7
MW-2L	01/16/13*	37.1	ND	1.5	42	203	42.4	2.6	822	NA
	09/12/13*	18.6	ND	0.88	17.8	95.2	15.1	1.3	414	NA
	12/11/13	18.7	ND	2.6	30.2	279	3.9	2.4	499	NA
	04/03/14	17.8	ND	3.4	24.4	348	4.6	4.1	654	NA
	09/09/15	28.6	ND	10.4	66.9	508	28.5	ND	1,400	NA
	07/06/16	20.8	ND	10.8	62.6	541	34.6	3.6	1,260	NA
	08/30/17	14	ND	11.7	65	564	30.6	65	1,370	NA
	08/22/18	12.8	ND	10.8	55.8	515	36.6	3.9	1,140	NA
	10/03/18	NA	NA	NA	NA	NA	NA	NA	NA	18.7
	06/18/19	13.7	ND	11	78	558	30.8	ND	1,300	26.2
	12/03/20	26	ND	16.6	130	717	97	8	2,550	35.4
	11/08/21	34.5	ND	14.1	140	858	123	8.2	2,760	32.3
	10/24/22	21 J	ND<15	ND<15	77	680	79	ND<35	1,800	45
	04/27/23	35 J	ND<15	ND<15	120	950	130	ND<35	2,700	49
MW-3U	01/15/13*	12.6	ND	ND	12.4	74	10.6	0.8	277	NA
	09/11/13	12.2	ND	ND	10.6	51.4	10.6	ND	266	NA
	12/11/13	4.4	ND	ND	5.4	56	1.3	0.85	198	NA
	04/03/14	4.4	ND	ND	4.4	24.3	0.85	ND	114	NA
	09/09/15	1.7	ND	ND	2.3	16.9	0.66	ND	43.5	NA
	07/05/16	2.3	ND	ND	2.8	11.2	0.79	ND	47	NA
	08/30/17	1.4	ND	ND	1.4	7.8	0.95	1.4	37	NA
	08/22/18	1.8	ND	ND	1.8	10.2	1.1	ND	38.8	NA
	06/18/19	2.2	ND	ND	2.1	6.5	1	ND	39.4	6.5
	12/03/20	2.6	ND	ND	3	11.4	2.1	ND	58	ND
	11/08/21	5.5	ND	ND	5.8	51.4	8	ND	178	ND
	10/24/22	3.7	ND<0.30	ND<0.30	4	21	6	ND<0.70	110	1.9
	04/27/23	ND<0.30	ND<0.30	ND<0.30	2.6	7.2	1.9	ND<0.70	40	0.76
	01/15/13*	ND	ND	ND	9.8	55.3	9.9	0.66	244	NA

Table 3
Groundwater Analytical Data Summary

Sample ID	Sample Date	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	*cis*-1,2-Dichloroethene (*cis*-1,2-Dichloroethylene)	Tetrachloroethene (Tetrachloroethylene (PCE))	*trans*-1,2-Dichloroethene (*trans*-1,2-Dichloroethylene)	Trichloroethene (Trichloroethylene (TCE))	1,4-Dioxane
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Groundwater SHS for a Used, Residential Aquifer		**200**	**5**	**31**	**7**	**70**	**5**	**100**	**5**	**6.5**
MW-3L	09/11/13*	ND	ND	ND	15.6	92.8	19.4	ND	441	NA
	12/11/13	ND	ND	ND	7.2	55.1	2.4	ND	150	NA
	04/03/14	ND	ND	ND	6.9	59.4	3	ND	144	NA
	09/09/15	ND	ND	ND	ND	22.3	ND	ND	67.3	NA
	07/05/16	1.7	ND	ND	2	16.3	0.6	ND	44.9	NA
	08/30/17	6.4	ND	0.8	7.8	74.4	1.6	7.8	162	NA
	08/22/18	12	ND	ND	13.1	112	14.4	0.61	411	NA
	06/18/19	10.9	ND	ND	13.8	91.7	12.7	0.59	312	ND
	12/03/20	6.8	ND	ND	7.8	44.6	8.2	ND	187	2.8
	11/08/21	4.1	ND	ND	4.3	30.2	6.7	ND	95.2	2.8
	10/24/22	4.5	ND<0.30	0.33 J	4.9	33	7.6	ND<0.70	150	2.6
	04/27/23	18	0.58 J	0.86 J	20	160	19	1.4 J	1,400	6.4
MW-4U	01/15/13*	5	ND	ND	3.5	26.8	2.8	ND	132	NA
	09/11/13*	20.7	ND	0.56	14.2	96.1	19.4	1.4	700	NA
	12/11/13	8.2	ND	ND	6.6	57.6	5	ND	373	NA
	04/03/14	7.4	ND	ND	5.6	58.6	4.6	ND	456	NA
	09/09/15	9	ND	ND	9.4	60.6	8	ND	349	NA
	07/05/16	11.5	ND	ND	11	74.1	8.9	ND	359	NA
	08/30/17	8.4	ND	ND	ND	45.7	10.2	6.4	259	NA
	08/22/18	9.9	ND	ND	8.3	60.8	15.4	ND	321	NA
	06/18/19	12.5	ND	ND	13.5	99.2	12.2	ND	413	ND
	12/03/20	8	ND	ND	8.9	58.6	12.3	ND	326	NA
	11/08/21	14.2	ND	0.53	14.4	105	19.8	0.74	507	2.7
	10/26/22	9.6 J	ND<3.0	ND<3.0	11	88	18	ND<7.0	400	4.2
	04/27/23	7.5 J	ND<3.0	ND<3.0	5.6 J	72	15	ND<7.0	300	4.0
MW-4L	09/11/13*	ND	5	ND	6.3	51.4	7	ND	306	NA
	12/12/13	ND	10.2	ND	4.4	56.1	1.1	ND	118	NA
	04/03/14	ND	5.7	ND	2.3	39.8	ND	ND	99	NA
	09/09/15	5.4	ND	ND	5.8	47.3	2	ND	196	NA
	07/05/16	5.8	ND	ND	6	50.6	2.1	ND	164	NA
	09/09/15	2.7	ND	ND	2.7	40	0.7	ND	122	NA
	08/30/17	6.8	ND	ND	ND	43.8	ND	5.5	201	NA
	08/22/18	5.4	ND	ND	4.9	43	2	ND	152	NA
	06/18/19	2.6	ND	ND	3.6	34	1	ND	91.7	3.1
	12/03/20	9.6	ND	ND	10.6	68.5	15.4	ND	383	3.5
	11/08/21	11.6	ND	0.6	11.1	80.1	16	0.58	378	3.3
	10/24/22	8.4 J	ND<3.0	ND<3.0	8.5 J	78	12	ND<7.0	320	4.8
	04/27/23	6.7 J	ND<3.0	ND<3.0	4.9 J	70	13	ND<7.0	280	4.1
MW-5	01/14/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	12/12/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	04/03/14	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/03/20	ND	ND	ND	ND	ND	0.52	ND	ND	ND
	11/08/21	ND	ND	ND	ND	ND	0.54	ND	ND	NA
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	0.57 J	ND<0.70	ND<0.30	NA
MW-6	01/14/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	090/9/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	12/11/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	04/02/14	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/22/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	ND<0.30	NA
MW-7U	01/23/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	12/12/13	ND	ND	ND	ND	1.3	ND	ND	8.5	NA
	04/02/14	ND	ND	ND	ND	1.7	ND	ND	10.7	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	ND<0.30	NA

Table 3
Groundwater Analytical Data Summary

Sample ID	Sample Date	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	*cis*-1,2-Dichloroethene (*cis*-1,2-Dichloroethylene)	Tetrachloroethene (Tetrachloroethylene (PCE))	*trans*-1,2-Dichloroethene (*trans*-1,2-Dichloroethylene)	Trichloroethene (Trichloroethylene (TCE))	1,4-Dioxane
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Groundwater SHS for a Used, Residential Aquifer		200	5	31	7	70	5	100	5	6.5
MW-7L	1/14/13*	ND	ND	ND	ND	0.71	ND	ND	5.7	NA
	9/9/13*	ND	ND	ND	ND	1.2	ND	ND	7.3	NA
	12/12/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	04/02/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	1.7	ND	ND	10.1	NA
	07/05/16	ND	ND	ND	ND	1.7	ND	ND	8.1	NA
	08/30/17	ND	ND	ND	ND	1.8	ND	ND	9.3	NA
	08/22/18	ND	ND	ND	ND	1.8	ND	ND	10.2	NA
	06/17/19	ND	ND	ND	ND	1.9	ND	ND	10.1	ND
	12/03/20	ND	ND	ND	0.67	2.8	0.55	ND	14.8	ND
	11/08/21	ND	ND	ND	ND	2.6	0.52	ND	11.9	ND
	10/24/22	0.43 J	ND<0.30	ND<0.30	0.50 J	3.6	0.77 J	ND<0.70	15	NA
	04/27/23	0.39 J	ND<0.30	ND<0.30	0.63 J	3.8	0.72 J	ND<0.70	15	0.41
MW-8	1/14/13*	ND	ND	ND	ND	3.7	ND	ND	ND	NA
	9/9/13*	ND	ND	ND	ND	4.7	ND	ND	ND	NA
	12/12/13	ND	ND	ND	ND	5.7	ND	ND	ND	NA
	04/02/14	ND	ND	ND	ND	6.7	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	ND<0.30	NA
MW-9	1/14/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	9/9/13*	ND	ND	ND	ND	ND	ND	ND	ND	NA
	12/12/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	04/02/14	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	ND<0.30	NA
MW-10L	1/15/13*	2.6	ND	ND	3.2	10.3	2	ND	64.9	NA
	9/11/13*	2.7	ND	ND	2.6	8.5	3.4	ND	72.6	NA
	12/12/13	2	ND	ND	2.3	7.9	2.5	ND	47.9	NA
	04/02/14	1.5	ND	ND	1.9	8	1.6	ND	51.5	NA
	09/09/15	ND	ND	ND	0.98	4.6	ND	ND	19.9	NA
	07/05/16	0.54	ND	ND	0.94	3.7	ND	ND	19	NA
	08/30/17	0.61	ND	ND	0.94	4.2	0.52	0.99	21.7	NA
	08/22/18	1	ND	ND	1.9	7.8	1.1	ND	44.3	NA
	06/17/19	0.92	ND	ND	1.8	7.5	0.86	ND	41	ND
	12/03/20	1.1	ND	ND	2.1	8.6	2.6	ND	52.4	ND
	11/08/21	0.95	ND	ND	1.6	7.3	2.1	ND	38.4	ND
	10/24/22	0.88 J	ND<0.30	ND<0.30	1.6	7.8	2.2	ND<0.70	38	0.53
	04/27/23	0.73 J	ND<0.30	ND<0.30	1.5	8.0	1.6	ND<0.70	36	0.58
MW-11U	9/12/13*	10	ND	ND	9.2	43.4	5.9	ND	146	NA
	12/11/13	6.9	ND	ND	6.9	36.4	3.7	ND	135	NA
	04/03/13	6.1	ND	ND	6.6	42.1	1.4	ND	146	NA
	09/09/15	5.1	ND	ND	6.4	32.6	2	ND	109	NA
	07/05/16	3.2	ND	ND	4.4	24.4	2.3	ND	78.7	NA
	08/30/17	3.8	ND	ND	4.7	25.9	2.7	4.9	66.7	NA
	08/22/18	5.9	ND	ND	8.4	44.6	5.6	ND	149	NA
	06/18/19	5.6	ND	ND	8.4	44.3	6.6	ND	157	4.1
	12/03/20	4.9	ND	ND	8.4	43.3	9	ND	170	2.8
	11/08/21	8.2	ND	ND	11.6	64.5	14.5	ND	233	2.8
	10/24/22	5.3	ND<1.5	ND<1.5	7.2	44	10	ND<3.5	180	3.2
	04/27/23	3.3 J	ND<1.5	ND<1.5	5.0	32	5.9	ND<3.5	110	3.5
MW-11L	9/12/13*	3.4	ND	ND	2.8	13.8	3	ND	57.2	NA
	12/11/13	ND	ND	ND	ND	ND	ND	ND	ND	NA
	04/03/14	ND	ND	ND	ND	ND	ND	ND	ND	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	ND	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	ND	NA
	08/30/17	ND	ND	ND	ND	ND	ND	ND	ND	NA
	08/22/18	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	0.83	ND	ND	0.5	2.6
	12/03/20	5.5	ND	ND	8.6	47.5	9	ND	176	2.8
	11/08/21	7.4	ND	ND	10.6	59.9	12.2	ND	203	2.9
	10/24/22	4.1 J	ND<1.5	ND<1.5	5	34	7.3	ND<3.5	130	3.2
	04/27/23	ND<1.5	ND<1.5	ND<1.5	ND<1.5	1.9 J	ND<1.5	ND<3.5	7.1	ND<0.17

Table 3
Groundwater Analytical Data Summary

Sample ID	Sample Date	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene (1,1-Dichloroethylene)	*cis*-1,2-Dichloroethene (*cis*-1,2-Dichloroethylene)	Tetrachloroethene (Tetrachloroethylene (PCE))	*trans*-1,2-Dichloroethene (*trans*-1,2-Dichloroethylene)	Trichloroethene (Trichloroethylene (TCE))	1,4-Dioxane
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
DEP Groundwater SHS for a Used, Residential Aquifer		**200**	**5**	**31**	**7**	**70**	**5**	**100**	**5**	**6.5**
MW-12U	9/10/13*	ND	ND	ND	ND	0.81	ND	ND	7.8	NA
	12/11/13	ND	ND	ND	ND	0.78	ND	ND	0.71	NA
	04/02/14	ND	ND	ND	ND	ND	ND	ND	0.97	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	0.7	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	1.2	NA
	08/30/17	ND	ND	ND	ND	ND	ND	ND	ND	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	0.3 J	NA
MW-12L	9/10/13*	ND	ND	ND	ND	0.68	ND	ND	4.8	NA
	12/12/13*	ND	ND	ND	ND	ND	ND	ND	5.7	NA
	04/02/14	ND	ND	ND	ND	ND	ND	ND	1.1	NA
	09/09/15	ND	ND	ND	ND	ND	ND	ND	1.3	NA
	07/05/16	ND	ND	ND	ND	ND	ND	ND	0.51	NA
	08/30/17	ND	ND	ND	ND	ND	ND	ND	0.66	NA
	06/17/19	ND	ND	ND	ND	ND	ND	ND	0.94	ND
	10/24/22	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.30	ND<0.70	1.1	NA
RC-1 @ 103'	01/17/23	180	4.7	8.0	11	1,500	100	12	**1,500**	NA
	04/27/23	110	7.3	6.0	12	1,700	57	23	**1,900**	NA
RC-1 @ 117'	01/17/23	160	4.3	7.4	8.8	1,600	92	20	**1,600**	NA
	04/27/23	110	4.6	5.1	8.6	1,200	50	17	**1,600**	NA
RC-1 @ 138'	01/17/23	3.6 J	ND<3.0	ND<3.0	ND<3.0	20	4.4 J	ND<7.0	**32**	NA
	04/27/23	4.8	ND<0.30	ND<0.30	0.41 J	52	6.9	ND<0.70	**65**	NA
RC-1 @ 148'	01/17/23	3.8	ND<0.30	ND<0.30	ND<0.30	24	6.4	ND<0.70	**41**	NA
	04/27/23	3.5	ND<0.30	ND<0.30	ND<0.30	39	5.1	ND<0.70	**47**	NA
RC-2 @ 112'	01/17/23	40	1.1	1.7	44	440	36	2.8	1,500	NA
	04/27/23	43	1.3	1.6	55	460 H	44	3.3	1,900 H	NA
RC-2 @ 142'	01/17/23	38	1.0	1.6	42	340	31	2.7	1,100	NA
	04/27/23	22	0.68 J	1.0	34	460	17	2.3	1,700	NA
RC-2 @ 180'	01/17/23	30	0.71 J	1.3	33	330	26	2.0	1,100	NA
	04/27/23	7.4	ND<0.30	ND<0.30	9.1	89	13	ND<0.70	310	NA
RC-2 @ 204'	01/17/23	0.96 J	ND<0.30	ND<0.30	0.65 J	4.3	17	ND<0.70	56	NA
	04/27/23	1.4	ND<0.30	ND<0.30	0.52 J	3.0	15	ND<0.70	120	NA
RC-2 @ 246'	01/17/23	0.78 J	ND<0.30	ND<0.30	0.33 J	2.0	19	ND<0.70	50	NA
	04/27/23	1.1	ND<0.30	ND<0.30	0.35 J	1.7	14	ND<0.70	88	NA

Notes:
DEP: Pennsylvania Department of Environmental Protection
SHS: Statewide Health Standard
µg/L: micrograms per liter
ND: Not detected
ND<#: Indicates analysis was performed for the compound but it was not detected (<# is the method detection limit)
J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value
H: Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.
Yellow Shaded: Indicates laboratory method detection limit exceeds the DEP Residential Act 2 Standards
Red Shaded: Indicates concentration exceeds the DEP Residential Act 2 Standards
Green Shaded: Indicates a concentration was detected.
* Well purged/sampled using a submersible pump. All others sampled using a passive diffusion bag or hydrasleeve

Attachment A – Soil Boring/Rock Core Logs

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
0					TOPSOIL: (0-0.5') Topsoil	TOPSOIL	Split spoon refusal at 5.4' bgs	Boring completed with temporary steel stick-up casing with bentonite seal to 5' bgs
2	12	4,8,12		0.0 0.0	ML: (0.5'-2.0') Reddish-brown silt, little clay, trace sand, weathered argillite fragments, medium dense, slightly moist	ML		
4	35	10,15,20,28		0.8 4.5 1.8 1.6				
6	50	28,45,50/4"	(5'-10') (17.5%) VERY POOR	52.8 11.8 48.3 483.6	CL: (2'-5') SAA, very dense, increasing weathered argillite fragments with depth	WEATHERED ARGILLITE	Rock core between 5'-150' bgs	
8				46.6 17.3 8.9	WEATHERED ARGILLITE: (5'-9') Gray weathered argillite, highly fractured with seams of brown silt and clay, odor	ARGILLITE		
10			(10'-15') (75%) GOOD	18 0.8 0.0	ARGILLITE: (9'-10') Competent Argillite, fracture at 9.5'			Open rock boring from 5' to 150' bgs
12				0.0	ARGILLITE: (10'-15') Gray competent argillite with fractures			
14			(15'-20') (94%) EX-CELLENT	0.0	ARGILLITE: (15'-30') Gray to dark gray argillite, laminated to thinly bedded, horizontal fractures at 23', 24.5', 80 degree fracture at 27.25'-29', red-brown clay within fracture			
16								
18								
20			(20'-25') (100%) EX-CELLENT					
22				0.0				
24			(25'-30') (91%) EX-CELLENT	0.0				
26				0.0 0.0				
28								
30			(30'-35') (100%) EX-CELLENT		ARGILLITE: (30'-40') Gray argillite, laminated to thinly bedded, 80 degree fracture at 30.5'-31.5', horizontal fractures at 43.5, 44', and 44.75'			
32								
34				0.0				
36			(35'-40') (93%) EX-CELLENT					
38								
40								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
42			(40'-45') (93%) EX-CELLENT		ARGILLITE: (40'-50') Gray to dark gray argillite, moderately calcareous, calcite filling in fractures at 46.25', 47', and 48.5'			
44				0.0				
46			(45'-50') (92%) EX-CELLENT	0.0				
48				0.0				
50				0.0				
52			(50'-55') (97%) EX-CELLENT	0.0	ARGILLITE: (50'-60') Gray to blue gray argillite, thinly bedded, moderately calcareous, calcite filling in fracture, trace pyrite within fracture at 54.5', interbedded dark gray siltstone at 59.5'-60', vertical fracture at 55'-59', 30 degree fracture at 59.25'			
54				0.0				
56			(55'-60') (72%) FAIR	0.0				
58				0.0				
60				0.0	ARGILLITE: (60'-65') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, calcite filling in fractures, trace pyrite within fractures, horizontal fractures at 61', 62', 63.5', and 64.5'			
62			(60'-65') (89%) GOOD					
64								
66			(65'-70') (90%) GOOD		ARGILLITE: (65'-70') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, calcite filling in fractures, trace pyrite within fractures, horizontal fractures at 67', 68', and 69'			
68				0.0				
70				0.0				
72			(70'-75') (95%) EX-CELLENT		ARGILLITE: (70'-80') Blue gray argillite, moderately calcareous, calcite and iron staining within fractures, 20 degree fracture at 73', 60 degree fracture at 74.5'			
74				0.0				
76			(75'-80') (100%) EX-CELLENT	0.0				
78				0.0				
80								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
82			(80'-85') (93%) EX-CELLENT	0.0	ARGILLITE: (80'-85') SAA, vertical fracture from 81.25'-81.75', 10 degree fractures at 83.75' and 84.25', weathered argillite at 10 degree fractures			
84				0.0				
86			(85'-90') (58%) FAIR	0.0	ARGILLITE: (85'-90') Gray to blue gray argillite, thinly bedded, calcite filling in horizontal fractures at 86', 87', 87.75', heavily fractured at 88.5'-90'			
88				0.0				
				0.0				
90				0.0				
92			(90'-95') (95%) EX-CELLENT	0.0	ARGILLITE: (90'-95') Blue gray argillite, calcareous, thinly bedded, calcite filling in fractures, horizontal fracture at 90.5', 20 degree fracture at 91.5'			
94				0.0				
96			(95'-100') (93%) EX-CELLENT	0.0	ARGILLITE: (95'-109.5') Blue gray argillite, moderately calcareous, thinly bedded, calcite and iron staining in fractures, 10 degree fracture at 96.25', 55 degree fracture at 97.5', horizontal fractures at 100.5', 103.5', and 104'			
98				0.0				
				0.0				
100			(100'-105') (100%) EX-CELLENT					
102								
104								
106			(105'-110') (83%) GOOD					
108					SILTSTONE: (109.5'-111') Red brown siltstone, trace fine-grained pyrite			
110			(110'-115') (89%) GOOD			SILTSTONE		
112				0.0	ARGILLITE: (111'-120') Dark gray to blue gray argillite, moderately calcareous, thinly bedded, calcite and iron staining in fractures, 25 degree fracture at 111.5', 70 degree fracture at 114.5', vertical frature at 116'	ARGILLITE		
114				0.0				
116			(115'-120') (89%) GOOD	0.0				
118								
120				0.0				

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
122			(120'-125') (95%) EX-CELLENT	0.0	ARGILLITE: (120'-125') Gray to blue gray argillite, thinly bedded, calcite and fine-grained pyrite in fractures at 120.5', 30 degree frature at 124'			
124				0.0				
126			(125'-130') (100%) EX-CELLENT		ARGILLITE: (125'-141.25') Blue gray argillite, thinly bedded, moderately calcareous, calcite within bedding planes, 75 degree fracture at 130.5'-132.75' with calcite and pyrite within fracture, vertical fracture at 135.5', 75 degree frature at 138.25'-139.25'			
128								
130			(130'-135') (56%) FAIR					
132				0.0 0.0				
134				0.0				
136			(135'-140') (83%) GOOD	0.0 0.0				
138								
140			(140'-145') (97%) EX-CELLENT					
142				0.0	SHALE: (141.25'-150') Red brown shale, slightly calcareous, trace calcite, 15 degree fracture at 148'	**SHALE**		
144				0.0				
146			(145'-150') (97%) EX-CELLENT				Boring terminated at 150' bgs	
148				0.0				
150								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
0					TOPSOIL: (0-0.5') Topsoil	TOPSOIL	Split spoon refusal at 5.3' bgs	Boring completed with temporary steel stick-up casing with bentonite seal to 5' bgs
2	5	1,2,3,7		0.0	ML: (0.5'-5.0') Light brown silt with clay, few to some weathered argillite fragments, moist, loose	ML		
4	48	13,25,23,28		0.0				
6	>50	28,25,50/3"	(5'-10') (58%) FAIR	0.0	WEATHERED ARGILLITE: (5'-9') Weathered argillite, heavily fractured with seams of silt and clay	WEATHERED ARGILLITE	Rock core between 5'-250' bgs	
8				0.0	ARGILLITE: (9'-10') Argillite, competent	ARGILLITE		
10			(10'-15') (87%) GOOD	0.0	ARGILLITE: (10'-25') Blue gray argillite, thinly bedded, moderately calcareous with several horizontal fractures, 55 degree fracture at 12.5'-13', fracture partially filled in with brown silt and clay at 16.5'-17.25', 20 degree fracture at 22.75'			Open rock boring from 5' to 250' bgs
12				0.0				
14			(15'-20') (93%) EX-CELLENT	0.0				
16				0.0				
18				0.0				
20			(20'-25') (95%) EX-CELLENT	0.0				
22				0.0				
24				0.0				
26			(25'-30') (95%) EX-CELLENT	0.0	ARGILLITE: (25-35') Gray to blue gray argillite, thinly bedded, moderately calcareous, horizontal fractures at 27.25' and 28.75', calcite and trace iron staining within fractures, near vertical fracture from 32'-34' with trace silt and clay			
28				0.0				
30			(30'-35') (81%) GOOD	0.0				
32								
34				0.0				
36			(35'-40') (92%) EX-CELLENT	0.0	ARGILLITE: (35'-40') Gray to blue gray argillite, thinly bedded, moderately calcareous, pyrite and calcite within foliations at 36.5', 75 degree fracture at 37'-38.5			
38				0.0				
40								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
42, 44			(40'-45') (86%) GOOD		ARGILLITE: (40'-45') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, thinly bedded, calcite within bedding plane			
46, 48, 50			(45'-50') (97%) EX-CELLENT	0.0 0.0	SILTSTONE: (45'-50.25') Dark gray siltstone with interbedded argillite, thinly bedded, calcite within bedding planes, horizontal fractures	SILTSONE		
52, 54, 56, 58, 60			(50'-55') (95%) EX-CELLENT (55'-60') (100%) EX-CELLENT	0.0 0.0 0.0	ARGILLITE: (50.25'-60') Gray to blue gray argillite, thinly bedded, moderately calcareous, calcite and pyrite observed within foliations, 60 degree fracture at 54' with trace clay within fracture	ARGILLITE		
62, 64			(60'-65') (84%) GOOD	0.0 0.0 0.0	ARGILLITE: (60'-65') Blue gray to dark gray argillite with interbedded siltstone, thinly bedded, moderately calcareous, horizontal fractures, slightly fissile at 64.5'			
66, 68, 70			(65'-70') (97%) EX-CELLENT	0.0 0.0 0.0	SILTSTONE: (65'-70') Dark gray siltstone with interbedded argillite, moderately calcareous, dark gray shale at 69.75'-70'	SILTSTONE		
72, 74, 76, 78, 80			(70'-75') (100%) EX-CELLENT (75'-80') (99%) EX-CELLENT	0.0 0.0 0.0	ARGILLITE: (70'-80') Blue gray argillite, thinly bedded, calcite within bedding planes, moderately calcareous	ARGILLITE		

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
82			(80'-85') (100%) EX-CELLENT		ARGILLITE: (80'-90') Blue gray argillite, thinly bedded, calcite within bedding planes, moderately calcareous, 80 degree fracture at 88.25'-90'			
84				0.0				
86			(85'-90') (77%) GOOD	0.0				
88				0.0				
				0.0				
90				0.0				
92			(90'-95') (83%) GOOD	0.0	ARGILLITE: (90'-95') Gray to blue gray argillite, heavily fractured at 90'-90.5', oblique fraacture at 94'			
94				0.0				
96			(95'-100') (97%) EX-CELLENT		ARGILLITE: (95'-100') Gray to blue gray argillite, moderately calcareous, thinly bedded, 80 degree fracture at 95'-96'			
98				0.0				
100			(100'-105') (73%) FAIR	0.0	ARGILLITE: (100'-105') Blue gray argillite, thinly bedded, heavily fractured, 70 degree fracture at 101'-101.5', vertical fracture at 103'			
102				0.0				
104				0.0				
106			(105'-110') (92%) EX-CELLENT	0.0	ARGILLITE: (105'-120') Blue gray argillite, thinly bedded, calcareous, vertical fracture at 105.5', 70 degree fracture at 109' and 116', calcite vein at 119' with pyrite			
108								
110			(110'-115') (100%) EX-CELLENT	0.0				
112				0.0				
114				0.0				
116			(115'-120') (100%) EX-CELLENT	0.0				
118								
120				0.0				

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
122			(120'-125') (96%) EX-CELLENT	0.0 0.0	ARGILLITE: (120'-125') Blue gray argillite, thinly bedded, calcareous, calcite vein at 121' with pyrite			
124				0.0				
126			(125'-130') (100%) EX-CELLENT		ARGILLITE: (125'-135') Blue gray argillite, thinly bedded, oblique proto-fractures with calcite at 127.5'-128' and 131'-133'			
128								
130			(130'-135') (100%) EX-CELLENT					
132								
134				0.0				
136			(135'-140') (95%) EX-CELLENT		ARGILLITE: (135'-140') Blue gray to dark gray argillite, moderately calcareous, few interbedded siltstone layers, oblique proto-fracture with calcite at 139'			
138								
140				0.0				
142			(140'-145') (94%) EX-CELLENT	0.0	ARGILLITE: (140'-145.5') Blue gray argillite, calcareous, thinly bedded, 70 degree fracture at 143'			
144				0.0				
146			(145'-150') (95%) EX-CELLENT	0.0	ARGILLITE: (145.5'-155') Red brown argillite, slightly calcareous, thinly bedded, 35 degree fracture at 152'			
148								
150			(150'-155') (98%) EX-CELLENT					
152				0.0				
154				0.0 0.0				
156			(155'-160') (93%) EX-CELLENT		SHALE: (155'-160') Red brown shale, slightly calcareous, fissile, thinly bedded with horizontal fractures	SHALE		
158				0.0 0.0				
160								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
162			(160'-165') (83%) GOOD	0.0	SHALE: (160'-170') Red brown shale, slightly calcareous, fissile, thinly bedded with horizontal fractures, 70 degree frcture at 163'			
164				0.0				
166			(165'-170') (80%) GOOD					
168								
170				0.0				
172			(170'-175') (92%) EX-CELLENT		ARGILLITE: (170'-180') Red brown argillite with horizontal fractures throughout	ARGILLITE		
174								
176			(175'-180') (98%) EX-CELLENT	0.0				
178				0.0				
180			(180'-185') (99%) EX-CELLENT		ARGILLITE: (180'-200') Red brown argillite with horizontal fractures throughout			
182				0.1				
184								
186			(185'-190') (92%) EX-CELLENT	0.2				
188								
190			(190'-195') (84%) GOOD					
192				0.1				
194								
196			(195'-200') (93%) EX-CELLENT					
198								
200								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
202			(200'-205') (100%) EX-CELLENT		ARGILLITE: (200'-205') Red brown argillite with horizontal fractures throughout			
204								
206			(205'-210') (98%) EX-CELLENT	0.0	ARGILLITE: (205'-220') Red brown argillite, thinly bedded, slightly calcareous with horizontal fractures throughout, 30 degree fracture at 218'			
208				0.0				
210			(210'-215') (100%) EX-CELLENT	0.0				
212				0.0				
214				0.0				
216			(215'-220') (100%) EX-CELLENT					
218								
220			(220'-225') (100%) EX-CELLENT		SHALE: (220'-221.5') Red brown to purple shale, slightly calcareous, thinly bedded	SHALE		
222					ARGILLITE: (221.5'-231') Red brown argillite, thinly bedded, slightly calcareous, oblique calcite vein at 221.5'-223'	ARGILLITE		
224								
226			(225'-230') (100%) EX-CELLENT					
228								
230			(230'-235') (97%) EX-CELLENT					
232					ARGILLITE: (231'-240') Gray to blue gray argillite, thinly bedded, moderately calcareous, few horizontal fractures			
234								
236			(235'-240') (93%) EX-CELLENT	0.0 0.0				
238					ARGILLITE: (240'-241.25') Gray to blue gray argillite, thinly bedded,			
240								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
			(240'-245') (100%) EX-CELLENT		moderately calcareous			
242					ARGILLITE: (241.25'-245') Gray to red brown argillite, moderately calcareous, fine-grained pyrite along bedding planes			
244								
246			(245'-250') (100%) EX-CELLENT	0.0	ARGILLITE: (245'-250') Blue gray argillite, thinly bedded, fine-grained calcite in fracture at 246.25'		Boring terminated at 250' bgs	
248								
250								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

Attachment B – GeoStructures, Inc. Report

GeoStructures

Bashar S. Qubain, Ph.D., P.E.
Eric J. Seksinsky, P.G., P.E.
Jianchao Li, P.E.

GEOTECHNICAL ENGINEERING CONSULTANTS

Project No. G23-101
January 10, 2023

Mr. Timothy Uhler
Groundwater & Environmental Services, Inc.
440 Creamery Way, Suite 500
Exton, PA 19341

Re: Rock Rippability Analysis
GTAC - Nockamixon TCE Site
Nockamixon Twp., Bucks Co., PA

Dear Mr. Uhler:

GeoStructures, Inc. has completed a rippability analysis for the referenced project per Proposal No. P22-135 dated March 1, 2022. The intent of this report is to assess the rippability of the rock within the depth of concern. Our completed services include laboratory testing, geotechnical analysis, and documentation of our findings and recommendations.

PROJECT DESCRIPTION

The site is located at 84 Brennan Road, 1,000 ft south of the intersection of Durham and Brennan Roads in Nockamixon Township, Bucks County, PA (see Figure 1. Site Location Map). Groundwater in the area has reportedly been impacted by trichloroethylene (TCE) contamination. Filed screening of samples obtained from the test borings showed contamination extending to a depth of 12 ft below grade in RC-1. Contaminated soil and rock are planned to be removed. The depth and extent of the removal area are not yet delineated. It is assumed, however, that the depth of excavation will be about 15 ft carried out within the vicinity of borings RC-1 and RC-2. See attached Geotechnical Investigation Plan of Drawing 1.

TEST BORINGS

Groundwater & Environmental Services, Inc. (GES) supervised the drilling of 2 test borings at the locations marked in Drawing 1 as RC-1 and RC-2. The borings extended to a depth of 150 and 250 ft below grade, respectively. Drilling was carried out by Eichelbergers, Inc. using a Deidrich D-50 drill rig over the timer period of October 26 through November 16, 2022. Rock coring was performed in all of the test borings per ASTM D2113 methods. Detailed documentation of the borings, including soil and rock descriptions, standard penetration test (SPT) blow counts per ASTM D1586, strata divisions, PID readings, etc. are recorded in the test boring logs of Attachment A. Photos of the upper 15 ft of the rock cores are included in Attachment A.

GEOTECHNICAL LABORATORY TESTING

GeoStructures performed unconfined compressive strength testing on 4 selected core specimens per ASTM D7012 for rippability assessment purposes. It is noted that 2 of the specimens did not reach the failure point and the tests were terminated at the machine's load capacity. The results and stress-strain curves are presented in Attachment B.

SUBSURFACE CONDITIONS

Geology and Bedrock

Per the USGS geologic maps (see Figure 2. Site Geologic Map), the site is underlain by of the Brunswick Formation (Trb), which consists of reddish-brown mudstone, siltstone, and shale, containing a few green and brown shale interbeds; red and dark-gray, interbedded argillites near base. A half mile northeast of the site is the geologic contact with the Lockatong Formations which is described as dark-gray to black, thick-bedded argillite containing a few zones of thin-bedded black shale; locally has thin layers of impure limestone and calcareous shale. Cores from the upper 15 ft of the rock are identified as gray to dark, bluish gray, calcareous argillite, which seems to more closely align with the description of the nearby Lockatong Formation rather than the Brunswick rocks. The overburden soils consist of stiff to hard, residual silt and clay with rock fragments, derived from advanced weathering of the argillite.

Rock Mass Characterization. The argillite rock was encountered at a depth of 5 ft. Based on our close visual examination of the cores from RC-1 and RC-2 and the laboratory measured unconfined compressive strength values, the upper 10 ft of the rock mass (to a depth of 15 ft below grade) is categorized into 2 layers that differ mainly in the fracturing and degree of weathering as follows.

1. ***Medium hard, highly to moderately weathered, closely fractured (upper 4 ft of rock mass at RC-1 and upper 1 ft of rock mass at RC-2).*** This condition characterizes the upper 4 ft of the rock mass at RC-1 (depth of 5 to 9 ft below grade) and the upper 1 ft of the rock mass at RC-2 (depth of 5 to 6 ft). It is described as medium hard, highly to moderately weathered, closely fractured (fracture spacing of 0.5 to 2 in. with both horizontal and vertical orientations). Vertical fractures were observed from 6.8-9 ft and 4-5 ft in RC-1 and RC-2 respectively. The fracture faces are stained with iron oxide and coated with light brown silt and clay throughout the layer with more dominant and thicker clay sublayers in the upper 1.8 ft of RC-1 (from 5 to 6.8 ft below grade). The boring logs note high PID readings and product odor within the this fractured and weathered zone of the rock mass.

2. ***Hard, fresh to slightly weathered, medium to very widely fractured.*** This condition characterizes the rock mass at RC-1 from a depth of 9 to 15 ft and the rock mass at RC-2 from a depth of 6 to 15 ft. It is pointed out that our characterization differs from that of the boring logs in that we conclude that the more competent rock starts at a depth of 6 ft rather than 9 ft in RC-2. This zone is described as hard, fresh to slightly weathered, and medium to widely fractured (fracture spacing of 6 in. to 4 ft with only 10° relative dip (nearly horizontal) fractures observed within the 15-ft depth of interest). No vertical fractures evident in the cores. It is worth noting that the natural fracture spacing is slightly less in RC-2 than RC-1, but otherwise the rock is essentially the same hardness in both borings. The laboratory determined, unconfined compressive strength of the intact rock specimens from this zone of the rock mass ranges from 12,173 to $20{,}000^{+}$ psi. Accordingly, the rocks are placed in the *hard* category (8,000 to 32,000 psi) per PennDOT Publication 293. The boring logs note low PID readings within this competent rock zone of the rock mass.

Groundwater

The *apparent* depth to groundwater recorded in the boring logs is 90 ft at RC-1 and 105 ft at RC-2.

GEOTECHNICAL ANALYSIS AND CONCLUSIONS

Rippability assessment. Rippability of the rock mass was assessed using the AASHTO Manual of Subsurface Investigations (1988)[1] and the Caterpillar Handbook of Ripping[2]. The assessment utilizes the unconfined compressive strength and hardness of intact rock specimens along with degree of fracturing, weathering, and jointing of the rock mass. The rippability assessment of both rock layers is presented in Table 1. The *rippability rating* of the medium hard, highly to moderately weathered and closely fractured rock is 40 which corresponds to *hard ripping*. The corresponding recommended horsepower is 270 which is comparable to a D8 Caterpillar

1 AASHTO Manual of Subsurface Investigations, AASHTO, 1st Edition,1988.
2 Caterpillar Handbook of Ripping, Caterpillar Inc. 12th Edition, 2000.

tractor. The rippability rating of the second rock layer (hard, fresh to slightly weathered and medium to very widely fractured) is 72 which corresponds to *Extremely hard ripping and blasting*. The corresponding recommended horsepower is 770 which is comparable to a DD9 Caterpillar tractor. It is important to note that this assessment was developed by AASHTO for *open roadway cuts*. Therefore, its applicability to smaller pits and more confined excavations is considered with a prudent degree of conservatism.

In summary, due to its closely spaced fractures in both the horizontal and vertical directions, the upper 4 ft of rock at RC-1 and only the upper 1 ft of rock at RC-2 have been shown by this study to be rippable with assistance with some pneumatic hammering using a large and powerful excavator. The rest of the rock at both locations within the 15-ft deep zone of interest below grade is expected to prove very difficult to extract due to its hardness, wide fracture spacing, and the fact that only horizontal fractures were observed. Accordingly, blasting is expected and pneumatic hammering is only worth attempting in combination with percussion line drilling.

Table 1. Rock Rippability Assessment

Rock Type	**Highly to moderately weathered, closely fractured**		**Fresh to slightly weathered, medium to widely fractured**	
Seismic Velocity[1]	1500 - 1200	12	2150 - 1850	24
Rock Hardness	Medium Hard Rock	2	Hard Rock	5
Rock Weathering	Highly Weathered	3	Moderately Weathered	5
Joint Spacing	Closely	10	Medium	20
Joint Continuity	-	-	-	-
Joint Gouge	< 5 mm	3	Slight Separation	5
Strike and Dip Orientation[2]	Slightly unfavorable	10	Unfavorable	13
Overall Rating	40		72	
Rippability Assessment[3]	Hard Ripping		Extremely Hard Ripping & Blasting	

Notes

1. Seismic velocity is correlated with the overall quality of the rock mass.
2. Strike and dip orientation is rated with aspect of applications of rock excavation.
3. Rippability is assessed as follows: 100 – 90, *blasting required*; 90 – 70, *extremely hard ripping and blasting*; 70 – 50, *very hard ripping*; 50 – 25, *hard ripping*; <25, *easy ripping*.

LIMITATIONS

The findings and recommendations documented in this report are based on the stated project information and the results of 2 test borings and the documented laboratory testing. The subsurface information has been idealized for geotechnical purposes and it is not implied in this report that the conditions as depicted in the test borings are identical to what will be encountered during construction. GeoStructures should be kept informed as the project progresses and the depth and limit of rock excavation are delineated as well as if additional subsurface information become available. GeoStructures should also be apprised during construction if the subsurface conditions vary from our characterization presented herein.

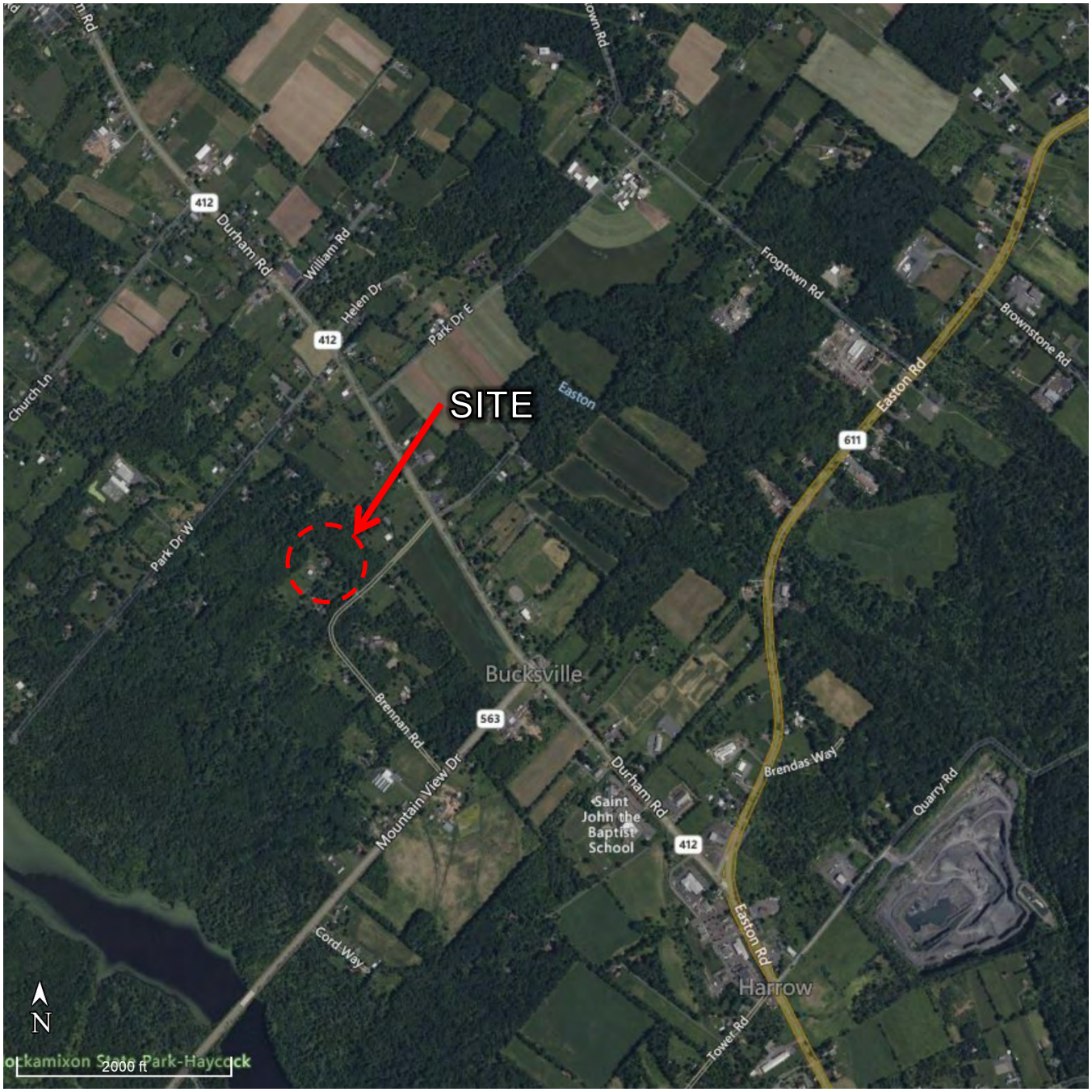
We appreciate the opportunity to provide services to you on this project. If you have any questions, please feel free to call.

Sincerely,

Kamil Nuzha, PE
Project Manager

Eric J. Seksinsky, PG, PE
Associate

Figures and Drawings



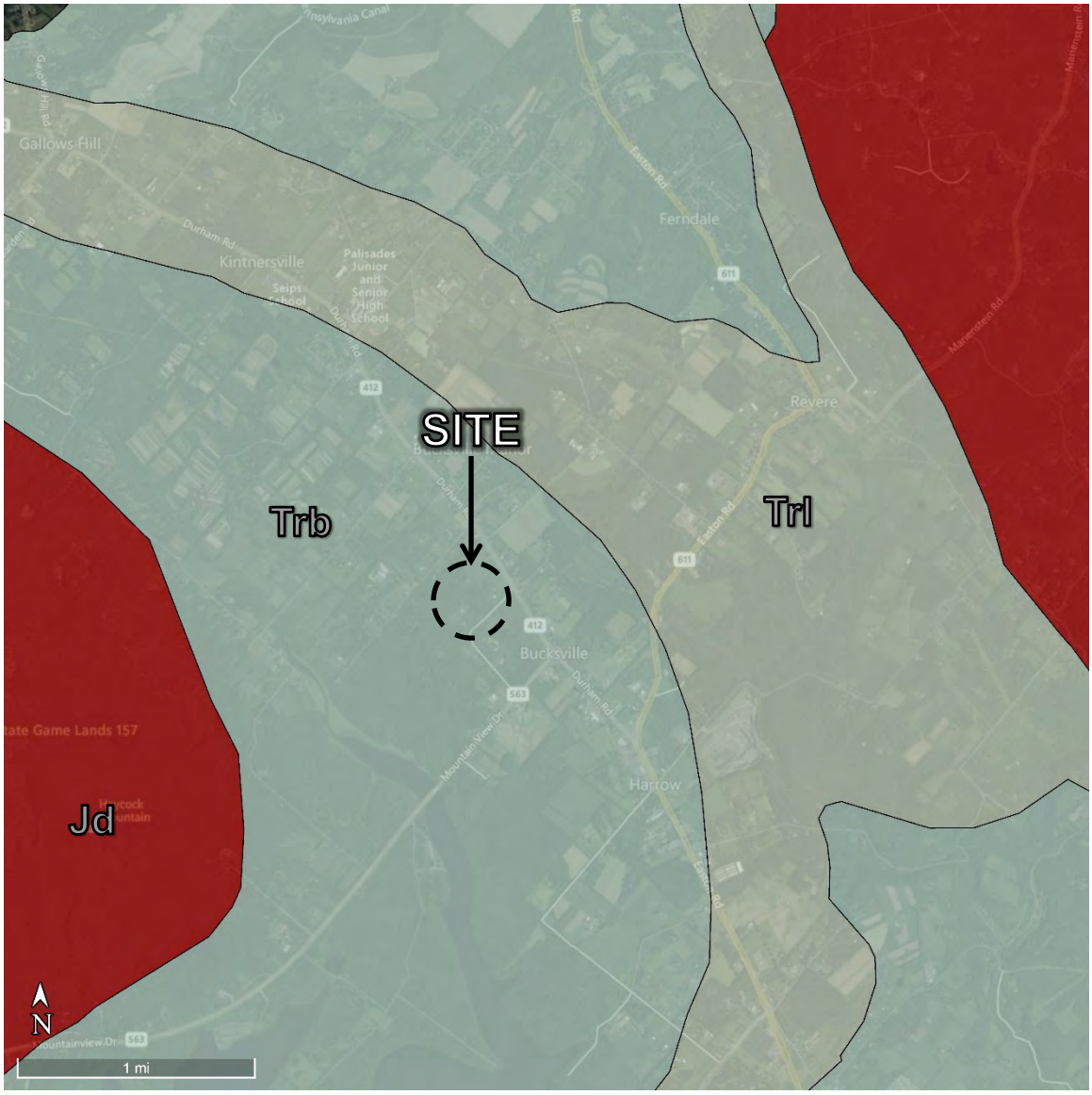
Source:

"Bing Maps in Google Earth." *Bing Maps in Google Earth*. N.p., n.d. Web. 1/4/2023. < http://ge-map-overlays.appspot.com/bing-maps/road >.

GeoStructures

FIGURE 1. SITE LOCATION MAP

GTAC - NOCKAMIXON TCE SITE
NOCKAMIXON TWP., BUCKS CO., PA



Trb: Brunswick Formation: Brunswick Formation - Reddish-brown mudstone, siltstone, and shale, containing a few green and brown shale interbeds; red and dark-gray, interbedded argillites near base. Youngest beds in Brunswick may be Jurassic in age.

Trl: Lockatong Formation (Triassic): Lockatong Formation - Dark-gray to black, thick-bedded argillite containing a few zones of thin-bedded black shale; locally has thin layers of impure limestone and calcareous shale.

Jd: Diabase (Jurassic): Diabase - Medium- to coarse-grained, quartz-normative tholeiite; composed of labradorite and various pyroxenes; occurs as dikes, sheets, and a few small flows.

Sources:

(1) "Bing Maps in Google Earth." *Bing Maps in Google Earth*. N.p., n.d. Web. 1/4/2023. < http://ge-map-overlays.appspot.com/bing-maps/road >.

(2) Bedrock Geologic Map of Pennsylvania by Socolow, A.A. & Berg, T.M., 1980.

(3) http://mrdata.usgs.gov/geology/state/state.php?state=PA

GeoStructures

FIGURE 2. SITE GEOLOGIC MAP

GTAC - NOCKAMIXON TCE SITE
NOCKAMIXON TWP., BUCKS CO., PA

LEGEND

TEST BORING

200' 100' 0 200'

SCALE: 1" = 200'

NOTE: THIS DRAWING IS BASED ON A SITE PLAN PROVIDED BY GES DATED 10/07/2021.

GeoStructures

GEOTECHNICAL INVESTIGATION PLAN		
GTAC - NOCKAMIXON TCE SITE 84 BRENNAN RD NOCKAMIXON TWP., OTTSVILLE, PA		
SCALE: 1" = 200'	DRAWN BY: KN	PROJECT NO: G23-101
DATE: 1/4/2023	CHECKED BY: KN	DRAWING NO: 1

PLOTTED: 1/4/2023 6:27:43 PM | BY: KAMIL NUZHA | PLOTSTYLE:GSI_HALF.CTB | PLOTTER:DWG TO PDF.PC3
FILE PATH: G:\PROJECT FOLDERS\2023\G23-101 GTAC-NOCKAMIXON\DRAWINGS\GEOTECHNICAL INVESTIGATION PLAN - GTAC.DWG

Appendix A
Test Boring Logs & Rock Core Photos

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
0					TOPSOIL: (0-0.5') Topsoil	TOPSOIL	Split spoon refusal at 5.4' bgs	Boring completed with temporary steel stick-up casing with bentonite seal to 5' bgs
2	12	4,8,12		0.0 0.0	ML: (0.5'-2.0') Reddish-brown silt, little clay, trace sand, weathered argillite fragments, medium dense, slightly moist	ML		
4	35	10,15,20,28		0.8 4.5 1.8 1.6				
6	50	28,45,50/4"	(5'-10') (17.5%) VERY POOR	52.8 11.8 48.3 483.6	CL: (2'-5') SAA, very dense, increasing weathered argillite fragments with depth	WEATHERED ARGILLITE	Rock core between 5'-150' bgs	
8				46.6 17.3 8.9	WEATHERED ARGILLITE: (5'-9') Gray weathered argillite, highly fractured with seams of brown silt and clay, odor			
10			(10'-15') (75%) GOOD	18 0.8	ARGILLITE: (9'-10') Competent Argillite, fracture at 9.5'	ARGILLITE		Open rock boring from 5' to 150' bgs
12				0.0	ARGILLITE: (10'-15') Gray competent argillite with fractures			
14				0.0	ARGILLITE: (15'-30') Gray to dark gray argillite, laminated to thinly bedded, horizontal fractures at 23', 24.5', 80 degree fracture at 27.25'-29', red-brown clay within fracture			
16			(15'-20') (94%) EX-CELLENT	0.0				
18								
20			(20'-25') (100%) EX-CELLENT					
22								
24				0.0				
26			(25'-30') (91%) EX-CELLENT	0.0				
28				0.0 0.0				
30			(30'-35') (100%) EX-CELLENT		ARGILLITE: (30'-40') Gray argillite, laminated to thinly bedded, 80 degree fracture at 30.5'-31.5', horizontal fractures at 43.5, 44', and 44.75'			
32								
34				0.0				
36			(35'-40') (93%) EX-CELLENT					
38								
40								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
42			(40'-45') (93%) EX-CELLENT		ARGILLITE: (40'-50') Gray to dark gray argillite, moderately calcareous, calcite filling in fractures at 46.25', 47', and 48.5'			
44				0.0				
46			(45'-50') (92%) EX-CELLENT	0.0				
48				0.0				
50				0.0				
52			(50'-55') (97%) EX-CELLENT		ARGILLITE: (50'-60') Gray to blue gray argillite, thinly bedded, moderately calcareous, calcite filling in fracture, trace pyrite within fracture at 54.5', interbedded dark gray siltstone at 59.5'-60', vertical fracture at 55'-59', 30 degree fracture at 59.25'			
54				0.0				
56			(55'-60') (72%) FAIR	0.0				
58				0.0				
60				0.0	ARGILLITE: (60'-65') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, calcite filling in fractures, trace pyrite within fractures, horizontal fractures at 61', 62', 63.5', and 64.5'			
62			(60'-65') (89%) GOOD					
64								
66			(65'-70') (90%) GOOD		ARGILLITE: (65'-70') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, calcite filling in fractures, trace pyrite within fractures, horizontal fractures at 67', 68', and 69'			
68				0.0				
70				0.0				
72			(70'-75') (95%) EX-CELLENT		ARGILLITE: (70'-80') Blue gray argillite, moderately calcareous, calcite and iron staining within fractures, 20 degree fracture at 73', 60 degree fracture at 74.5'			
74				0.0				
76			(75'-80') (100%) EX-CELLENT	0.0				
78				0.0				
80								

General Comments:

bgs - below ground surface

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RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
82			(80'-85') (93%) EX-CELLENT	0.0	ARGILLITE: (80'-85') SAA, vertical fracture from 81.25'-81.75', 10 degree fractures at 83.75' and 84.25', weathered argillite at 10 degree fractures			
84				0.0				
86			(85'-90') (58%) FAIR	0.0	ARGILLITE: (85'-90') Gray to blue gray argillite, thinly bedded, calcite filling in horizontal fractures at 86', 87', 87.75', heavily fractured at 88.5'-90'			
88				0.0 0.0 0.0				
90			(90'-95') (95%) EX-CELLENT	0.0	ARGILLITE: (90'-95') Blue gray argillite, calcareous, thinly bedded, calcite filling in fractures, horizontal fracture at 90.5', 20 degree fracture at 91.5'			
92				0.0				
94				0.0				
96			(95'-100') (93%) EX-CELLENT	0.0	ARGILLITE: (95'-109.5') Blue gray argillite, moderately calcareous, thinly bedded, calcite and iron staining in fractures, 10 degree fracture at 96.25', 55 degree fracture at 97.5', horizontal fractures at 100.5', 103.5', and 104'			
98				0.0 0.0				
100			(100'-105') (100%) EX-CELLENT					
102								
104								
106			(105'-110') (83%) GOOD					
108					SILTSTONE: (109.5'-111') Red brown siltstone, trace fine-grained pyrite	SILTSTONE		
110			(110'-115') (89%) GOOD					
112				0.0	ARGILLITE: (111'-120') Dark gray to blue gray argillite, moderately calcareous, thinly bedded, calcite and iron staining in fractures, 25 degree fracture at 111.5', 70 degree fracture at 114.5', vertical frature at 116'	ARGILLITE		
114				0.0				
116			(115'-120') (89%) GOOD	0.0				
118								
120				0.0				

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-1

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	150 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	10/26/-11/2/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
122			(120'-125') (95%) EX-CELLENT	0.0	ARGILLITE: (120'-125') Gray to blue gray argillite, thinly bedded, calcite and fine-grained pyrite in fractures at 120.5', 30 degree frature at 124'			
124				0.0				
126			(125'-130') (100%) EX-CELLENT		ARGILLITE: (125'-141.25') Blue gray argillite, thinly bedded, moderately calcareous, calcite within bedding planes, 75 degree fracture at 130.5'-132.75' with calcite and pyrite within fracture, vertical fracture at 135.5', 75 degree frature at 138.25'-139.25'			
128								
130			(130'-135') (56%) FAIR					
132				0.0 0.0				
134				0.0				
136			(135'-140') (83%) GOOD	0.0 0.0				
138								
140			(140'-145') (97%) EX-CELLENT					
142				0.0	SHALE: (141.25'-150') Red brown shale, slightly calcareous, trace calcite, 15 degree fracture at 148'	SHALE		
144				0.0				
146			(145'-150') (97%) EX-CELLENT				Boring terminated at 150' bgs	
148				0.0				
150								

General Comments:
bgs - below ground surface
ppm - parts per million
RQD - Rock Quality Designation

Symbol Key:
Apparent Water Level
Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
0					TOPSOIL: (0-0.5') Topsoil	TOPSOIL	Split spoon refusal at 5.3' bgs	Boring completed with temporary steel stick-up casing with bentonite seal to 5' bgs
2	5	1,2,3,7		0.0	ML: (0.5'-5.0') Light brown silt with clay, few to some weathered argillite fragments, moist, loose	ML		
				0.0				
				0.0				
4	48	13,25,23,28		0.0				
	>50	28,25,50/3"		0.0				
6			(5'-10') (58%) FAIR	0.0	WEATHERED ARGILLITE: (5'-9') Weathered argillite, heavily fractured with seams of silt and clay	WEATHERED ARGILLITE	Rock core between 5'-250' bgs	
				0.0				
8				0.0	ARGILLITE: (9'-10') Argillite, competent	ARGILLITE		
				0.0				
10			(10'-15') (87%) GOOD		ARGILLITE: (10'-25') Blue gray argillite, thinly bedded, moderately calcareous with several horizontal fractures, 55 degree fracture at 12.5'-13', fracture partially filled in with brown silt and clay at 16.5'-17.25', 20 degree fracture at 22.75'			Open rock boring from 5' to 250' bgs
12				0.0				
14				0.0				
16			(15'-20') (93%) EX-CELLENT	0.0				
				0.0				
18				0.0				
20				0.0				
22			(20'-25') (95%) EX-CELLENT	0.0				
24				0.0				
26			(25'-30') (95%) EX-CELLENT	0.0	ARGILLITE: (25-35') Gray to blue gray argillite, thinly bedded, moderately calcareous, horizontal fractures at 27.25' and 28.75', calcite and trace iron staining within fractures, near vertical fracture from 32'-34' with trace silt and clay			
28				0.0				
				0.0				
30			(30'-35') (81%) GOOD					
32								
34				0.0				
36			(35'-40') (92%) EX-CELLENT		ARGILLITE: (35'-40') Gray to blue gray argillite, thinly bedded, moderately calcareous, pyrite and calcite within foliations at 36.5', 75 degree fracture at 37'-38.5			
38				0.0				
				0.0				
40								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
42, 44			(40'-45') (86%) GOOD		ARGILLITE: (40'-45') Blue gray to dark gray argillite with interbedded dark gray siltstone, moderately calcareous, thinly bedded, calcite within bedding plane			
46, 48, 50			(45'-50') (97%) EX-CELLENT	0.0 0.0	SILTSTONE: (45'-50.25') Dark gray siltstone with interbedded argillite, thinly bedded, calcite within bedding planes, horizontal fractures	SILTSONE		
52, 54, 56, 58, 60			(50'-55') (95%) EX-CELLENT (55'-60') (100%) EX-CELLENT	0.0 0.0 0.0	ARGILLITE: (50.25'-60') Gray to blue gray argillite, thinly bedded, moderately calcareous, calcite and pyrite observed within foliations, 60 degree fracture at 54' with trace clay within fracture	ARGILLITE		
62, 64			(60'-65') (84%) GOOD	0.0 0.0 0.0	ARGILLITE: (60'-65') Blue gray to dark gray argillite with interbedded siltstone, thinly bedded, moderately calcareous, horizontal fractures, slightly fissile at 64.5'			
66, 68, 70			(65'-70') (97%) EX-CELLENT	0.0 0.0 0.0	SILTSTONE: (65'-70') Dark gray siltstone with interbedded argillite, moderately calcareous, dark gray shale at 69.75'-70'	SILTSTONE		
72, 74, 76, 78, 80			(70'-75') (100%) EX-CELLENT (75'-80') (99%) EX-CELLENT	0.0 0.0 0.0	ARGILLITE: (70'-80') Blue gray argillite, thinly bedded, calcite within bedding planes, moderately calcareous	ARGILLITE		

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
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Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
82			(80'-85') (100%) EX-CELLENT		ARGILLITE: (80'-90') Blue gray argillite, thinly bedded, calcite within bedding planes, moderately calcareous, 80 degree fracture at 88.25'-90'			
84				0.0				
86			(85'-90') (77%) GOOD	0.0				
88				0.0 0.0 0.0				
90			(90'-95') (83%) GOOD	0.0	ARGILLITE: (90'-95') Gray to blue gray argillite, heavily fractured at 90'-90.5', oblique fraacture at 94'			
92				0.0				
94				0.0				
96			(95'-100') (97%) EX-CELLENT		ARGILLITE: (95'-100') Gray to blue gray argillite, moderately calcareous, thinly bedded, 80 degree fracture at 95'-96'			
98								
100				0.0				
102			(100'-105') (73%) FAIR	0.0	ARGILLITE: (100'-105') Blue gray argillite, thinly bedded, heavily fractured, 70 degree fracture at 101'-101.5', vertical fracture at 103'			
104				0.0 0.0				
106			(105'-110') (92%) EX-CELLENT	0.0	ARGILLITE: (105'-120') Blue gray argillite, thinly bedded, calcareous, vertical fracture at 105.5', 70 degree fracture at 109' and 116', calcite vein at 119' with pyrite			
108								
110			(110'-115') (100%) EX-CELLENT	0.0				
112				0.0				
114				0.0				
116			(115'-120') (100%) EX-CELLENT	0.0				
118								
120				0.0				

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
122			(120'-125') (96%) EX-CELLENT	0.0 0.0	ARGILLITE: (120'-125') Blue gray argillite, thinly bedded, calcareous, calcite vein at 121' with pyrite			
124				0.0				
126			(125'-130') (100%) EX-CELLENT		ARGILLITE: (125'-135') Blue gray argillite, thinly bedded, oblique proto-fractures with calcite at 127.5'-128' and 131'-133'			
128								
130			(130'-135') (100%) EX-CELLENT					
132								
134				0.0				
136			(135'-140') (95%) EX-CELLENT		ARGILLITE: (135'-140') Blue gray to dark gray argillite, moderately calcareous, few interbedded siltstone layers, oblique proto-fracture with calcite at 139'			
138								
140				0.0				
142			(140'-145') (94%) EX-CELLENT	0.0	ARGILLITE: (140'-145.5') Blue gray argillite, calcareous, thinly bedded, 70 degree fracture at 143'			
144				0.0				
146			(145'-150') (95%) EX-CELLENT	0.0	ARGILLITE: (145.5'-155') Red brown argillite, slightly calcareous, thinly bedded, 35 degree fracture at 152'			
148								
150			(150'-155') (98%) EX-CELLENT					
152				0.0				
154				0.0 0.0				
156			(155'-160') (93%) EX-CELLENT		SHALE: (155'-160') Red brown shale, slightly calcareous, fissile, thinly bedded with horizontal fractures	SHALE		
158				0.0 0.0				
160								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
162			(160'-165') (83%) GOOD	0.0	SHALE: (160'-170') Red brown shale, slightly calcareous, fissile, thinly bedded with horizontal fractures, 70 degree frcture at 163'			
164				0.0				
166			(165'-170') (80%) GOOD					
168								
170				0.0				
172			(170'-175') (92%) EX-CELLENT		ARGILLITE: (170'-180') Red brown argillite with horizontal fractures throughout	ARGILLITE		
174								
176			(175'-180') (98%) EX-CELLENT	0.0				
178				0.0				
180			(180'-185') (99%) EX-CELLENT		ARGILLITE: (180'-200') Red brown argillite with horizontal fractures throughout			
182				0.1				
184								
186			(185'-190') (92%) EX-CELLENT	0.2				
188								
190			(190'-195') (84%) GOOD					
192								
194				0.1				
196			(195'-200') (93%) EX-CELLENT					
198								
200								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
202, 204			(200'-205') (100%) EX-CELLENT		ARGILLITE: (200'-205') Red brown argillite with horizontal fractures throughout			
206, 208, 210, 212, 214, 216, 218			(205'-210') (98%) EX-CELLENT; (210'-215') (100%) EX-CELLENT; (215'-220') (100%) EX-CELLENT	0.0; 0.0; 0.0; 0.0; 0.0	ARGILLITE: (205'-220') Red brown argillite, thinly bedded, slightly calcareous with horizontal fractures throughout, 30 degree fracture at 218'			
220			(220'-225') (100%) EX-CELLENT		SHALE: (220'-221.5') Red brown to purple shale, slightly calcareous, thinly bedded	SHALE		
222, 224, 226, 228, 230			(225'-230') (100%) EX-CELLENT; (230'-235') (97%) EX-CELLENT		ARGILLITE: (221.5'-231') Red brown argillite, thinly bedded, slightly calcareous, oblique calcite vein at 221.5'-223'	ARGILLITE		
232, 234, 236, 238, 240			(235'-240') (93%) EX-CELLENT	0.0; 0.0	ARGILLITE: (231'-240') Gray to blue gray argillite, thinly bedded, moderately calcareous, few horizontal fractures; ARGILLITE: (240'-241.25') Gray to blue gray argillite, thinly bedded,			

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

ROCK CORING LOG

RC-2

Groundwater and Environmental Services, Inc.

PROJECT:	GTAC Nockamixon TCE Site	CASING ELEVATION:	NA	TOTAL DEPTH:	250 feet
ADDRESS:	77 Brennan Road	BOREHOLE DIAMETER:	4"	WATER DEPTH:	NA
	Nockamixon, PA	WELL DIAMETER:	NA		

Logged By:	Daniel Sivco, Brian Hale	Drilling Method:	Split spoon/Rock Core
Dates Drilled:	11/3-11/16/2022	Sampling Method:	Split Spoon (140 lb hammer, 30" drop)
Drilling Company:	Eichelbergers, Inc.	Soil Class. System:	USCS
Drill Rig Type:	Deitrich D-50	Field Screening:	PID 11.7 eV Lamp (ppm)

Depth (feet)	N-Value	Blow Counts	RQD	Field Screening (ppm)	SAMPLE LITHOLOGY (USCS)	Stratigraphy	Comments	COMPLETION DETAILS
			(240'-245') (100%) EX-CELLENT		moderately calcareous			
242					ARGILLITE: (241.25'-245') Gray to red brown argillite, moderately calcareous, fine-grained pyrite along bedding planes			
244								
246			(245'-250') (100%) EX-CELLENT	0.0	ARGILLITE: (245'-250') Blue gray argillite, thinly bedded, fine-grained calcite in fracture at 246.25'		Boring terminated at 250' bgs	
248								
250								

General Comments:

bgs - below ground surface

ppm - parts per million

RQD - Rock Quality Designation

Symbol Key:

Apparent Water Level

Lab Sample Location

Photo 1. Cores of Boring RC-1

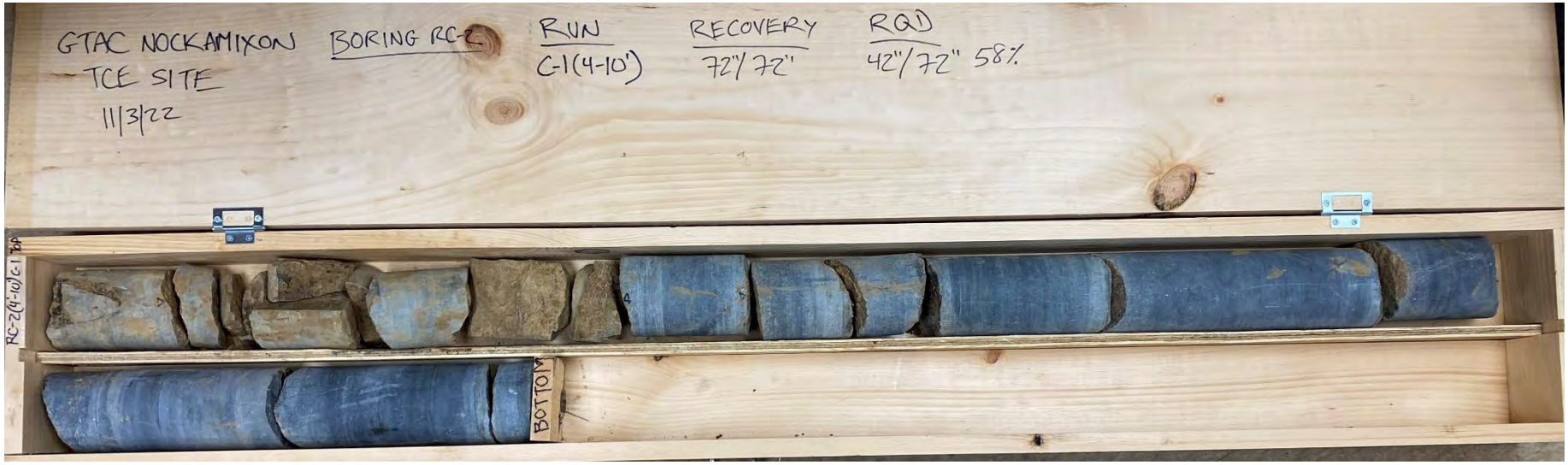


Photo 2. Cores of Boring RC-2

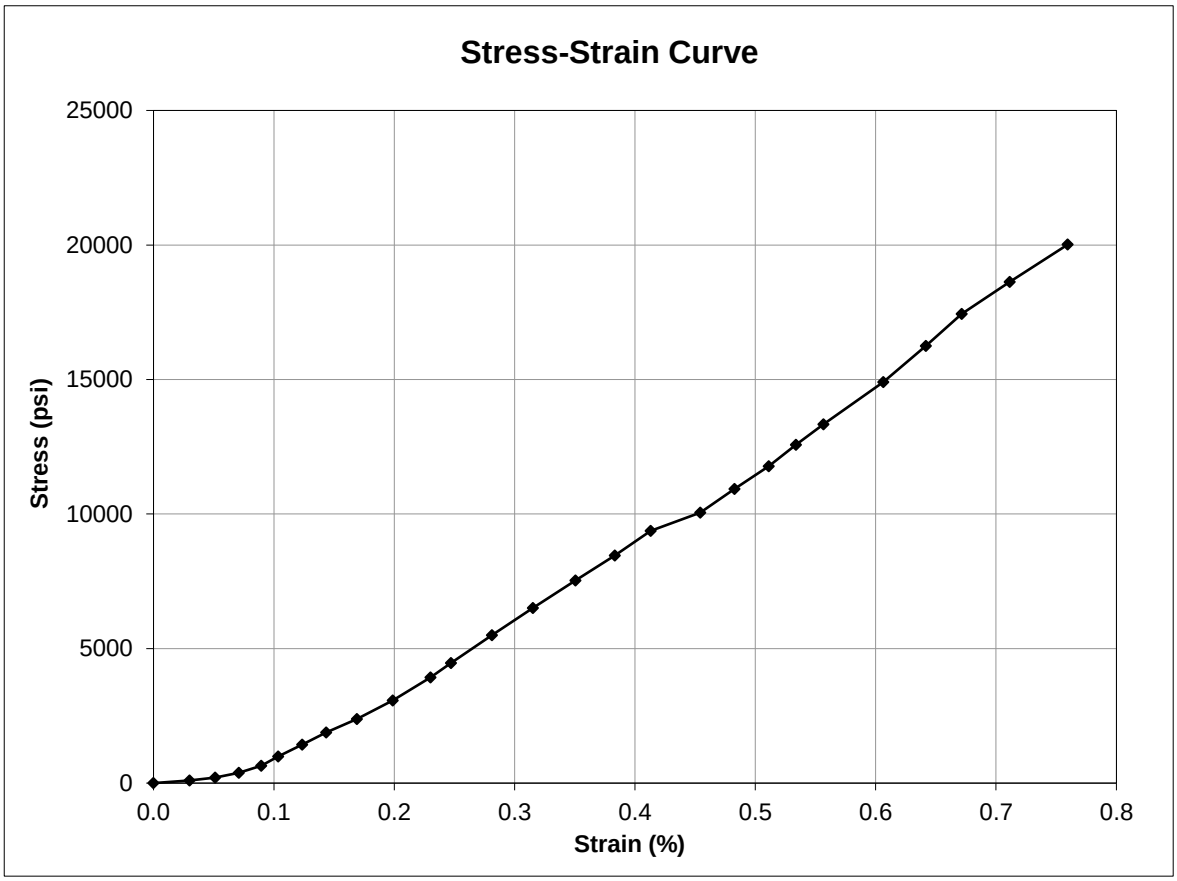
GeoStructures

ROCK CORE BOX PHOTO

GTAC - NOCKAMIXON TCE SITE
NOCKAMIXON TWP., BUCKS CO., PA

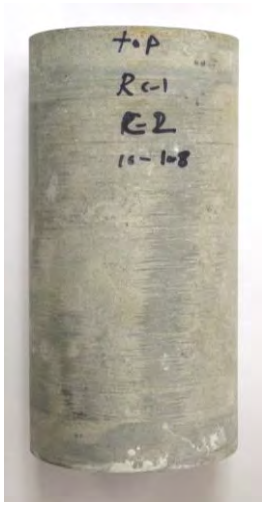
Appendix B
Laboratory Testing Results

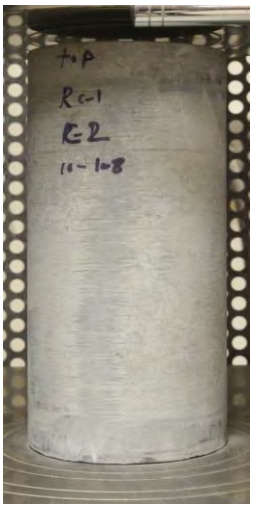
ROCK UNCONFINED COMPRESSION TEST REPORT
(ASTM D7012)



ID / Run	Depth	Diameter (in.)	Height (in.)	Unit weight (pcf)	Compressive Strength (psi)
RC-1 / C-2	10.0 - 10.8	3.32	7.04	162.2	20,014

Photos:





GeoStructures

GTAC - Nockamixon TCE Site, Nockamixon Twp., Bucks Co., PA

GeoStructures Project No.: G23-101

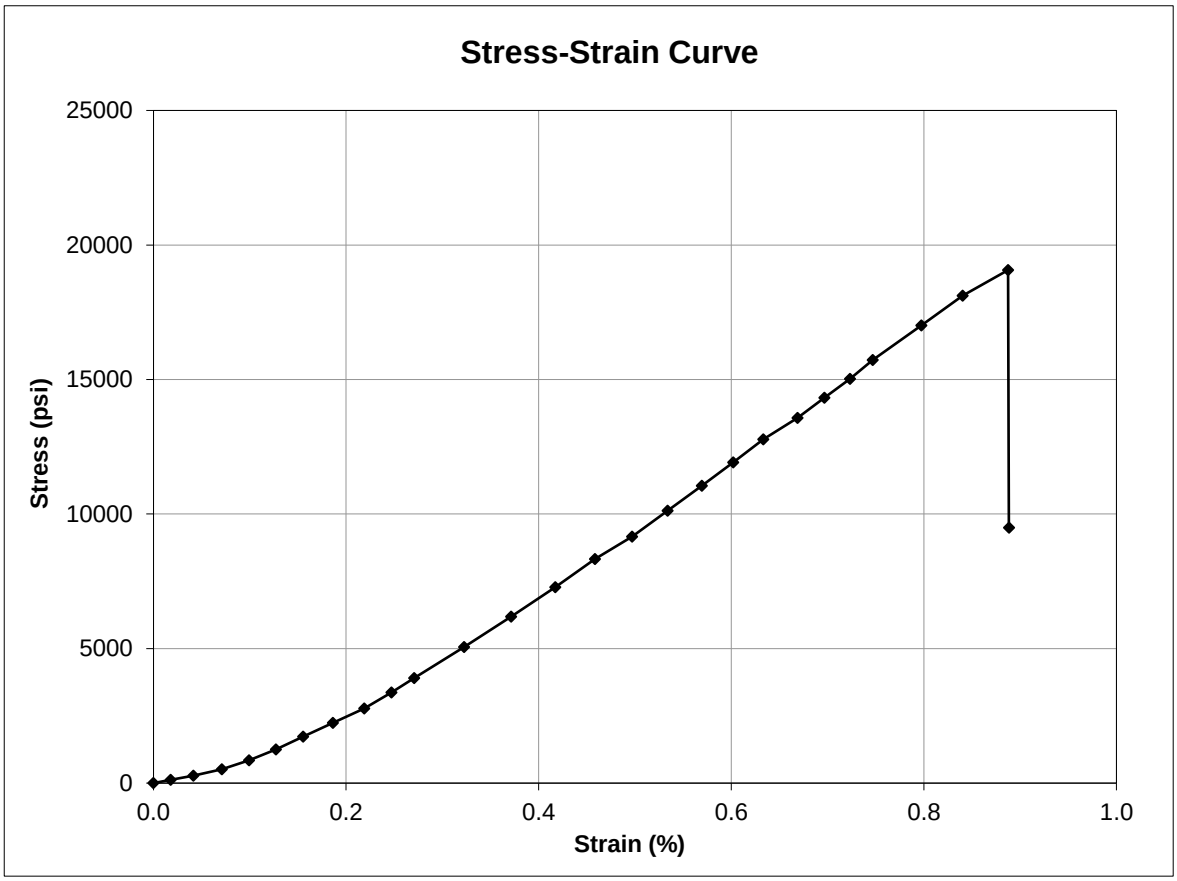
1/9/2023

Ph. 610.265.1818
Fax 610.265.1833

GeoStructures, Inc
1000 West 9th Ave., King of Prussia, PA 19406

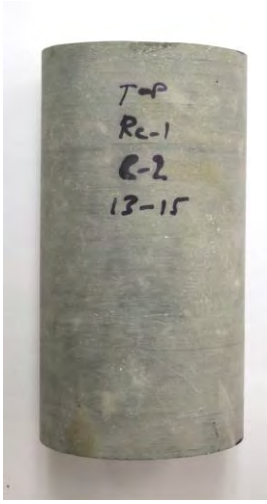
www.geostructures.net

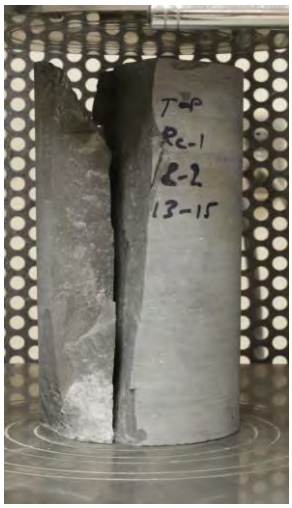
ROCK UNCONFINED COMPRESSION TEST REPORT
(ASTM D7012)



ID / Run	Depth	Diameter (in.)	Height (in.)	Unit weight (pcf)	Compressive Strength (psi)
RC-1 / C-2	13.0 - 15.0	3.32	6.76	165.3	19,066

Photos:





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GTAC - Nockamixon TCE Site, Nockamixon Twp., Bucks Co., PA

GeoStructures Project No.: G23-101 | 1/9/2023

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1000 West 9th Ave., King of Prussia, PA 19406

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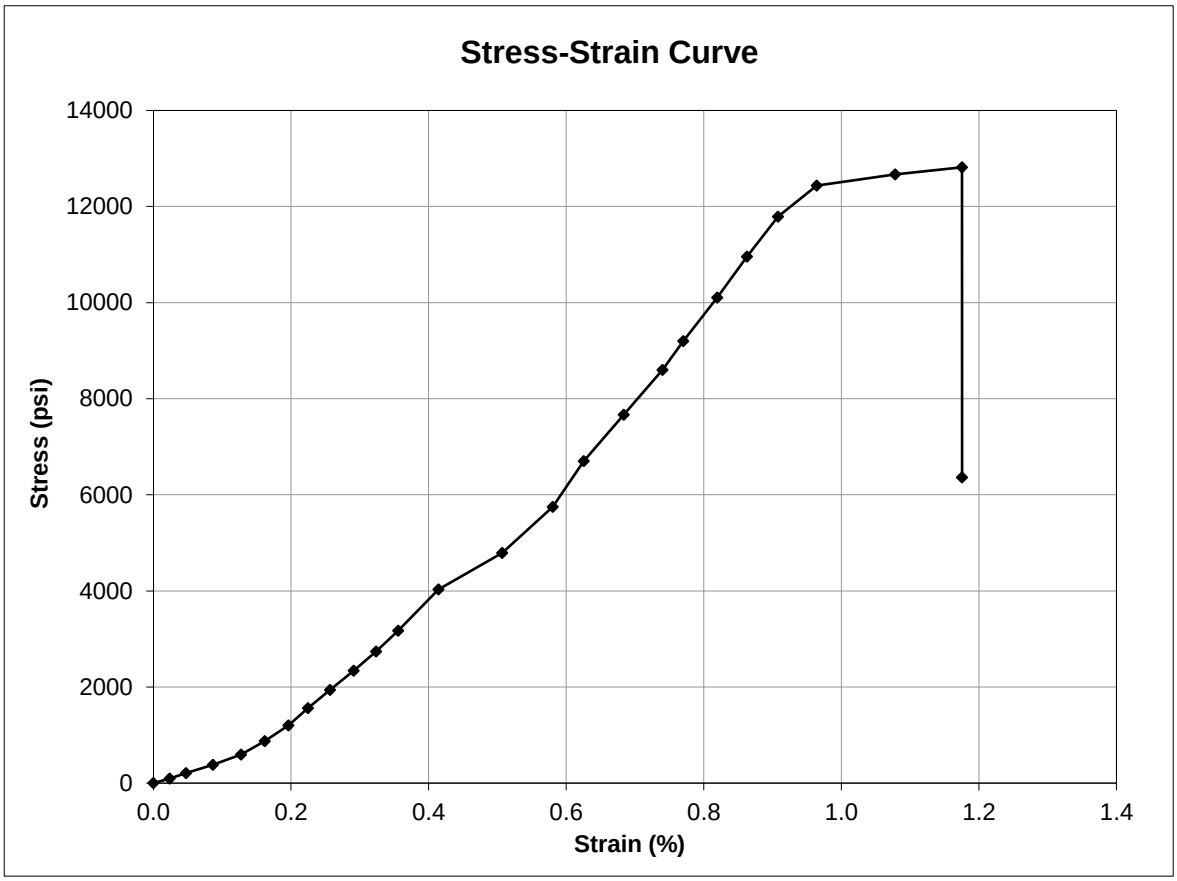
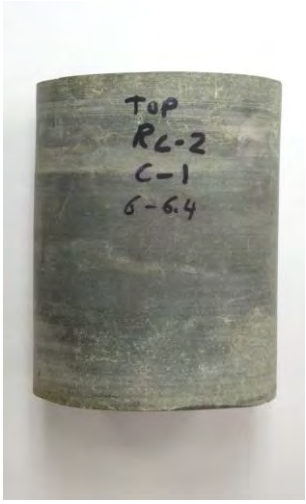
ROCK UNCONFINED COMPRESSION TEST REPORT
(ASTM D7012)



ID / Run	Depth	Diameter (in.)	Height (in.)	Unit weight (pcf)	Corrected Compressive Strength (psi)
RC-2 / C-1	6.0 - 6.4	3.32	4.64	162.2	12,173

Photos:



GeoStructures

GTAC - Nockamixon TCE Site, Nockamixon Twp., Bucks Co., PA

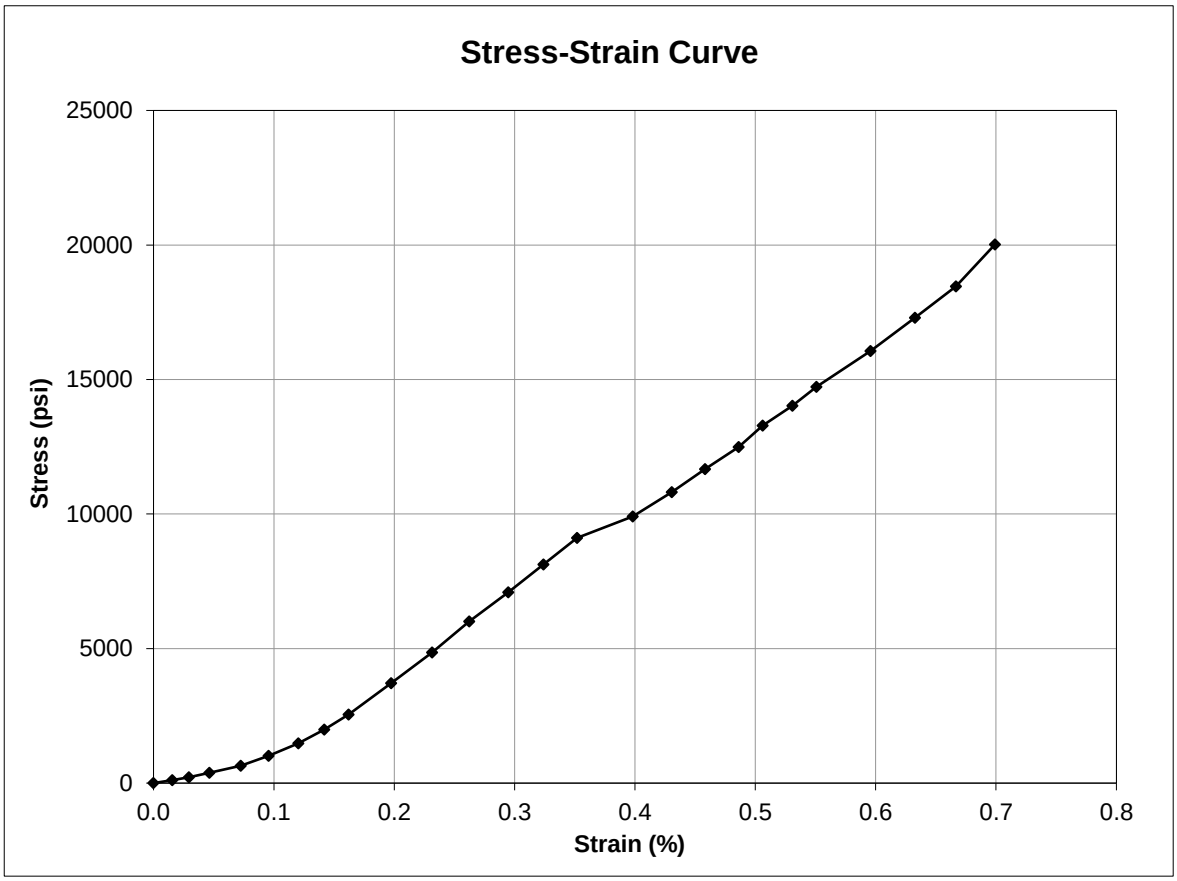
GeoStructures Project No.: G23-101 | 1/9/2023

Ph. 610.265.1818
Fax 610.265.1833

GeoStructures, Inc
1000 West 9th Ave., King of Prussia, PA 19406

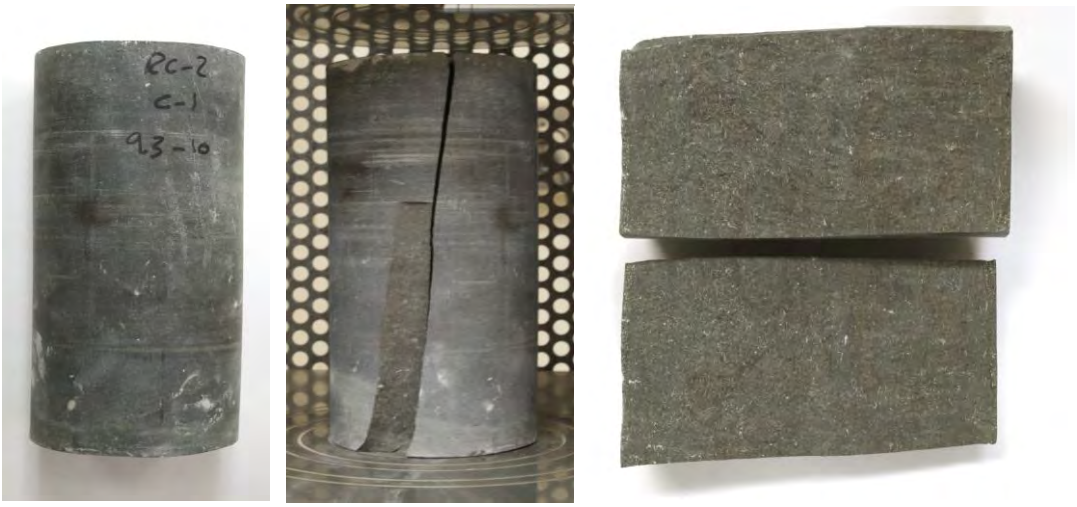
www.geostructures.net

ROCK UNCONFINED COMPRESSION TEST REPORT
(ASTM D7012)



ID / Run	Depth	Diameter (in.)	Height (in.)	Unit weight (pcf)	Compressive Strength (psi)
RC-2 / C-1	9.3 - 10.0	3.32	6.48	169.5	20,013

Photos:



GTAC - Nockamixon TCE Site, Nockamixon Twp., Bucks Co., PA

GeoStructures Project No.: G23-101

1/6/2023

Ph. 610.265.1818
Fax 610.265.1833

GeoStructures, Inc
1000 West 9th Ave., King of Prussia, PA 19406

www.geostructures.net

Attachment C – Waste Disposal Documentation

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number:
2. Page 1 of 1
3. Emergency Response Phone: 800-258-5585
4. Waste Tracking Number: 0008447

5. Generator's Name and Mailing Address:
Pennsylvania Department of Environmental Protection
77 Brennan Road
Ottsville, PA 18942
Generator's Phone: 484-250-5723

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: Lewis Environmental, Inc.
U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601
Facility's Phone: 717-393-2627
U.S. EPA ID Number: PAD987266749

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

1) 2212-05400-LPT

30057PL

14. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Christine McCarthy on behalf of DEP
Signature: Christine McCarthy
Month: 02 Day: 00 Year: 2023

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Date leaving U.S.:
Transporter Signature (for exports only):

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Dylan Romano
Signature:
Month: 02 Day: 06 Year: 23
Transporter 2 Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
U.S. EPA ID Number:
17b. Alternate Facility (or Generator)
Facility's Phone:
17c. Signature of Alternate Facility (or Generator)
Month: Day: Year:

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY TO GENERATOR

169-BLC-O 5 11977 (Rev. 9/09)

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NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number

2. Page 1 of 1

3. Emergency Response Phone: 800-258-5585

4. Waste Tracking Number: 0008448

5. Generator's Name and Mailing Address: Pennsylvania Department of Environmental Protection, 77 Brennan Road, Ottsville, PA 18942

Generator's Phone: 484-250-5723

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: Lewis Environmental, Inc.

U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name:

U.S. EPA ID Number:

8. Designated Facility Name and Site Address: VLS Lancaster, LLC, 1076 Old Manheim Pike, Lancaster, PA 17601

Facility's Phone: 717-393-2627

U.S. EPA ID Number: PAD987266749

	9. Waste Shipping Name and Description	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.
1.	Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2.					
3.					
4.					

13. Special Handling Instructions and Additional Information:

1) 2212-05400-LPT

30057PL

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Christine McCarthy on behalf of DEP

Signature: Christine McCarthy

Month 02 Day 06 Year 2023

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Date leaving U.S.:

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Noah Bry

Signature:

Month 02 Day 06 Year 2023

Transporter 2 Printed/Typed Name:

Signature:

Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

U.S. EPA ID Number:

17b. Alternate Facility (or Generator)

Facility's Phone:

Month Day Year

17c. Signature of Alternate Facility (or Generator)

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name:

Signature:

Month Day Year

DESIGNATED FACILITY TO GENERATOR

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

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169-BLC-O 5 11977 (Rev. 9/09)

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number
2. Page 1 of: 1
3. Emergency Response Phone: 800-258-5585
4. Waste Tracking Number: 0008450

5. Generator's Name and Mailing Address
Pennsylvania Department of Environmental Protection
77 Brennan Road
Ottsville, PA 18942
Generator's Phone: 484-250-5723

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: Lewis Environmental, Inc
U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name
U.S. EPA ID Number

8. Designated Facility Name and Site Address
VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601
Facility's Phone: 717-393-2627
U.S. EPA ID Number: PAD987266749

9. Waste Shipping Name and Description	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

LJ 2212-05400-LPT

30057PL

14. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Christine McCarthy on behalf of DEP
Signature: Christine McCarthy
Month 02 Day 06 Year 2023

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S.
Port of entry/exit:
Transporter Signature (for exports only):
Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Nick Berry
Signature:
Month 02 Day 06 Year 2023
Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

17. Discrepancy
17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
17b. Alternate Facility (or Generator)
U.S. EPA ID Number
Facility's Phone:
17c. Signature of Alternate Facility (or Generator)
Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name:
Signature:
Month Day Year

GENERATOR
INT'L
TRANSPORTER
DESIGNATED FACILITY

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NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number:
2. Page 1 of 1
3. Emergency Response Phone: 800-258-5585
4. Waste Tracking Number: 0008449

5. Generator's Name and Mailing Address
Pennsylvania Department of Environmental Protection
77 Brennan Road
Ottsville, PA 18942
Generator's Phone: 484-250-5723

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: Lewis Environmental, Inc.
U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601
Facility's Phone: 717-393-2627
U.S. EPA ID Number: PAD987266749

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information
1) 2212-05400-LPT
30057PL

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Christine McCarthy on behalf of DEP
Signature: Christine McCarthy
Month 02 Day 06 Year 2023

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Dylan Romano
Signature:
Month 02 Day 06 Year 23

Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

17. Discrepancy
17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

17b. Alternate Facility (or Generator)
U.S. EPA ID Number:
Facility's Phone:

17c. Signature of Alternate Facility (or Generator)
Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name:
Signature:
Month Day Year

GENERATOR
TRANSPORTER
INT'L
DESIGNATED FACILITY

169-BLC-O 5 11977 (Rev. 9/09)

DESIGNATED FACILITY TO GENERATOR

ASSOCIATES INC. Neenah, WI • USA • (800) 327 6868 • www.uline.com • Printed in the United States

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number

2. Page 1 of 1

3. Emergency Response Phone: 800-258-5585

4. Waste Tracking Number: 0008453

5. Generator's Name and Mailing Address:
Pennsylvania Department of Environmental Protection
77 Brennan Road
Ottsville, PA 18942

Generator's Site Address (if different than mailing address): SAME

Generator's Phone: 484-250-5723

6. Transporter 1 Company Name: Lewis Environmental, Inc.
U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601

U.S. EPA ID Number: PAD987266749

Facility's Phone: 717-393-2627

	9. Waste Shipping Name and Description	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.
1	Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2					
3					
4					

13. Special Handling Instructions and Additional Information

1) 2212-05400-LPT

30057PL

14. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: For DADEP Dustin A. Armstrong

Signature: [signature]

Month 02 Day 07 Year 23

INT'L

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S.

Port of entry/exit:

Transporter Signature (for exports only):

Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Noah Bry

Signature: [signature]

Month 02 Day 07 Year 23

Transporter 2 Printed/Typed Name:

Signature:

Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number:

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name:

Signature:

Month Day Year

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NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number

2. Page 1 of 1

3. Emergency Response Phone: 800-258-5585

4. Waste Tracking Number: 0008452

5. Generator's Name and Mailing Address: Pennsylvania Department of Environmental Protection, 77 Brennan Road, Ottsville, PA 18942

Generator's Site Address (if different than mailing address): SAME

Generator's Phone: 484-250-5723

6. Transporter 1 Company Name: Lewis Environmental, Inc.

U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address: VLS Lancaster, LLC, 1076 Old Manheim Pike, Lancaster, PA 17601

U.S. EPA ID Number: PAD987266749

Facility's Phone: 717-393-2627

	9. Waste Shipping Name and Description	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.
1	Non RCRA/DOT Liquids (Groundwater)	15	DM	775	G
2					
3					
4					

13. Special Handling Instructions and Additional Information

1) 2212-05400-LPT

30057PL

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Dustin A. Armstrong for DADEP

Signature

Month Day Year: 02 07 23

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: Date leaving U.S.:

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Dylan Romano

Signature

Month Day Year: 02 07 23

Transporter 2 Printed/Typed Name

Signature

Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name

Signature

Month Day Year

GENERATOR

TRANSPORTER

INT'L

DESIGNATED FACILITY

DESIGNATED FACILITY TO GENERATOR

169-BLC-O 5 11977 (Rev. 9/09)

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0008446

Pennsylvania Department of Environmental Protection
11 Bowman Road
Orrville, PA 18942
484-250-5777

SAME

Lewis Environmental, Inc

PA0987376540

VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601
717-391-2827

PA0087166749

Number	Type	Quantity	Total Volume
Non RCRA/DOT Liquids (Groundwater)			G

11. Special Handling Instructions and Additional Information

1) 2212-05400-LPT

30057PL

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: For DASEP Dustin A. Armstrong
Signature:
Month 02 Day 07 Year 23

TRANSPORTER INTL

15. International Shipments: Import to U.S. Export from U.S. Port of entry/exit: Date leaving U.S.:

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Dylan Romano
Signature:
Month Day Year 02 07 23

Transporter 2 Printed/Typed Name
Signature:
Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space: Quantity Type Residue Partial Rejection Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name
Signature
Month Day Year

169-BLC-O 5 11977 (Rev. 9/09)

DESIGNATED FACILITY TO GENERATOR

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number:
2. Page 1 of: 1
3. Emergency Response Phone: 800-258-5585
4. Waste Tracking Number: 0008445

5. Generator's Name and Mailing Address:
Pennsylvania Department of Environmental Protection
77 Brennan Road
Ottsville, PA 18942
Generator's Phone: 484-250-5728

Generator's Site Address (if different than mailing address): SAME

6. Transporter 1 Company Name: Lewis Environmental, Inc.
U.S. EPA ID Number: PAD987378940

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address:
VLS Lancaster, LLC
1076 Old Manheim Pike
Lancaster, PA 17601
Facility's Phone: 717-393-2627
U.S. EPA ID Number: PAD987266749

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non RCRA/DOT Solids (PPE)	10	Drm	750	P
2. Non RCRA/DOT Liquids (Groundwater)				G
3. Non RCRA/DOT Solids (Soil)				P
4.				

13. Special Handling Instructions and Additional Information:
1) 2212-05401-SPT
2) 2212-05400-LPT
3) 2212-05399-SPT
30057PL

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: For PADEP Dustin A. Armstrong
Signature: [signature]
Month 02 Day 07 Year 23

15. International Shipments: ☐ Import to U.S. ☐ Export from U.S.
Port of entry/exit:
Date leaving U.S.:
Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Noah Bos
Signature: [signature]
Month 02 Day 07 Year 23
Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

17. Discrepancy
17a. Discrepancy Indication Space: ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
17b. Alternate Facility (or Generator):
U.S. EPA ID Number:
Facility's Phone:
17c. Signature of Alternate Facility (or Generator):
Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a:
Printed/Typed Name:
Signature:
Month Day Year

GENERATOR — INT'L — TRANSPORTER — DESIGNATED FACILITY

DESIGNATED FACILITY TO GENERATOR

169-BLC-O 5 11977 (Rev. 9/09)

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Attachment D – Advanced Geological Services, Inc. Geophysical Investigation Report

Advanced Geological Sevices, Inc.
3 Mystic Lane
Malvern, PA 19355
(610) 722-5500 (ph.)

January 27, 2023
AGS Reference: 22-149-1-Rev 1

Mr. Tim Uhler
Groundwater & Environmental Services, Inc.
44 Creamery Way, Suite 500
Exton, PA 19341

Subject: Geophysical Logging Results
GTAC – Nockamixon TCE Site
Nockamixon Township, Pennsylvania

Dear Mr. Uhler:

Advanced Geological Services (AGS) is pleased to present this letter report summarizing the results of borehole geophysical logging completed in newly drilled wells RC-1 and RC-2 that are located off of Brennan Drive in Nockamixon Township, Pennsylvania. Geophysical logging activities were completed on November 15 and 17, 2022.

A suite of logs was collected in wells RC-1 and RC-2 to characterize geologic and hydrogeologic conditions. Logs completed included natural gamma, 16 and 64 inch normal resistivity, single-point resistance, fluid conductivity, fluid temperature, 3-arm caliper, optical televiewer, acoustic televiewer, and heat pulse flowmeter.

1.0 METHODOLOGY

The logs that were run for this investigation include:

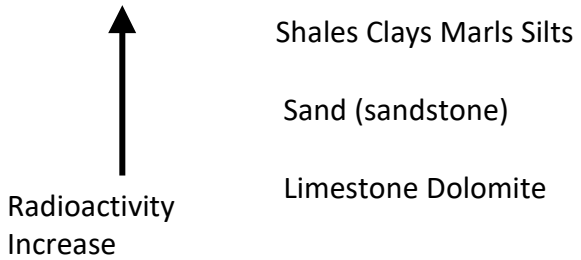
- Multi-Tool Logs:
  - Natural Gamma
  - Fluid Temperature
  - Fluid Conductivity (Fluid Resistivity)
  - 16-inch Normal Resistivity (16N)
  - 64-inch Normal Resistivity (64N)
  - Single Point Resistance (SPR)
- 3-Arm Caliper
- Acoustic Televiewer (ACTV)
- Optical Televiewer (OPTV)
- Heat Pulse Flowmeter (Non-pumping Conditions)

All logs were acquired with a Mount Sopris Matrix logging system. Each of the logs are described briefly below.

1.1. NATURAL GAMMA RAY LOGS

The natural gamma ray log is a passive instrument that measures the amount of naturally occurring radioactivity from geologic units within the borehole. Commonly occurring radioelements include potassium, thorium, and uranium; the two former elements are predominant within a common fine-grained rock sequence. The gamma ray log is also an excellent lithologic indicator because fine-grained clays and shales contain a higher radioelement concentration than limestones or sands. Gamma ray values are often used to assess the percentage of clay materials (indurated or non-indurated) that are present within a formation by utilizing empirically derived equations and sand-shale base line information.

The natural radioactivity range for earth materials is as follows:



1.2. LONG AND SHORT NORMAL ELECTRICAL RESISTIVITY LOGS

Resistivity is a measure of how well an electric current passes through a material. Formation resistivity is an intrinsic property of rocks and depends on the porosity and resistivity of the interstitial fluid and rock matrix.

In sedimentary rocks, the resistivity values of shales is generally lower than the resistivity of sandstone, which is lower than the resistivity of limestone. The resistivity log often shows a picture of the overall depositional sequence in sedimentary environment. Resistivity of unweathered igneous and metamorphic rocks are often extremely high when compared to resistivity in sedimentary rocks, with values that are commonly thousands of ohm-meters.

The normal resistivity logs are generated by non-focused current resistivity instrumentation within the well bore. The ultimate objective of these measurements is to determine the true resistivity of the formation (matrix and fluids). The normal electrode configuration assumes a point source of current from which the voltage drop is measured by a potential electrode in the well. A second set of current and potential electrodes are positioned at a large distance (ground surface) from the downhole electrodes to complete the circuit. The distance between the downhole current electrode and the downhole voltage electrode is either 16 inches or 64 inches. The volume of material measured is approximately two times the electrode separation: 32 inches and 128 inches, respectively. The calculation of resistivity is determined by applying Ohm's Law and known electrode separations.

Since the 64-inch normal utilizes a greater electrode separation, the instrument will measure more deeply into the formation and obtain resistivity values that closely approximate the true formation resistivity. Conversely, the 16-inch normal device will record resistivities that are found in a zone that is at least partially invaded by borehole fluids. In the case where borehole mud pressures are greater than formation water pressures, a comparison of these curves gives an indication of the depth of invasion of borehole fluids and formation permeability. If formation pressures are greater, the true resistivity values are easier to attain due to the lack of influence of the borehole fluids.

1.3. FLUID RESISTIVITY (CONDUCTIVITY) LOGS

A log of fluid resistivity, which is the reciprocal of fluid conductivity, provides data related to the concentration of dissolved solids in the fluid column. Fluid resistivity is measured in units of ohm-meters, which is equivalent to 1/microsiemen/centimeter (1/µS/cm). Although the quality of the fluid column may not reflect the quality of adjacent interstitial fluids, the information can be quite useful when combined with other logs. For example, change in fluid resistivity associated with a water-producing zone that is corroborated by other logs may indicate the inflow of impacted ground water.

1.4. SINGLE-POINT RESISTANCE LOGS

Single point resistance measurements are made by passing a constant current between two electrodes and recording the voltage fluctuations as the probe is moved up the hole. The resistance variations measured in the borehole are primarily due to variations in the immediate vicinity of the downhole electrode.

The resistance log is strongly affected by the resistance of the drilling fluid and variations in borehole diameter. It is extremely useful for detecting fractures in boreholes with relatively constant diameter. In sedimentary environments, the resistance log generally follows the variations in resistivity of the formation. Shales generally exhibit low values, sandstones have intermediate values, while coal and limestone beds have high resistance values.

1.5. TEMPERATURE LOGS

Temperature logs measure the change in fluid temperature within the borehole as a function of depth. The utility of this log is that it can provide information on the location of water-bearing strata or fracture zones within the well. The inherent assumptions of this technique are that the fluids entering the borehole from the water zones are either cooler or warmer than the mud fluids used for drilling purposes. In this case, it is possible to relate a temperature anomaly to a depth range in which waters of different temperature are emanating from a water-bearing or fractured lithologic unit.

Differential temperature (or delta temperature) values can be computed and sometimes presented on the same plot due to their greater sensitivity and improved visual clarity. Temperature anomalies are more easily recognized because differences of only a few degrees translate to large-scale deflections of the differential temperature curve.

1.6. CALIPER LOGS

The caliper log measures variations in borehole size as a function of depth in a well. The log data enables (a) the detection of competent or fractured geologic units, (b) the location of washouts or tight zones, (c) the optimal placement of well screen, sand, and bentonite, and (d) the establishment of appropriate borehole correction factors to be applied to other well log curves. Further, when run in combination with other logs, the caliper log may be an indicator of lithologic makeup and degree of consolidation. The typical caliper response in a fractured, or weathered, unit is a relatively abrupt increase in borehole size.

1.7. ACOUSTIC TELEVIEWER (ACTV) LOGS

The acoustic televiewer log provides an oriented high-resolution image of the borehole using high-resolution ulta-sound waves. The oriented image of the borehole is presented in both amplitude and travel time. ACTV logs cannot be collected in an air-filled borehole, but unlike the OPTV log, ACTV logs can be collected in mud filled holes, water with low or no clarity, or boreholes that have FLUTE liners installed. Results from this tool provide location and orientation information of features such as fractures, lithologic contacts, and cavities. The ACTV digitizes 256 measurements around the borehole every 0.02 feet along the length of the borehole. Since the acquired image is digitized and properly oriented with respect to borehole deviation and tool rotation, it allows data processing to provide accurate strike and dip information of structural features.

1.8. OPTICAL TELEVIEWER (OPTV) LOGS

The optical televiewer log provides an oriented, high-resolution, 360-degree photographic image of the borehole in either an air-filled, or water-filled borehole. The oriented image of the borehole is presented in unwrapped format on the log. Results from this tool provide location, color, and orientation information of features such as fractures, litholoic contacts, cavities and sidewall staining. The acquired image is digitized and properly oriented with respect to borehole deviation and tool rotation. Processing of the resulting image can provide accurate strike and dip information of fractures and other structural features.

1.9. HEAT PULSE FLOWMETER (HPFM) LOGS

The heat pulse flowmeter (HPFM) measures the vertical flow rates within a borehole. The log may be used to identify contributing fracture zones under natural and pumping conditions.

The system operates by heating a wire grid that is located between two thermistors. The heated body of water moves toward one of the thermistors under the effect of the vertical component of flow within the well. Positive and negative values on the log represent upward and downward flow, respectively. The flow is calibrated to gallons/minute (gpm) for the flowmeter tool. The heat pulse flowmeter tool used in this investigation can detect vertical flow rates between 0.03 and 1.0 gpm.

The heat pulse flowmeter can be used in either ambient, non-pumping conditions or in pumped conditions. In a well under natural ambient conditions, water will flow vertically through the well bore as a result of different head conditions at different fractures or water producing zones. If the head levels are the same in fractures penetrated by the well bore there will be no driving force for water to flow vertically within the well bore. While these fractures could potentially produce significant amounts of water if pumped, without a head difference to produce the driving force there will be no flow within the well.

Pumping a well at a low flow rate during the completion of a HPFM log can help to better identify potential water producing fractures, particularly in wells that exhibit no vertical flow under ambient conditions. In a well that already has a relatively high vertical flow rate under ambient conditions, pumping the well may not provide any additional information. This is particularly true if the well experiences upward vertical flow rates under ambient conditions that are already near the upper measurable limit of the HPFM sonde (1 gpm).

Heat pulse flowmeter data were only collected under ambient, or non-pumping conditions during this investigation.

2.0 RESULTS AND DISCUSSION

Two newly drilled wells, RC-1 and RC-2, were logged with a suite of geophysical tools to identify potential water-bearing fracture zones, determine the structural orientation of fractures and to characterize borehole conditions. Both wells were drilled with PQ core, yielding a borehole diameter of approximately 5 inches. Well RC-1 was relatively close to existing wells MW-1S and MW-1D, and well RC-2 was located to the west of RC-1. Both wells had temporary casing installed within the upper 5 to 10 feet of the wells at the time logging was completed.

Attempts were made to collect ambient heat pulse flowmeter data in both RC-1 and RC-2. Unfortunately it was not possible to obtain a stable baseline in either of the wells, which is required to collect valid heat pulse flowmeter data. Two different heat pulse flowmeter tools were used in both of the wells to try to collect data, with the same results in both wells. Functional tests of both of the heat pulse flowmeter tools indicted the tools themselves were operating correctly, so it is unclear why valid data could not be obtained. There is a possibility that the very fine suspended sediment (rock flour) may have coated the thermistors of the instrument and affected their stability. If heat pulse flowmeter data is needed at these well locations, it is suggested that an attempt to collect heat pulse flowmeter data again in the future after the wells have been allowed to settle for a longer period of time.

Review of the well logs indicated a very strong gamma response in well RC-1 at a depth of 66.5 to 69 feet and a similar gamma response in well RC-2 at a depth of 65.5 to 68 feet. This gamma response is a very good marker bed to allow stratigraphic correlation between the two wells.

The findings of each of the wells are discussed briefly below and the geophysical logs are provided as an attachment to the end of this report.

Well RC-1

Depth Datum: Ground surface
Well diameter: 5 inches (PQ core)
Total depth: 150 feet
Casing type: Steel
Casing depth: approx. 5 feet (temporary casing)
Casing stick-up height: 2.25 feet
Static water level: 97.5 feet

Several thin bedding partings and joint fractures are present within well RC-1. The most prominent bedding partings occur at a depth of approximately 90 feet as seen from the caliper and optical televiewer logs. This series of bedding partings is situated above the static water level. The two most prominent open joints are at depths of 115.8 and 116.1 feet. The fluid conductivity increases abruptly at the depth of those joints suggesting that they could be the major water producing zone in this well.

Orientations of the primary identified planar structures identified in well RC-1 are shown on the well log and are provided in Table 1.

Table 1: Well RC-1; Identified Planar Structure Orientations

Mean Depth of Feature (feet)	Dip Azimuth (degrees)	Dip Angle (degrees)	Comments
29.2	320	82	Partially open joint
79.0	281	3	Bedding parting
89.5	327	10	Bedding parting; partially open
90.0	165	7	Bedding parting; partially open
90.4	340	8	Bedding parting; partially open
98.8	47	65	Partially open joint
108.5	14	79	Partially open joint
115.8	17	74	Open joint (likely water-bearing)
116.1	19	76	Open joint (likely water-bearing)
119.7	21	73	Partially open joint
132.9	103	85	Partially open joint
136.6	289	84	Discontinuous fracture
137.4	128	7	Bedding parting; partially open (distinctive resistivity response)
149.0	27	26	Bedding parting

Well RC-2

Depth Datum: Ground surface
Well diameter: 5 inches (PQ core)
Total depth: 251 feet
Casing type: Steel
Casing depth: approx. 10 feet (temporary casing)
Casing stick-up height: 1.4 feet
Static water level: 107.8 feet

Well RC-2 was similar in character to well RC-1, with several thin joints and bedding partings. Although well RC-2 was an open hole and relatively close to well RC-1, the static water level at the time of logging was approximately 10 feet lower than the encountered in well RC-1. Also, whereas the fluid conductivity in RC-1 was low within the upper portion of the water column, the fluid conductivity in well RC-2 was high within the upper portion of the water column, then decreased significantly at a depth of 179.2 feet where an open bedding parting is located. The change in fluid conductivity at 179.2 feet may indicate that this is a water bearing bedding plane parting. The optical televiewer indicated an increase in the amount of suspended sediment below a depth of approximately 182 feet suggesting that there may be little water movement between 182 feet and the bottom of the well.

Orientations of the primary identified planar structures identified in well RC-2 are shown on the well log and are provided in Table 2.

Table 2: Well RC-2; Identified Planar Structure Orientations

Mean Depth of Feature (feet)	Dip Azimuth (degrees)	Dip Angle (degrees)	Comments
14.6	152	14	Bedding parting
18.2	10	76	Partially open joint
35.1	314	84	Discontinuous fracture
55.8	219	66	Filled joint or fracture
67.8	246	23	Bedding parting (strong gamma kick)
91.5	311	83	Filled joint or fracture
103.0	3	71	Partially open joint
104.7	191	20	Bedding parting
109.2	45	60	Partially open joint
112.0	307	83	Filled joint or fracture
117.9	18	75	Partially open joint
120.7	106	75	Filled joint or fracture
128.9	300	84	Filled joint or fracture
129.8	303	82	Filled joint or fracture
133.7	293	83	Filled joint or fracture
141.4	0	0	Bedding parting; partially open (distinctive resistivity response)

Mean Depth of Feature (feet)	Dip Azimuth (degrees)	Dip Angle (degrees)	Comments
145.0	49	74	Partially open joint
171.2	0	0	Bedding parting; partially open
171.6	126	23	Bedding parting; partially open
179.2	285	10	Bedding parting; partially open (likely water bearing)
203.2	289	80	Discontinuous fracture
204.8	300	10	Bedding parting
208.9	297	14	Bedding parting
236.4	149	14	Bedding parting

3.0 SUMMARY AND CLOSING

A suite of geophysical well logs was completed in newly drilled wells RC-1 and RC-2 to help characterize geologic and hydrogeologic conditions. Both wells penetrated several distinct bedding partings that can assist the stratigraphic correlation between the wells. Several thin joints were also visible in both wells above and below the static water levels. Despite RC-1 and RC-2 being relatively close to one another, there was approximately 10 feet difference in the static water levels and each well also had a distinctly different fluid conductivity profile.

The data collection and interpretation methodologies used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site.

Please contact us if you have any questions or would like to discuss the logging results. We appreciate your business and look forward to working with you again.

Sincerely,

Donald Jagel

Donald Jagel, P.G.
Principal Geophysicist

Attachments: Well Logs of RC-1 and RC-2

ADVANCED GEOLOGICAL SERVICES

AGS Project No.: 22-149-1

Client: GES

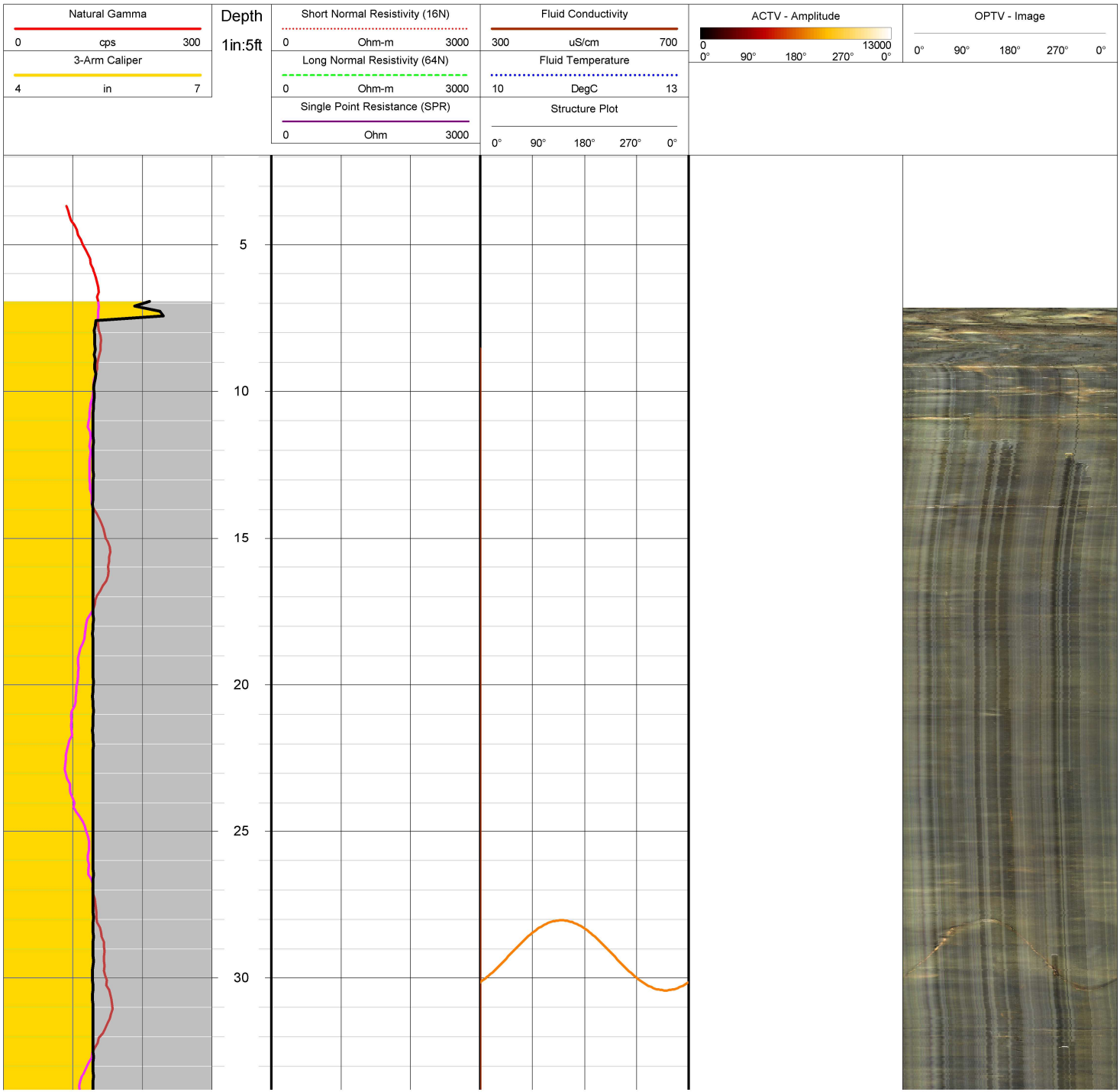
Well ID: RC-1

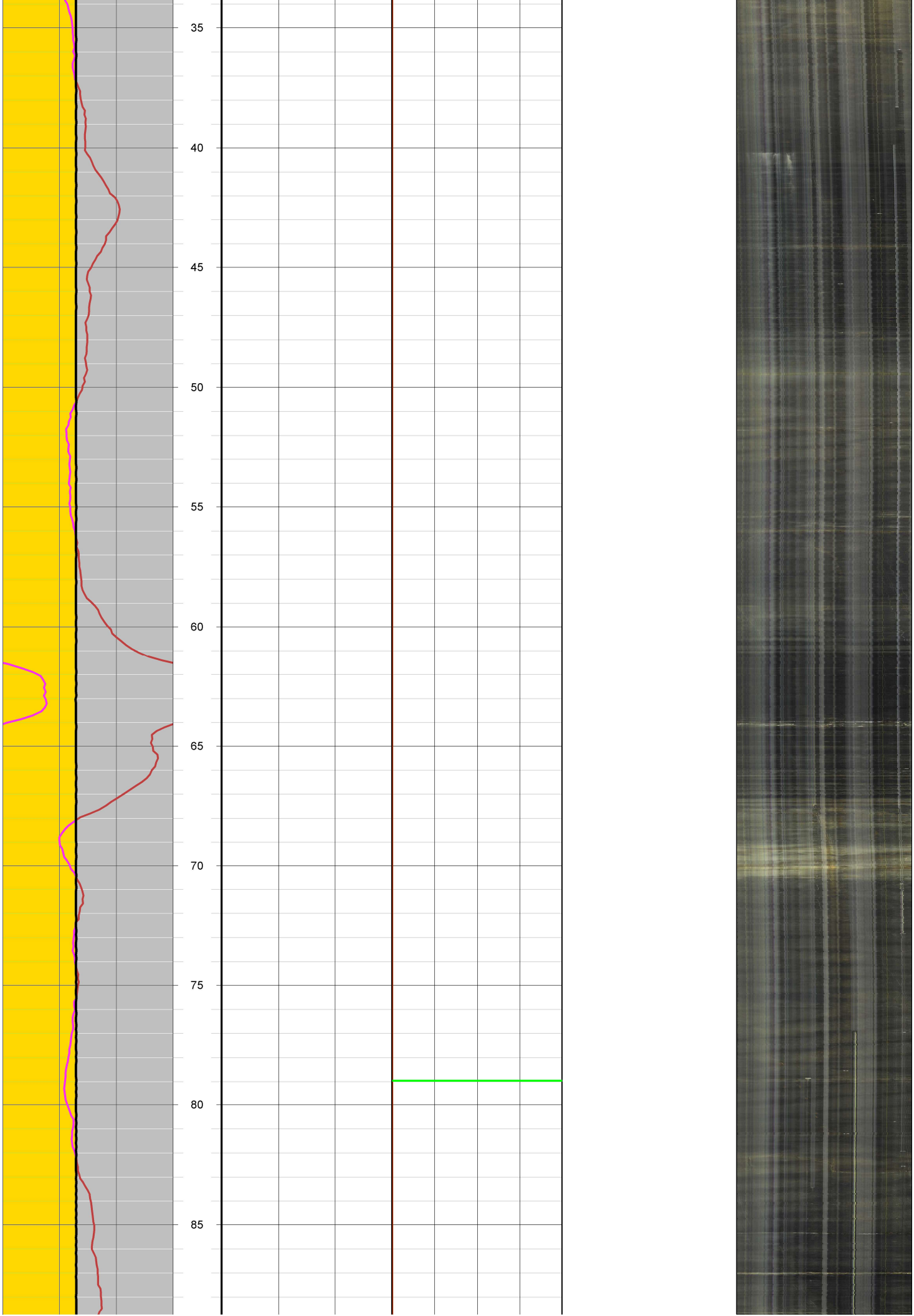
Site: GTAC - Nockamixon TCE Site
Nockamixon Twp., Pennsylvania

Date: 11/15/2022

Depth Datum: Ground Surface
Borehole Dia.: 5 in. (PQ core)
Total Depth: 150 ft.
Casing Type: Steel
Casing Depth: approx. 5 ft.
Casing Stickup Ht.: 2.25 ft. (temporary casing)
Water Level: 97.5 ft.

Remarks: Structure Plot Colors: Green = Bedding plane, parting or fracture
Magenta = Open joint or fracture
Orange = partially open joint or fracture
Gray = Filled joint or fracture
Cyan = Discontinuous fracture

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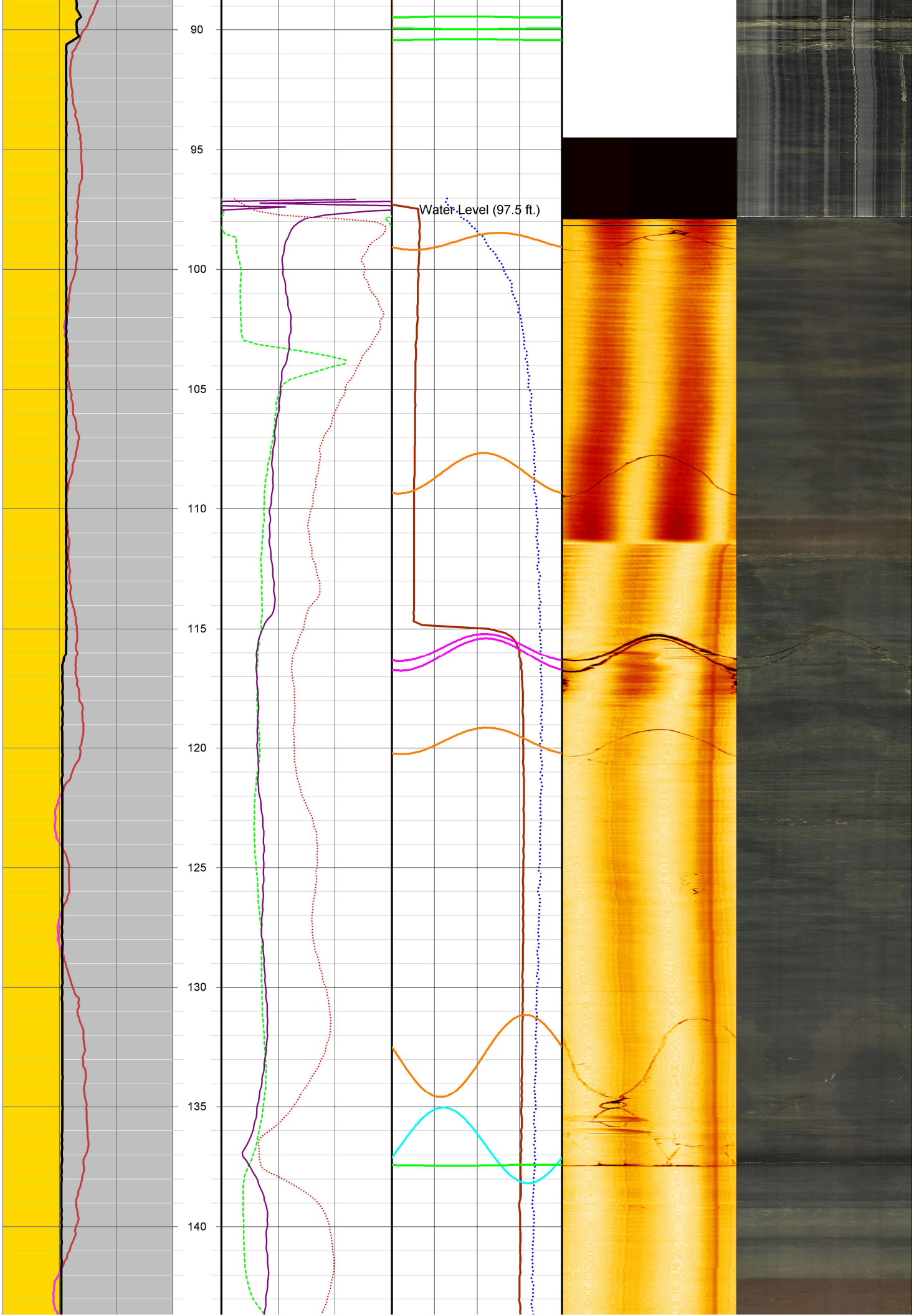
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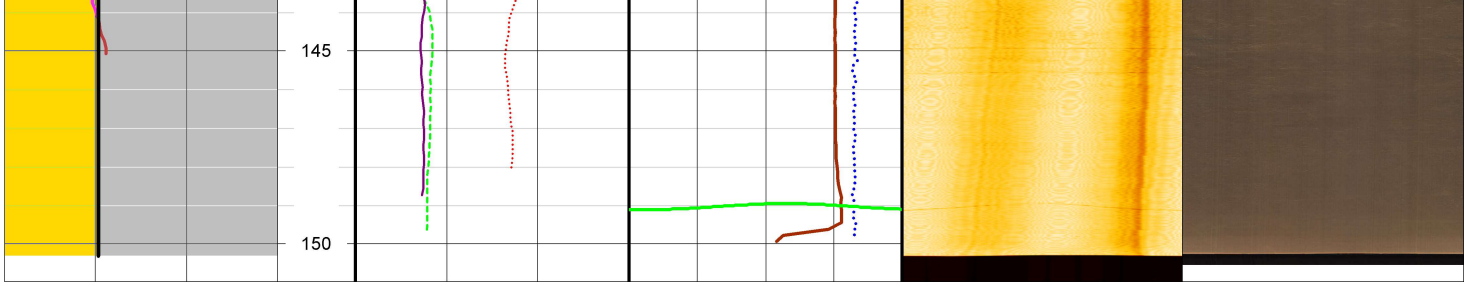
Water Level (97.5 ft.)


145
150

ADVANCED GEOLOGICAL SERVICES

AGS Project No.: 22-149-1

Client: GES

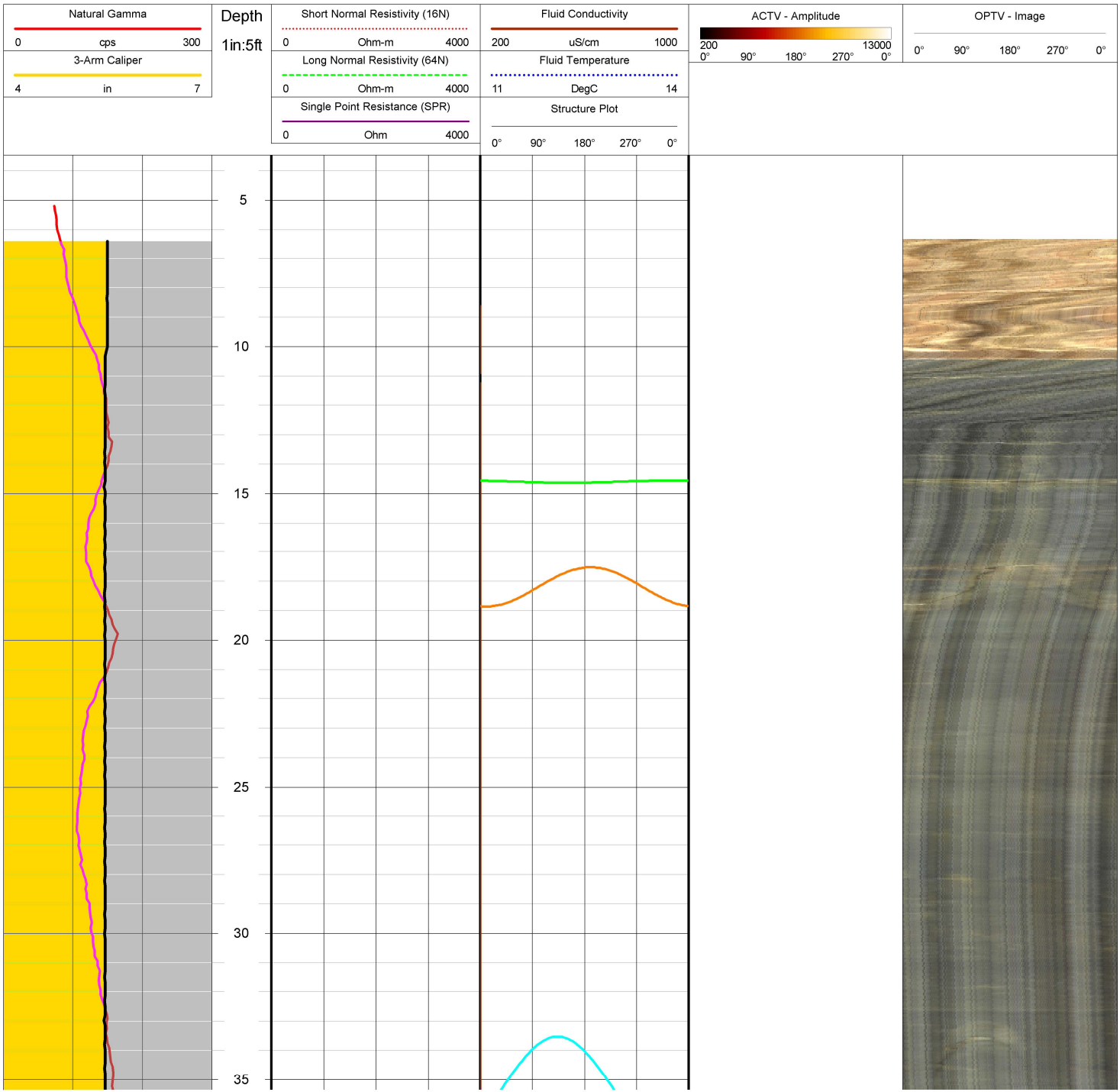
Well ID: RC-2

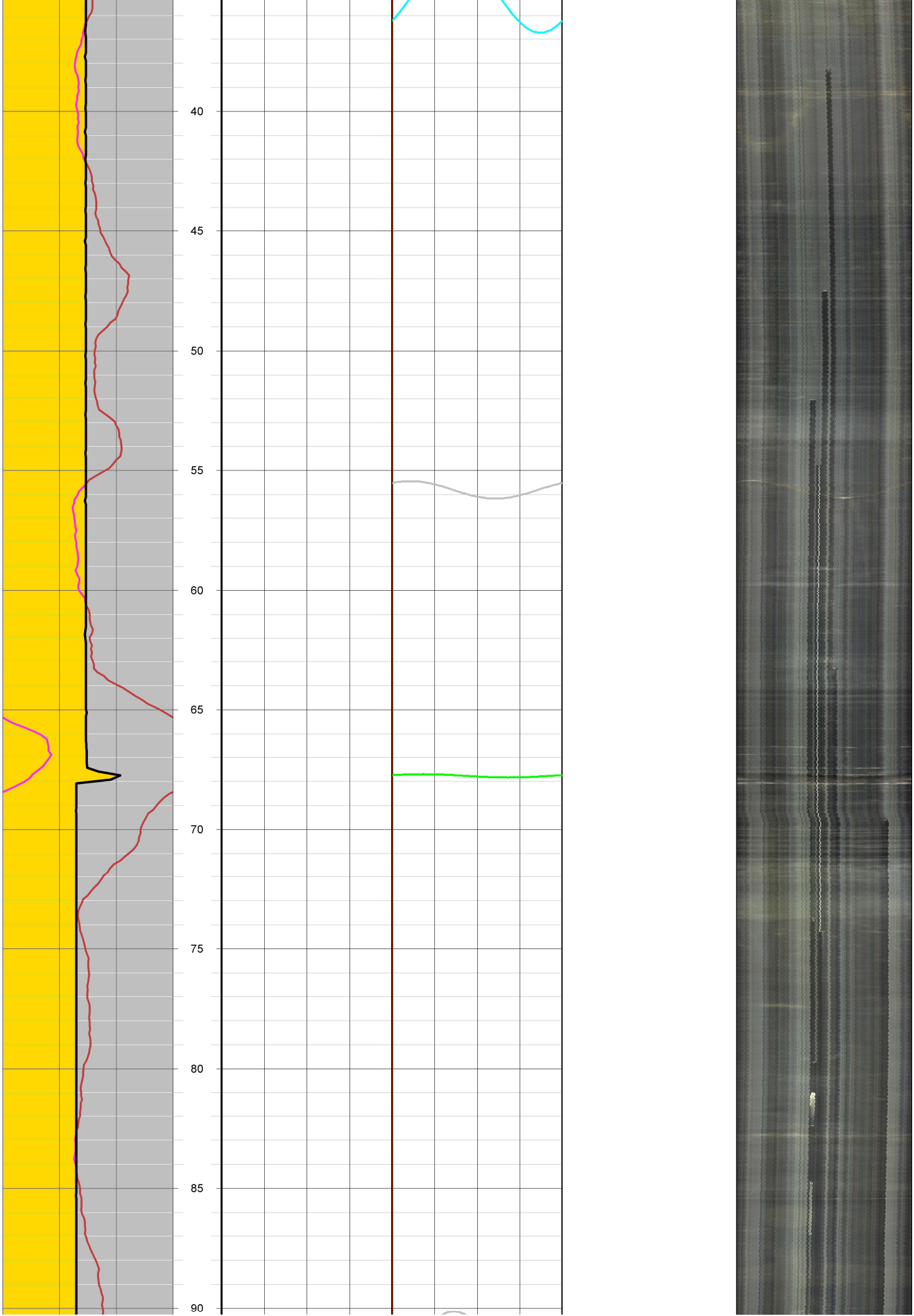
Site: GTAC - Nockamixon TCE Site
Nockamixon Twp., Pennsylvania

Date: 11/17/2022

Depth Datum: Ground Surface
Borehole Dia.: 5 in. (PQ core)
Total Depth: 251 ft.
Casing Type: Steel
Casing Depth: approx. 10 ft.
Casing Stickup Ht.: 1.4 ft. (temporary case)
Water Level: 107.8 ft.

Remarks: Structure Plot Colors: Green = Bedding plane, parting or fracture
Magenta = Open joint or fracture
Orange = partially open joint or fracture
Gray = Filled joint or fracture
Cyan = Discontinuous fracture

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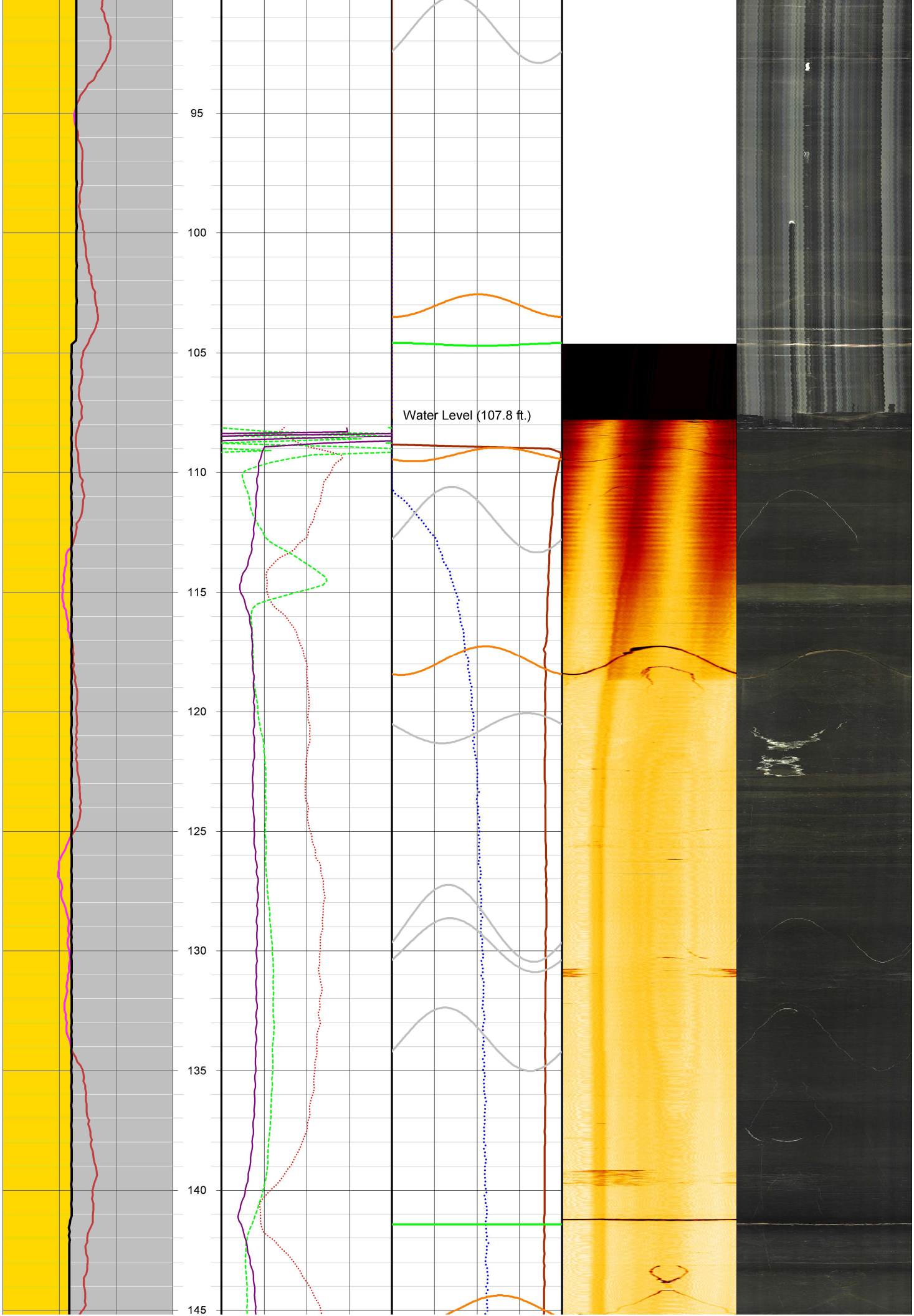
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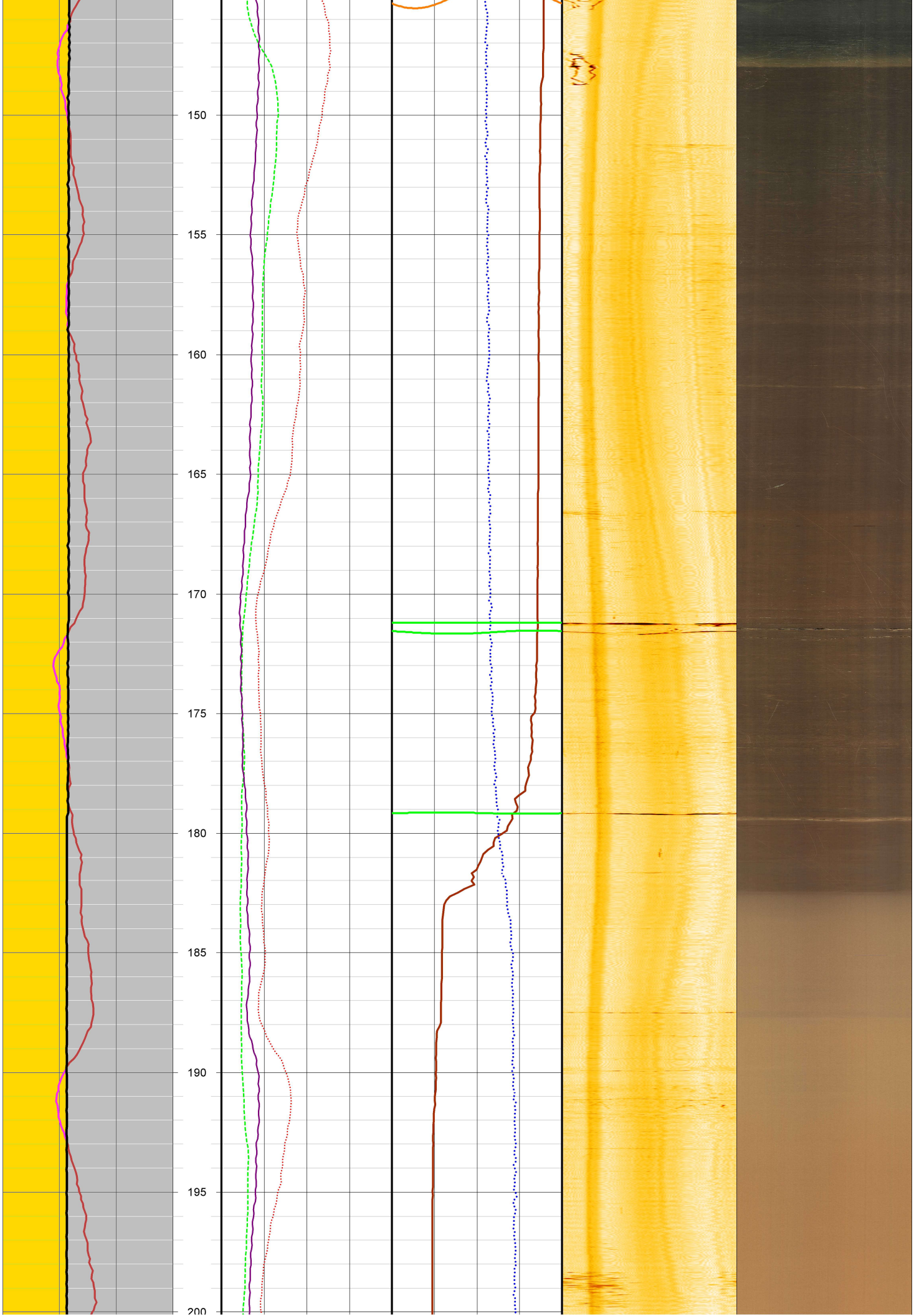
Water Level (107.8 ft.)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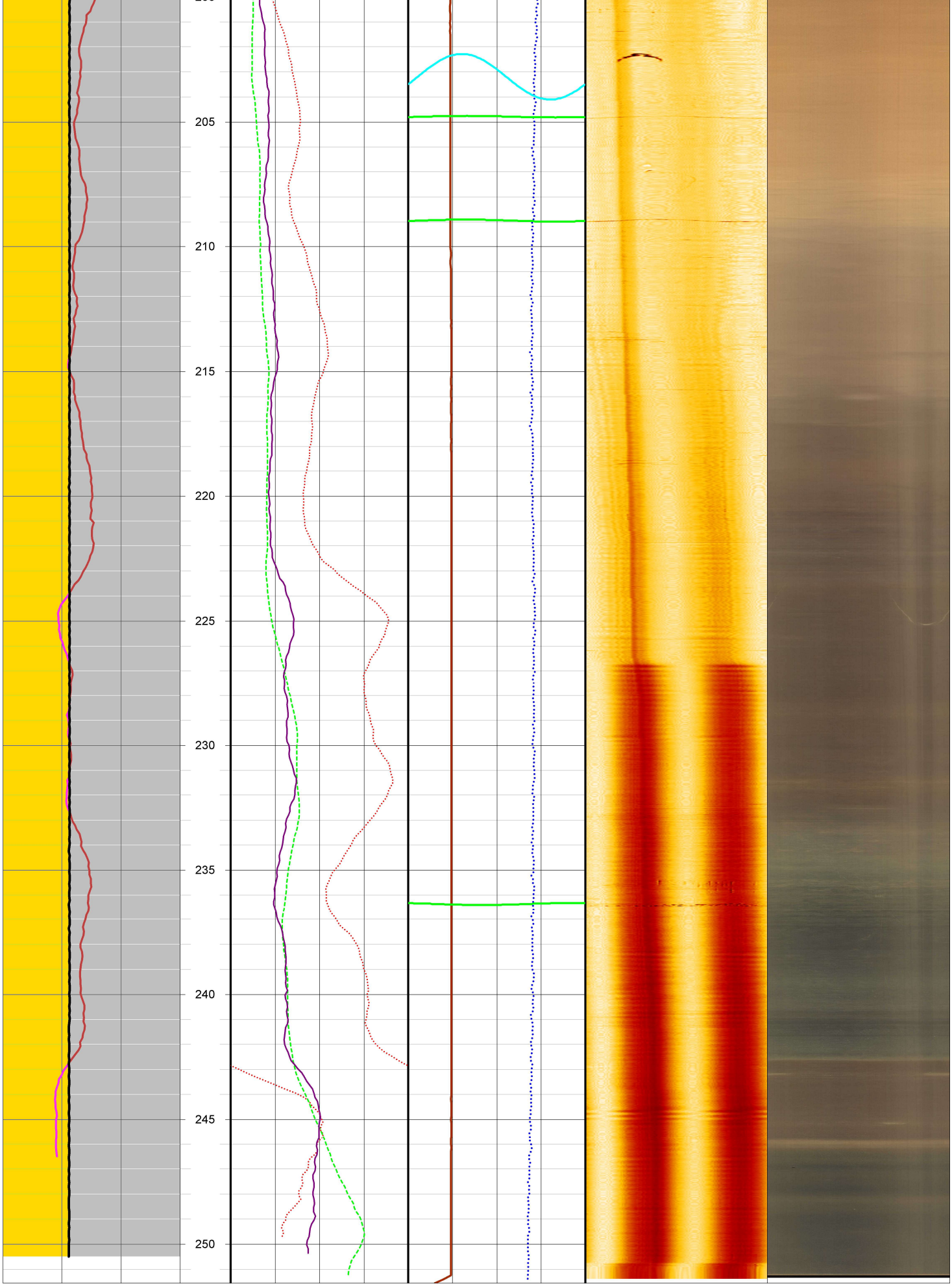
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