Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

Appendix A
Pre-Design Investigation Report

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PRE-DESIGN INVESTIGATION SUMMARY - UPDATED

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LIST OF ABBREVIATIONS

CAP	Corrective Action Plan
CFRW	Cape Fear River Watch
cm/day	centimeters per day
cm/s	centimeters per second
CO	Consent Order
CPT	piezocone penetration tests
CSM	Conceptual Site Model
CU	Consolidated Undrained
DO	Dissolved Oxygen
DQO	Data Quality Objectives
DVM	Data Verification Module
EIM	Environmental Information Management
ft	feet
ft bgs	feet below ground surface
ft/yr	feet per year
GAC	granular activated carbon
gpm	gallons per minute
HDPE	high density polyethylene
HPT	hydraulic profiling tool
IDW	Investigation Derived Waste
LiDAR	Light Detection and Ranging
mg/s	milligrams per second
ng/L	nanograms per liter
NCDEQ	North Carolina Department of Environmental Quality
NTU	nephelometric turbidity units
ORP	Oxidation Reduction Potential
P_c	capillary pressure
PDI	Pre-Design Investigation
PFAS	per- and polyfluoroalkyl substances

LIST OF ABBREVIATIONS (CONT'D)

PFM	passive flux meter
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RPD	relative percent difference
SC	Specific Conductivity
SOP	standard operating procedure
SPT	standard penetration test
S_W	wetting phase saturation
UCC	Upper Cape Fear Confining Unit
UCFA	Upper Cape Fear Aquifer
$\mu g/m^2/day$	micrograms per square meter per day

1 INTRODUCTION AND OBJECTIVES

Geosyntec Consultants of NC, P.C. (Geosyntec) and GEOServices, LLC (GEOServices) have prepared this Pre-Design Investigation (PDI) Report Version 2 for The Chemours Company, FC, LLC (Chemours). Chemours operates the Fayetteville Works facility in Bladen County, North Carolina (Figure 1, the Site). The PDI was conducted to collect additional subsurface data relevant to the design of potential long-term remedies for containment of Table 3+ per- and polyfluoroalkyl substances (PFAS)[1] in onsite groundwater.

This report provides an updated description of the PDI activities that were conducted at the Site, the data collected during those activities, and updates to the Conceptual Site Model (CSM) based on the PDI data. Collection of PDI data and preparation of this report support the requirements of Paragraph 3b of the Addendum to the executed Consent Order (CO) among Chemours, the North Carolina Department of Environmental Quality (NCDEQ), and Cape Fear River Watch (CFRW). The PDI is consistent with goals and remedies described in the Corrective Action Plan (CAP; Geosyntec, 2019a). The CAP proposed corrective actions to reduce the total loading of PFAS originating from the Site to the Cape Fear River by at least 75% from baseline, including a potential onsite barrier wall with hydraulic containment to reduce PFAS discharge from onsite groundwater to the Cape Fear River. The objective of this report is to present data and CSM updates that inform the design of a barrier wall at the Site.

The PDI Report Version 1 was submitted to NCDEQ on March 24, 2021 and had identified data gaps along the proposed barrier wall alignment. Since then, twelve additional boreholes were advanced to fill these gaps. The additional data collected from these boreholes is included in this PDI Report Version 2 to further inform barrier wall design. The table below summarize the differences in content between Version 1 and Version 2:

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[1] Table 3+ Method PFAS compounds are often related to operations at the Site.

Version	Date submitted to NCDEQ	Comments	Detailed Comments
1	March 24, 2021	Version 1 (V1)	-
2	June 29, 2021	Version 2 (V2) Seven additional mud rotary borings and five rotary sonic soil borings were advanced in the vicinity of the proposed barrier wall alignment in March and April 2021 to better refine the subsurface conditions in specific areas identified in the PDI Report V1 and to collect undisturbed samples needed to aid design considerations from the barrier wall contractors.	The following text sections were updated: 1, 2.5, 2.6, 2.8 (new in V2), 2.10, 3.3.1, 5.3, 6, 7, 8, and 9 The following tables have been updated: 1, 12, and 13 The following figures have been updated: 9, 10A, and 10B The following appendices have been updated: B, C, D, E, and J

1.1 Report Organization

The remainder of this document is organized as follows:

- **Section 2 – Summary of Pre-Design Investigations Completed** describes the methods employed for PDI data collection and the rationale behind the investigations completed;
- **Section 3 – Pre-Design Investigation Results** reports the PDI data collected under three categories that pertain to the CSM: (a) Table 3+ PFAS distribution and flux, (b) aquifer properties, and (c) geology and geotechnical properties;
- **Section 4 – Regional Geology and Hydrogeology Update** describes updates to our understanding of the regional geology and hydrogeology based on the PDI results;

- **Section 5 – Results Interpretation** describes the interpretation of the PDI results in the context of the CSM, discussed under three categories: (a) Table 3+ PFAS distribution and flux, (b) aquifer properties, and (c) geology and geotechnical properties;
- **Section 6 – Numerical Model** provides a summary of the calibrated flow model incorporating the PDI results;
- **Section 7 – Updated Geological Interpretation** presents a high-resolution cross section produced using the PDI data and describes components of the geological interpretation that will be relevant to the remedy design;
- **Section 8 – Summary** reviews the key CSM updates based on the PDI data, and describes implications for the 60% Basis of Design Report; and
- **Section 9 – References** lists the documents referenced in the report.

2 SUMMARY OF PRE-DESIGN INVESTIGATIONS COMPLETED

The subsections below summarize the scope of work completed under the PDI. Further details on the scope of work are provided in Appendix A (Field Methods). Table 1 presents a list of the activities conducted under the PDI, and the objectives for each activity for informing the remedy design. Appendix B includes field forms from the PDI field investigations.

2.1 Installation of Monitoring Wells and Extraction Wells

Five two-inch polyvinyl chloride (PVC) monitoring wells (PIW-11 to PIW-15) were installed at regular intervals adjacent to Willis Creek (Figure 2) to assess hydraulic gradients and Table 3+ PFAS concentrations in groundwater. The wells were completed above the Upper Cape Fear Confining Unit (UCC), in the Black Creek Aquifer (Table 2). At each location, a sonic drill rig was used to establish the depth of the UCC by drilling five to thirteen feet (ft) into the unit. Two additional two-inch PVC monitoring wells (PIW-16S and PIW-16D) were installed west of the Chemours property, between Highway 87 and the Site (Figure 2) to extend understanding of the lithologic and hydraulic boundary conditions of the Black Creek Aquifer west of the Site. PIW-16S and PIW-16D were screened in the Surficial Aquifer and the Black Creek Aquifer, respectively. Continuous soil cores were collected and logged during well installation. Borehole logs, well construction forms, and a photolog for the boreholes are provided in Appendix C. Well construction and installation followed North Carolina Administrative Code Title 15A, Subchapter 2C (15A NCAC 2C). Two-inch monitoring wells were constructed using a 20/30 size silica sand filter pack and 0.010-inch machine slotted PVC screen. Well construction materials and specifications can be found in Table 2 and Appendix B.

Five extraction wells (EW-1 to EW-5) were installed along the proposed barrier wall alignment. At each extraction well location, up to three additional PVC observation wells were installed first, to log lithology and establish the depth of the UCC. The locations of the extraction wells and corresponding observation wells are shown in Figure 3. Continuous soil cores were collected and logged by a geologist for each well in the cluster. Extraction wells were installed using six-inch stainless steel, wire-wrapped, 0.020 inch slotted well screens; screen intervals ranged from 20-40 ft in length in the Black Creek Aquifer. The PVC well casing and the stainless-steel screen were placed in the 10-inch borehole with centralizers above and below the screen to aid in centering the casing during construction. Extraction wells and monitoring wells were completed with flush-mount and stick up protective casings, respectively. Extraction well design based on particle size analysis is presented in Appendix A.

The wells were developed using submersible pumps to remove materials that may have been introduced during installation. Turbidity, oxidation redox potential (ORP), temperature, pH, specific conductivity (SC), and dissolved oxygen (DO) were monitored during well development. Monitoring wells were considered developed after at least 3 consecutive turbidity readings less than 50 nephelometric turbidity units (NTUs) or if the turbidity stabilized following development for an extended period (e.g., turbidity readings that have not improved for an hour and 3 or more consecutive measurements are within 10% of each other). Extraction wells were considered developed once groundwater appeared free of visible sediments and turbidity readings were approximately 10 to 15 NTUs.

2.2 Groundwater and Surface Water Sampling and Analysis

Seven groundwater samples were collected from the newly installed monitoring wells after well development (PIW-11 to PIW-16D; Figure 2) to assess the concentrations of Table 3+ PFAS in groundwater. Six surface water grab samples were collected from Willis Creek including previously sampled locations WC-1 and WC-2 and four additional locations at approximately equal intervals between WC-1 and WC-2 (WC-IP-1 through WC-IP-4; Figure 4) to assess the concentrations of Table 3+ PFAS in Willis Creek. The sampling procedures were conducted following procedures outlined in Appendix A including low-flow techniques for groundwater sampling.

Groundwater and surface water samples were packed on ice and shipped to the laboratory for PFAS analysis by the Table 3+ Laboratory Standard Operating Procedure (SOP).

2.3 Passive Flux Meter Installation and Analysis

Passive flux meters (PFMs) were deployed to assess groundwater velocity and Table 3+ PFAS flux along potential groundwater discharge paths to Willis Creek and the Cape Fear River. PFMs were installed in seventeen monitoring wells located along Willis Creek and the Cape Fear River (Table 3 and Figure 5). PFMs, provided by Enviroflux, were constructed with alternating layers of granulated activated carbon (GAC) to analyze Darcy velocity and a virgin macroporous polymer resin to assess PFAS flux. Monitoring wells screened in the Black Creek Aquifer and within floodplain deposits were targeted for this study. Each PFM is five ft long and one or two PFMs were installed along the full length of the monitoring well screen length (nominally 5-10 ft). The time and date of installation were recorded along with the initial and final water levels. After fifteen days, the PFMs were removed for analysis. The GAC and resin layers were composited separately to produce two samples per monitoring well (one GAC, one resin). Sample material was composited using decontaminated stainless-steel spatulas and stainless-steel mixing bowls. GAC samples were packed on ice and shipped to Enviroflux, for Darcy velocity and PFAS flux analysis, while the resin samples were packed on ice and shipped to Test America for PFAS analysis by Table 3+ Laboratory SOP.

2.4 Aquifer Tests

Step drawdown tests and constant rate tests were performed at five extraction wells along the proposed barrier wall alignment to refine the groundwater flow model and inform the remedy design. The aquifer tests support (1) optimization of extraction well pumping rates and spacing to reduce hydraulic head on the proposed barrier, (2) estimation of appropriate distances of pumping wells and suitable terrain from the barrier wall, and (3) improved understanding of complex geological features along the alignment with respect to pumping scenarios.

2.4.1 Step Drawdown Tests

Step drawdown tests were performed at the five extraction wells (Figure 3). A submersible pump was placed at the midpoint of the screen in the extraction well. Specification sheets for the submersible pump are presented in Appendix A. Transducers were placed at the midpoint of the screen in the adjacent observation wells. A transducer was placed approximately one foot above the pump. A barometric datalogger (Barologger) was also placed in one of the observation wells, above the water table. Baseline data was collected for 1 to 5 days prior to the start of the aquifer test at 10 second intervals. After baseline data collection, the transducers were downloaded and redeployed to collect readings at 5 second intervals. A transducer with a live data cable was deployed in the extraction well to observe water level change in real time. Manual water levels were collected just before the start of the test.

The pumping rate was programmed to the lowest discharge rate (5-12 gallons per minute [gpm]) and increased once the water level appeared stable. The discharge rate was controlled using a diaphragm valve on a discharge manifold in conjunction with a flow controller. The flow rate was monitored using a mechanical totalizer and a timer. The flow rate and manual water levels were recorded about every 5 minutes during the test. The discharge rate was increased 3 to 4 times depending on available drawdown in the extraction well. The water level was maintained above the transducer and pump intake. Once the final step stabilized, the pump was shut off. Manual water levels were collected, and transducers were left in place until the aquifer recovered to near baseline conditions. The steps used for each extraction well are provided in Table 4.

2.4.2 Constant Rate Tests

The data collected during the step drawdown tests were used to design a constant rate pumping test conducted at each extraction well. Pumping rates were selected to maximize the tested area while attempting to limit the amount of water generated.

A submersible pump was placed at the midpoint of the screen in the extraction well. Transducers were placed at the midpoint of the screen in the adjacent observation wells. The extraction well transducer was placed approximately one foot above the pump. A barometric datalogger (Barologger) was also placed in one of the observation wells, above the water table. Baseline data was collected for 1 to 5 days prior to the start of the aquifer test at 10 second intervals. After baseline data collection, the transducers were downloaded and redeployed to collect readings at 5 second intervals. A transducer with a live data cable was deployed in the extraction well to observe water level change in real time. Manual water levels were collected just before the start of the test.

The pump was programmed to the target flowrate and monitored regularly to maintain a near constant rate. Pump rates were calculated using a mechanical totalizer and a timer. Depth to water was recorded in the extraction and observation wells every half hour throughout the test. Tests operated until there was less than 0.1 ft of change in the water levels over a two-hour period. Constant rate tests ranged in duration from 22 to 81 hours of elapsed time. Once stabilization was achieved, the pump was shut off, with transducers recording the aquifer recovery. Equipment and transducers were not mobilized to the next location until aquifer conditions returned to near baseline levels. Pumping rates and durations for the constant rate tests at each extraction well are provided in Table 4.

2.5 Geotechnical Exploration

The subsurface conditions along the proposed barrier wall alignment were explored with a series of integrated electronic seismic piezocone penetration tests (CPT),traditional mud rotary borings (standard penetration test [SPT] borings), and rotary sonic soil borings. The mud rotary borings and cone soundings were alternated and spaced at increments of 250 ft along the proposed alignment to generate adequate coverage. This resulted in a total of nineteen cone soundings and nineteen traditional mud rotary borings completed in 2020. To resolve several identified data gaps, seven additional mud rotary borings, and five rotary sonic soil borings were advanced in 2021, and logged by GEOServices with support from Geosyntec. Individual logs for the SPT borings, the CPT soundings, and the rotary sonic soil borings are presented in the GEOServices report and addendum included in Appendix D of this report. Exploration locations are indexed by station number along the roadway alignment at the time of exploration.

2.6 Standard Penetration Testing

Two phases of geotechnical borings were advanced, the first phase occurred from October to November 2020, and the second phase occurred in March 2021. A total of 26 (19 in 2020, 7 in 2021) geotechnical borings advanced using open hole methods with NWJ (2-5/8 inch diameter) drill rods. The drill crew worked in general accordance with ASTM D 6151 (HSA Drilling) and ASTM D783 (Direct Rotary with Water-Based Drilling Fluid). The soil cuttings and drilling fluid were collected and placed in drums. The borings were then backfilled with grout. Detailed test boring records are presented in the full GEOServices geotechnical report and addendum (Appendix D).

SPT blow counts were measured using the split-spoon standard penetration test procedure (ASTM D 1586). In split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth and provide an indication of the relative density of granular materials and strength of cohesive materials. Soil collected by the sampler during the SPT are used for material property tests. Less disturbed samples for hydraulic conductivity and strength testing were collected using thin-walled tube sampling test procedure (ASTM D 1587).

2.7 Cone Penetration Testing

An additional nineteen locations were explored using an integrated electronic seismic CPT (piezocone). The piezocone dimensions and the operating procedure were in accordance with ASTM D 5778. Since the CPT is a direct push technology, it allows data to be obtained continuously (approximately every 2 inches). A computer connected to the cone records tip resistance, sleeve friction, and dynamic pore pressure via instruments in the cone. Additionally, when the cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, water is injected into a saturated porous material to generate excess pore pressures, then without advancing the cone, the pressure is then allowed to dissipate and pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file. Pore pressure dissipation testing was performed in each of the nineteen CPT sounding locations. The pore pressure dissipation results are presented in the appendices of the GEOServices report in Appendix D of this report.

2.8 Rotary Sonic Soil Borings

In April 2021, a total of five geotechnical borings were advanced using sonic drilling methods. The drill crew worked in general accordance with ASTM D 6914 (Sonic Drilling for Site Characterization). Sonic drilling is a method in which the drill string is advanced, and the borehole is simultaneously cased by rotation and oscillation of the drill bit to collect a relatively continuous and undisturbed sample of the subsurface material. Sonic drilling methods were selected for the supplementary excavation because a continuous sample of the layered strata is valuable for barrier wall mix design and identification of the presence of gravels and other non-soil materials identified in isolated borings during the preliminary exploration. The borings were backfilled with grout upon completion of each location. Detailed test boring records are presented in the addendum to the GEOServices geotechnical report (Appendix D).

2.9 Geotechnical Laboratory Test Program

Soil samples collected during drilling were transported to the GEOServices laboratory for visual classification and laboratory testing. Laboratory tests were performed on representative split-spoon samples, Shelby tube (thin-walled tube) samples and bulk samples obtained during the field exploration phase of this project. The following laboratory testing was performed on select samples to determine various properties of the soil:

Atterberg Limits (ASTM D 4318): Seventeen Atterberg limits tests were performed. These tests help to confirm visual classifications according to the Unified Soil Classification System. The plastic limit and liquid limit represent the moisture content at which a cohesive soil changes from a semi-solid to a plastic state and from a plastic state to liquid state, respectively.

Natural Moisture Content (ASTM D 2216): Moisture content determinations were performed on 371 samples. The natural moisture content is defined as the ratio of the weight of water present in the soil to the dry weight of soil.

Particle Size Analysis (ASTM D 6913): Fourteen particle size analyses were performed. The particle size analysis is used to determine the soil classification and determine drainage properties of the material. The results will later be used in the laboratory soil classification (ASTM D 2487).

Wash 200 (ASTM D 1140): Sixteen wash 200 tests were performed. This test measures the total amount of clay and silt sized particles in a sample and is used to assist in the soil classification (ASTM D 2487).

Standard Proctor Moisture-Density Tests (ASTM D 698): Two Standard Proctor tests were performed on collected soil samples. This test provides information concerning the relationship between moisture content, compaction effort, and density.

Consolidated Undrained (CU) Triaxial Testing (ASTM D 4767): Two triaxial tests were performed on an undisturbed Shelby Tube sample. The triaxial testing provided the strength characteristics of the sampled soil.

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (ASTM D 5084): Seventeen hydraulic conductivity tests were performed on undisturbed Shelby Tube samples. These tests provide permeability measurements necessary for estimating the flow of water through the subsurface and necessary in designing the depth of the barrier wall.

2.10 Investigation Derived Waste

Investigation Derived Waste (IDW) including soil and groundwater generated during the PDI was containerized according to the Soil and Material Waste Management Plan (Chemours, 2020) and the Fayetteville Consent Order Activities Waste Management Plan (AECOM, 2021). An inventory of IDW generated during the PDI is presented in Appendix E.

Soil cuttings, drilling mud or slurry and any dirty plastic sheeting or otherwise contaminated waste generated during the installation of observation, extraction, and monitoring wells were placed in steel, Department of Transportation (DOT) approved, open top 55-gallon drums. Liquid wastes from drilling with high turbidity were placed in steel, DOT approved, closed top drums, and temporarily staged. All drums were then moved to temporary staging areas. The drum exteriors were wiped clean, labeled with “Non-hazardous” labels, and inventoried.

Low turbidity liquid waste from well development, purging wells, and pump testing were temporarily stored onsite in double walled 18,000-gallon frac-tanks. Following the startup of the Old Outfall 002 treatment system, the stored groundwater IDW was transferred to the treatment system utilizing a vacuum truck. Liquid waste transferred to the new treatment system was treated prior to discharge to the Outfall 003.

After drum staging, Chemours Fayetteville Works (Plant) personnel inspected each drum for conformance. Once accepted, the Plant then assumed responsibility for drum profiling, transporting and disposal consistent with plant-specific procedures. The Plant continues to dispose of drummed PDI waste as practicable to a landfill coordinated by AECOM and the plant. Solid wastes will be disposed at a Subtitle C landfill.

3 PRE-DESIGN INVESTIGATION RESULTS

The results of the PDI are described in the sections below and presented in the referenced tables and figures. The results are categorized into three groups that inform different components of the CSM: Table 3+ PFAS distribution and flux (Section 3.1), aquifer properties (Section 3.2), and geology and geotechnical properties (Section 3.3).

3.1 Table 3+ PFAS Distribution and Flux

3.1.1 Data Quality

The analytical data were reviewed using the Data Verification Module (DVM) within the Locus™ Environmental Information Management (EIM) system, a commercial software program used to manage data. Following the DVM process, a manual review of the data was conducted. The DVM and the manual review results were combined in a data review narrative report for each set of sample results, which were consistent with Stage 2b of the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA-540-R-08-005, 2009). The narrative report summarizes which samples were qualified (if any), the specific reasons for the qualification, and any potential bias in reported results. The data usability, in view of the project's data quality objectives (DQOs), was assessed, and the data were entered into the EIM system.

The data were evaluated by the DVM against the following data usability checks:

- Hold time criteria;
- Field and laboratory blank contamination;
- Completeness of quality assurance/quality control samples;
- Matrix spike/matrix spike duplicate recoveries and the relative percent differences (RPDs) between these spikes;
- Laboratory control sample/control sample duplicate recoveries and the RPD between these spikes;
- Surrogate spike recoveries for organic analyses; and
- RPD between field duplicate sample pairs.

A manual review of the data was also conducted and includes instrument-related quality control results for calibration standards, blanks, and recoveries. The data review process (DVM plus manual review) applied the following data evaluation qualifiers to the analytical results as required:

- J Analyte present, reported value may not be accurate or precise;
- UJ Analyte not present above the reporting limit, reporting limit may not be accurate or precise; and
- B Analyte present in a blank sample, reported value may have a high bias.

The data review process described above was performed for the laboratory chemical analytical data generated for the sampling event. The DQOs were met for the analytical results for accuracy and precision. The data collected are believed to be complete, representative and comparable, with the exception of R-PSDA, Hydrolyzed PSDA, and R-EVE.

As reported in the *Matrix Interference During Analysis of Table 3+ Compounds* memorandum (Geosyntec, 2020a), matrix interference studies conducted by the analytical laboratory (TestAmerica, Sacramento) have shown that the quantitation of these three compounds (R-PSDA, Hydrolyzed PSDA, and R-EVE) is inaccurate due to interferences by the sample matrix in both groundwater and surface water. Given the matrix interference issues, Total Table 3+ PFAS concentrations are calculated and presented two ways in this report: (i) summing over 17 of the 20 Table 3+ compounds "Total Table 3+ (17 compounds)", i.e., excluding results of R-PSDA, Hydrolyzed PSDA, and R-EVE, and (ii) summing over 20 of the Table 3+ compounds "Total Table 3+ (20 compounds)". Expressing these data as a range represents possible values of what these results might be without matrix interferences. In other words, the sum of all 17 compounds is an underestimate of the actual value while the sum of the 20 compounds is likely an overestimate of the total actual value. Analytes included in the Total Table 3+ (17 compounds) group and those included in the Total Table 3+ (20 compounds) group are presented in Table 5. For clarity, the text and figures of this report describe the Total Table 3+ (17 compounds) while Total Table 3+ (20 compounds) are included in the tables. Groundwater and surface water samples were also analyzed by the Table 6 SOP. Analytical results for four Table 6 compounds (MTP, PPF Acid, DFSA, and MMF) are affected by matrix interference issues, as described in the *Matrix Interference During PFAS Analysis via the Table 6 Method* Memo (Geosyntec, 2020b). As such, results for these four compounds are not included in this report.

3.1.2 Groundwater and Surface Water Results

Groundwater samples were collected from the seven new Site monitoring wells and surface water samples were collected from six locations in Willis Creek. Field parameters measured during sampling are reported in Table 6 for groundwater and Table 7 for surface water. Table 3+ PFAS concentrations for the groundwater and surface water samples and for associated quality assurance/ quality control (QA/QC) samples are reported in Table

8. Concentrations for perfluoroheptanoic acid in groundwater and surface water samples are reported in Appendix F. Figure 6 and Figure 7 show the Total Table 3+ (17 compounds) concentrations reported for samples collected from the groundwater and surface water locations, respectively. Laboratory DVM reports are included in Appendix G.

Total Table 3+ concentrations were highest in the monitoring wells adjacent to the mouth of the creek (PIW-14 and PIW-15). Total Table 3+ concentrations were relatively low (<1,000 nanograms per liter [ng/L]) upstream in Willis Creek and were non-detect above the associated reporting limits for PIW-16D, located in the Black Creek Aquifer to the west of the Site.

3.1.3 Passive Flux Meter Results

GAC and resin samples were collected from PFMs installed in seventeen monitoring wells. Dry weight Table 3+ PFAS concentrations for the resin samples and for associated QA/QC samples are reported in Table 9. Concentrations for perfluoroheptanoic acid in PFM resin are reported in Appendix F. Darcy velocity values and flux values for each Table 3+ compound are shown in Table 10, as reported by Enviroflux.

3.2 Aquifer Properties

3.2.1 Step Test Results

Raw data sets from the step drawdown tests were corrected for barometric pressure and processed through the Aqtesolv program. Best fit solution results are attached in Appendix H and calculated bulk hydraulic conductivity values (K) are summarized in Table 11.

Extraction wells located toward the northern end of the study area (EW-1 and EW-4) exhibited lower yield aquifer conditions with results indicating a leaky confined system, suggesting that there may be some groundwater migration through the overlying confining unit. Extraction wells EW-3 and EW-5 exhibited comparatively higher yield, also with leaky confined aquifer conditions. Results from extraction well EW-2 indicate a high yield unconfined system, which is consistent with boring logs from the area. Aquifer properties are discussed further in Section 5.

3.2.2 Constant Rate Pump Test Results

Raw data sets from the constant rate tests were corrected for barometric pressure and processed through the Aqtesolv program. Best fit solution results are attached in Appendix I, and calculated bulk K values are summarized in Table 11.

Constant rate pump tests resulted in generally higher calculated K-values when compared to step drawdown results. EW-3 and EW-5 are the highest yielding wells, while EW-1, EW-4, and EW-2 showed relatively lower yields. Aquifer solution fits are consistent with solutions for the step drawdown tests. Aquifer properties determined from constant rate tests are further discussed in Section 5.

3.3 Geology and Geotechnical Properties

3.3.1 Geotechnical Subsurface Conditions

Generally, the borings/soundings encountered water deposited (alluvial and deltaic) soil layers for the full penetration/boring depth. These soils are referred to as "alluvial" in subsequent discussion of geotechnical properties and in the boring logs as a geotechnical representation of the deposition method. The borings were extended to penetration refusals ranging from 24.5 to 89.2 ft below existing grade, or to predetermined refusal depths of 90 ft below existing grade.

Due to the previous clearing and grading very little topsoil and vegetation were encountered in the borings. Topsoil measuring approximately six inches in thickness was encountered in borings 5+00, 20+00, and 62+50. Beneath these surficial soil layers in these borings and from the ground surface in the remaining borings, alluvial soils were encountered to cone penetration refusal or predetermined termination depths ranging from 24.5 to 89.2 ft.

The CAP (Geosyntec, 2019a) categorized the alluvial soils in the vicinity of the barrier wall as the Black Creek Confining Unit, Black Creek Aquifer, Floodplain Deposits, and the Upper Cape Fear Confining Unit. The geotechnical scope of the PDI was to determine the geotechnical properties of soils encountered in boring logs and provide recommendations for the design of the proposed roadway and barrier wall. Therefore, descriptions provided on the boring logs are limited to the geotechnical engineering classifications necessary for that task and do not match the deposit definitions established by Geosyntec.

From a geotechnical perspective, the alluvial deposits at the site are generally divided into two classifications: fine and coarse grained. The fine-grained soils generally consisted of a combination of dark gray and black clays (CL and CH). In some areas the clay had isolated sand deposits and the quantity of silt varied. Additionally, petrified (silicious) wood chunks were identified in some samples. The N-values in the fine-grained soils ranged from 4 blows per foot to 50 blows per 0 inches of penetration, indicating a consistency of soft to very hard. The soft to firm clay layers were generally isolated to the upper soils and the clays below the aquifer sand layers were generally hard or better in consistency.

The coarse-grained alluvial soils encountered consisted of silty sands, clayey sands, poorly graded sands, gravelly sands (SM, SC, SP, SPG). These materials were light gray, light brown and even orangish brown in color. The N-values in the coarse-grained alluvium ranged from 3 blows per foot to 50 blows per 0 inches of penetration, indicating a relative density of very loose to very dense. The coarse-grained materials were primarily loose to medium dense with some isolated dense and very dense layers.

Auger refusal was not encountered in any of the twenty six mud rotary or the five sonic borings, however, cone refusal was observed in seventeen of the nineteen penetration locations during field exploration (Table 12). Refusal is a designation applied to any material that cannot be penetrated by the equipment.

3.3.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative split-spoon samples, Shelby tube samples and bulk samples obtained during the field exploration phase. Moisture content determinations, Atterberg limit tests, particle size analyses and Wash 200 tests were performed to assist in classification of the sampled soils. The resulting soil descriptions are provided on the boring logs in the GEOServices geotechnical report (Appendix D).

In addition to the index property testing, Consolidated Undrained (CU) triaxial testing was performed on two selected Shelby tube samples to evaluate the general shear strength conditions of the underlying soils. The Shelby tube samples were obtained at stations of 62+50 and 87+50 at depths of 35 to 37 ft and 55 to 57 ft, respectively. Effective cohesion values ranged from 0.63 to 2.51 pounds per square inch (psi) and effective friction angles ranged from 22.8 to 26.4 degrees.

Seventeen hydraulic conductivity tests were also performed on Shelby tube ("undisturbed") samples obtained during the field exploration. The hydraulic conductivities obtained within the clays were generally on the order of 10^{-8} or 10^{-9} centimeters per second (cm/s), while those obtained in the sands where on the order of 10^{-4} cm/s. The full laboratory testing results are provided in the geotechnical report (Appendix D).

4 REGIONAL GEOLOGY AND HYDROGEOLOGY UPDATE

4.1 Regional Geology

The Site geology consists of four primary units in stratigraphic order; the Cretaceous Cape Fear formation (the oldest formation), the Cretaceous Black Creek formation, the Surficial Aquifer, and younger sediments along the Cape Fear River, designated as floodplain deposits. Since the On and Offsite Assessment report (Geosyntec, 2019b) was submitted, additional literature review has identified resources that better describe the geology of the area and the nature of the depositional environments. Principally, the Surficial Geologic Map of the Elizabethtown 30' x 60' Quadrangle (Weems, Lewis, & Crider, 2011), and the Cretaceous Stratigraphy of the Carolina Coastal Plain (Sohl & Owens 1991) describe the surficial and underlying geology surrounding the Site.

The Upper Cape Fear formation consists of an overlying confining unit (the UCC), the Upper Cape Fear Aquifer (UCFA), the Lower Cape Fear Confining Unit, and the Lower Caper Fear Aquifer. The depositional environment is interpreted to be either a marginal marine or deltaic consisting of interbedded clays and sand. The clay beds are typically pale to medium gray which is consistent with clay beds identified in the base of most onsite borings. Clay strata are up to 8 ft in thickness. The sands are either massive or poorly cross-bedded and commonly contain clay clasts. Sands range from fine to very coarse grained (Sohl & Owens, 1991).

The Tar Heel formation of the Black Creek Group overlies the Cape Fear unconformably and consists of the Black Creek Aquifer and the Black Creek Confining Unit. In the area of the Site, the Tar Heel formation is interpreted to be a delta plain depositional environment. Horizontal beds of black carbonaceous clays are interbedded with sands. Wood is especially common in these facies, with silicified logs present (petrified wood). The deltaic sequences generally have a mixture of higher energy channel sands and lower energy mud flats typical of transgressive and regressive sequences of sea water levels.

The Varina Grove unit of early Pleistocene age unconformably overlies the Black Creek group and in previous reports was designated the Surficial Aquifer. The Varina Grove unit consists of sands, very fine to fine grained, silty and clayey, grading downward through fine to medium to medium to coarse to very coarse-grained sands. The sands and clay are generally dark grayish orange and/or dark yellow brown. They are interpreted as terrace deposits. As the uppermost unconfined unit, this will continue to be designated as the Surficial Aquifer. The overlying Perched Zone is interpreted to be the result of a topographically isolated clay unit (Perched Zone Clay) from this unit.

The flood plain deposits are presented on the surficial geological map to be older alluvium of the late Pleistocene age. Deposits are described as gravel, with rounded to sub-rounded quartz clasts of the 6 cm in diameter in a silty quartose. Color is typically dark grayish orange.

4.2 Regional Hydrogeology

The additional onsite data collected during the PDI is consistent with the original characterization of the regional hydrogeology described in the On and Offsite Assessment (Geosyntec, 2019b). The Site is located within the North Carolina Coastal Plain Hydrogeologic region. Of the nine aquifer units that comprise that framework, three are present at the Site. In stratigraphic order from shallowest to deepest, the Perched zone, Surficial Aquifer, Black Creek Aquifer, and Upper Cape Fear Aquifer underlay the Site.

The Perched Zone is the uppermost unconfined hydrostratigraphic unit in the vicinity of the Site and is created by a topographically isolated bed of clay associated with the Varina Grove unit.

The Surficial Aquifer directly underlies the Perched Zone and constitutes the surface water table and follows the surface topography where the perched clay is not laterally present.

The Black Creek Aquifer is separated from the Surficial Aquifer by the Black Creek confining unit, which consists of dark gray to black organic-rich clay. The Black Creek Aquifer is associated with the Black Creek Formation. The Black Creek Aquifer is interpreted to have a delta plain depositional area. The lateral variability and changing energy conditions expected of a delta plain is supported by the varying yield and thickness observed during the PDI. Monitoring wells installed along Willis Creek showed little to no Black Creek Aquifer material.

5 RESULTS INTERPRETATION

The results presented above in Section 3 provide an updated understanding of the CSM, previously described in the CAP (Geosyntec, 2019a) and the On and Offsite Assessment (Geosyntec, 2019b). Updates to the CSM are described below, under the following categories: Table 3+ PFAS distribution and flux (5.1), aquifer properties (5.2), and geology and geotechnical Properties (5.3).

5.1 Table 3+ PFAS Distribution and Estimated Flux

5.1.1 PFAS Distribution in Groundwater and Surface Water

The following interpretations can be made based on the Table 3+ PFAS concentrations for groundwater and surface water samples, provided in Table 8.

- The groundwater sample collected from Black Creek well to the west of the Site, PIW-16D, was non-detect for Table 3+ PFAS, while the groundwater sample from the surficial well, PIW-16S, was characterized primarily by PMPA and HFPO-DA followed by PFO2HxA, similar to other groundwater samples previously collected from areas west of the Site (Geosyntec, 2019a).
- Table 3+ PFAS concentrations in groundwater increase slightly from PIW-11 to PIW-15, moving south and closer to the mouth of Willis Creek. PFMOAA concentrations are also highest among the monitoring wells sampled at PIW-15, closest to the mouth of Willis Creek.
- Table 3+ PFAS concentrations in surface water are highest closest to the mouth of Willis Creek at WC-1 and lowest upstream at WC-2. PFMOAA concentrations are relatively low at WC-2 (32 ng/L), then increase and stay relatively stable at the locations moving downstream (between 89 and 100 ng/L). Previous samples collected along Willis Creek described in the Seeps and Creeks Investigation Report (Geosyntec, 2019c) showed small stepwise increases in Table 3+ PFAS concentrations along Willis Creek from WC-5 at Highway 87 to WC-2, and a large increase in concentrations between WC-2 and WC-1 at the mouth of Willis Creek. The data for the samples collected during the PDI suggest that the largest increase in PFAS concentrations occurs directly downstream of WC-2.

5.1.2 Darcy Velocity and PFAS Flux

Figure 8 shows the Darcy velocity, in centimeters per day (cm/day), and the Table 3+ PFAS flux values, in micrograms per square meter per day (µg/m^2/day), for each monitoring well where a PFM was deployed. The results at each location are aligned to show the horizontal location of the monitoring wells relative to the other PFM locations. The Darcy velocity ranged from 2.8 to 8.4 cm/day (at PIW-9D and PIW-7S, respectively). Darcy velocity results for the Floodplain wells (PIW-6S and PIW-7S) were similar to the results for the Black Creek Aquifer wells, suggesting that the Darcy velocity is similar among the Floodplain Deposits and Black Creek Aquifers.

The Table 3+ PFAS flux (Figure 8), was highest for Black Creek Aquifer and Surficial wells adjacent to the Site (PW-10R, PIW-7S, PIW-8D). The locations with the highest PFAS flux were also typically dominated by PFMOAA (e.g., PIW-8D and PW-10R; Table 10). The flux for wells adjacent to Willis Creek (PIW-11 and PIW-12) was very small.

5.2 Aquifer Properties

5.2.1 Hydraulic Conductivities

The Black Creek Aquifer is generally regionally extensive, typically 20 ft to 40 ft thick, that has hydraulic conductivity values ranging from 1.8E-03 to 2.8E-02 cm/s (Geosyntec, 2019d). Slug tests have been conducted in previous Site investigations to provide estimates of the hydraulic conductivity in the Floodplain Deposits and the Black Creek Aquifer. The estimated hydraulic conductivities for the Floodplain Deposits ranged between 2.5E-04 to 4.2E-04 cm/s, resulting in a geometric mean of 3.2E-04 cm/s. The estimated hydraulic conductivities for the Black Creek Aquifer ranged between 4.1E-03 to 2.8E-02 cm/s, resulting in a geometric mean of 9.9E-03 cm/s. Tables 6-4 and E-1 from the On and Offsite Assessment (Geosyntec, 2019b) summarize these results.

The PDI included a series of aquifer pump tests (step drawdown and constant rate pumping) to further refine estimates for the hydraulic conductivity of the Black Creek Aquifer. The estimated hydraulic conductivity for the Black Creek Aquifer from step tests and constant rate pumping tests completed in this program ranged from 1.2E-03 to 3.1E-02 cm/s and 3.1E-03 to 1.0E-02 cm/s, respectively (Table 11). With the exception of the step test result from EW-1 (1.2E-03 to 1.5E-03 cm/s) and from EW-2 (3.4E-03 to 3.1E-02 cm/s), these hydraulic conductivity values are similar to the estimated Black Creek Aquifer hydraulic conductivities from historical slug tests performed at the Site. As mentioned in Section 3.2, the solutions used to estimate these hydraulic conductivities are for a leaky confined or an unconfined unit. The range of hydraulic conductivities is variable across the site and may be caused by lithological features in the Black Creek Aquifer such as interstratified clays and cross-stratified sands (Geosyntec, 2019b).

5.2.2 Aquifer Transmissivity and Storativity

Aquifer transmissivity is defined as hydraulic conductivity multiplied by the aquifer thickness. Storativity is the volume of water released per unit decline of hydraulic head, per unit area of the aquifer. Table 11 summarizes the results from the aquifer test. The Black Creek Aquifer has lower yields in EW-1, EW-2 and EW-4, whereas higher yields were observed in EW-3 and EW-5. The greater transmissivities and yields that are observed near EW-3 and EW-5 indicate that these areas are more permeable compared to the other areas of the Site near EW-1, EW-2 and EW-4. Well EW-2 is located in an area of the site where the Black Creek confining unit is thin to absent indicating unconfined conditions.

5.3 Upper Cape Fear Confining Unit Depth and Thickness

As part of Paragraph 3b of the Addendum to the executed CO, a barrier wall will be constructed at the Site. The purpose of the wall is to reduce Table 3+ PFAS loading to the Cape Fear River along a specified alignment on the property. The barrier wall is expected to extend from ground surface and key into the UCC. Ultimately, the depth of embedment and barrier wall thickness will be selected based on the results of the seepage modeling during the design process and the chosen method for installation of the barrier wall. Table 13 provides the approximate elevation and depth of the UCC. The mud rotary (SPT), and sonic borings were used to delineate this unit. Once encountered in the twenty six mud rotary borings and the five sonic borings, the UCC continued until the final depth of the geotechnical exploration (nominally 60 to 80 ft).

6 NUMERICAL MODEL

The 3D transient-state finite element numerical groundwater flow model was refined from the original model developed during preparation of the CAP (Geosyntec, 2019a) to evaluate the groundwater flow pathways at the Site under current conditions. Refinements in the model incorporate modification of the layer characteristics to match field observations and the results of the step-drawdown and constant-rate tests.

The model was constructed in FEFLOW version 7.2 (DHI-WASY), which incorporates the Richards' equation, the conservation of mass, and nonlinear relationships between capillary pressure (P_c) and wetting phase saturation (S_w) and between S_w and K to solve for hydraulic heads. The model was constructed using field-observed parameters, which were interpolated to approximate aquifer conditions across the model domain and assumed to be representative in between measured locations.

The model domain covers an area approximately 72,690,473 square ft (2.61 square miles). The model uses 7 hydrostratigraphic units to represent, from surface downward, the Floodplain deposits, Perched Zone, Perched Clay, Surficial Aquifer, Black Creek Confining unit, Black Creek Aquifer, and UCC. The model varies in thickness from about 170 ft near the plant to 55 ft at the base of the bluff adjacent to the Cape Fear River. The North Carolina Department of Public Safety Light Detection and Ranging (LiDAR) elevation model was imported to present ground surface topography (NC DPS, 2015), while topography of the underlying model layers were based on lithostratigraphic data obtained from Site monitoring wells, soil borings, hydraulic profiling tool (HPT), and CPT contained in the three-dimensional visualization model, EVS^{TM}. Additional soil boring logs advanced along the barrier wall in 2021 were incorporated into the model geology.

Updates were applied to the 3D groundwater flow model to incorporate the PDI data collected at the Site in 2020. The new data including soil borings, hydraulic conductivity (i.e. from the pump tests), and groundwater velocities were incorporated into the groundwater flow model. The 3D groundwater model was calibrated to groundwater conditions and measurements observed from 2018 to 2020.

The 3D flow model was calibrated to 139 Site Wells: 60 wells in the perched zone, 32 wells in the Surficial Aquifer and 47 wells in the Black Creek Aquifer. Results of the flow simulations are presented in Appendix J.

To verify the calibration, the model was set up to simulate the constant rate pumping tests that were conducted at the extraction wells EW-1, EW-2, EW-3, EW-4 and EW-5. A description of the model and calibration process is presented in Appendix J. Results indicate that the model simulation compares reasonably well with the observed drawdown in monitoring wells. This outcome provides more validation of the groundwater model's ability to simulate the field conditions.

The calibration results and statistics show the flow model is well calibrated, based on a reasonable agreement between the observed and calculated heads and flows. Figure 9 presents the flow simulation results for the Surficial and the Black Creek Aquifers.

Overall, groundwater flow in the Surficial and the Black Creek units is easterly towards the Cape Fear River. Due to the Cape Fear River fluctuations, the water levels in the subsurface are varying constantly, and therefore some ambiguity about the gradients is expected. The calculated groundwater velocity in the Surficial Aquifer is estimated to range between approximately 11 and 96 feet per year (ft/yr). The calculated groundwater velocity in the Black Creek Aquifer is estimated to range between approximately 2.1 and 91 ft/yr.

The calibrated flow model will be used as a tool to evaluate various remedy designs to mitigate PFAS migration from the Site to the Cape Fear River.

7 UPDATED GEOLOGICAL INTERPRETATION

A high-resolution cross section along the proposed barrier wall alignment was developed using data collected during the PDI. The investigative locations used to develop the cross section, including geotechnical boring locations and monitoring well locations, are shown in Figure 10A, and the high-resolution cross section is shown in Figure 10B. These figures include additional borings advanced in March and April 2021 as well as the borings advanced in 2020. The key findings from the PDI incorporated in the cross section are as follows:

- The cross section for the proposed barrier wall alignment is not indicative of "layer cake" geology; instead, the geology demonstrates variability typical of a series of sand channels and mud flats associated with a deltaic depositional environment.
- The depth of the top of the UCC varies horizontally, existing at shallower depths at the northern extent of the proposed barrier wall alignment than to the south.
- The northern extent of the proposed barrier wall alignment near Willis Creek is characterized by a higher proportion of fine grain material than the remainder of the barrier wall alignment, with a thicker Black Creek Confining unit, a slight elevation of the top of the Upper Cape Fear Confining unit, and a progressively thinning Black Creek Aquifer layer.
- The northern extent of the proposed barrier wall alignment near Willis Creek is also characterized by lower extraction yields, consistent with the corresponding geological observations.
- Throughout the cross section, the Black Creek Aquifer contains interbedded sequences of finer sediments among the sand layers.
- Additional investigations conducted in March and April 2021 refined certain areas of the cross section.
    - A gravelly layer encountered in the vicinity of Seep A during the initial investigation was not observed in subsequent soil borings.
    - The erosional feature initially described in the southern portion of the cross section was not supported after additional soil borings were advanced in this area. The southern portion of the Black Creek Confining clay layer is characterized by a higher proportion of coarse-grained material.

8 SUMMARY

The results of the PDI will inform the design for a barrier and will be incorporated into the development of a 60% Basis of Design Report for the onsite groundwater remedy. Prior to development of the 60% Basis of Design Report, further evaluations will be completed to support the design, including numerical modeling for different remedial scenarios for the onsite groundwater remedy and an evaluation of groundwater extraction methods to be implemented along with a barrier wall.

The calibrated FEFLOW model will support remedy evaluation, selection and design at the Site. The calibrated model is deemed sufficiently accurate for the modeling goals of this work however new data should be incorporated into both the conceptual and numerical models when it becomes available. The numerical model is to be used to support remedy and design evaluations.

The results of the PDI provide improved understanding of the PFAS distribution and flux, aquifer properties, and geological and geotechnical properties on Site as they affect PFAS loading to the Cape Fear River.

9 REFERENCES

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Tables

TABLE 1
PDI TASKS AND OBJECTIVES
Chemours Fayetteville Works, North Carolina

Pre-Design Investigation Task	Objectives
Installation of Monitoring Wells Groundwater and Surface Water Sampling and Analysis	- Measure hydraulic gradients and assess groundwater PFAS concentrations - Extend boundary to the west for model refinement - Refine PFAS concentration profile along Willis Creek near the mouth to the Cape Fear River
PFM Installation and Analysis	- Assess Darcy Velocity and PFAS flux along potential groundwater discharge paths to both Willis Creek and the Cape Fear River - Refinement of the CSM at the Willis Creek discharge reach - Support ongoing effort to estimate baseline loading rates to surface water from onsite groundwater
Installation of Extraction Wells and Observation Wells Aquifer Tests	- Refine the groundwater flow model - Measure the transmissivity and storativity of the aquifer - Determine the zone of influence/drawdown from pumping - Determine the performance and efficiency of the wells
Standard Penetration Tests	- Delineate soil properties for use in the barrier wall design
Piezocone Penetration Tests	- Determine soil bearing capacity along the proposed barrier wall alignment - Evaluate depth and penetration resistance of the UCC
Soil Geotechnical Analyses	- Evaluate roadway stability, make recommendations for construction of roadway - Establish design permeability performance criteria for the proposed barrier wall
Additional Standard Penetration Tests and Soil Borings	- Evaluate depth of the UCC - Refine soil properties for use in the barrier wall design - Establish design permeability performance criteria for the proposed barrier wall - Collect undisturbed samples along the proposed barrier wall alignment for barrier wall contractors - Refine the subsurface conditions in specific areas identified in the PDI Report Version 1

Notes:

CSM - Conceptual Site Model
PDI - Pre-Design Investigation
PFAS - per- and polyfluoroalkyl substances
PFM - Passive Flux Meter
UCC - Upper Cape Fear Confining Unit

TABLE 2
WELL CONSTRUCTION LOG
Chemours Fayetteville Works, North Carolina

Well ID	Well Type	Northing (NAD83)	Easting (NAD83)	Installation Date	Casing Construction	Casing Diameter (in)	Well Casing Depth (ft bgs)	Screen Interval (ft bgs)	Screen Material	Screen Slot Size (in)	Filter Pack Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Top of Casing Elevation (ft NAVD88)	Ground Elevation (ft NAVD 88)
EW-1	Extraction Well	399,934.65	2,051,297.51	7/24/2020	PVC	6	60	40-60	Stainless Steel Vee Wire Wrap	0.020	37-60	35-37	91.33	91.86
EW-2	Extraction Well	396,164.48	2,052,232.61	8/14/2020	PVC	6	65	40-65	Stainless Steel Vee Wire Wrap	0.020	37-65	34-37	77.25	77.77
EW-3	Extraction Well	395,059.78	2,052,214.66	8/11/2020	PVC	6	67	37-67	Stainless Steel Vee Wire Wrap	0.020	32-67	29-32	76.48	76.66
EW-4	Extraction Well	398,581.51	2,051,805.58	7/30/2020	PVC	6	73	53-73	Stainless Steel Vee Wire Wrap	0.020	50-73	48-50	80.64	81.13
EW-5	Extraction Well	397,200.16	2,052,052.65	10/14/2020	PVC	6	67	37-67	Stainless Steel Vee Wire Wrap	0.020	34-67	32-34	78.5	78.28
OW-1	Observation Well	399,930.53	2,051,287.87	7/23/2020	PVC	2	50	40-50	Machine Slotted PVC	0.010	37-50	35-37	95.01	91.61
OW-2	Observation Well	398,572.28	2,051,801.62	7/28/2020	PVC	2	73	63-73	Machine Slotted PVC	0.010	60-73	58-60	84.37	81.11
OW-3	Observation Well	398,601.08	2,051,812.32	7/29/2020	PVC	2	73	63-73	Machine Slotted PVC	0.010	60-73	63-73	84.64	81.26
OW-4	Observation Well	395,049.16	2,052,210.81	8/6/2020	PVC	2	57	47-57	Machine Slotted PVC	0.010	44-57	42-44	80.85	77.62
OW-5	Observation Well	395,070.03	2,052,196.97	8/7/2020	PVC	2	64	54-64	Machine Slotted PVC	0.010	51-64	49-51	81.61	78.12
OW-6	Observation Well	396,168.41	2,052,223.54	8/12/2020	PVC	2	60	50-60	Machine Slotted PVC	0.010	47-50	45-47	80.53	78.15
OW-7	Observation Well	397,180.06	2,052,052.69	10/13/2020	PVC	2	67	57-67	Machine Slotted PVC	0.010	54-67	52-54	81.45	78.94
OW-8	Observation Well	397,202.33	2,052,041.98	10/13/2020	PVC	2	67	57-67	Machine Slotted PVC	0.010	54-67	52-54	82.3	79.57
OW-9	Observation Well	395,075.14	2,052,211.07	10/16/2020	PVC	2	64	54-64	Machine Slotted PVC	0.010	51-64	49-51	79.78	77.13
OW-10	Observation Well	399,948.17	2,051,291.21	10/20/2020	PVC	2	50	40-50	Machine Slotted PVC	0.010	37-50	35-37	94.39	91.94
PIW-11	Monitoring Well	401,911.03	2,050,416.29	8/25/2020	PVC	2	57	47-57	Machine Slotted PVC	0.010	44-57	42-44	67.02	64.95
PIW-12	Monitoring Well	401,703.10	2,051,025.77	9/1/2020	PVC	2	74	64-74	Machine Slotted PVC	0.010	61-74	59-61	83.78	81.65
PIW-13	Monitoring Well	401,464.29	2,051,122.60	9/3/2020	PVC	2	64	54-64	Machine Slotted PVC	0.010	51-64	49-51	83.18	81.4
PIW-14	Monitoring Well	401,163.98	2,051,186.57	9/4/2020	PVC	2	66	56-66	Machine Slotted PVC	0.010	53-56	51-53	87.43	84.65
PIW-15	Monitoring Well	400,706.51	2,051,532.80	9/9/2020	PVC	2	44	34-44	Machine Slotted PVC	0.010	31-44	29-31	67.85	65.16
PIW-16S	Monitoring Well	396,267.84	2,046,586.09	8/18/2020	PVC	2	45	35-45	Machine Slotted PVC	0.010	32-45	32-45	149.74	147.26
PIW-16D	Monitoring Well	396,257.96	2,046,587.07	8/20/2020	PVC	2	100	90-100	Machine Slotted PVC	0.010	87-127	85-87	150.06	147.41

Notes:

Survey data obtained from survery conducted by Donaldson Garrett & Associates October 2020.

ft bgs - feet below ground surface

in - inches

Elevations are reference to NAVD 1988 (GEOID 12B) Datum.

NAVD88 - North American Vertical Datum of 1988

PVC - polyvinyl chloride

PDI - Pre-design Investigation

TABLE 3
PASSIVE FLUX METER DEPLOYMENT
Chemours Fayetteville Works, North Carolina

Well ID	Geologic Completion Zone	Screen Interval (ft bgs)	PFM 1 (Lower Screen Interval)	PFM 2 (Upper Screen Interval)[1]	Date Placed	Time Placed	DTW$_{initial}$ (ft TOC)	DTB$_{intial}$ (ft bgs)	Apparent DTB$_{final}$ (ft bgs)	Date Removed and Sampled	Time Removed	Days Elapsed	Transducer Present
PIW-1D	Black Creek Aquifer	25-30	PFM-14	--	10/7/2020	13:07	18.1	29.0	24.2	10/22/2020	14:25	15	Yes
PIW-2D	Black Creek Aquifer	40-50	PFM-12	PFM-13	10/7/2020	12:40	36.7	50.1	41.1	10/22/2020	14:00	15	No
PIW-3D	Black Creek Aquifer	19-24	PFM-11	--	10/7/2020	12:05	17.0	24.0	19.1	10/22/2020	13:10	15	Yes
PIW-4D	Black Creek Aquifer	32.3-37.3	PFM-10	--	10/7/2020	11:30	10.8	38.2	33.3	10/22/2020	12:45	15	Yes
PIW-7D	Black Creek Aquifer	29-34	PFM-5	--	10/7/2020	9:45	5.54	34.3	29.4	10/22/2020	9:40	15	No
PIW-8D	Black Creek Aquifer	35.5-45.5	PFM-4	--	10/7/2020	9:05	6.98	40.1	34.7	10/22/2020	9:10	15	Yes
PIW-9D	Black Creek Aquifer	40-45	PFM-3	--	10/6/2020	16:18	14.5	46.2	40.8	10/21/2020	16:30	15	No
PIW-10DR	Black Creek Aquifer	48-58	PFM-8	PFM-9	10/6/2020	15:45	36.9	58.0	47.5	10/22/2020	15:45	15	No
PIW-11	Black Creek Aquifer	47-57	PFM-15	PFM-16	10/7/2020	13:50	23.5	57.2	47.3	10/22/2020	15:05	15	No
PIW-12	Black Creek Aquifer	64-74	PFM-17	PFM-18	10/7/2020	14:02	49.4	74.7	65.4	10/22/2020	15:30	15	No
PIW-13	Black Creek Aquifer	54-64	PFM-19	PFM-20	10/7/2020	14:25	48.7	65.3	55.3	10/22/2020	15:50	15	No
PIW-14	Black Creek Aquifer	56-66	PFM-29	PFM-30	10/7/2020	14:55	52.4	67.5	58.4	10/22/2020	10:55	15	No
PIW-15	Black Creek Aquifer	34-44	PFM-21	PFM-22	10/7/2020	15:30	34.0	45.1	36.2	10/22/2020	16:25	15	No
PW-10R	Black Creek Aquifer	57-67	PFM-1	PFM-2	10/6/2020	11:15	27.3	67.9	59.2	10/21/2020	11:40	15	No
PW-11	Black Creek Aquifer	53-63	PFM-6	PFM-7	10/7/2020	10:30	31.6	64.6	54.8	10/22/2020	10:50	15	Yes
PIW-6S	Floodplain	18-28	PFM-23	PFM-24	10/7/2020	16:03	13.9	28.8	--	10/22/2020	12:10	15	Yes
PIW-7S	Floodplain	7-17	PFM-25	PFM-26	10/7/2020	--	5.30	17.5	7.80	10/22/2020	10:00	15	No

Notes:

1. For wells with ten foot screen intervals, two PFMs were placed.

-- Not recorded/not present
PFM - passive flux meter
ft BGS - feet below ground surface
ft TOC - feet from the top of casing
DTB - depth to bottom
DTW - depth to water
DTW $_{initial}$ - meausred DTW prior to PFM placement
DTB $_{initial}$ - confirmation of depth to bottom prior to PFM placement
Apparent DTB $_{final}$ - apparent depth to bottom after PFM placement and confirmation of depth to top of PFM

TABLE 4
AQUIFER TEST PUMPING SUMMARY
Chemours Fayetteville Works, North Carolina

Extraction Well (North - South)	**Step Drawdown**	**Constant Rate**	
	Steps (GPM)	Pumping Rate (GPM)	Duration (Hours)
EW-1	5, 6, 7.4	6.6	26
EW-2	5.8, 7.6, 12.8	16	26
EW-3	10, 15, 20, 27	26	27.5
EW-4	12, 16, 20	16.5	81.25
EW-5	14.5, 20, 30	20	26.5

Notes:
GPM - gallons per minute

TABLE 5
PFAS ANALYTE LIST
Chemours Fayetteville Works, North Carolina

Common Name	PFAS Grouping		Chemical Name	CASN	Chemical Formula
	Table 3+ (17 compounds)	Table 3+ (20 compounds)			
HFPO-DA	✓	✓	Hexafluoropropylene oxide dimer acid	13252-13-6	C6HF11O3
PEPA	✓	✓	Perfluoro-2-ethoxypropionic acid	267239-61-2	C5HF9O3
PFECA-G	✓	✓	Perfluoro-4-isopropoxybutanoic acid	801212-59-9	C12H9F9O3S
PFMOAA	✓	✓	Perfluoro-2-methoxyacetic acid	674-13-5	C3HF5O3
PFO2HxA	✓	✓	Perfluoro-3,5-dioxahexanoic acid	39492-88-1	C4HF7O4
PFO3OA	✓	✓	Perfluoro-3,5,7-trioxaoctanoic acid	39492-89-2	C5HF9O5
PFO4DA	✓	✓	Perfluoro-3,5,7,9-tetraoxadecanoic acid	39492-90-5	C6HF11O6
PMPA	✓	✓	Perfluoro-2-methoxypropionic acid	13140-29-9	C4HF7O3
Hydro-EVE Acid	✓	✓	2,2,3,3-tetrafluoro-3-({1,1,1,2,3,3-hexafluoro-3-[(1,2,2,2-tetrafluoroethyl)oxy]propan-2-yl}oxy)propionic acid	773804-62-9	C8H2F14O4
EVE Acid	✓	✓	2,2,3,3-tetrafluoro-3-({1,1,1,2,3,3-hexafluoro-3-[(1,2,2-trifluoroethenyl)oxy]propan-2-yl}oxy)propionic acid	69087-46-3	C8HF13O4
PFECA B	✓	✓	Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	C5HF9O4
R-EVE	--	✓	Pentanoic acid, 4-(2-carboxy-1,1,2,2-tetrafluoroethoxy)-2,2,3,3,4,5,5,5-octafluoro-	2416366-22-6	C8H2F12O5
PFO5DA	✓	✓	Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid	39492-91-6	C7HF13O7
R-PSDA	--	✓	Pentanoic acid, 2,2,3,3,4,5,5,5-octafluoro-4-(1,1,2,2-tetrafluoro-2-sulfoethoxy)-	2416366-18-0	C7H2F12O6S
R-PSDCA	✓	✓	Ethanesulfonic acid, 1,1,2,2-tetrafluoro-2-[1,2,2,3,3-pentafluoro-1-(trifluoromethyl)propoxy]-	2416366-21-5	C6H2F12O4S
Hydrolyzed PSDA	--	✓	Acetic acid, 2-fluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2-tetrafluoro-2-sulfoethoxy)propoxy]-	2416366-19-1	C7H3F11O7S
NVHOS	✓	✓	1,1,2,2,4,5,5,5-heptafluoro-3-oxapentanesulfonic acid; or 2-(1,2,2,2-ethoxy)tetrafluoroethanesulfonic acid; or 1-(1,1,2,2-tetrafluoro-2-sulfoethoxy)-1,2,2,2-tetafluoroethane	1132933-86-8	C4H2F8O4S
PES	✓	✓	Perfluoro-2-ethoxyethanesulfonic acid	113507-82-7	C4HF9O4S
PS Acid	✓	✓	Ethanesulfonic acid, 2-[1-[difluoro[(1,2,2-trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-	29311-67-9	C7HF13O5S
Hydro-PS Acid	✓	✓	Ethanesulfonic acid, 2-[1-[difluoro(1,2,2,2-tetrafluoroethoxy)methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-	749836-20-2	C7H2F14O5S
PFHpA	--	--	Perfluoroheptanoic acid	375-85-9	C7HF13O2

Notes:
EPA - Environmental Protection Agency
PFAS - Per- and Polyfluoroalkyl substances
SOP - Standard Operating Procedure

TABLE 6
GROUNDWATER FIELD PARAMETERS
Chemours Fayetteville Works, North Carolina

Location	Date	pH (S.U.)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Turbidity (NTU)	Specific Conductance (µS/cm)	Temperature (^{o}C)
PIW-11	9/29/2020	6.58	0.14	-76.5	675	125	20.1
PIW-12	10/1/2020	4.04	0.14	151	7.9	354	18.2
PIW-13	10/1/2020	3.74	0.040	233	4.2	373	18.0
PIW-14	11/18/2020	4.57	0.17	99.1	2.5	148	17.1
PIW-15	10/2/2020	4.29	0.090	82.9	32	133	17.4
PIW-16D	9/28/2020	6.21	0.22	-63.9	2.1	61.3	19.4
PIW-16S	9/28/2020	5.19	0.49	199	5.2	84.7	18.7

Notes:

mg/L - milligrams per liter
mV- millivolts
NTU - Nephelometric Turbidity Unit
S.U. - Standard Units
µS/cm - microsiemens per centimeter
°C - degrees Celsius

TABLE 7
SURFACE WATER FIELD PARAMETERS
Chemours Fayetteville Works, North Carolina

Location	Date	pH (S.U.)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Turbidity (NTU)	Specific Conductivity (µS/cm)	Temperature (°C)
WC-1	9/30/2020	6.36	7.2	174	--	186	20.5
WC-IP-1	9/30/2020	6.03	5.8	152	--	65.2	20.6
WC-IP-2	9/30/2020	6.07	6.1	154	--	64.8	20.7
WC-IP-3	9/30/2020	6.11	6.7	141	--	64.4	20.8
WC-IP-4	9/30/2020	6.12	6.6	148	--	64.4	20.8
WC-2	9/30/2020	6.13	6.2	150	--	64.6	20.9

Notes:
°C - degrees Celsius
mg/L - milligrams per liter
µS/cm - microsiemens per centimeter
mV- millivolts
NTU - Nephelometric Turbidity Units
S.U. - Standard Units
-- - not measured

TABLE 8
GROUNDWATER AND SURFACE WATER PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	**PIW-11**	**PIW-12**	**PIW-13**	**PIW-14**	**PIW-15**
Field Sample ID	**PIW-11-20200929**	**PIW-12-20201001**	**PIW-13-20201001**	**PIW-14-20201118**	**PIW-15-20201002**
Sample Date	**9/29/2020**	**10/1/2020**	**10/1/2020**	**11/18/2020**	**10/2/2020**
QA/QC					
Sample Matrix	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**
Sample Delivery Group (SDG)	**280-141161-1**	**280-141161-1**	**280-141161-1**	**320-67054-1**	**280-141161-1**
Lab Sample ID	**280-141161-5**	**280-141161-6**	**280-141161-7**	**320-67054-2**	**280-141161-20**
Table 3+ SOP (ng/L)					
HFPO-DA	**280**	**710**	**650**	**6,300**	**7,900**
PFMOAA	**540**	**93**	**130**	**1,500**	**12,000**
PFO2HxA	**300**	**140**	**220**	**4,000**	**6,600**
PFO3OA	**23**	**3.7**	**4.3**	**550**	**1,000**
PFO4DA	<2	<2	<2	**33**	**39**
PFO5DA	<2	<2	<2	**13**	<7.8
PMPA*	**250**	**640**	**1,100**	**7,000**	**8,200**
PEPA*	**26**	**100**	**170**	**2,100**	**2,700**
PS Acid	<2	<2	<2	<2	<2
Hydro-PS Acid	<2	**2**	<2	**16**	**8.6**
R-PSDA	**120**	**16**	**7**	**290**	**230**
Hydrolyzed PSDA	**290**	<2	<2	<3.8	**4.4**
R-PSDCA	<2	<2	<2	<2	<2
NVHOS	**29**	**2.8**	**3.1**	**30**	**100**
EVE Acid	<2	<2	<2	<2	<2
Hydro-EVE Acid	<2	<2	<2	**5.0**	**8**
R-EVE	**32**	**18**	**10**	**250**	**180**
PES	<2	<2	<2	<2	<2
PFECA B	<2	<2	<2	<2.7	<2.7
PFECA-G	<2	<2	<2	<4.8	<4.8
Total Table 3+ (17 Compounds)	**1,400**	**1,700**	**2,300**	**22,000**	**39,000**
Total Table 3+ (20 Compounds)	**1,900**	**1,700**	**2,300**	**22,000**	**39,000**

TABLE 8
GROUNDWATER AND SURFACE WATER PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	**PIW-16D**	**PIW-16D**	**PIW-16S**	**WC-1**	**WC-2**
Field Sample ID	**PIW-16D-20200928**	**DUP-1-20200928**	**PIW-16S-20200928**	**WC-1-20200930**	**WC-2-20200930**
Sample Date	**9/28/2020**	**9/28/2020**	**9/28/2020**	**9/30/2020**	**9/30/2020**
QA/QC		**Field duplicate**			
Sample Matrix	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**
Sample Delivery Group (SDG)	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**
Lab Sample ID	**280-141161-2**	**280-141161-19**	**280-141161-1**	**280-141161-13**	**280-141161-14**
Table 3+ SOP (ng/L)					
HFPO-DA	<2	<2	**2,000**	**150**	**94**
PFMOAA	<2	<2	**110**	**95**	**32 J**
PFO2HxA	<2	<2	**850**	**160**	**120**
PFO3OA	<2	<2	**120**	**21**	**14**
PFO4DA	<2	<2	**75**	**6.4**	**5.4**
PFO5DA	<2	<2	<2	<2	<2
PMPA*	<2	<2	**1,700**	**250**	**210**
PEPA*	<2	<2	**600**	**63**	**43**
PS Acid	<2	<2	<2	<2	<2
Hydro-PS Acid	<2	<2	**61**	**10**	**9.9**
R-PSDA	<2 UJ	**7.4 J**	**83**	**42**	**31 J**
Hydrolyzed PSDA	<2	<2	<2	**22**	<2
R-PSDCA	<2	<2	<2	<2	<2
NVHOS	<2	<2	**10**	**2.7**	**2.3**
EVE Acid	<2	<2	<2	<2	<2
Hydro-EVE Acid	<2	<2	**7.8**	<2	<2
R-EVE	<2	<2	**29**	**15**	**12 J**
PES	<2	<2	<2	<2	<2
PFECA B	<2	<2	<2	<2	<2
PFECA-G	<2	<2	<2	<2	<2
Total Table 3+ (17 Compounds)	ND	ND	**5,500**	**760**	**530**
Total Table 3+ (20 Compounds)	ND	**7.4**	**5,600**	**840**	**570**

TABLE 8
GROUNDWATER AND SURFACE WATER PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	**WC-2**	**WC-IP-1**	**WC-IP-2**	**WC-IP-3**	**WC-IP-4**
Field Sample ID	**SW-DUP-1-20200930**	**WC-IP-1-20200930**	**WC-IP-2-20200930**	**WC-IP-3-20200930**	**WC-IP-4-20200930**
Sample Date	**9/30/2020**	**9/30/2020**	**9/30/2020**	**9/30/2020**	**9/30/2020**
QA/QC	**Field duplicate**				
Sample Matrix	**Liquid**	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**
Sample Delivery Group (SDG)	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**
Lab Sample ID	**280-141161-10**	**280-141161-15**	**280-141161-16**	**280-141161-17**	**280-141161-18**
Table 3+ SOP (ng/L)					
HFPO-DA	**100**	**110**	**120**	**110**	**110**
PFMOAA	**31**	**91**	**89**	**89**	**100**
PFO2HxA	**120**	**140**	**140**	**140**	**150**
PFO3OA	**13**	**18**	**17**	**17**	**18**
PFO4DA	**4.4**	**6.4**	**4.8**	**5.1**	**6.4**
PFO5DA	<2	<2	<2	<2	<2
PMPA*	**220**	**250**	**240**	**250**	**230**
PEPA*	**40**	**51**	**46**	**53**	**48**
PS Acid	<2	<2	<2	<2	<2
Hydro-PS Acid	**9.3**	**10**	**10**	**9.8**	**11**
R-PSDA	**29 J**	**42**	**35**	**35**	**45**
Hydrolyzed PSDA	<2	**23**	**21**	**21**	**25**
R-PSDCA	<2	<2	<2	<2	<2
NVHOS	<2	**2.6**	**2.3**	**3**	**4**
EVE Acid	<2	<2	<2	<2	<2
Hydro-EVE Acid	<2	<2	<2	<2	<2
R-EVE	**9.1 J**	**14**	**9.9**	**12**	**17**
PES	<2	<2	<2	<2	<2
PFECA B	<2	<2	<2	<2	<2
PFECA-G	<2	<2	<2	<2	<2
Total Table 3+ (17 Compounds)	**540**	**680**	**670**	**680**	**680**
Total Table 3+ (20 Compounds)	**580**	**760**	**740**	**740**	**760**

TABLE 8
GROUNDWATER AND SURFACE WATER PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	**EB**	**EB**	**FBLK**	**FBLK**	**FBLK**
Field Sample ID	**EQBLK-1-20200929**	**EQBLK-SW-1-20200930**	**FBLK-GW-1-20200928**	**FBLK-SW-1-20200930**	**FBLK-GW-2-20201001**
Sample Date	**9/29/2020**	**9/30/2020**	**9/28/2020**	**9/30/2020**	**10/1/2020**
QA/QC	**Equipment Blank**	**Equipment Blank**	**Field Blank**	**Field Blank**	**Field Blank**
Sample Matrix	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**	**LIQUID**
Sample Delivery Group (SDG)	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**	**280-141161-1**
Lab Sample ID	**280-141161-4**	**280-141161-11**	**280-141161-3**	**280-141161-12**	**280-141161-8**
Table 3+ SOP (ng/L)					
HFPO-DA	<2	<2	<2	<2	<2
PFMOAA	<2	<2	<2	<2	<2
PFO2HxA	<2	<2	<2	<2	<2
PFO3OA	<2	<2	<2	<2	<2
PFO4DA	<2	<2	<2	<2	<2
PFO5DA	<2	<2	<2	<2	<2
PMPA*	<2	<2	<2	<2	<2
PEPA*	<2	<2	<2	<2	<2
PS Acid	<2	<2	<2	<2	<2
Hydro-PS Acid	<2	<2	<2	<2	<2
R-PSDA	<2	<2	<2	<2	<2
Hydrolyzed PSDA	<2	<2	<2	<2	<2
R-PSDCA	<2	<2	<2	<2	<2
NVHOS	<2	<2	<2	<2	<2
EVE Acid	<2	<2	<2	<2	<2
Hydro-EVE Acid	<2	<2	<2	<2	<2
R-EVE	<2	<2	<2	<2	<2
PES	<2	<2	<2	<2	<2
PFECA B	<2	<2	<2	<2	<2
PFECA-G	<2	<2	<2	<2	<2
Total Table 3+ (17 Compounds)	ND	ND	ND	ND	ND
Total Table 3+ (20 Compounds)	ND	ND	ND	ND	ND

TABLE 8
GROUNDWATER AND SURFACE WATER PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	CSM Groundwater Sampling	CSM Groundwater Sampling
Location ID	**FBLK**	**FBLK**
Field Sample ID	**FBLK-GW-3-20201002**	**FBLK-20201118**
Sample Date	**10/2/2020**	**11/18/2020**
QA/QC	**Field Blank**	**Field Blank**
Sample Matrix	**LIQUID**	**LIQUID**
Sample Delivery Group (SDG)	**280-141161-1**	**320-67054-1**
Lab Sample ID	**280-141161-9**	**320-67054-1**
Table 3+ SOP (ng/L)		
HFPO-DA	<2	<2
PFMOAA	<2	<2
PFO2HxA	<2	<2
PFO3OA	<2	<2
PFO4DA	<2	<2
PFO5DA	<2	<2
PMPA*	<2	<2
PEPA*	<2	<2
PS Acid	<2	<2
Hydro-PS Acid	<2	<2
R-PSDA	<2	<2
Hydrolyzed PSDA	<2	<2
R-PSDCA	<2	<2
NVHOS	<2	<2
EVE Acid	<2	<2
Hydro-EVE Acid	<2	<2
R-EVE	<2	<2
PES	<2	<2
PFECA B	<2	<2
PFECA-G	<2	<2
Total Table 3+ (17 Compounds)	ND	ND
Total Table 3+ (20 Compounds)	ND	ND

Notes:

* Results for PMPA and PEPA are reported by both the Table 3+ SOP and the Table 6 SOP. Where results are non-detect below the Table 6 reporting limit (2 ng/L), the Table 6 result is shown here. Where results are detected, the higher concentration between the Table 3+ result and the Table 6 result is shown here.

Results for PFHpA by the Table 3+ SOP are reported in Appendix F.

Bold - Analyte detected above associated reporting limit

PFAS - Per- and polyfluoroalkyl substances

UJ - Analyte not detected. Reporting limit may not be accurate

J - Analyte detected. Reported value may not be accurate or precise

B - Not detected substantially above the level reported in the laboratory or field blanks.

ND - no Table 3+ analytes were detected above the associated reporting limits.

ng/L - nanograms per liter

QA/QC - Quality assurance/ quality control

SOP - standard operating procedure

< - Analyte not detected above associated reporting limit.

TABLE 9
PFM RESIN PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**
Location ID	**PIW-10DR**	**PIW-11**	**PIW-12**	**PIW-13**	**PIW-14**	**PIW-15**	**PIW-15**	**PIW-1D**	**PIW-2D**
Field Sample ID	**PIW-10DR-48-58-R**	**PIW-11-47-57-R**	**PIW-12-64-74-R**	**PIW-13-54-64-R**	**PIW-14-56-66-R**	**PIW-15-34-44-R**	**DUP-1R**	**PIW-1D-25-30-R**	**PIW-2D-40-50-R**
Sample Date	**10/21/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**48-58**	**47-57**	**64-74**	**54-64**	**56-66**	**34-44**	**34-44**	**25-30**	**40-50**
QA/QC							**Field duplicate**		
Sample Matrix	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**
Sample Type	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-1**	**280-141986-14**	**280-141986-15**	**280-141986-16**	**280-141986-11**	**280-141986-17**	**280-141986-18**	**280-141986-13**	**280-141986-12**
Table 3+ SOP	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)
HFPO-DA	**610,000**	**18,000**	**12,000**	**130,000**	**190,000**	**660,000**	**800,000**	**1,100,000**	**12,000**
PFMOAA	**790,000**	**21,000**	**3,100**	**22,000**	**39,000**	**250,000**	**230,000**	**900,000**	**100,000**
PFO2HxA	**610,000**	**16,000**	**3,200**	**30,000**	**110,000**	**300,000**	**320,000**	**620,000**	**23,000**
PFO3OA	**220,000**	**1,800**	<1,000	<1,000	**16,000**	**52,000**	**60,000**	**87,000**	<1,000
PFO4DA	**42,000**	<1,100	<1,000	<1,000	<1,400	<22,000	<20,000	<24,000	<1,100
PFO5DA	<19,000	<1,000	<1,000	<1,000	<1,300	<20,000	<19,000	<22,000	<1,000
PMPA	**250,000**	**8,500**	**15,000**	**97,000**	**190,000**	**230,000**	**220,000**	**550,000**	**6,800**
PEPA	**110,000**	**1,900**	**2,200**	**24,000**	**66,000**	**110,000**	**120,000**	**180,000**	<1,000
PS Acid	<7,100	<1,000	<1,000	<1,000	<1,000	<7,800	<7,100	<8,300	<1,000
Hydro-PS Acid	<6,600	<1,000	<1,000	<1,000	<1,000	<7,300	<6,600	<7,700	<1,000
R-PSDA	<17,000	**2,500**	<1,000	<1,000	<1,100	<19,000	<17,000	<20,000	<1,000
Hydrolyzed PSDA	<28,000	**12,000**	<2,000	<2,000	<2,000	<31,000	<28,000	<33,000	<2,000
R-PSDCA	<7,100	<1,000	<1,000	<1,000	<1,000	<7,800	<7,100	<8,300	<1,000
NVHOS	**14,000**	**2,200**	<1,000	<1,000	<1,000	<9,300	<8,400	<9,800	<1,000
EVE Acid	<6,600	<1,000	<1,000	<1,000	<1,000	<7,300	<6,600	<7,700	<1,000
Hydro-EVE Acid	**30,000**	<1,000	<1,000	<1,000	<1,000	<8,300	<7,500	<8,800	<1,000
R-EVE	<23,000	<2,000	<2,000	<2,000	<2,000	<25,000	<23,000	<26,000	<2,000
PES	<7,500	<1,000	<1,000	<1,000	<1,000	<8,300	<7,500	<8,800	<1,000
PFECA B	<11,000	<1,000	<1,000	<1,000	<1,000	<12,000	<11,000	<13,000	<1,000
PFECA-G	<16,000	<1,000	<1,000	<1,000	<1,100	<18,000	<16,000	<19,000	<1,000
Total Table 3+ (17 Compounds)	**2,700,000**	**69,000**	**36,000**	**300,000**	**610,000**	**1,600,000**	**1,800,000**	**3,400,000**	**140,000**
Total Table 3+ (20 Compounds)	**2,700,000**	**84,000**	**36,000**	**300,000**	**610,000**	**1,600,000**	**1,800,000**	**3,400,000**	**140,000**
Other Analytical									
Percent Moisture (%)	**64 J**	**66 J**	**69 J**	**67 J**	**68 J**	**62 J**	**61 J**	**67 J**	**66 J**
Percent Solids (%)	**36 J**	**34 J**	**31 J**	**33 J**	**32 J**	**38 J**	**39 J**	**33 J**	**34 J**

TABLE 9
PFM RESIN PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**
Location ID	**PIW-3D**	**PIW-4D**	**PIW-6S**	**PIW-7D**	**PIW-7S**	**PIW-8D**	**PIW-9D**	**PW-10R**	**PW-11**
Field Sample ID	**PIW-3D-20-25-R**	**PIW-4D-32-37-R**	**PIW-6S-18-28-R**	**PIW-7D-29-34-R**	**PIW-7S-7-17-R**	**PIW-8D-35-40-R**	**PIW-9D-40-45-R**	**PW-10R-57-67-R**	**PW-11-54-64-R**
Sample Date	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/21/2020**	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**20-25**	**32-37**	**18-28**	**29-34**	**7-17**	**35-40**	**40-45**	**57-67**	**54-64**
QA/QC									
Sample Matrix	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**
Sample Type	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-10**	**280-141986-9**	**280-141986-8**	**280-141986-4**	**280-141986-5**	**280-141986-3**	**280-141986-2**	**280-141986-6**	**280-141986-7**
Table 3+ SOP	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)	(ng/kg)
HFPO-DA	**1,600,000**	**1,000**	**490,000**	**510,000**	**5,100,000**	**3,700,000**	**210,000**	**1,300,000**	**330,000**
PFMOAA	**300,000**	<1,000	**3,100,000**	**4,000,000**	**1,600,000**	**9,600,000**	**1,400,000**	**7,400,000**	**3,700,000**
PFO2HxA	**1,000,000**	<1,000	**1,200,000**	**1,100,000**	**3,600,000**	**5,200,000**	**590,000**	**3,400,000**	**1,000,000**
PFO3OA	**160,000**	<1,000	**160,000**	**110,000**	**1,400,000**	**2,000,000**	**140,000**	**240,000**	**380,000**
PFO4DA	**72,000**	<1,300	<59,000	<97,000	**170,000**	**370,000**	**32,000**	<120,000	**190,000**
PFO5DA	<25,000	<1,200	<54,000	<89,000	<58,000	<130,000	<20,000	<110,000	<53,000
PMPA	**900,000**	<1,000	**180,000**	<61,000	**1,600,000**	**540,000**	**83,000**	**450,000**	**180,000**
PEPA	**410,000**	<1,000	**70,000**	<38,000	**1,500,000**	**190,000**	**33,000**	**99,000**	**61,000**
PS Acid	<9,400	<1,000	<21,000	<34,000	<22,000	<51,000	<7,600	<40,000	<20,000
Hydro-PS Acid	**13,000**	<1,000	<19,000	<32,000	**110,000**	<47,000	<7,200	<38,000	<19,000
R-PSDA	<22,000	<1,100	<49,000	<80,000	<52,000	<120,000	<18,000	<96,000	<48,000
Hydrolyzed PSDA	<37,000	<2,000	<81,000	<130,000	<87,000	<200,000	<30,000	<160,000	<79,000
R-PSDCA	<9,400	<1,000	<21,000	<34,000	<22,000	<51,000	<7,600	<40,000	<20,000
NVHOS	<11,000	<1,000	**34,000**	<40,000	**250,000**	**110,000**	**19,000**	**98,000**	**35,000**
EVE Acid	<8,800	<1,000	<19,000	<32,000	<21,000	<47,000	<7,200	<38,000	<19,000
Hydro-EVE Acid	<10,000	<1,000	<22,000	<36,000	**210,000**	**210,000**	**28,000**	<43,000	<21,000
R-EVE	<30,000	<2,000	<66,000	<110,000	<70,000	<160,000	<24,000	<130,000	<64,000
PES	<10,000	<1,000	<22,000	<36,000	<23,000	<54,000	<8,100	<43,000	<21,000
PFECA B	<15,000	<1,000	<32,000	<53,000	<34,000	<79,000	<12,000	<63,000	<31,000
PFECA-G	<22,000	<1,100	<48,000	<78,000	<51,000	<120,000	<18,000	<93,000	<46,000
Total Table 3+ (17 Compounds)	**4,500,000**	**1,000**	**5,200,000**	**5,700,000**	**16,000,000**	**22,000,000**	**2,500,000**	**13,000,000**	**5,900,000**
Total Table 3+ (20 Compounds)	**4,500,000**	**1,000**	**5,200,000**	**5,700,000**	**16,000,000**	**22,000,000**	**2,500,000**	**13,000,000**	**5,900,000**
Other Analytical									
Percent Moisture (%)	**70 J**	**72 J**	**65 J**	**72 J**	**65 J**	**69 J**	**66 J**	**69 J**	**64 J**
Percent Solids (%)	**30 J**	**28 J**	**35 J**	**28 J**	**35 J**	**31 J**	**34 J**	**32 J**	**36 J**

TABLE 9
PFM RESIN PFAS RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**PFM Sampling**	**PFM Sampling**
Location ID	**Blank Resin**	**FBLK**
Field Sample ID	**Blank Resin-102220**	**PFM-Field blank**
Sample Date	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**-**	**-**
QA/QC	**Field Blank**	**Field Blank**
Sample Matrix	**Solid**	**Liquid**
Sample Type	**Resin**	**Liquid**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-20**	**280-141986-19**
Table 3+ SOP	(ng/kg)	(ng/L)
HFPO-DA	<1,000	<2
PFMOAA	<1,000	<2
PFO2HxA	<1,000	<2
PFO3OA	<1,000	<2
PFO4DA	<1,000	<2
PFO5DA	<1,000	<2
PMPA	<1,000	<20
PEPA	<1,000	<10
PS Acid	<1,000	<2
Hydro-PS Acid	<1,000	<2
R-PSDA	<1,000	<2
Hydrolyzed PSDA	<2,000	<2
R-PSDCA	<1,000	<2
NVHOS	<1,000	<2
EVE Acid	<1,000	<2
Hydro-EVE Acid	<1,000	<2
R-EVE	<2,000	<2
PES	<1,000	<2
PFECA B	<1,000	<2
PFECA-G	<1,000	<2
Total Table 3+ (17 Compounds)	ND	ND
Total Table 3+ (20 Compounds)	ND	ND
Other Analytical		
Percent Moisture (%)	**57 J**	**--**
Percent Solids (%)	**43 J**	**--**

Notes:

Reported resin concentrations are on a dry weight basis.

Results for PFHpA by the Table 3+ SOP are reported in Appendix F.

Bold - Analyte detected above associated reporting limit

B - Not detected substantially above the level reported in the laboratory or field blanks.

EPA - Environmental Protection Agency

ft bgs - feet below ground surface

J - Analyte detected. Reported value may not be accurate or precise

ND - no Table 3+ analytes were detected above the associated reporting limits

ng/kg - nanograms per kilogram

ng/L - nanograms per liter

PFAS - Per- and polyfluoroalkyl substances

PFM - Passive flux meter

QA/QC - Quality assurance/ quality control

SDG - Sample Delivery Group

SOP - standard operating procedure

< - Analyte not detected above associated reporting limit.

TABLE 10
PFM DARCY VELOCITY AND FLUX VALUES
Chemours Fayetteville Works, North Carolina

Sample ID	Location ID	Depth below top of well casing (ft)	Darcy Velocity (cm/day)	NVHOS (µg/m^2/day)	PES (µg/m^2/day)	PMPA (µg/m^2/day)	HFPO-DA (µg/m^2/day)
PIW-10DR-48-58-G	PIW-10DR	53	3.0	26	13	500	1,200
PIW-11-47-57-G	PIW-11	52	3.6	2	ND	15	35
PIW-12-64-74-G	PIW-12	69	3.0	ND	ND	29	22
PIW-13-54-64-G	PIW-13	59	3.2	ND	ND	200	260
PIW-14-56-66-G	PIW-14	61	3.0	ND	ND	390	390
PIW-15-34-44-G	PIW-15	39	3.3	17	15	470	1,300
PIW-1D-25-30-G	PIW-1D	28	5.3	18	16	1,100	2,200
PIW-2D-40-50-G	PIW-2D	45	3.1	ND	ND	12	22
PIW-3D-20-25-G	PIW-3D	23	7.2	20	18	1,800	3,300
PIW-4D-32-37-G	PIW-4D	35	4.5	ND	ND	ND	ND
PIW-6S-18-28-G	PIW-6S	23	3.3	68	43	370	1,000
PIW-7D-29-34-G	PIW-7D	32	3.2	80	72	120	1,000
PIW-7S-7-17-G	PIW-7S	12	8.4	520	46	3,300	11,000
PIW-8D-35-40-G	PIW-8D	38	3.1	220	110	1,100	7,600
PIW-9D-40-45-G	PIW-9D	43	2.8	37	15	170	430
PW-10R-57-67-G	PW-10R	62	6.6	200	87	930	2,700
PW-11-54-64-G	PW-11	59	3.6	70	41	370	670
DUP-1G	PIW-15	39	3.3	17	15	450	1,600
PIW-15-34-44-GMS	PIW-15	39	3.3	ND	ND	ND	ND
PIW-15-34-44-GMSD	PIW-15	39	3.2	ND	ND	ND	ND

Notes:

Darcy velocity and PFAS flux data reported by EnviroFlux
All values rounded to 2 significant digits
ft - feet
ND - analyte not detected above the associated reporting limit
PFAS - per- and polyfluoroalkyl substances
PFM - passive flux meter
cm/day - centimeters per day
µg/m^2/day - micrograms per square meter per day

TABLE 10
PFM DARCY VELOCITY AND FLUX VALUES
Chemours Fayetteville Works, North Carolina

Sample ID	Location ID	Depth below top of well casing (ft)	Darcy Velocity (cm/day)	PFECA B (µg/m^2/day)	R-PSDA (µg/m^2/day)	Hydrolyzed PSDA (µg/m^2/day)	R-PSDCA (µg/m^2/day)
PIW-10DR-48-58-G	PIW-10DR	53	3.0	20	32	53	12
PIW-11-47-57-G	PIW-11	52	3.6	ND	3	20	ND
PIW-12-64-74-G	PIW-12	69	3.0	ND	ND	ND	ND
PIW-13-54-64-G	PIW-13	59	3.2	ND	ND	ND	ND
PIW-14-56-66-G	PIW-14	61	3.0	ND	0	ND	ND
PIW-15-34-44-G	PIW-15	39	3.3	22	37	59	14
PIW-1D-25-30-G	PIW-1D	28	5.3	24	39	63	15
PIW-2D-40-50-G	PIW-2D	45	3.1	ND	ND	ND	ND
PIW-3D-20-25-G	PIW-3D	23	7.2	29	43	71	17
PIW-4D-32-37-G	PIW-4D	35	4.5	ND	0	ND	ND
PIW-6S-18-28-G	PIW-6S	23	3.3	64	99	160	41
PIW-7D-29-34-G	PIW-7D	32	3.2	110	160	260	68
PIW-7S-7-17-G	PIW-7S	12	8.4	69	110	180	44
PIW-8D-35-40-G	PIW-8D	38	3.1	160	240	410	100
PIW-9D-40-45-G	PIW-9D	43	2.8	23	35	57	14
PW-10R-57-67-G	PW-10R	62	6.6	130	200	330	81
PW-11-54-64-G	PW-11	59	3.6	61	96	160	39
DUP-1G	PIW-15	39	3.3	23	35	57	15
PIW-15-34-44-GMS	PIW-15	39	3.3	ND	ND	ND	ND
PIW-15-34-44-GMSD	PIW-15	39	3.2	ND	ND	ND	ND

Notes:
Darcy velocity and PFAS flux data reported by EnviroFlux
All values rounded to 2 significant digits
ft - feet
ND - analyte not detected above the associated reporting limit
PFAS - per- and polyfluoroalkyl substances
PFM - passive flux meter
cm/day - centimeters per day
µg/m^2/day - micrograms per square meter per day

TABLE 10
PFM DARCY VELOCITY AND FLUX VALUES
Chemours Fayetteville Works, North Carolina

Sample ID	Location ID	Depth below top of well casing (ft)	Darcy Velocity (cm/day)	R-EVE (µg/m^2/day)	PEPA (µg/m^2/day)	PS Acid (µg/m^2/day)	PFO2HxA (µg/m^2/day)
PIW-10DR-48-58-G	PIW-10DR	53	3.0	43	220	12	1,200
PIW-11-47-57-G	PIW-11	52	3.6	ND	2	ND	31
PIW-12-64-74-G	PIW-12	69	3.0	ND	2	ND	5
PIW-13-54-64-G	PIW-13	59	3.2	ND	47	ND	59
PIW-14-56-66-G	PIW-14	61	3.0	ND	130	ND	230
PIW-15-34-44-G	PIW-15	39	3.3	47	220	14	610
PIW-1D-25-30-G	PIW-1D	28	5.3	49	370	15	1,300
PIW-2D-40-50-G	PIW-2D	45	3.1	ND	ND	ND	45
PIW-3D-20-25-G	PIW-3D	23	7.2	57	830	17	2,000
PIW-4D-32-37-G	PIW-4D	35	4.5	ND	ND	ND	ND
PIW-6S-18-28-G	PIW-6S	23	3.3	130	140	41	2,500
PIW-7D-29-34-G	PIW-7D	32	3.2	220	76	68	2,200
PIW-7S-7-17-G	PIW-7S	12	8.4	140	3,100	44	7,500
PIW-8D-35-40-G	PIW-8D	38	3.1	320	390	100	11,000
PIW-9D-40-45-G	PIW-9D	43	2.8	45	66	14	1,200
PW-10R-57-67-G	PW-10R	62	6.6	260	200	81	7,000
PW-11-54-64-G	PW-11	59	3.6	130	120	39	2,000
DUP-1G	PIW-15	39	3.3	47	250	15	660
PIW-15-34-44-GMS	PIW-15	39	3.3	ND	ND	ND	ND
PIW-15-34-44-GMSD	PIW-15	39	3.2	ND	ND	ND	ND

Notes:
Darcy velocity and PFAS flux data reported by EnviroFlux
All values rounded to 2 significant digits
ft - feet
ND - analyte not detected above the associated reporting limit
PFAS - per- and polyfluoroalkyl substances
PFM - passive flux meter
cm/day - centimeters per day
µg/m^2/day - micrograms per square meter per day

TABLE 10
PFM DARCY VELOCITY AND FLUX VALUES
Chemours Fayetteville Works, North Carolina

Sample ID	Location ID	Depth below top of well casing (ft)	Darcy Velocity (cm/day)	PFO3OA (µg/m^2/day)	PFO4DA (µg/m^2/day)	PFO5DA (µg/m^2/day)	PFMOAA (µg/m^2/day)
PIW-10DR-48-58-G	PIW-10DR	53	3.0	440	83	36	1,600
PIW-11-47-57-G	PIW-11	52	3.6	2	0	ND	41
PIW-12-64-74-G	PIW-12	69	3.0	ND	ND	ND	4
PIW-13-54-64-G	PIW-13	59	3.2	ND	ND	ND	43
PIW-14-56-66-G	PIW-14	61	3.0	31	1	1	79
PIW-15-34-44-G	PIW-15	39	3.3	100	43	39	510
PIW-1D-25-30-G	PIW-1D	28	5.3	180	47	43	1,800
PIW-2D-40-50-G	PIW-2D	45	3.1	ND	0	ND	200
PIW-3D-20-25-G	PIW-3D	23	7.2	320	140	49	610
PIW-4D-32-37-G	PIW-4D	35	4.5	ND	1	0	ND
PIW-6S-18-28-G	PIW-6S	23	3.3	330	120	110	6,400
PIW-7D-29-34-G	PIW-7D	32	3.2	220	200	180	8,200
PIW-7S-7-17-G	PIW-7S	12	8.4	2,900	350	120	3,300
PIW-8D-35-40-G	PIW-8D	38	3.1	4,100	760	260	20,000
PIW-9D-40-45-G	PIW-9D	43	2.8	280	63	39	2,900
PW-10R-57-67-G	PW-10R	62	6.6	490	250	230	15,000
PW-11-54-64-G	PW-11	59	3.6	780	390	110	7,600
DUP-1G	PIW-15	39	3.3	120	41	39	470
PIW-15-34-44-GMS	PIW-15	39	3.3	ND	ND	ND	ND
PIW-15-34-44-GMSD	PIW-15	39	3.2	ND	ND	ND	ND

Notes:

Darcy velocity and PFAS flux data reported by EnviroFlux

All values rounded to 2 significant digits

ft - feet

ND - analyte not detected above the associated reporting limit

PFAS - per- and polyfluoroalkyl substances

PFM - passive flux meter

cm/day - centimeters per day

µg/m^2/day - micrograms per square meter per day

TABLE 10
PFM DARCY VELOCITY AND FLUX VALUES
Chemours Fayetteville Works, North Carolina

Sample ID	Location ID	Depth below top of well casing (ft)	Darcy Velocity (cm/day)	EVE Acid (µg/m^2/day)	Hydro-PS Acid (µg/m^2/day)	Hydro-EVE Acid (µg/m^2/day)	PFECA-G (µg/m^2/day)
PIW-10DR-48-58-G	PIW-10DR	53	3.0	11	11	59	30
PIW-11-47-57-G	PIW-11	52	3.6	ND	ND	ND	ND
PIW-12-64-74-G	PIW-12	69	3.0	ND	ND	ND	ND
PIW-13-54-64-G	PIW-13	59	3.2	ND	ND	ND	ND
PIW-14-56-66-G	PIW-14	61	3.0	ND	ND	ND	0
PIW-15-34-44-G	PIW-15	39	3.3	13	13	15	35
PIW-1D-25-30-G	PIW-1D	28	5.3	14	14	16	37
PIW-2D-40-50-G	PIW-2D	45	3.1	ND	ND	ND	ND
PIW-3D-20-25-G	PIW-3D	23	7.2	16	24	18	43
PIW-4D-32-37-G	PIW-4D	35	4.5	ND	ND	ND	0
PIW-6S-18-28-G	PIW-6S	23	3.3	37	37	43	97
PIW-7D-29-34-G	PIW-7D	32	3.2	63	63	72	160
PIW-7S-7-17-G	PIW-7S	12	8.4	42	230	440	100
PIW-8D-35-40-G	PIW-8D	38	3.1	94	94	430	240
PIW-9D-40-45-G	PIW-9D	43	2.8	13	13	55	35
PW-10R-57-67-G	PW-10R	62	6.6	77	77	87	190
PW-11-54-64-G	PW-11	59	3.6	37	37	41	92
DUP-1G	PIW-15	39	3.3	14	14	15	33
PIW-15-34-44-GMS	PIW-15	39	3.3	ND	ND	ND	ND
PIW-15-34-44-GMSD	PIW-15	39	3.2	ND	ND	ND	ND

Notes:
Darcy velocity and PFAS flux data reported by EnviroFlux
All values rounded to 2 significant digits
ft - feet
ND - analyte not detected above the associated reporting limit
PFAS - per- and polyfluoroalkyl substances
PFM - passive flux meter
cm/day - centimeters per day
µg/m^2/day - micrograms per square meter per day

TABLE 11
AQUIFER TEST RESULTS
Chemours Fayetteville Works, North Carolina

Extraction Well ID	Step Drawdown Test			Constant Rate Test			Interpretation
	Transmissivity (cm^2/s)	Bulk K (ft/day)	Bulk K (cm/s)	Transmissivity (cm^2/s)	Bulk K (ft/day)	Bulk K (cm/s)	
EW-1	7.1 - 9.1	3.3-4.24	1.2E-03 - 1.5E-03	3.2	14.66	5.20E-03	Best fit with leaky confined aquifer solutions (e.g., Hantush-Jacob, Moench). Lower yield BCA.
EW-4	1.7*	7.8*	2.80E-03	1.9	8.69	3.10E-03	Best fit with leaky confined aquifer solutions (e.g., Hantush-Jacob, Moench). Lower yield BCA.
EW-5	8.0	24.68	8.70E-03	9.3 - 9.4	28.8 - 29.26	1.00E-02	Best fit with leaky confined aquifer solutions (e.g., Hantush-Jacob, Moench). Higher yield BCA.
EW-2	2.6 - 24	9.61 - 87.58	3.4E-03 - 3.1E-02	3.0	11.14	3.90E-03	Best fit with delayed yield unconfined aquifer solutions(e.g., Hantush-Jacob, Moench). Lower yield, unconfined BCA.
EW-3	2.8 - 6.2	8.64 - 19.34	3.0E-03 - 6.8E-03	7.3	22.53	7.90E-03	Best fit with leaky confined aquifer solutions (e.g., Hantush-Jacob, Moench). Higher yield BCA.

Notes:
K - conductivity
cm/s - centimeters per second
cm^2/s - centimeters squared per second
ft/day - feet per day
BCA - Black Creek Aquifer
* EW-4 results for Step Drawrdown Test estimated using Thiem Dupuit equation for confined aquifers (Fetter, 1998)

TABLE 12
GEOTECHNICAL EXPLORATION
CPT BORING PENETRATION REFUSAL SUMMARY
Chemours Fayetteville Works, North Carolina

Sounding Number	Station Number at Time of Original Exploration	Elevation at Penetration Location (ft MSL)	Refusal Depth (ft)	Refusal Elevation (ft MSL)
C-1	2+50	83.8	24.5	59.3
C-3	12+50	70.1	68.6	1.5
C-5	22+50	70.3	76.5	-6.2
C-6	27+50	72.0	71.4	0.6
C-7	32+00	80.9	71.1	9.8
C-8	35+00	79.1	89.7	-10.6
C-9	40+00	72.8	82.9	-10.1
C-10	45+00	71.4	59.8	11.6
C-10A	45+00	71.4	56.7	14.7
C-11	50+00	73.0	71.9	1.1
C-12	55+00	78.6	61.0	17.6
C-13	60+00	75.7	71.3	4.4
C-14	65+00	79.3	78.5	0.8
C-15	70+00	77.9	70.5	7.4
C-16	75+00	81.4	61.3	20.1
C-16A	75+00	81.4	57.9	23.5
C-17	80+00	78.8	66.9	11.9
C-18	85+00	77.1	80.2	-3.1
C-19	90+00	75.1	69.0	6.1

Notes:

CPT - piezocone penetration tests

ft - feet

ft MSL - feet above mean sea level

Station Number locations are shown in Appendix D of this report.

TABLE 13
OBSERVED DEPTH TO UPPER CAPE FEAR CONFINING LAYER - MUD ROTARY AND SONIC SOIL BORINGS
Chemours Fayetteville Works, North Carolina

Boring Number	Station Based on Alignment at Time of Original Exploration	Elevation at Boring Location (ft MSL)	Depth to Confining Layer (ft)	Elevation at top of Confining Layer (ft MSL)
S-1	0+00	74.5	70	4.5
S-2	5+00	74.0	77	-3.0
S-3	10+00	71.5	72	-0.5
S-4	15+00	70.5	57	13.5
S-5	20+00	73.0	67	6.0
S-6	25+00	71.0	67	4.0
S-7	30+00	76.0	67	9.0
S-8	33+50	83.0	79	4.0
S-9	37+50	74.5	68	12.5
S-10	42+50	71.5	77	-5.5
S-11	47+50	72.0	62	10.0
S-12	52+50	77.5	62	15.5
S-13	57+50	78.5	67	11.5
S-14	62+50	76.0	51	25.0
S-15	67+50	71.5	77	-5.5
S-16	72+50	79.0	77	2.0
S-17	77+50	78.5	62	16.5
S-18	82+50	82.5	77	5.5
S-19	87+50	78.0	72	6.0
B-1	-5+0	71.3	67	4.3
B-2	-3+0	65.0	67	-2.0
B-3	-2+0	71.3	67	4.3
B-4	-1+0	73.3	67	6.3
B-5	2+50	80.3	77	3.3
B-6	6+60	71.9	77	-5.1
B-7	8+30	71.8	67	4.8
B-8	41+75	71.9	76	-4.1
B-9	43+25	83.2	75	8.2
B-10	53+75	76.7	67	9.7
B-11	55+75	74.4	64	10.4
B-12	59+75	76.3	54	22.3

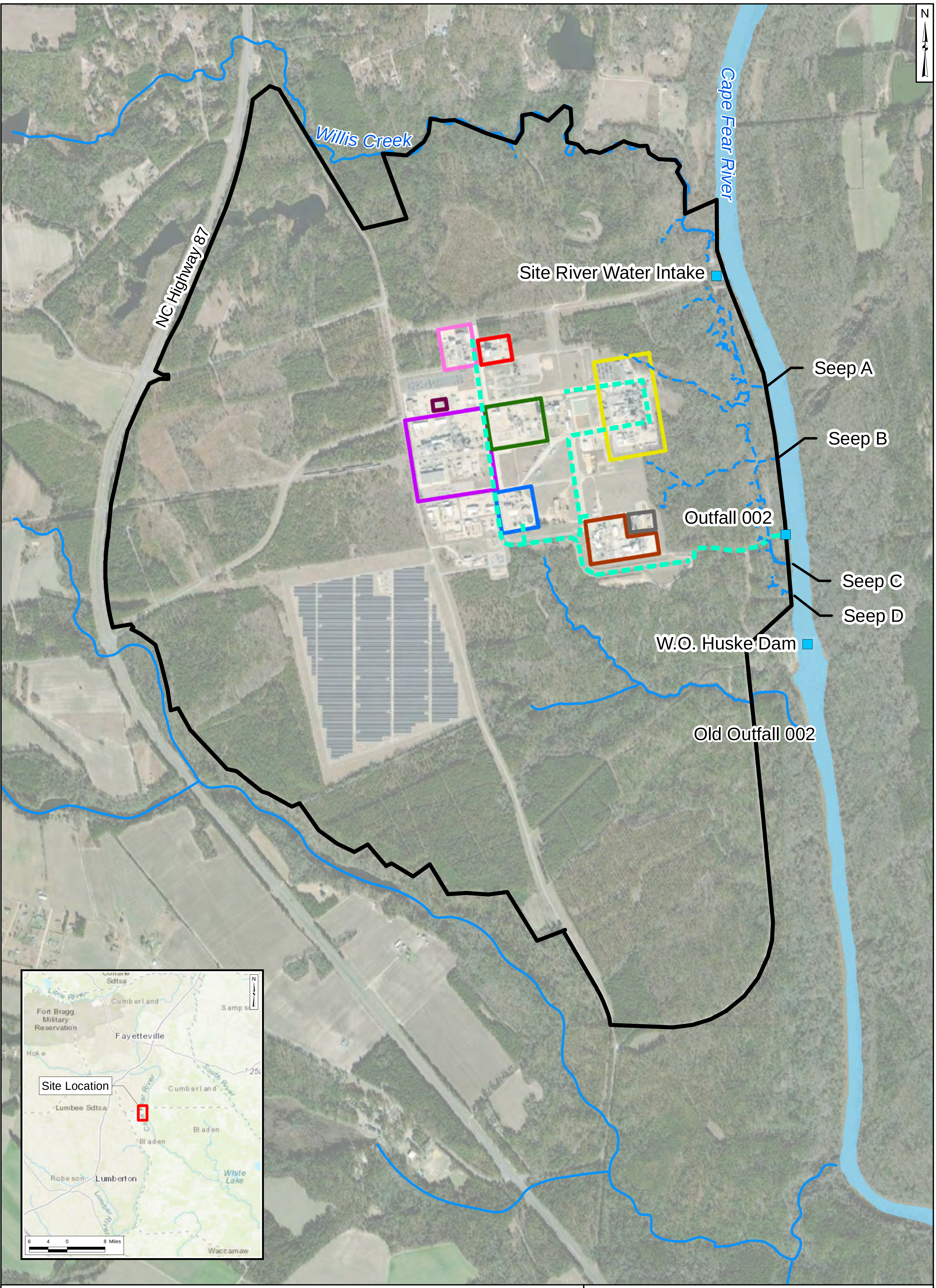
Notes:

ft - feet

ft MSL - feet above mean sea level

Station Number locations are shown in Appendix D of this report.

Figures



Legend

- 🟦 Site Features
- ━ Site Boundary
- ─ Nearby Tributary
- ╌ Observed Seep
- ╍ Site Conveyance Network

Areas at Site

- ▢ Chemours Monomers IXM
- ▢ Chemours Polymer Processing Aid Area
- ▢ DuPont Polyvinyl Fluoride Leased Area
- ▢ Former DuPont PMDF Area
- ▢ Kuraray SentryGlas® Leased Area
- ▢ Kuraray Trosifol® Leased Area
- ▢ Wastewater Treatment Plant
- ▢ Power - Filtered and Demineralized Water Production
- ▢ Kuraray Laboratory

Notes:
1. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
2. Basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1,000 500 0 1,000 Feet

Site Location Map

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C 3500 and C 295

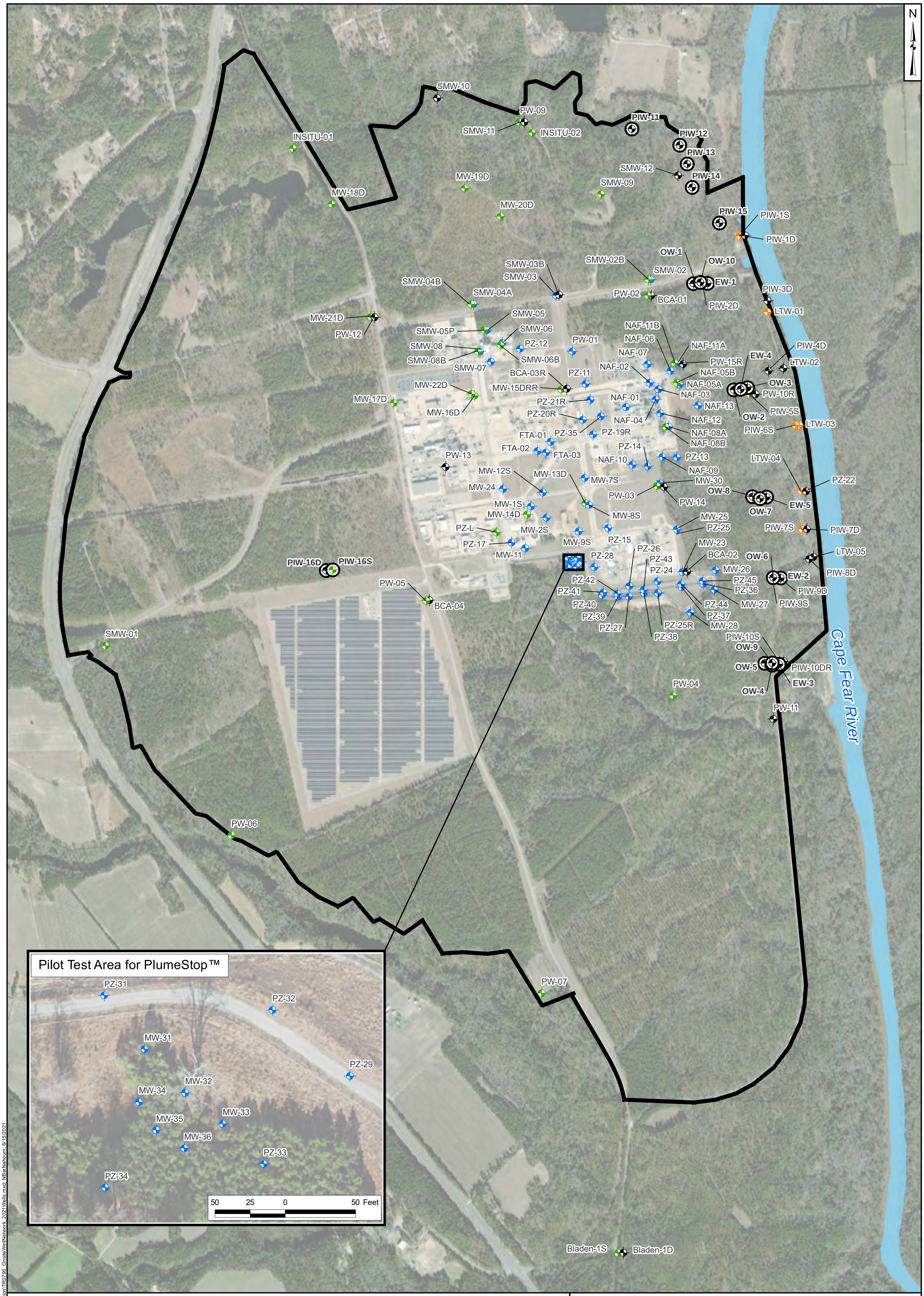
Raleigh

June 2021

Figure
1

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795_SiteLocation.mxd Last Revised: 6/15/2021 Author: NBarNahoum

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Legend

⊕	Perched Zone
⊕	Surficial Aquifer
⊕	Floodplain Deposits
⊕	Black Creek Aquifer
○	Wells installed for the Pre-Design Investigation
▬	Site Boundary

Notes:

1. Due to the scale of the map, pairs of wells that are in close proximity have been offset for visibility. Therefore, the placement of these wells on this map do not reflect their true geographic coordinates.
2. The outline of the River shown on this figure is approximate (River outline based on compilation of open data sources from ArcGIS online service and North Carolina Department of Environmental Quality Online GIS - Major Hydro shapefile).
3. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1,000 500 0 1,000 Feet

Onsite Well Network
(Perched, Surficial, Floodplain, and Black Creek)

Chemours Fayetteville Works, North Carolina

Geosyntec
consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C 3500 and C 295

Figure
2

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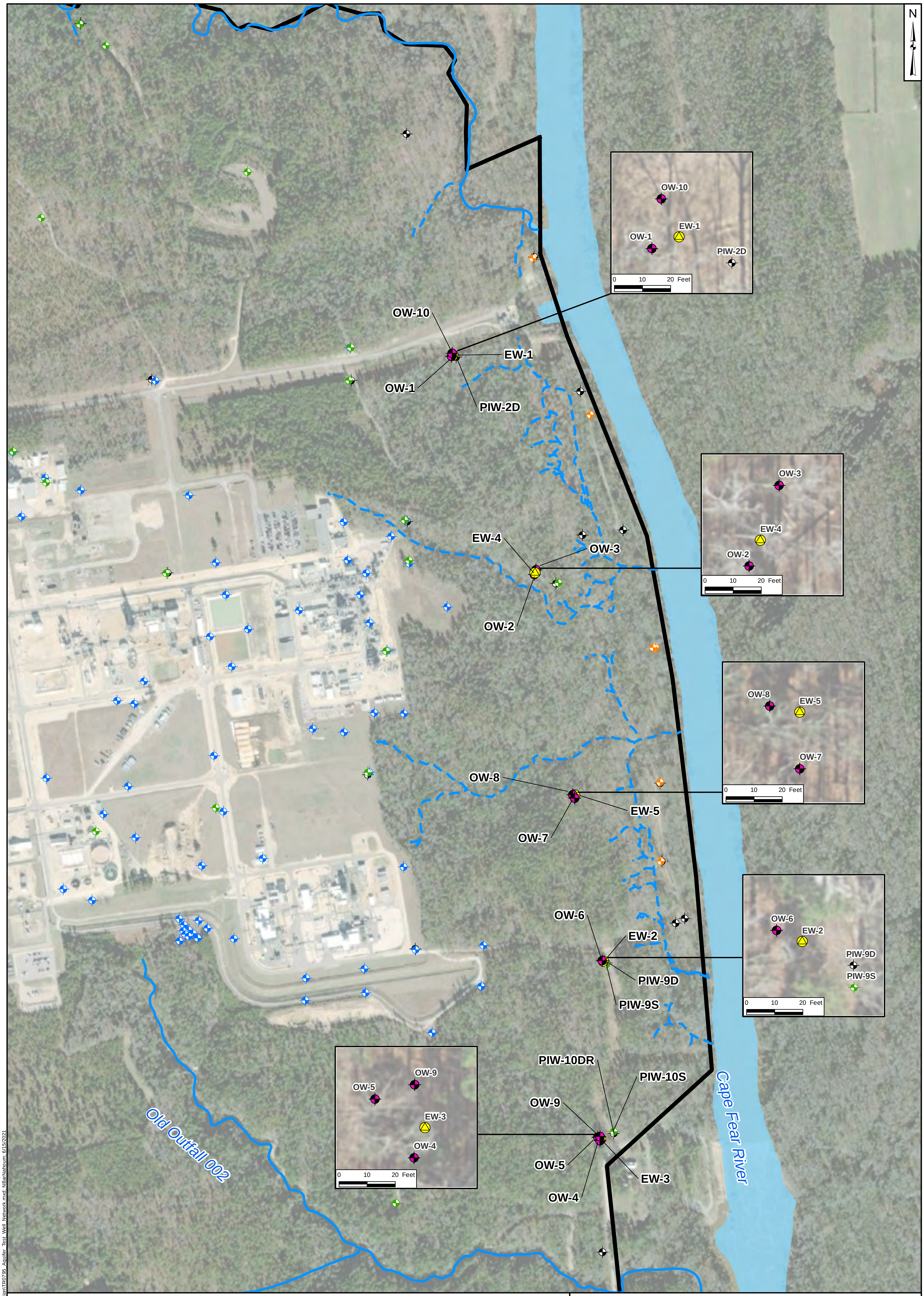
Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795_OnsiteWellNetwork_2021Wells.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Legend

✦ Perched Zone	✦ Observation Well	━ Site Boundary
✦ Surficial Aquifer	△ Extraction Well	
✦ Floodplain Deposits	- - Observed Seep	
✦ Black Creek Aquifer	━ Nearby Tributary	

500 250 0 500 Feet

Aquifer Test Locations

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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Figure

3

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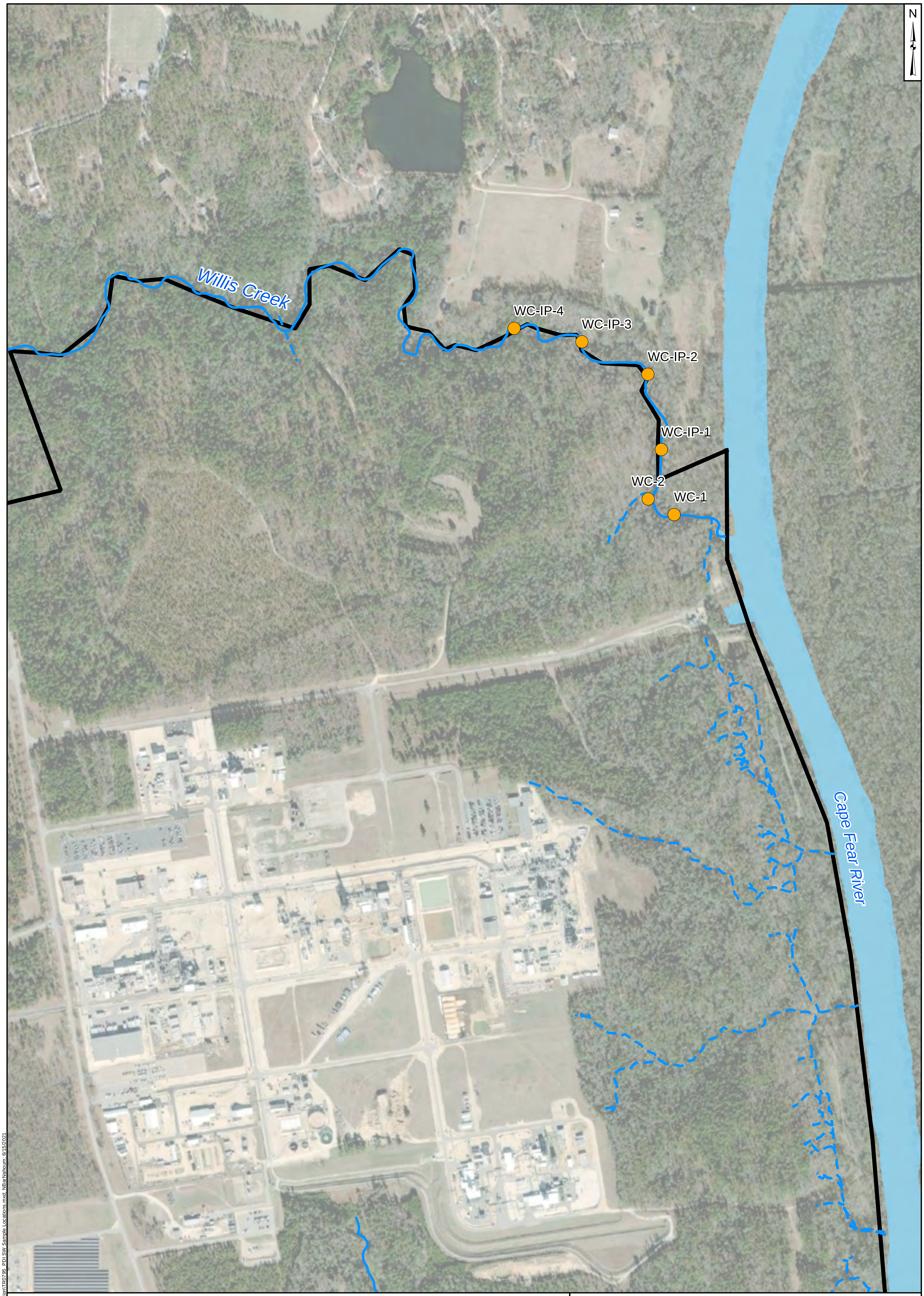
Notes:
1. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
2. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795 Aquifer Test Well Network.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Legend

● Surface Water Sample Location

Observed Seep

Nearby Tributary

Site Boundary

Notes:
1. The outline of the River shown on this figure is approximate (River outline based on compilation of open data sources from ArcGIS online service and North Carolina Department of Environmental Quality Online GIS - Major Hydro shapefile).
2. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Surface Water Sample Locations

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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Raleigh

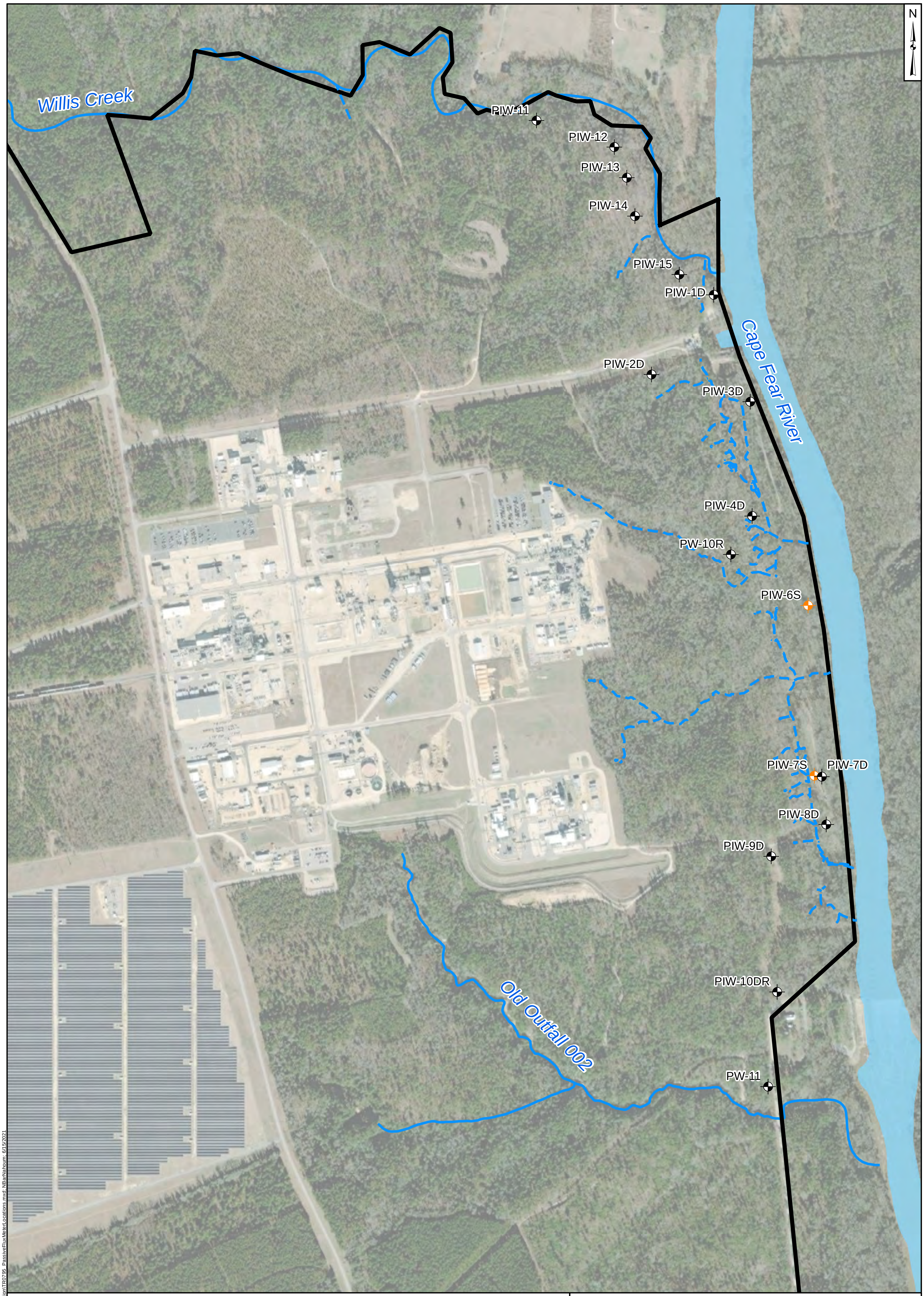
June 2021

Figure

4

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795_PDI SW Sample Locations.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Legend

- ⊕ Floodplain Deposits
- ⊕ Black Creek Aquifer
- ━ Nearby Tributary
- ╌ Observed Seep
- ━ Site Boundary

1,000 500 0 1,000 Feet

Notes:

1. Due to the scale of the map, pairs of wells that are in close proximity have been offset for visibility. Therefore, the placement of these wells on this map do not reflect their true geographic coordinates.
2. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
3. PIW and PW-well locations were surveyed by a licensed North Carolina Surveyor.
4. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795 PassiveFluxMeterLocations.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

Monitoring Wells Where Passive Flux Meters Were Installed

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

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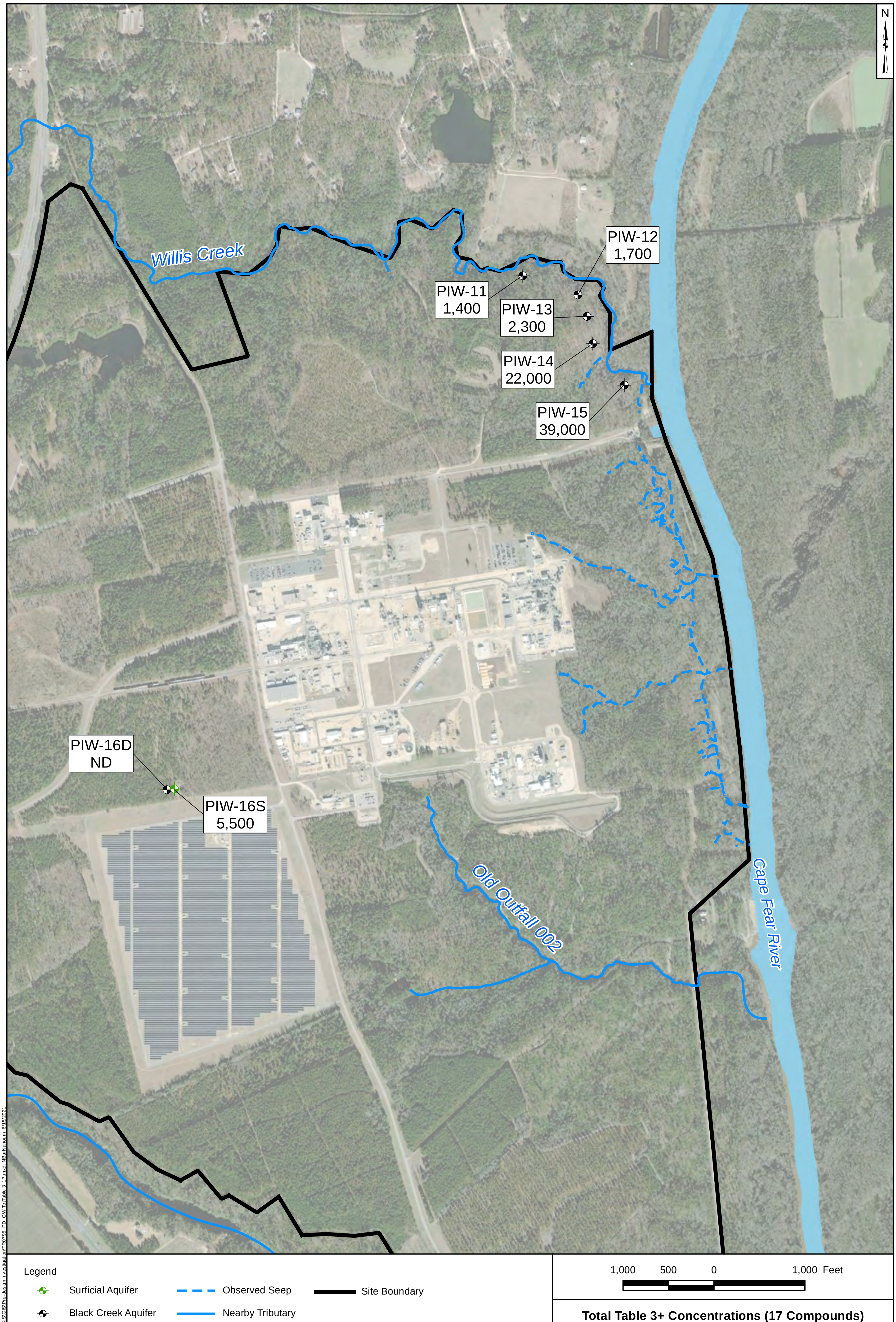
Raleigh

June 2021

Figure
5



Legend

● Surficial Aquifer	- - Observed Seep	▬ Site Boundary
● Black Creek Aquifer	— Nearby Tributary	

Notes:
ND - Non-detect above the associated reporting limits.
1. Results are for groundwater samples collected in September and October 2020 as part of the Pre-Design Investigation.
2. All results are in nanograms per liter.
3. Total Table 3+ concentration does not include R-PSDA, Hydrolyzed PSDA, and R-EVE.
4. Non-detect values were not included in sum of Total Table 3+ results.
5. Total Table 3+ results include J-qualified data.
6. Due to the scale of the map, pairs of wells that are in close proximity have been offset for visibility. Therefore, the placement of these wells on this map do not reflect their true geographic coordinates.
7. The outline of the River shown on this figure is approximate (River outline based on compilation of open data sources from ArcGIS online service and North Carolina Department of Environmental Quality Online GIS - Major Hydro shapefile).
8. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795_PDI GW TotTable 3_17.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

Total Table 3+ Concentrations (17 Compounds) in PDI Installed Groundwater Wells

Chemours Fayetteville Works, North Carolina

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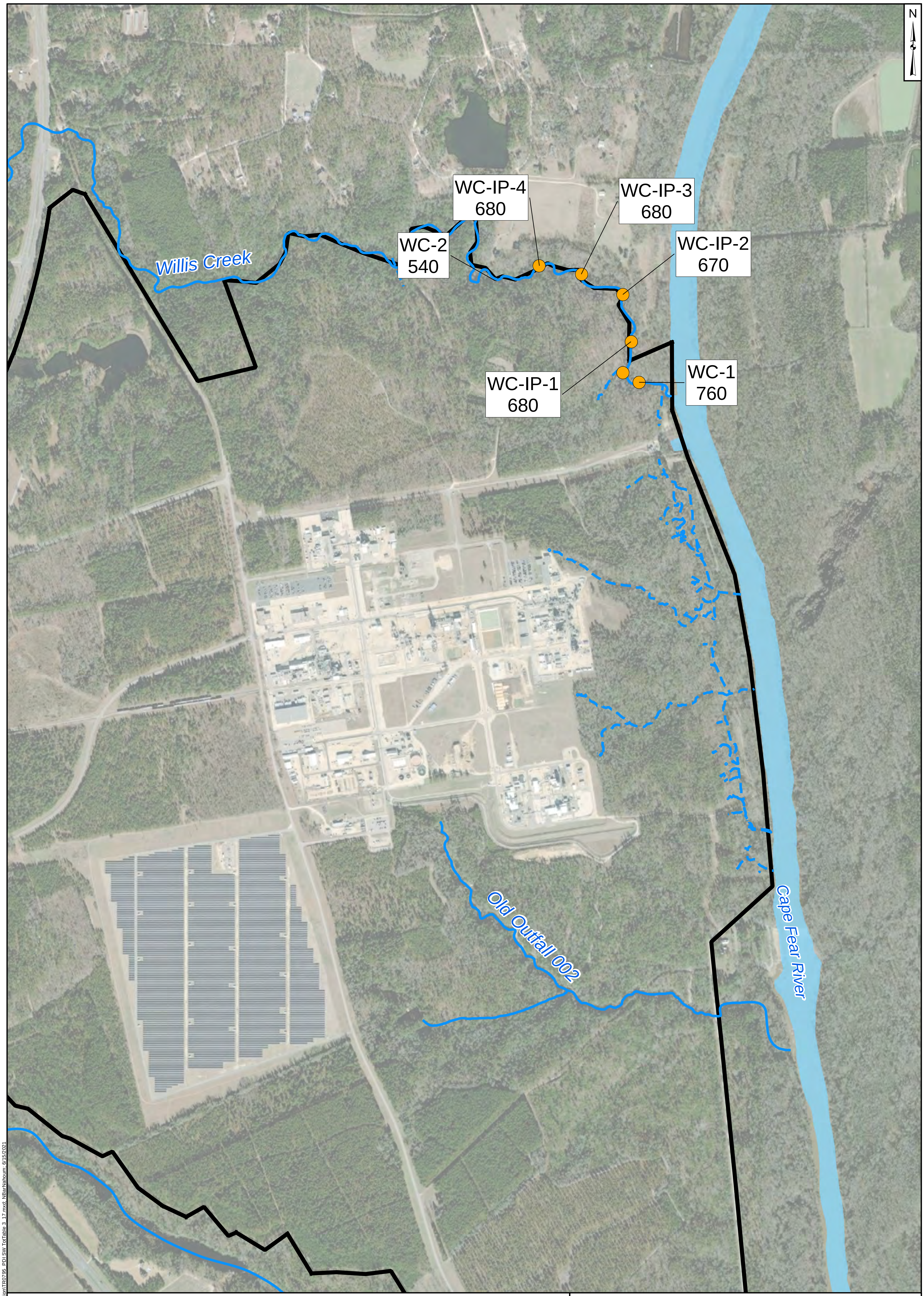
Figure 6



Legend

● Surface Water Sample Location

Observed Seep

Nearby Tributary

Site Boundary

Notes:
1. Results are for surface water grab samples collected in September 2020 as part of the Pre-Design Investigation.
2. All results are in nanograms per liter.
3. Total Table 3+ concentration does not include R-PSDA, Hydrolyzed PSDA, and R-EVE.
4. Non-detect values were not included in sum of Total Table 3+ results.
5. Total Table 3+ results include J-qualified data.
6. The outline of the River shown on this figure is approximate (River outline based on compilation of open data sources from ArcGIS online service and North Carolina Department of Environmental Quality Online GIS - Major Hydro shapefile).
7. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: \\guelph-01\data\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795_PDI SW TotTable 3_17.mxd; NBarNahoum; 6/15/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

1,000 500 0 1,000 Feet

Total Table 3+ Concentrations
(17 Compounds) in Surface Water

Chemours Fayetteville Works, North Carolina

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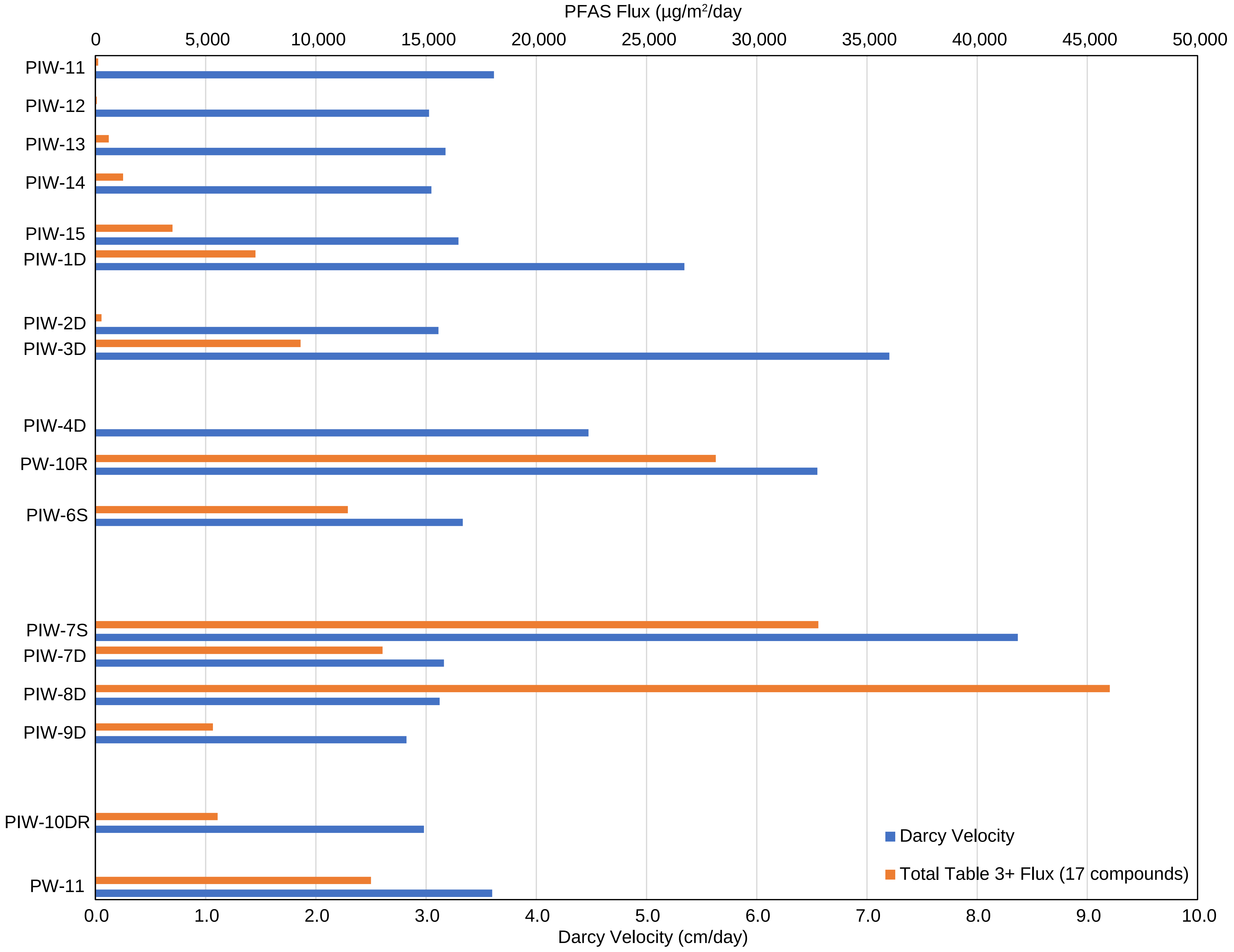
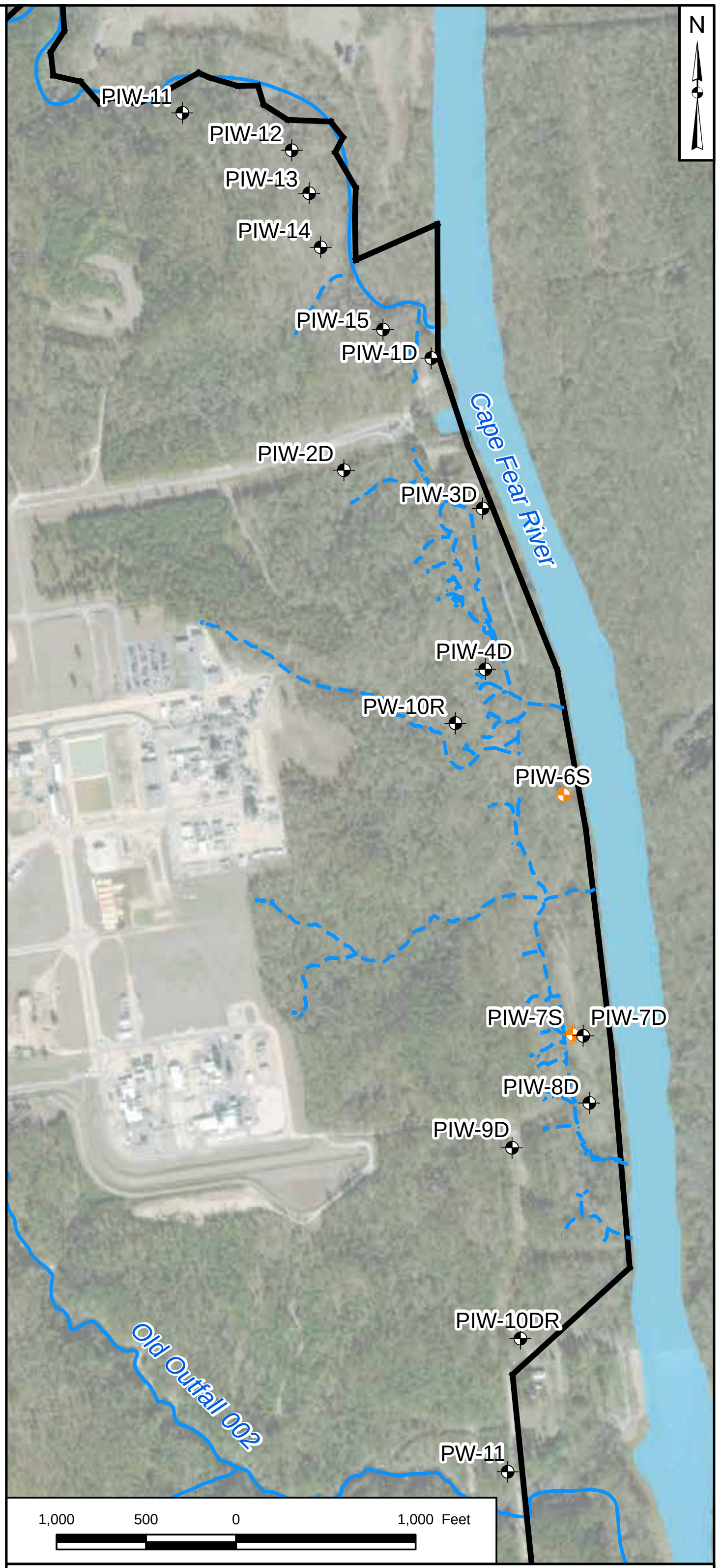
Figure
7





Notes:
Site map with PFM locations is shown for reference. Darcy velocity bars and PFAS flux bars are aligned to approximate their relative locations on the site map.
The Darcy Velocity is the rate at which a volume of water moves across a surface of specified area, giving units of volume per area per time which reduces to distance per time.
This quantity is not the travel speed of groundwater.
PIW-7S and PIW-7D are screened in the Floodplain Deposits and Black Creek Aquifer, respectively.
Total Table 3+ flux does not include R-PSDA, Hydrolyzed PSDA, and R-EVE.
All locations had measurable Total Table 3+ PFAS flux, however, flux observed at PIW-4D, PIW-11, and PIW-12 was < 130 µg/m²/day.
PFM - Passive flux meter
cm/day - centimeters per day
PFAS - Per- and polyfluoroalkyl substances
PFM - Passive flux meter
µg/m²/day - Micrograms per square meter per day

Inset Map Legend
⌖ Floodplain Deposits
⌖ Black Creek Aquifer
— Nearby Tributary
- - Observed Seep
— Site Boundary

Passive Flux Meter Results - Darcy Velocities and PFAS Flux

Chemours Fayetteville Works, North Carolina

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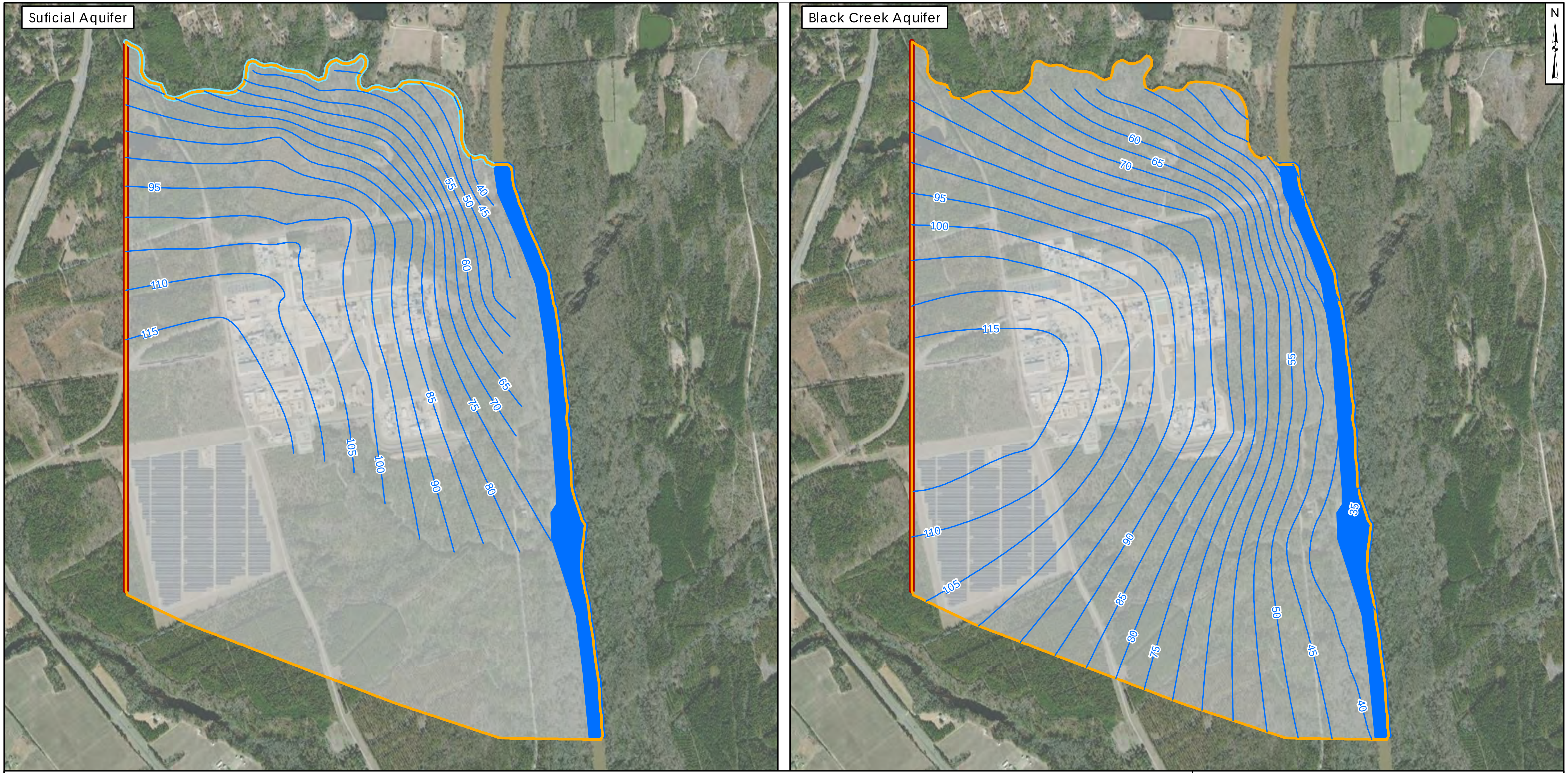
June 2021

Figure
8

Path: P:\PRJ\Projects\TR0795\Database and GIS\Illustrator/Pre-design Investigation\Passive Flux Meter Results TR0795.ai



2,000 1,000 0 2,000 Feet

Legend

- Simulated Equipotentials (feet NAVD 88)
- Constant Head Boundary
- Constant Head River Boundary (Willis Creek)
- Transient Head River Boundary (Cape Fear)
- Recharge Area
- Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Flow Model Simulated Equipotentials

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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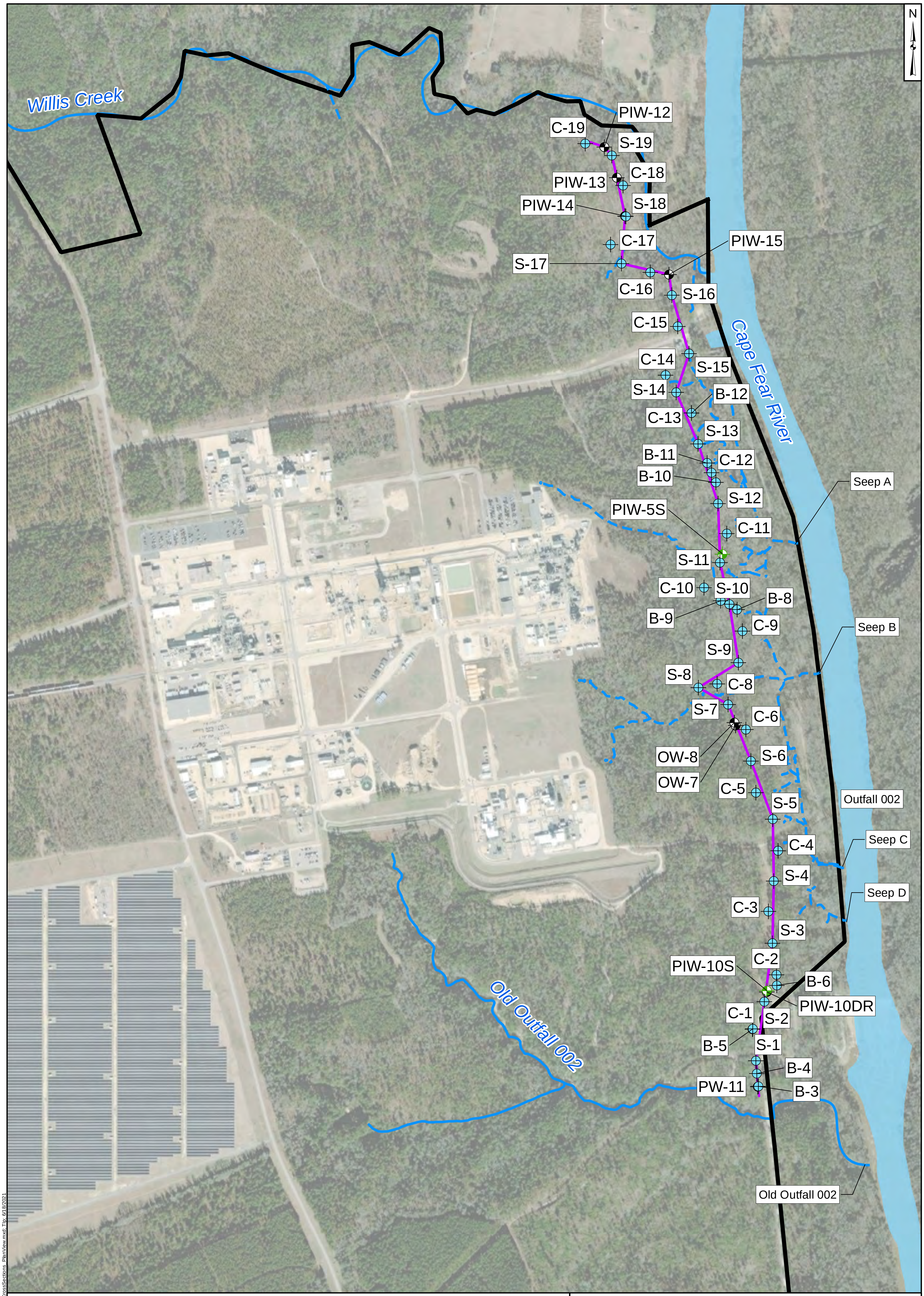
Raleigh

June 2021

Figure

9



Legend

⊕	Surficial Aquifer
⊕	Black Creek Aquifer
⊕	CPT, SPT, or Rotary Sonic Soil Boring
—	Cross-Section Transect
—	Nearby Tributary
- - -	Observed Seep
▬	Site Boundary

Notes:
CPT - piezocone penetration test
SPT - standard penetration test
1. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
2. PIW and PW-well locations were surveyed by a licensed North Carolina Surveyor.
3. A high resolution cross-section is provided in Figure 10B based on the locations identified here.
4. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

1,000 500 0 1,000 Feet

High Resolution Cross-Section Investigative Locations

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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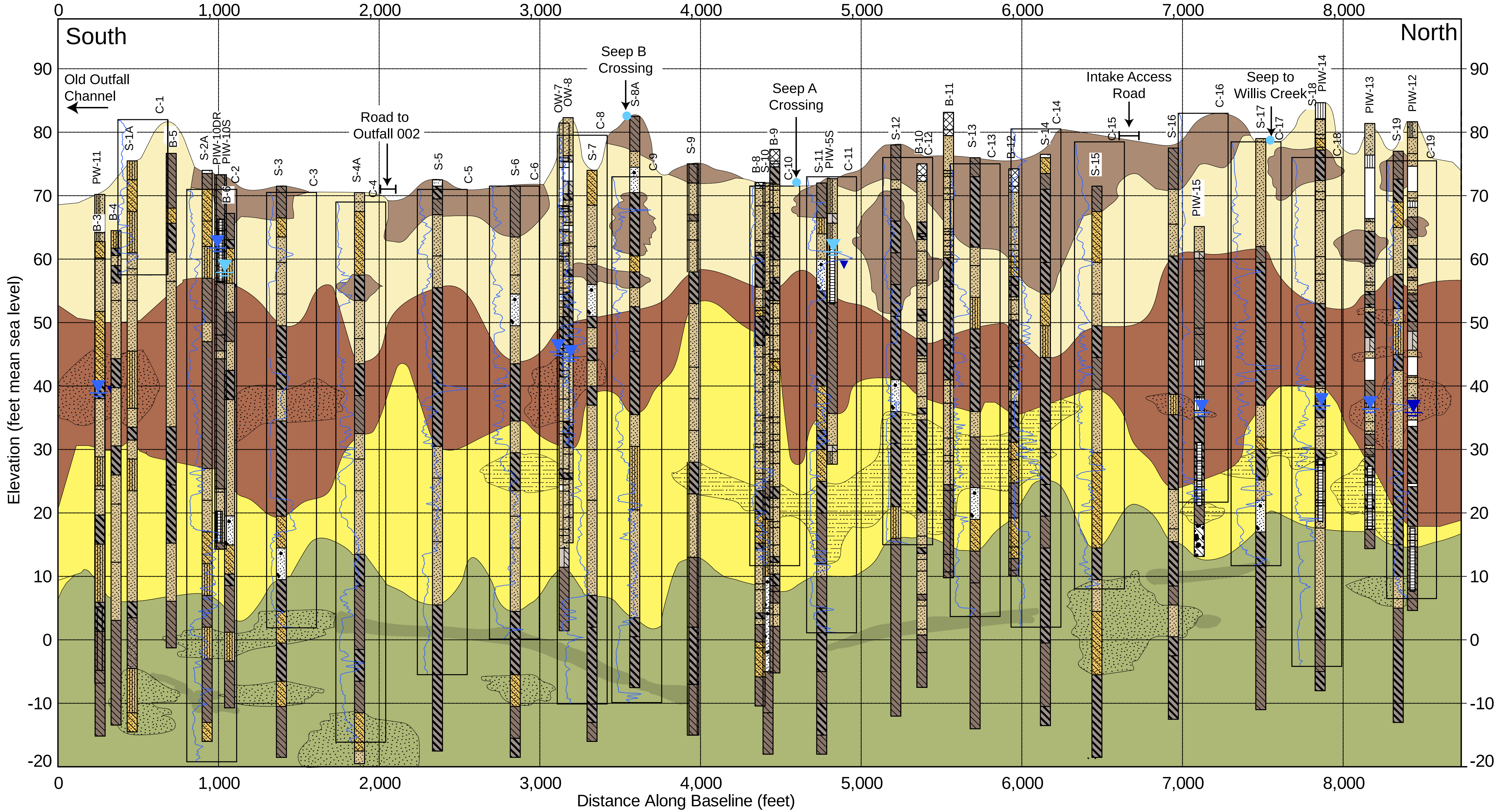
Figure

10A

Raleigh | June 2021

Path: P:\PRJ\Projects\TR0795\Database and GIS\GIS\Pre-design Investigation\TR0795 CrossSections PlanView.mxd; TIp; 6/18/2021

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US



Legend

▨	USCS Well-graded Sand	▥	USCS Low Plasticity Silty Clay	☐	No Core
▨	USCS High Plasticity Clay	▨	USCS Poorly-graded Sand	▨	USCS Low Plasticity Clay
▨	USCS Well-graded Sand with Silt	▨	USCS Well-graded Sand with Clay	▨	USCS Poorly-graded Sand with Silt
▥	USCS Elastic Silt	▨	USCS Clayey Sand	▥	USCS Silt
▨	USCS Low to High Plasticity Clay	▨	USCS Clayey Gravel	▨	USCS Silty Sand

Interpreted Geology

🟫	Perched Clay	🟨	Black Creek Aquifer
▨	Surficial Aquifer	▨	Black Creek Aquifer – Zone of Interspersed Finer Sediments
🟥	Black Creek Confining Unit	🟩	Upper Cape Fear Confining Unit
▨	Black Creek Confining Unit – Zone of Interspersed Coarser Sediments	▨	Upper Cape Fear Confining Unit – Zone of Interspersed Coarser Sediments

Water Levels

▽	Surficial Aquifer
▼	Black Creek Aquifer
▼	Upper Cape Fear

Notes:

CPT - piezocone penetration test
SPT- standard penetration test

Cross-section developed using data from investigative locations identified in Figure 10A.

Further details on SPT logs, CPT logs, and rotary sonic borings logs provided in Appendix D (GEOServices Report of Geotechnical Exploration). CPT logs show downhole cone resistance profile.

"S-" denotes SPT borings advanced in October-November 2020. "C-" denotes CPT borings advanced in October-November 2020. "B-" denotes SPT borings or rotary sonic soil borings advanced in March 2021.

621 310 0 621 Feet

Horizontal 1" = 621' Vertical exaggeration is 39.5x

High Resolution Cross Section with Interpreted Geology

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C 3500 and C 295

Raleigh	June 2021	Figure 10B

Report: MASTER FENCE (TR0795); File: C:\PROJECTS\TR0795\GINT\TR0795-ONSITE_CHARACTERIZATION.GPJ; 11/21/2020 "P:\PRJ\Projects\TR0795\Database and GIS\Illustrator\Pre-design Investigation\Cross-Section CPT-PIW Data Jun2021 TR0795 revised.ai"

Geotechnical, Environmental and Materials Engineers

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Appendix A
Field Methods

APPENDIX A

FIELD METHODS

INTRODUCTION AND OBJECTIVES

This appendix summarizes the field methods employed to conduct the pre-design investigation (PDI) at the Chemours Fayetteville Works Site (the Site). The effort described herein was conducted by Geosyntec, Parsons, and GEOServices in 2020. The PDI was conducted to collect additional subsurface data associated with the design of potential long-term remedies to limit discharge of per- and polyfluoroalkyl substances (PFAS) from onsite groundwater to the Cape Fear River.

SCOPE OF WORK

The PDI scope of work involved the following tasks:

- Installation of extraction wells;
- Step drawdown tests;
- Constant rate tests;
- Installation of additional monitoring wells;
- Groundwater sampling;
- Surface water sampling; and
- Deployment of Passive Flux Meters (PFMs).

Field forms collected during implementation of this scope of work are provided in Appendix B. The geotechnical scope of work conducted by GEOServices is described in Appendix D.

The work was performed according to the project health and safety plan (HASP) prepared by Parsons (Parsons Health and Safety Plan Chemours Fayetteville Site, 2020). A Plan on Action Discussion (POAD) and Project Safety Analysis (PSA) was held prior to commencing field activities. Monitoring wells were installed following well construction standards outlined in the North Carolina Administrative Code Title 15A, Subchapter 2C (15A NCAC 2C).

METHODS

This section describes the field methods and procedures that were employed for collecting data during the PDI.

Extraction Well Installation

Five new 6-inch diameter extraction wells (EW-1 through EW-5) were installed relatively equidistantly along the presumed barrier wall alignment and screened in the Black Creek Aquifer. The appendix to these field methods provides detail on the extraction well design. Where existing monitoring wells were not in close proximity, two to three additional 2-inch observation wells were installed at intervals of ten, fifteen, and twenty feet from the proposed extraction well. These observation wells were installed in advance of the extraction well and logged in a manner to inform target depth and design of the pumping well screen. At each location, borings were performed by the sonic drill rig to delineate the depth of the top of the Upper Cape Fear Confining Unit.

Grain size sample data (PIW-10D, 2D, and 9D) near the proposed extraction wells were evaluated to select an appropriately sized filter pack according to the methods presented by Driscoll (2008). Based on the analysis, approximately 70% of formation material at each location is coarser than .020 millimeters (mm), and 90% retention is still achieved when using 20-40 sand and a 0.020 slot screen.

Traditional machine-slotted poly vinyl chloride (PVC) well screens do not have a large amount of open area (i.e., area exposed to aquifer materials to transmit groundwater into the well). Stainless steel, wire-wrapped screens with a continuous slotted surface around the well screen were selected to provide a larger open area than PVC slotted wells or PVC Vee Wire screens.

The borehole for the observation well closest to the extraction well was advanced first and was over-drilled at least 10 feet into the Upper Cape Fear confining unit to confirm depth. The over-drilled portion was backfilled with bentonite and allowed to hydrate before adding a 2-foot sand pack at the bottom of the well. A 2-inch diameter PVC well with ten-foot of screen was installed in the borehole. The screened interval intersects the Black Creek aquifer formation.

For the extraction well installation, sonic drilling techniques were used to install a minimum 10-inch diameter borehole. Well installation followed well construction standards outlined in 15A NCAC 2C. The wells are constructed of 6-inch inner diameter PVC casing threaded to stainless steel wire-wrapped screens ranging in length from 20 to 30 feet. Both PVC and stainless steel are compatible materials for the aquifer conditions, notably the low pH (around 4.0 SU).

Environmental grade, graded silica sand (approximately 20/40 size) were used for the well screen filter pack material. The top of the filter pack extended no more than 4 ft above the top of the well screen. A cement grout mixture, consisting of 95%cement to 5% powdered bentonite; a mixture of 6.5 gallons of water per 94-pound bag of Portland Type I/II cement; and 4 pounds of bentonite powder (minimum density of 13.5 pounds per gallon [lb/gal]), was set to seal the annular space from the top of the filter pack seal to within approximately 1 foot below ground surface (bgs) for setting a concrete flush mount well pad.

PVC centralizers were placed above and below the well screen. A tremie pipe was used to emplace bentonite, grout, and sand to avoid bridging around centralizers.

To maximize well efficiency, the 6-inch diameter well was developed by the drilling subcontractor using a combination of air-lifting and over pumping. The focus of this effort was to remove fines from the well screen and filter pack, and to encourage sorting of the sand filter pack. The well was developed until purge water was free of visible sediments and turbidity of the extracted groundwater was between approximately 10 to 15 nephelometric turbidity units (NTU). During development, depth to water, drawdown, and pumping rate were noted by field personnel every 15 minutes to provide estimates on well capacity and yield for subsequent use.

Transducers were installed in the observation and extraction wells at least one day prior to the step drawdown tests to document groundwater level conditions and were retrieved when water level conditions returned to pre-testing levels. Groundwater levels in the extraction and observation wells were continuously monitored during testing using transducers.

Prior to installing the transducers, field personnel recorded the depth to water in each observation well to normalize transducer readings. The transducers set in the observation wells, and extraction well were set to record data at an interval of 10 to 15 seconds.

Step Drawdown Tests

Step drawdown tests were performed at the five new 6-inch diameter extraction wells (EW-1 through EW-5). These tests evaluated potential extraction rates, which were used to inform constant rate aquifer tests. At the conclusion of the step-drawdown tests, field data was evaluated to design constant rate aquifer tests. The data informed extraction rates and associated water management requirements, and the locations of additional monitoring points to better assess interaction between the Black Creek aquifer and the Cape Fear River.

For the step drawdown tests a 4-inch (nominal) 2-hp submersible test pump was used, a Grundfos 40S20-7 capable of an estimated flow of 40 gallons per minute (GPM) at 175 ft of head. Once installed, the test pump remained in the well until water level readings returned to baseline conditions after every test.

The drop pipe between the submersible pump and the surface was two-inch diameter high-density polyethylene (HDPE) and transition to a system manifold. The manifold included a digital, and mechanical flow meter equipped with a direct read and totalizing capability, a diaphragm valve (to regulate flow), and a sample port for sample collection. The flow meter was initially positioned upstream of the diaphragm valve and separated by at least ten times the diameter of the manifold piping diameter.

During the step-drawdown test, the wells were pumped at up to four discharge rates and the drawdown for each pumping rate was recorded using the transducers programmed for the pre-determined data collection intervals. Field personnel also collected manual depth to water readings at the observation points every fifteen to thirty minutes. The pumping rates were estimated using Aqtesolv to be between 6 and 30 GPM. The transducers were programmed to record data on a maximum linear data collection interval of 5 seconds. Pumping rates for each step were assessed in the field based on drawdown observations during the test.

Each step lasted approximately two hours; however, the final duration was determined by field personnel based on observed drawdown stabilization. Upon completion of the final step of each step-drawdown test, the pump was shut off and aquifer recovery data was collected in the observation wells and pumping well.

Manual measurements during the step drawdown test of water levels at the observation wells were taken using an electronic water level indicator prior to changing the flow rate.

Constant Rate Tests

Following completion of the step drawdown tests, a constant rate test was conducted at each extraction well. Pump rates and duration of the tests were selected using data collected during the step drawdown testing. Constant rate tests were continuously monitored by Parsons and Geosyntec field personnel. All general field procedures established during the step drawdown tests were employed for the constant rate tests with slight modifications.

For the constant rate tests a 3-inch (nominal) Grundfos Rediflo3 pump was used, with a flow controller. Following the first round of aquifer tests, the flowmeters were relocated downstream of the diaphragm valve to improve the flowmeter performance. The diaphragm valve used in combination with the flow controller allowed flowrates to be finely adjusted (<0.2 GPM).

Constant rate tests generally operated from 27-72 hours and required continuous monitoring by field staff. A twelve-hour shift schedule was established, and overnight crews were supplied with adequate lighting and safety procedures.

Monitoring Well Installation

At regular intervals along the Willis Creek investigation area, five two-inch PVC monitoring wells (PIW-11 through 15) were installed to measure hydraulic gradients and assess groundwater PFAS concentrations in this area. At each location, the sonic drill rig also delineated the depth of the top of the Upper Cape Fear Confining Unit, to take advantage of the mobilization. Depths for these monitoring wells were between 65 and 80 feet bgs.

To extend the boundaries of the existing numerical flow model domain, two additional monitoring wells (PIW-16S and PIW-16D) were installed on Chemours property to target the Surficial and Black Creek aquifers. This well cluster was installed west of the site, in between the Site proper and Highway 87. The monitoring wells refined the boundary conditions of the lithologic and hydrologic models of the site, while contributing to PFAS profiling. When wells were installed below an identified confining unit, drilling techniques were employed to install override casing to prevent drag-down and aquifer comingling.

Continuous soil cores were collected during well installation for soil logging. Wells were installed following well construction standards outlined in 15A NCAC 2C. Wells were developed to remove materials that were introduced into the subsurface during drilling. Well development continued until turbidity readings were less than 50 NTUs or stabilized following development for an extended period (e.g., turbidity readings that did not improve for an hour and 3 or more consecutive measurements were within 10% of each other).

Groundwater Sampling

Groundwater sampling of newly installed monitoring wells was intended to monitor groundwater quality and refine extent of PFAS signatures emanating from the Site. Groundwater sampling commenced after allowing sufficient time for the aquifer to re-equilibrate to static conditions following monitoring well installation and development. A certified analytical laboratory was contacted to procure sufficient sampling containers, including quality control samples discussed below.

Groundwater samples were collected, where possible, using low-flow sampling techniques as discussed in detail in the Long-term Groundwater Monitoring Plan (Parsons, 2018) and briefly summarized here.

New dedicated HDPE tubing was placed at the midpoint of the well’s screened interval and water was purged through a flow-through cell attached to a water quality parameter probe capable of measuring pH, temperature, specific conductance (SC), dissolved oxygen (DO) and oxidation-reduction potential (ORP). Water was pumped using a peristaltic pump, with dedicated silicone tubing for the pump head, at wells with water levels less than 30 feet. A bladder pump was utilized for wells with water levels deeper than 30 feet. Groundwater was pumped directly from dedicated submerged tubing through the pump head to a flow-through cell until the field parameters (pH, temperature, SC, DO, ORP) were stabilized within ±10% over a fifteen-minute interval. The water level in the well was measured during purging so that minimum draw-down of the water column was maintained. Once flow-through cell readings were stable, the flow-through cell was disconnected, the tubing cut to provide a new clean end and samples were collected from the discharge of the peristaltic or bladder pump in new 250 milliliter (mL) laboratory-supplied HDPE bottles for PFAS analysis by Table 3+. Sample identification information (e.g., well/sample identification number, sample time and date, samplers’ names, preservative, and analytical parameters) were recorded on the bottle label with permanent ink after the sample was collected.

Surface Water Sampling

Four new Willis Creek surface water samples (WC-IP-1 through 4) were collected in addition to WC-1 and WC-2 for a total of six samples. Willis Creek water samples were collected as grab samples. Sample bottles were lowered into the flowing water of the creek to collect the sample. The bottles were lowered into the stream using a properly decontaminated dip rod with bottle attached with a nylon zip tie. The bottle was lowered into the stream with the cap removed, open and facing oncoming flow. Where possible, the sample was collected from the middle of the stream. Care was taken to avoid collecting suspended solids or other materials in the sample. Samples were collected into new 250 mL laboratory-supplied HDPE bottles for PFAS analysis by Table 3+ SOP. Water quality parameters were measured (pH, temperature, SC, DO, and ORP) after sample collection using water from the same location in the stream.

Passive Flux Meters

Passive flux meters (PFMs) were installed down-well in select locations to assess groundwater velocity and/or contaminant flux along potential groundwater discharge paths to both Willis Creek and the Cape Fear River. In addition to refinement of the conceptual site model (CSM) at the Willis Creek discharge reach, this was also in support of the ongoing effort to recalculate baseline loading rates to surface water from onsite groundwater.

PFMs are 5-ft long sampling devices with permeable sorbent (pre-loaded with tracers) that are deployed for two to three weeks and then retrieved for sampling. PFMs were installed in the five new Willis Creek monitoring wells and in 12 other monitoring wells, which are adjacent to the Cape Fear River, and screened in the Black Creek aquifer or in flood plain deposits.

GENERAL FIELD PROCEDURES

Calibration

Equipment was inspected by the field program on-site supervisor and calibrated at least daily prior to use in the field according to the manufacturer’s recommended guidelines. Calibration information was recorded in a field logbook or appropriate field form. Groundwater field parameters were measured with a water quality meter prior to sample collection and included the following:

- pH;
- Temperature (degrees Celsius; °C);
- Specific conductance [SC] (micromhos, µmho);
- Dissolved oxygen [DO] (mg/L);
- Oxidation/reduction potential [ORP] (millivolts; mV);
- Turbidity (nephelometric turbidity units, NTU);
- Color; and
- Odor.

Decontamination

Non-dedicated equipment was decontaminated between sample locations in the following manner:

- De-ionized water rinse;
- Non-phosphate detergent wash (i.e., Alconox®);
- De-ionized water rinse; and
- Air dry.

Disposable equipment (e.g. gloves, tubing, etc.) were not reused. New sample containers were used for each sample.

Sample Packing and Shipping

Upon sample collection, each containerized sample was labeled and placed as soon as possible into an insulated sample cooler. The cooler served as a shipping container and was provided by the laboratory along with the appropriate sample containers. Wet ice was placed around the sample containers within heavy-duty plastic bags within the sample cooler. Samples were maintained at a cool temperature (optimum 4°C ± 2°C) from the time of collection until the coolers arrived at the laboratory. Plastic "bubble wrap" and/or polystyrene foam were also used to protect the samples during shipping.

Prior to shipment of the samples to the laboratory, a chain-of-custody (COC) form was completed by the field sample custodian. Sample locations, sample identification numbers, description of samples, number of samples collected, and specific laboratory analyses to be run on each sample were recorded on the COC form.

Field QA/QC Samples

The following field quality assurance/ quality control (QA/QC) samples were collected:

- A minimum of one daily blind duplicate sample, or at a frequency of 1 per 20 samples;
- A minimum of one matrix spike and replicate sample per sampling event, or at a frequency of 1 per 20 samples;
- A minimum of two field blanks per sampling event;
- A daily rinsate sample when any HDPE tubing and peristaltic pump equipment are used to collect the sample.

Field Notes and Data Reporting

The project field team kept a daily diary of field activities and note sample collection times, measured field parameters, and other recorded field data or observations. All data collected in the field were furnished to the project team within 10 business days of the conclusion of the field event.

REFERENCES

Driscoll, F.G., 2008. Groundwater and Wells. New Brighton, MN. Johnson Screens.

Parsons, 2018. Long-term Groundwater Monitoring Plan. September 28, 2018.

Parsons, 2020. Fayetteville Works Health and Safety Plan.

Appendix: Aquifer Test Well Design

1.0 Black Creek Aquifer Pumping Test

Location 1: Adjacent to PIW-10DR and PIW-10 (EW-3)

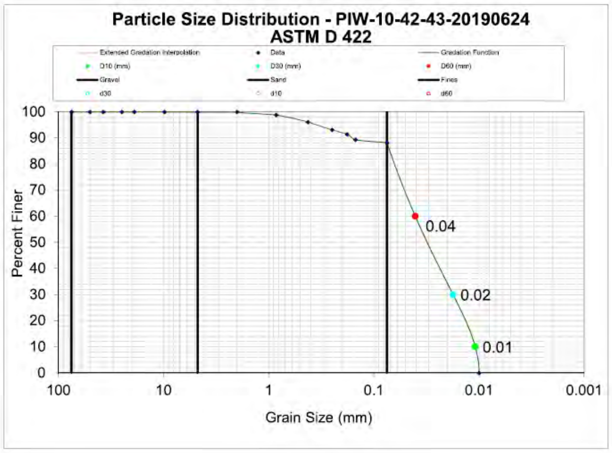
At a depth of 42-43' the grain size is described as moderately well sorted sandy silt, low in fines. 90% coarser than ~0.1mm. The uniformity coefficient is d60/d10=4; slot opening must retain 60% of formation material. Approximately 70% of formation material is coarser than 0.020 mm. 90% retention is still achieved when using 20-40 sand and 0.020 slot screen (20-40 is better at holding back fines over longer period of time and under higher pumping rates).

The general design specifications of EW-3 include the following:

- A minimum 10-inch diameter borehole advanced to a target depth of approximately 70 ft bgs. This depth is intended to correspond the bottom of the Black Creek Aquifer at this location. The target depth is subject to change based on lithologic observations during installation.
- The 6-inch inner diameter extraction well will consist of a 15-ft Stainless steel Wire wound well screen with a 0.020-inch slot size and schedule (SCH) 40 PVC riser. The target screen interval is 50-70 ft bgs.
- Graded silica sand (approximately 20-40 size) will be used for filter pack material. The top of the filter pack will extend no more than 4 ft above the top of the well screen. The approximate interval for the filter pack is 46 to 70 ft bgs.
- A cement grout mixture, consisting of 95 percent Cement to 5 percent powdered Bentonite; a mixture of 6.5 gallons of water per 94-pound bag of Portland Type I/II cement and 4 pounds of bentonite powder (minimum density of 13.5 pounds per gallon [lb/gal]) to 1 ft bgs to set protective casing and well pad.
- PVC Centralizers will be placed along the well screen and well riser at a rate of approximately every 20 ft. A tremie pipe must be used to emplace bentonite, grout, and sand to avoid bridging around centralizers.

Construction Characteristic	Suggestion	Justification
Well Casing Type	Sch 80 PVC or stainless steel wire wrap	Resistance to hydraulic collapse pressure (PSI) is about 312 for PVC. Less likely to collapse due to surging during development
Well Diameter	6”	Allow large pump in easily
Filter Pack Material	20-40 silica	Low fines in grain size analysis
Screen Slot Size	20 slot screen (Stainless steel or PVC Vee Wire)	Low fines in grain size analysis, better production. 0.020 in opening
Cap Material	Bentonite pellets or granular bentonite via tremie pipe	Less susceptible to bridging, better seal
Grout Material	Neat cement	Standard
Screen Interval	50-70’	Subject to vary in field based on observations
Depth of Borehole	>=70’	Confirm Lithology below
Casing Diameter	12”, 10”, 8”	Telescope through confining units

Appendix H
Grain Size Analysis On and Offsite Wells
Chemours Fayetteville Works, North Carolina



Location 2: Adjacent to PIW-9D and PIW-9S (EW-2)

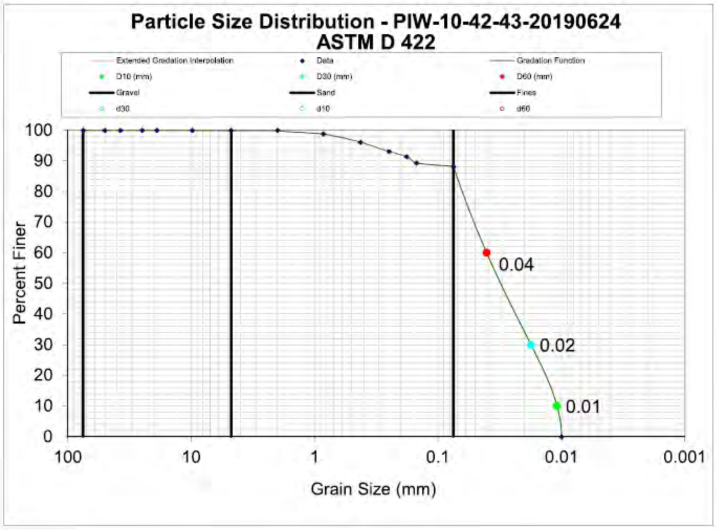
At a depth of 19-20, grain size is described as moderately well sorted sand, low in fines. 90% coarser than ~0.01mm. The uniformity coefficient is d60/d10=4; slot opening must retain 60% of formation material. Approximately 70% of formation material is coarser than .020 mm. 90% retention is still achieved when using 20-40 sand and 0.020 slot screen (20-40 is better at holding back fines over longer period of time and under higher pumping rates).

The general design specifications of EW-2 include the following:

- A minimum 10-inch diameter borehole advanced to a target depth of approximately 65 ft bgs. This depth is intended to correspond the bottom of the Black Creek Aquifer at this location. The target depth is subject to change based on lithologic observations during installation.
- The 6-inch inner diameter extraction well will consist of a 10-ft Stainless steel Wire wound well screen with a 0.020-inch slot size and schedule (SCH) 40 PVC riser. The target screen interval is 45-55 ft bgs.
- Graded silica sand (approximately 20-40 size) will be used for filter pack material. The top of the filter pack will extend no more than 4 ft above the top of the well screen. The approximate interval for the filter pack is 41 to 55 ft bgs.
- A cement grout mixture, consisting of 95 percent Cement to 5 percent powdered Bentonite; a mixture of 6.5 gallons of water per 94-pound bag of Portland Type I/II cement and 4 pounds of bentonite powder (minimum density of 13.5 pounds per gallon [lb/gal]) to 1 ft bgs to set protective casing and well pad.
- PVC Centralizers will be placed along the well screen and well riser at a rate of approximately every 20 ft. A tremie pipe must be used to emplace bentonite, grout, and sand to avoid bridging around centralizers.

Construction Characteristic	**Suggestion**	**Justification**
Well Casing Type	Sch 80 or stainless steel wire wrap (wedge)	Resistance to hydraulic collapse pressure (PSI) is about 312 for PVC. Less likely to collapse due to surging during development
Well Diameter	6"	Allow large pump in easily
Filter Pack Material	20-40 silica sand	Low fines in grain size analysis
Screen Slot Size	20 slot screen (0.020)	Low fines in grain size analysis, better production. Reduce chance of clogging from fines
Cap Material	Bentonite pellets or granular bentonite via tremie pipe	Less susceptible to bridging, better seal
Grout Material	Neat cement	Standard
Screen Interval	45-55' (excel suggests 0-60?)	Subject to vary in field based on observations
Depth of Borehole	>=60'	Confirm Lithology below
Casing Diameter	10", 8"	Telescope through confining units. No BCCU?

Appendix H
Grain Size Analysis On and Offsite Wells
Chemours Fayetteville Works, North Carolina



Location 3: Near PIW-2D (EW-1)

At a depth of 24-25’, grain size is described as moderately well sorted sandy silt, low in fines. 90% coarser than ~0.01mm. At a depth of 46-47’, grain size is described as poorly sorted sand low in fines. The uniformity coefficient is d60/d10=2.7; slot opening must retain 70% of formation material. Approximately 70% of formation material is coarser than 0.26 mm. Approximately 90% of formation material is coarser than 0.13 mm. 90% retention is still achieved when using 20-40 sand and 0.020 slot screen (20-40 is better at holding back fines over longer period of time and under higher pumping rates).

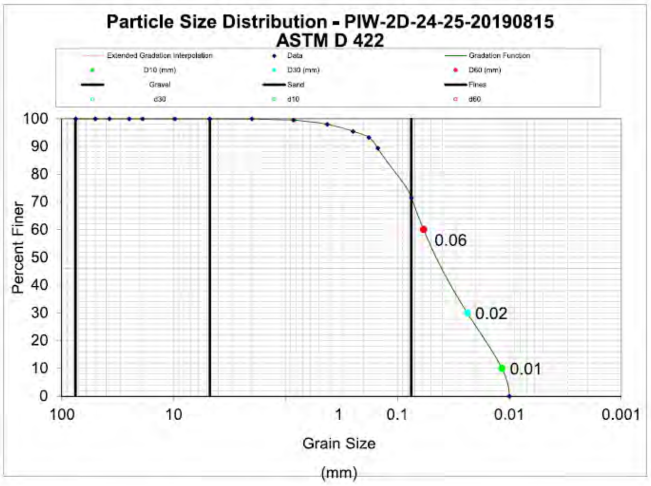
The general design specifications of EW-1 include the following:

- A minimum 10-inch diameter borehole advanced to a target depth of approximately 65 ft bgs. This depth is intended to correspond the bottom of the Black Creek Aquifer at this location. The target depth is subject to change based on lithologic observations during installation.
- The 6-inch inner diameter extraction well will consist of a 15-ft Stainless steel Wire wound well screen with a 0.020-inch slot size and schedule (SCH) 40 PVC riser. The target screen interval is 30-45 ft bgs.
- Graded silica sand (approximately 20-40 size) will be used for filter pack material. The top of the filter pack will extend no more than 4 ft above the top of the well screen. The approximate interval for the filter pack is 26 to 45 ft bgs.
- A cement grout mixture, consisting of 95 percent Cement to 5 percent powdered Bentonite; a mixture of 6.5 gallons of water per 94-pound bag of Portland Type I/II cement and 4 pounds of bentonite powder (minimum density of 13.5 pounds per gallon [lb/gal]) to 1 ft bgs to set protective casing and well pad.

- PVC Centralizers will be placed along the well screen and well riser at a rate of approximately every 20 ft. A tremie pipe must be used to emplace bentonite, grout, and sand to avoid bridging around centralizers.

Construction Characteristic	**Suggestion**	**Justification**
Well Casing Type	Sch 80 OR stainless steel wire wrap (wedge)	Resistance to hydraulic collapse pressure (PSI) is about 312 for PVC. Less likely to collapse due to surging during development
Well Diameter	6”	Allow large pump in easily
Filter Pack Material	20-40	Low fines in grain size analysis
Screen Slot Size	20 slot screen (Stainless steel or PVC Vee Wire)	Low fines in grain size analysis, better production. Reduce chance of clogging from fines
Cap Material	Bentonite pellets or granular bentonite via tremie pipe	Less susceptible to bridging, better seal
Grout Material	Neat cement	Standard
Screen Interval	30-45’	Subject to vary in field based on observations. Clay lenses throughout
Depth of Borehole	>=65’	Confirm Lithology below
Casing Diameter	10”, 8”	Telescope through confining units. No BCCU?

Appendix H
Grain Size Analysis On and Offsite Wells
Chemours Fayetteville Works, North Carolina



Poly-vinyl chloride and stainless-steel screen were considered as well screen material. Traditional machine slotted PVC typically exhibit less open area (typically 3-5%) compared to continuous wound PVC or wound stainless steel screens (typically 12-30% open area). The wedge shape of the wire wound screens has been shown to reduce clogged of finer materials due to the wider opening on the inside of the screen. Clogging of the screen is an important consideration, particularly due to the possible presence of clay lenses throughout the Black Creek Aquifer. Continuous wrap wire (Vee Screen or SS Wire Wrap) is less likely to collapse, provide ample open area for pumping rates, and minimize clogging.

Calc Check for Pump Rate and Open Area:

Max Pumping Rate Q=VA

Q=6in, 20 slot Wire Wrap Screen (0.020”)

SS Wire Width= 0.120”; Slot Opening= 14%

Vee Screen= 24.9 sq in/ft;

Open Area/foot of screen= 24.9 sq in/ft * 0.14= 3.486 in^2

EX) Q=*0.31gal/min/ft* * 3.486 in^2 = 1.08GMP/ft screen

20 ft Screen = 1.08GMP/ft screen * 20 = **21.61 gpm max**

Depends on pump and setting

Geotechnical, Environmental and Materials Engineers

Geosyntec consultants

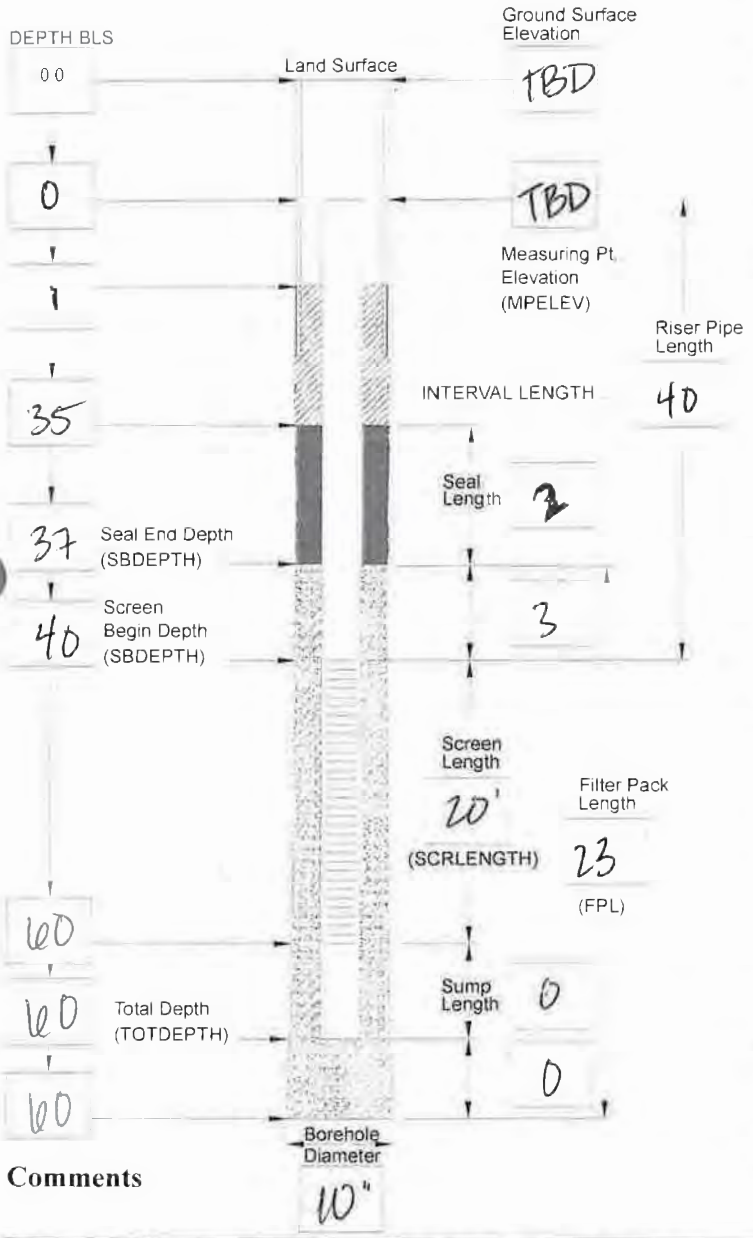
Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Appendix B
Field Forms

WELL CONSTRUCTION LOG
STANDARD FLUSH MOUNT

Well I.D.: EW-1
Drilling Company: SAEDACCO
Driller(s): WILL KEYES / DYLAN F / JOHN G.
Geologist/Eng./Tech.: AW / VO
Signature: allen

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 7/24/2020
Well Type: ~~Groundwater Monitoring~~ Recovery
Well Completion Method: Flush Mount



Well Completion
Guard Posts (Y / N) Date: TBD
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: TBD
Depth BGS: _____ Weep Hole (Y / N)

Grout
Composition/Proportions: Aquaguard
2 bags (7/27/2020)
Placement Method: tremie pipe

Seal Date:
Type: Pellets (bentonite) 1/4' TR30
Source: Pel-Plug
Set-up/Hydration Time: 1.5 hr
Placement Method: tremie pipe
Vol. Fluid Added: 0 gal

Filter Pack
Type: 20-40 gravel pack
Source: ~~Southern Product & Silica Co~~ DS1
Amount Used: 17 bags
Placement Method: tremie pipe

Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 6 in.

Screen
Material: Screen Stainless Steel Wire Wrap
Inside Diameter: 6 in.
Screen Slot Size:: 0.020 in.
Percent Open Area:
Sump or Bottom Cap ([✓ Y] N)
Type/Length: 20' Stainless Steel

Total Water Volume During Construction
Introduced (Gal): 700 Recovered (Gal): 5 drums

Reviewed By: allen Date: 7/24/2020

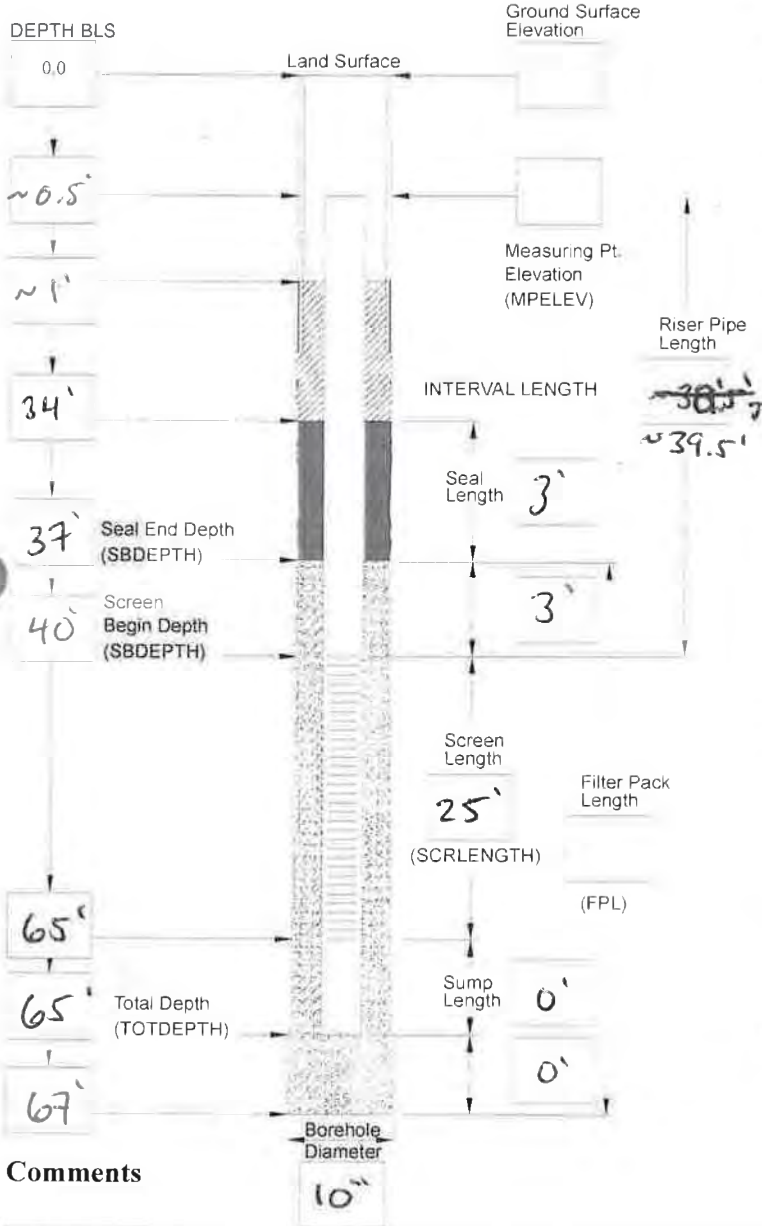
Comments

Centralizers positioned at 34-35' and 16-17'.
To be completed by 4th SAEDACCO guy (7/28/2020)
and Nick Charles (geosyntec) to be developed at later date

WELL CONSTRUCTION LOG
STANDARD FLUSH MOUNT

Well I.D.: EW-2
Drilling Company: SAEDACCO
Driller(s): Will Keyes
Geologist/Eng./Tech.: ~~JH~~ Justin Hobart
Signature: Justin Hobart

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date:
Well Type: ~~Groundwater Monitoring~~ Extraction Well
Well Completion Method: Flush Mount



DEPTH BLS: 0.0
~0.5'
~1'
34'
37' Seal End Depth (SBDEPTH)
40' Screen Begin Depth (SBDEPTH)
65'
65' Total Depth (TOTDEPTH)
67'

Riser Pipe Length: ~~38.5'~~ JH ~39.5'
Seal Length: 3'
3'
Screen Length: 25' (SCRLENGTH)
Sump Length: 0'
0'
Borehole Diameter: 10"

Well Completion
Guard Posts ([✓ Y] / N) Date: 8/14/20
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: ~~10~~ 12" manhole cover, steel
Depth BGS: 12" Weep Hole (Y / [✓ N])

Grout
Composition/Proportions: Aquaguard
Placement Method: tremie pipe

Seal Date: 8/13/20
Type: Bentonite pellet
Source: Pel-plug TR30 1/4"
Set-up/Hydration Time: 1.5 hrs.
Placement Method: gravity + tremie pipe
Vol. Fluid Added: 1 bucket bentonite

Filter Pack
Type: 20/40 sand
Source: Southern Products + Silica Co.
Amount Used: 17 bags
Placement Method: gravity

Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 6 in.

Screen
Material: stainless steel
Inside Diameter: 6 in.
Screen Slot Size:: 0.020 in.
Percent Open Area:
Sump or Bottom Cap (Y / [✓ N])
Type/Length:

Total Water Volume During Construction
Introduced (Gal): ~650 Recovered (Gal):

Reviewed
By: Date:

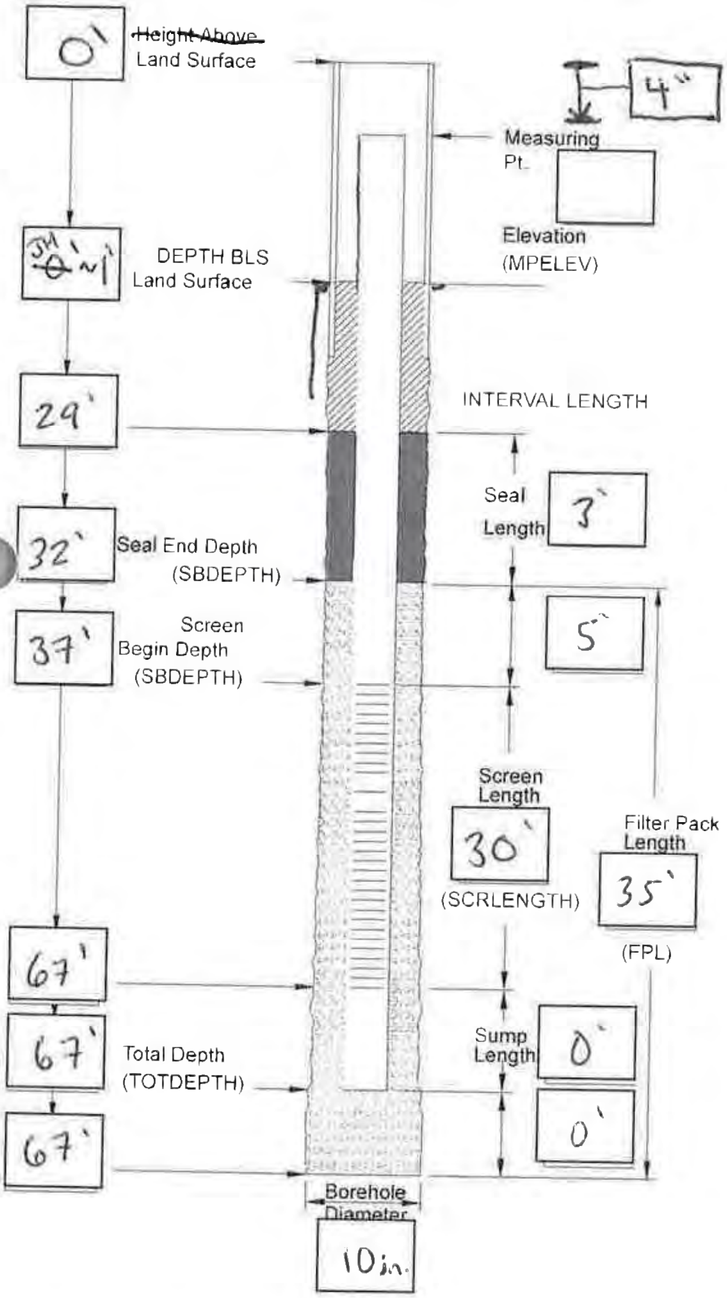
Comments

Hole caved-in from 65-67 ft.

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: Ew-3

Drilling Company: SAEDACCO
Drillers: Will Keyes
Geologist/Engineer: Alli Vo, Justin Hobart
Signature: Justin Hobart



0' ~~Height Above~~ Land Surface
4"
JH ~~0~~' ~1' DEPTH BLS Land Surface
29'
32' Seal End Depth (SBDEPTH)
37' Screen Begin Depth (SBDEPTH)
67'
67' Total Depth (TOTDEPTH)
67'
Seal Length 3'
5'
Screen Length 30' (SCRLENGTH)
Filter Pack Length 35' (FPL)
Sump Length 0'
0'
Borehole Diameter 10in.

Comments
~~10" Outer diam casing set to 30 ft BLS.~~ JH

Site: Chemours
Project Number: TR0795
Installation Method: Rotosonic
Casing Installation Date: 8/11/20
Well Type: Groundwater Extraction
Well Completion Method: Flush-mount
Geologic Completion Zone: Black Creek aquifer

Well Completion
Guard Posts ([✓ Y] / N) Date: 8/12/20
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: ~~4" Steel casing~~
Depth BGS: Weep Hole (Y / [✓ N])

Grout
Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 8/11/20
Type: Bentonite pellet
Source: Pel-plug TR30 1/4"
Set-up/Hydration Time: 1.5hrs.
Placement Method: gravity + tremmie
Vol. Fluid Added:

Filter Pack
Type: 20/40 sand
Source: Southern Products + Silica Co.
Amount Used: 18 bags
Placement Method: ~~tremie pipe~~ JH gravity/tremmie

Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 6 in.

Screen
Material: stainless steel
Inside Diameter: 6 in.
Screen Slot Size: 0.020 in.
Percent Open Area:
Sump or Bottom Cap (Y / [✓ N])
Type/Length: — / 30 ft

Backfill Plug (Y / [✓ N])
Material:
Placement Method:
Set-up/Hydration Time:

Total Water Volume During Construction
Introduced (Gal): ~900gal Recovered (Gal): NA

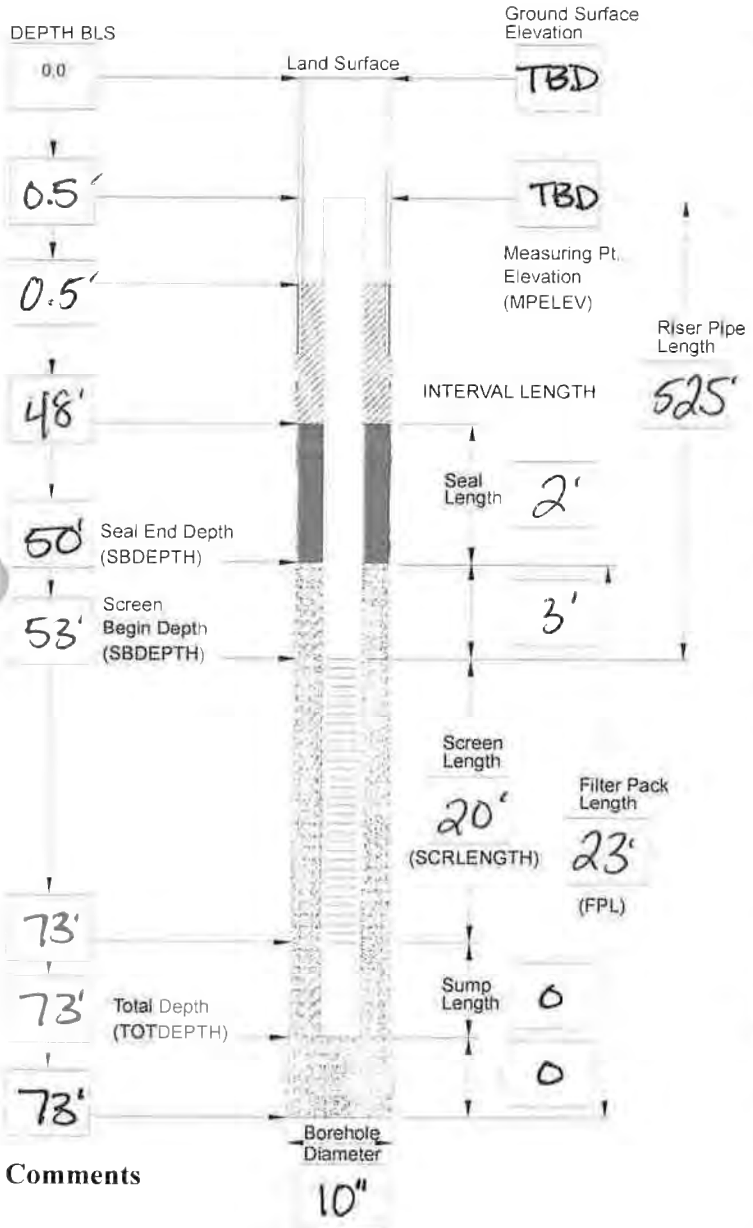
Reviewed
By: Date:

FLWP/Forms/Field forms/Well Construction/Well Construction Logs

WELL CONSTRUCTION LOG
STANDARD FLUSH MOUNT

Well I.D.: EW-4
Drilling Company: SAEDACCO
Driller(s): WILL KEYES, JOHN GOFF, DYLAN FEAST
Geologist/Eng./Tech.: ANN VO
Signature:

Site: CHEMOURS
Project Number: TR0795
Installation Method: SONIC
Casing Installation Date: 7/30/2020
Well Type: ~~Groundwater Monitoring~~ RECOVERY WELL
Well Completion Method: Flush Mount



Well Completion
Guard Posts ([✓ Y] / N) Date:
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type:
Depth BGS: Weep Hole (Y / N)

Grout
Composition/Proportions: Aquaguard
Placement Method: tremie pipe

Seal Date: 7/30/2020
Type: Bentonite Pellet
Source: DStaun Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1.5 hr
Placement Method: tremie pipe
Vol. Fluid Added: NA

Filter Pack
Type: ~~DSI~~ avv 20-40 sand
Source: DSI
Amount Used:
Placement Method: gravity

Well Riser Pipe
Casing Material: PVC
Casing Inside Diameters: 6 in.

Screen
Material: Stainless Steel
Inside Diameter: 6 in.
Screen Slot Size:: 0.020 in.
Percent Open Area: 24.9
Sump or Bottom Cap (Y / [✓ N])
Type/Length: NA

Total Water Volume During Construction
Introduced (Gal): 600 Recovered (Gal): 9 drums (495 gal)

Reviewed By: Date: 7/30/2020

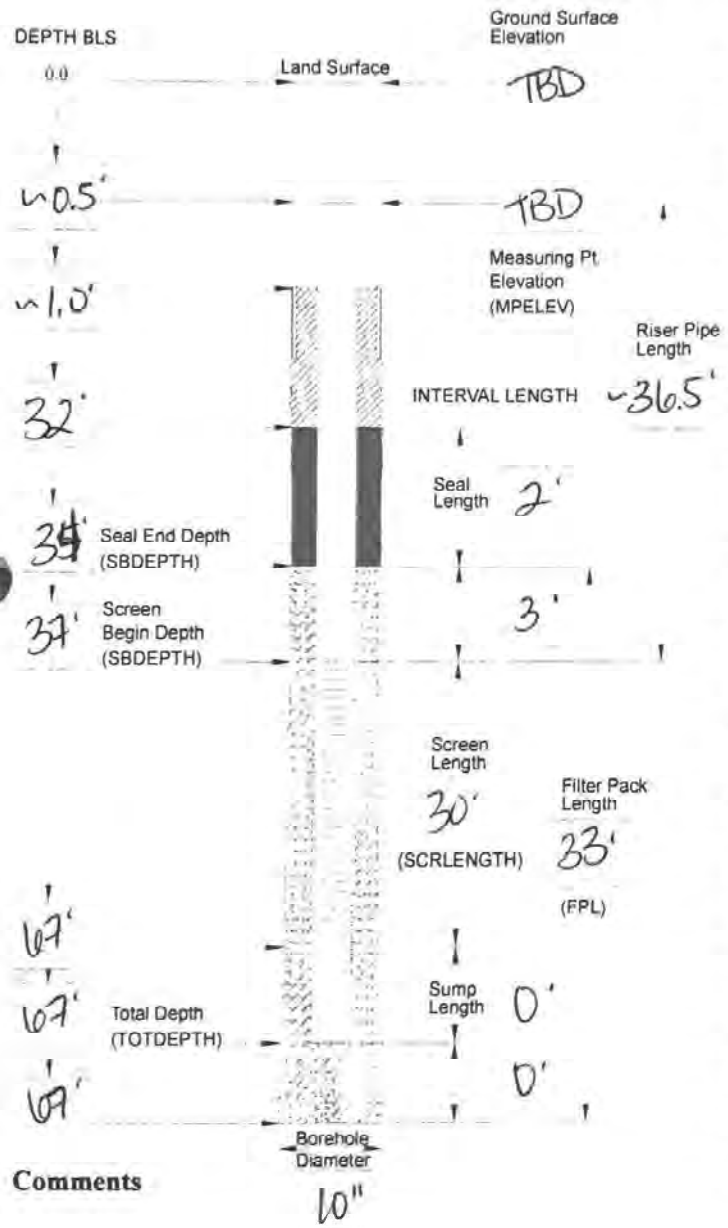
Comments

Centralizers at 47', 27', and 7'. To be developed at later date.

WELL CONSTRUCTION LOG
STANDARD FLUSH MOUNT

Well I.D.: EW-5
Drilling Company: SAEDACCO
Driller(s): Dylan Fierst, Will Keyes, Josh Holt
Geologist/Eng./Tech.: ALLI VO
Signature: Alli

Site: CHEMOURS
Project Number: TR0795A
Installation Method: 10/14/2020
Casing Installation Date: 10/15/2020
Well Type: ~~Groundwater Monitoring~~ Recovery
Well Completion Method: Flush Mount



Well Completion
Guard Posts ([✓ Y] / N) Date: 10/15/2020
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: 3"
Depth BGS: ~1.0 Weep Hole (Y / [✓ N])

Grout
Composition/Proportions: aquaguard
Placement Method: tremie pipe

Seal Date: 10/15/2020
Type: Bentonite Pellets
Source: Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1.5hr.
Placement Method: gravity
Vol. Fluid Added: 0 gal

Filter Pack
Type: 20-40 gravel pack III
Source: Southern Products
Amount Used: 22 bags
Placement Method: gravity

Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 6 in.

Screen
Material: Stainless Steel
Inside Diameter: 6 in.
Screen Slot Size:: 0.020 in.
Percent Open Area:
Sump or Bottom Cap ([✓ Y] / N)
Type/Length: 0"

Total Water Volume During Construction
Introduced (Gal): 350 Recovered (Gal): ~700

Reviewed
By: Alli Date:

Comments

Centralizers placed above screen.
Use quik-gel mud to help keep hole open during drilling.

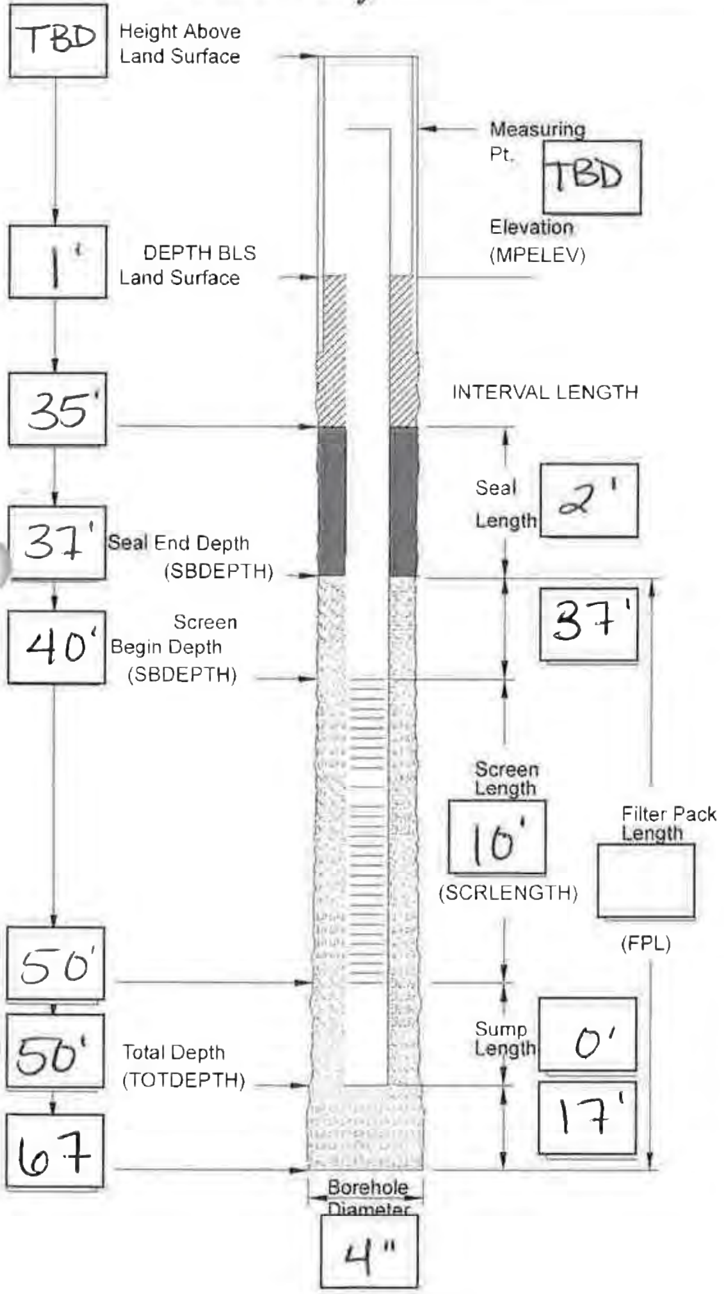
FLWP/Forms/Field Forms/Well Construction/Well Construction Logs/12B_Geosyntec Well Construction Log-Flush Completion

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: ~~PHW-18~~ And OW-1

Drilling Company: SAEDACCO
Drillers: Will Keyes
Geologist/Engineer: Alli Vo
Signature:

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 7/23/2020
Well Type: Stick up type II
Well Completion Method: Stick
Geologic Completion Zone: Black Creek Aqu.



TBD Height Above Land Surface

Measuring Pt. Elevation (MPELEV): TBD

1' DEPTH BLS Land Surface

35'

INTERVAL LENGTH

Seal Length: 2'

37' Seal End Depth (SBDEPTH)

37'

40' Screen Begin Depth (SBDEPTH)

Screen Length: 10' (SCRLENGTH)

Filter Pack Length: (FPL)

50'

Sump Length: 0'

17'

50' Total Depth (TOTDEPTH)

67'

Borehole Diameter: 4"

Well Completion
Guard Posts ([✓ Y] / N) Date: TBD
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: 3" Steel Casing
Depth BGS: TBD Weep Hole (Y / N)

Grout
Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 7/23/2020
Type: bentonite Pel Plug BR30 1/4"
Source: Pel Plug
Set-up/Hydration Time: 1.5hr 1115
Placement Method: tremie pipe
Vol. Fluid Added: 0'

Filter Pack
Type: 20-40
Source: Southern Products & Silica Co.
Amount Used: 4 bags
Placement Method: tremie

Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 2 in.

Screen
Material: PVC 0.010 Sch 40
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap (Y / N)
Type/Length: 10' Slot Machine

Backfill Plug ([✓ Y] / N)
Material: Pel Plug TR30 1/4" (1/2 bucket)
Placement Method: gravity (0hr)
Set-up/Hydration Time: NA

Total Water Volume During Construction
Introduced (Gal): 250 Recovered (Gal): 1 drum

Reviewed By: Date: 7/23/2020

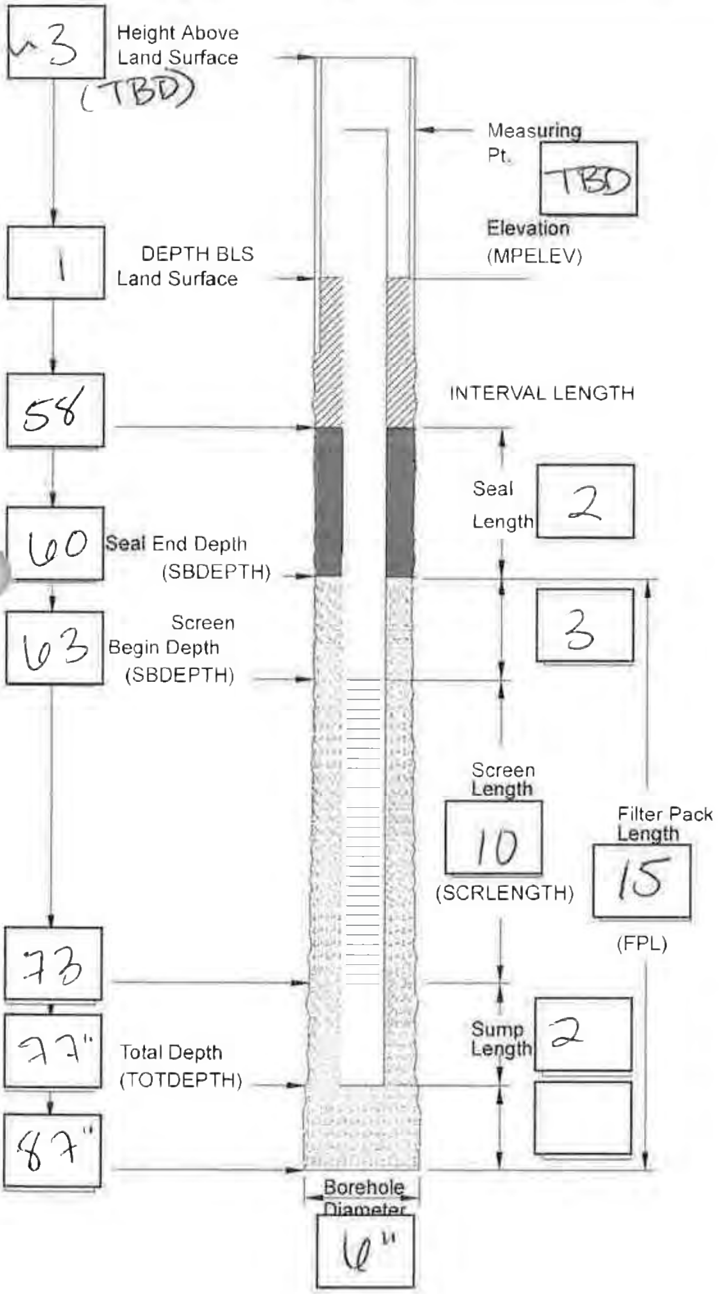
Comments
SAND emplaced 50-52' (below screen. Clay swelled below 50' requiring less backfill

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: OW-2

Drilling Company: SAEDACCO
Drillers: WILL KEYES, DYLAN FIERST, JOHN GOFF
Geologist/Engineer: Ali Vo
Signature:

Site: CHEMOURS
Project Number: TR0795
Installation Method: 7/28/2020
Casing Installation Date: 7/28/2020
Well Type: II
Well Completion Method: Black Creek Aq.
Geologic Completion Zone: Stick up



Height Above Land Surface: ~3 (TBD)
Measuring Pt. Elevation (MPELEV): TBD
DEPTH BLS Land Surface: 1
58
Seal Length: 2
Seal End Depth (SBDEPTH): 60
3
Screen Begin Depth (SBDEPTH): 63
Screen Length (SCRLENGTH): 10
Filter Pack Length (FPL): 15
73
Sump Length: 2
Total Depth (TOTDEPTH): 77"
87"
Borehole Diameter: 6"

Well Completion
Guard Posts ([✓ Y] / N) Date: TBD
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: Steel 3"
Depth BGS: 1 Weep Hole (Y / N)

Grout
Composition/Proportions: Aquaguard (2 bags ≈ 1 drum)
Placement Method: tremie pipe

Seal Date: 7/28/2020
Type: bentonite pellets TR30 1/4"
Source: Pel-Plug
Set-up/Hydration Time: 1400 (1.5hr)
Placement Method: tremie pipe
Vol. Fluid Added: 0 gal

Filter Pack
Type: 20-30 Sand
Source: Southern Product & Silica Co
Amount Used: 6 bags
Placement Method: gravity (2bag/2 min)

Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 2 in.

Screen
Material: PVC Sch 40
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap ([✓ Y] / N)
Type/Length: Machine Slot / 10'

Backfill Plug ([✓ Y] / N)
Material: Bentonite Pellets
Placement Method: tremie pipe
Set-up/Hydration Time: 1300 ; 0 hr

Total Water Volume During Construction
Introduced (Gal): 350 Recovered (Gal): 110

Reviewed By: Date: 7/28/2020

Comments
Backfill bentonite to 75'. 20-30 sand 75-60'

FLWP/Forms/Field forms/Well Construction/Well Construction Logs

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: OW-3

Drilling Company: SAEDACCO

Drillers: WILL KEMES/DYLAN FIERST, JOHN GOFF

Geologist/Engineer: DAN VO

Signature:

Site: CHEMOURS

Project Number: TR0795

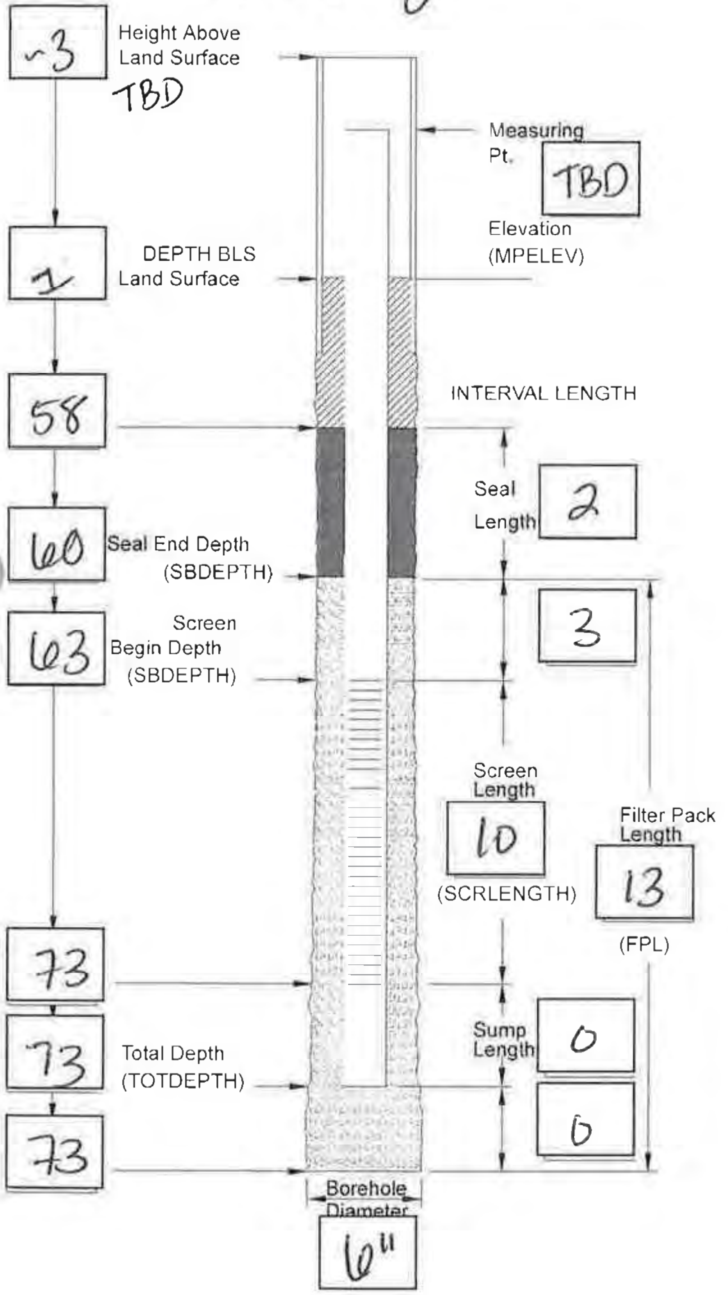
Installation Method: SONIC

Casing Installation Date: 7/29/2020

Well Type:

Well Completion Method: STICK UP

Geologic Completion Zone: Black Creek Aquifer



Height Above Land Surface: ~3 TBD

Measuring Pt. Elevation (MPELEV): TBD

DEPTH BLS Land Surface: 1

58

Seal Length: 2

Seal End Depth (SBDEPTH): 60

3

Screen Begin Depth (SBDEPTH): 63

Screen Length (SCRLENGTH): 10

Filter Pack Length (FPL): 13

73

Sump Length: 0

Total Depth (TOTDEPTH): 73

0

73

Borehole Diameter: 6"

Well Completion

Guard Posts (Y / N) Date:

Surface Pad Size: ____ ft x ____ ft

Protective Casing or Cover

Diameter/Type:

Depth BGS: ____ Weep Hole (Y / N)

Grout

Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date:

Type: Bentonite Pellets TR30 1/4"

Source: Pel-Plug

Set-up/Hydration Time:

Placement Method: tremie pipe

Vol. Fluid Added: NA (0 gal)

Filter Pack

Type: 20-30

Source: DSI

Amount Used: 5 bags

Placement Method: gravity

Well Riser Pipe

Casing Material: PVC Sch 40

Casing Inside Diameters: 2 in.

Screen

Material: Sch 40 PVC

Inside Diameter: 2 in.

Screen Slot Size: 0.010 in.

Percent Open Area:

Sump or Bottom Cap ([✓ Y] / N)

Type/Length: —

Backfill Plug (Y / [✓ N])

Material: —

Placement Method: —

Set-up/Hydration Time: —

Total Water Volume During Construction

Introduced (Gal): 300 Recovered (Gal): 110

Reviewed By: Date: 7/29/2020

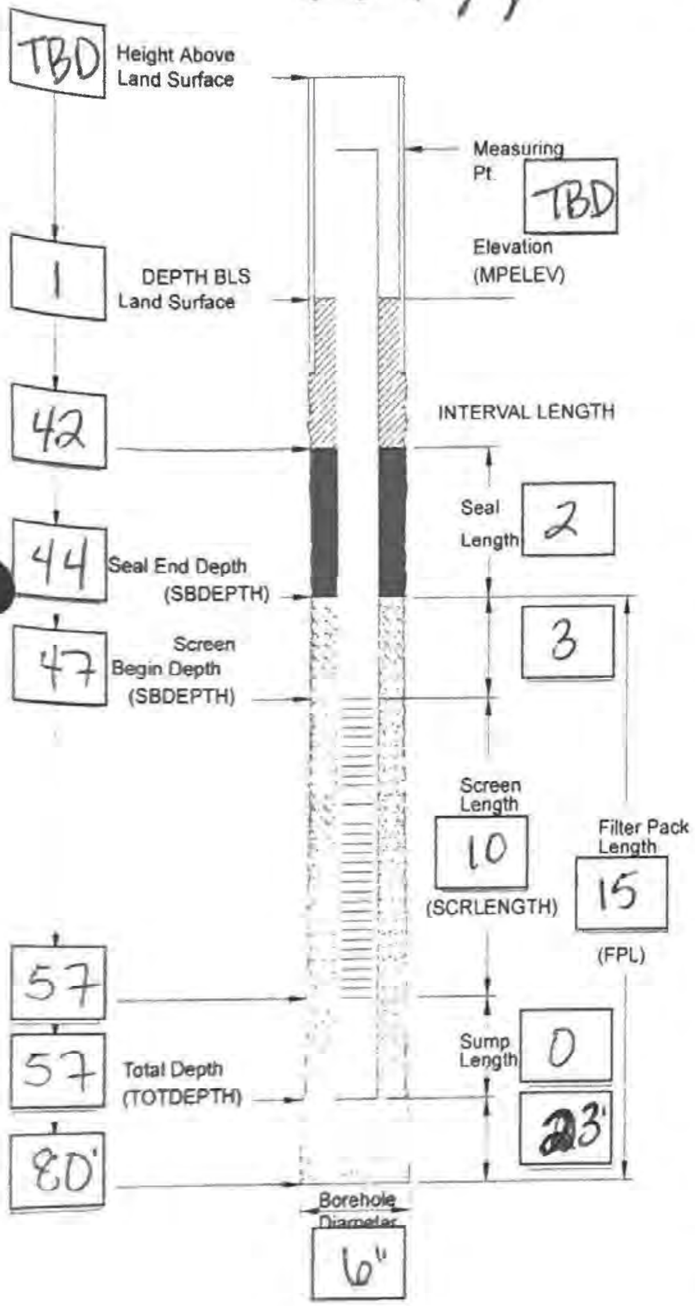
Comments

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: OW-4

Drilling Company: SAEDACCO
Drillers: WILL KEYES
Geologist/Engineer: Ani Vo
Signature:

Site: CHEMOURS
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 8/6/2020
Well Type: II
Well Completion Method: Stick up
Geologic Completion Zone: Black Creek Aqu.



TBD Height Above Land Surface
Measuring Pt. Elevation (MPELEV): TBD
1 DEPTH BLS Land Surface
42
INTERVAL LENGTH
Seal Length: 2
44 Seal End Depth (SBDEPTH)
3
47 Screen Begin Depth (SBDEPTH)
Screen Length (SCRLENGTH): 10
Filter Pack Length (FPL): 15
57
Sump Length: 0
57 Total Depth (TOTDEPTH)
23'
80'
Borehole Diameter: 6"

Well Completion
Guard Posts ([✓ Y] / N) Date:
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: 3" Steel Stick up
Depth BGS: ~1' Weep Hole (Y / N)

Grout
Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 8/6/2020
Type: bentonite pellets TRBO 1/4"
Source: Pel-Plug (1/2 bucket)
Set-up/Hydration Time: 1.5 hr.
Placement Method: tremie pipe
Vol. Fluid Added: 0 gal

Filter Pack
Type: Type II 20-30
Source: Southern Product & Silica Co
Amount Used:
Placement Method: gravity

Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 2 in.

Screen
Material: PVC Sch 40
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap (Y / [✓ N])
Type/Length: ~~10~~ NA

Backfill Plug (Y / N)
Material: Pel-Plug TRBO 1/4" bentonite
Placement Method: gravity
Set-up/Hydration Time: 0hr (1 bucket)

Total Water Volume During Construction
Introduced (Gal): — Recovered (Gal): 110 gal

Reviewed
By: Date:

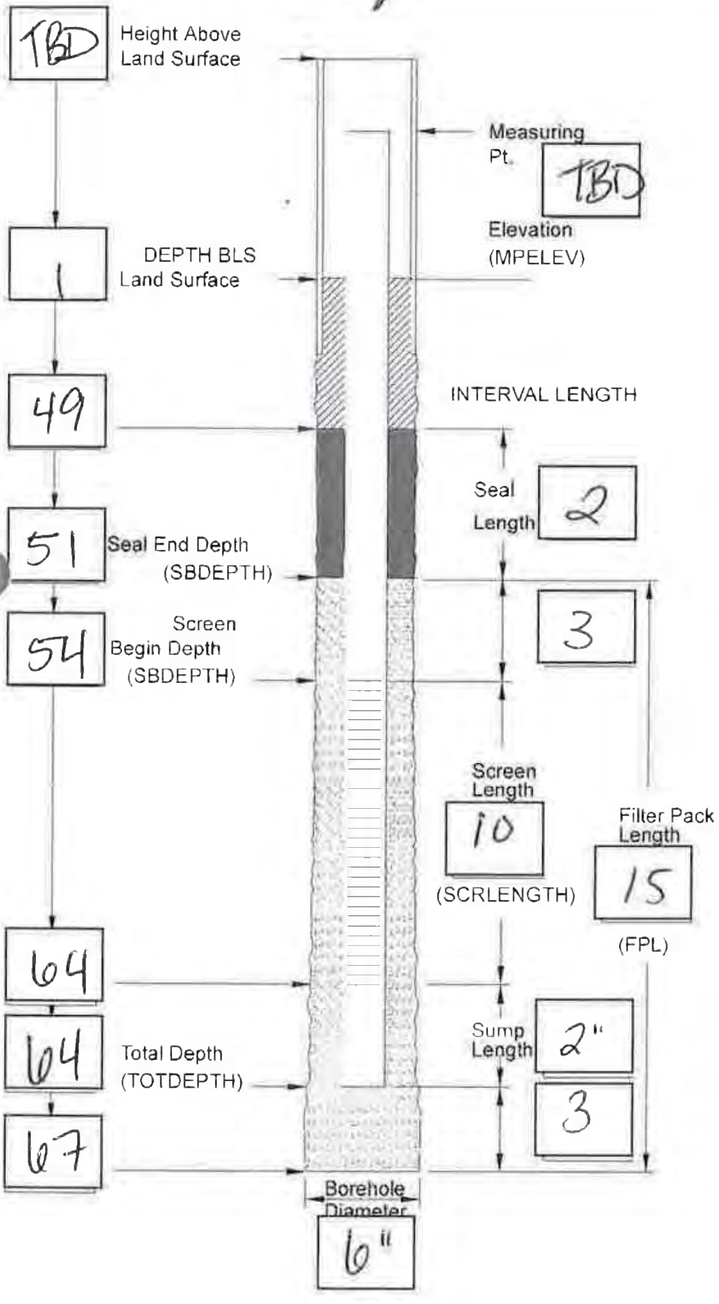
Comments
Borehole collapsed to 65' when rods were pulled to install Pel-Plug. 2' sand below screen

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: OW-5

Drilling Company: SAEDACCO
Drillers: WILL KEYES
Geologist/Engineer: Ali VO
Signature:

Site: CHEMOURS
Project Number: TR0795
Installation Method: SONIC
Casing Installation Date: 8/7/2020
Well Type: II
Well Completion Method: Stick up
Geologic Completion Zone: Black Creek Aquifer



Well Completion
Guard Posts ([✓ Y] / N) Date:
Surface Pad Size: 2 ft x 2 ft
Protective Casing or Cover
Diameter/Type: 2"
Depth BGS: ~1' Weep Hole (Y / N)
Grout
Composition/Proportions: Aquaguard (2 bags)

Placement Method: tremie pipe

Seal Date: 8/7/2020
Type: Bentonite Pellets
Source: Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1.5 hr
Placement Method:
Vol. Fluid Added: 0 gal
Filter Pack
Type: II 20-30
Source: Southern Product & Silica Co.
Amount Used: 5 bags
Placement Method: gravity
Well Riser Pipe
Casing Material: PVC Sch 40
Casing Inside Diameters: 2 in.
Screen
Material: PVC Sch 40
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap ([✓ Y] / N)
Type/Length: 2"
Backfill Plug (Y / N)
Material: Pel-Plug bentonite pellets TR30
Placement Method: gravity
Set-up/Hydration Time: 0 hr /
Total Water Volume During Construction
Introduced (Gal): Recovered (Gal): 110 gal
Reviewed
By: Date:

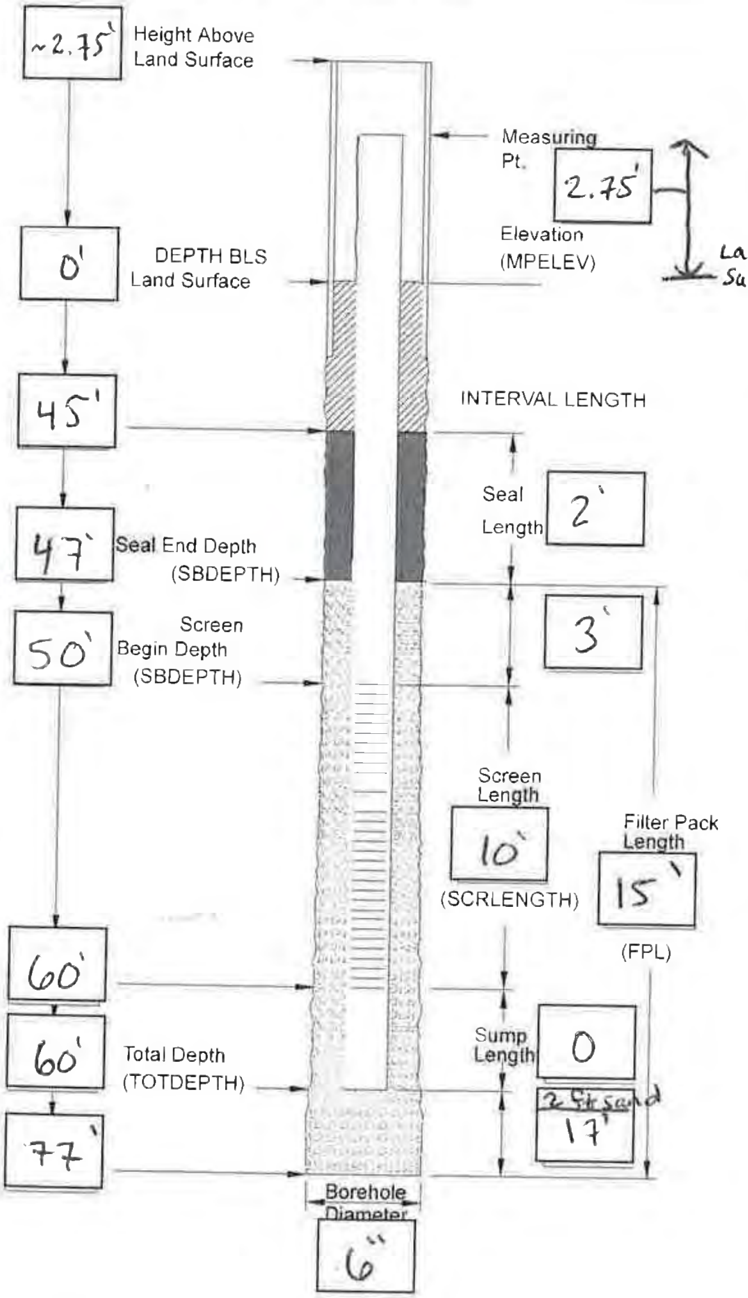
Comments

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: OW-6

Drilling Company: SAEDACCO
Drillers: Will Keye
Geologist/Engineer: Justin Hobart
Signature: Justin Hobart

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 8/12/20
Well Type: II Monitoring
Well Completion Method: Stick up
Geologic Completion Zone: Black Creek Aquifer



Height Above Land Surface: ~2.75'
Measuring Pt. Elevation (MPELEV): 2.75'
Land Surf.
DEPTH BLS Land Surface: 0'
45'
INTERVAL LENGTH
Seal Length: 2'
Seal End Depth (SBDEPTH): 47'
3'
Screen Begin Depth (SBDEPTH): 50'
Screen Length (SCRLENGTH): 10'
Filter Pack Length (FPL): 15'
60'
Total Depth (TOTDEPTH): 60'
Sump Length: 0
2 ft sand
17'
77'
Borehole Diameter: 6"

Well Completion
Guard Posts ([✓ Y] / N) Date: 8/14/20
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: 3" steel stick-up
Depth BGS: ~1 ft Weep Hole (Y / [✓ N])

Grout
Composition/Proportions: Aquaguard 3 bags
Placement Method: tremie pipe

Seal Date: 8/12/20
Type: 1/4" bentonite pellets
Source: Pel-plug TR30
Set-up/Hydration Time: >1.5 hrs.
Placement Method: tremmie pipe
Vol. Fluid Added: ~1 bag

Filter Pack
Type: Type II, 20-30
Source: Southern Products + Silica Co.
Amount Used: 5 bags
Placement Method: gravity

Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 2 in.

Screen
Material: SCH-40 PVC
Inside Diameter: ~~0.010~~ 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap (Y / [✓ N])
Type/Length: 10'

Backfill Plug ([✓ Y] N)
Material: Pel-plug bentonite pellets, 1/4" TR30
Placement Method: gravity
Set-up/Hydration Time: 0 hr

Total Water Volume During Construction
Introduced (Gal): ~110 Recovered (Gal): ~~~110~~ JH

Reviewed
By: Date:

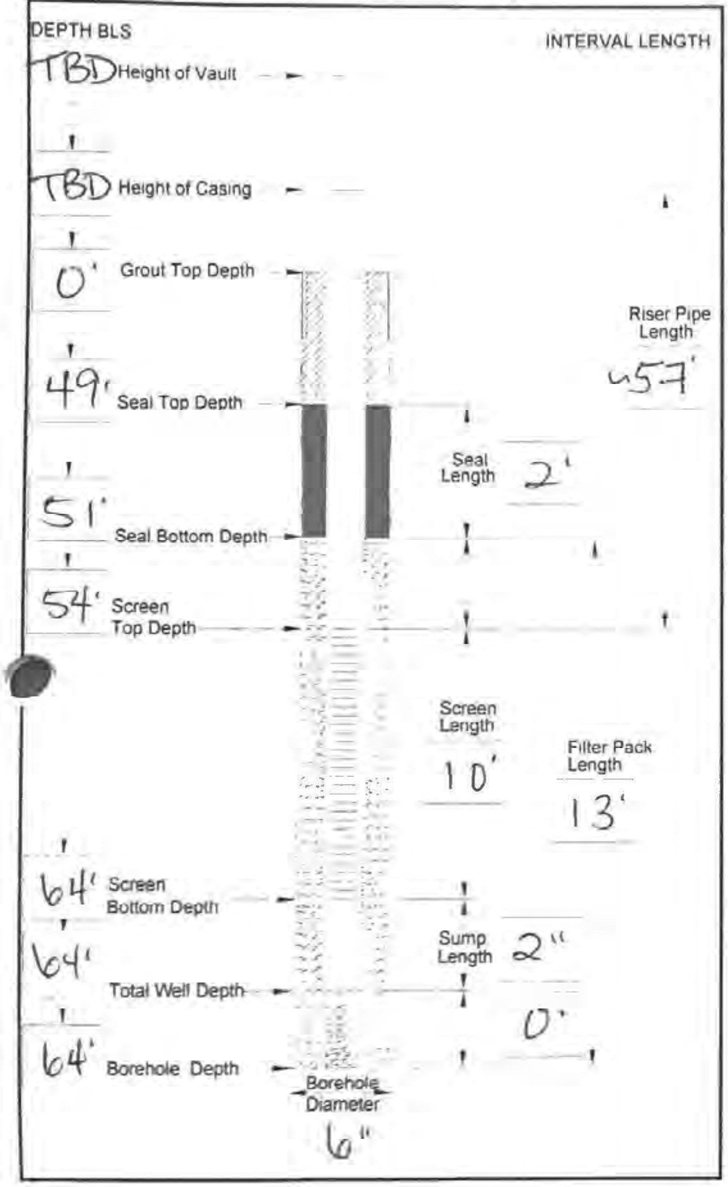
Comments
2 ft sand below the well screen to 62 ft BLS. Remaining depth backfilled with bentonite.

Geosyntec consultants

Well Construction Log

Well I.D.: OW-9
Drilling Company: SAEDACCO
Driller: WILL KEYES
Geologist/Engineer: ALLI VD
Geologic Completion Zone: BCA
Well Completion Method: STICK-UP

Site: CHEMOURS
Installation Method: SONIC
Casing Installation Date: 10/16/2020
Well Type: II Monitoring


DEPTH BLS
INTERVAL LENGTH
TBD Height of Vault
TBD Height of Casing
0' Grout Top Depth
Riser Pipe Length ~57'
49' Seal Top Depth
Seal Length 2'
51' Seal Bottom Depth
54' Screen Top Depth
Screen Length 10'
Filter Pack Length 13'
64' Screen Bottom Depth
Sump Length 2"
64' Total Well Depth
0'
64' Borehole Depth
Borehole Diameter 6"

Notes:
1. Drawing not to scale
2. Units are in feet unless otherwise specified

Well Completion
Bollards: ☒ Yes ☐ No Date Completion finished: ____
Surface Pad Size: 2 ft x 2 ft x 4 inches thick

Protective Vault or Cover - ☐ None
Diameter: ____ inches
Type: ☒ Steel ☐ Aluminum ☐
Depth BGS: 1.5' Weep Hole: ☐ Yes ☒ No

Grout – Date: 10/14/2020
Composition/Proportions:
☐ 95/5 Type I/Type II Cement – Bentonite Mix ☒ Other: Aquaguad
Placement Method: ☒ Pressure Tremie ☐ Gravity ☐ Other: ____

Seal - Date: 10/16/2020
Type: ☐ 3/8" Bentonite Chips ☐ Morie #00 Sand
☒ Coated Bentonite Pellets-Time: ____ ☐ Other: ____
Source/Brand: Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1130 1.5hr
Placement Method: ☒ Pressure Tremie ☐ Gravity ☐ Other: ____
Vol. Fluid Added: 0 ☒ gallons ☐ liters ☐ Other: ____

Filter Pack
Type: ☒ Morie #2 Sand or equiv. ☐ Morie #1 Sand or equiv.
☐ Gravel ☐ Other: 20-30 Sand
Source/Brand: Southern Product & Silica Co
Amount Used 5 ☒ bags ☐ pounds
Placement Method: ☐ Pressure Tremie ☒ Gravity
☐ Other: ____

Well Riser Pipe
Material: ☒ Schedule 40 PVC – Flush Threaded Joints
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____

Screen
Material: ☒ Schedule 40 PVC – Machine Slotted
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____
Screen Slot Size: ☒ 0.010-inch ☐ 0.020-inch ☐ Other: ____
Percent Open Area: ☒ 3.25% - 2-inch, 0.010 slot ☐ Other: ____
Sump or Bottom Cap: ☒ Yes ☐ No Length: 2"

Backfill Plug ☐ Yes ☒ No
Material: ☐ Grout ☐ Bentonite
Placement Method: ☐ Pressure Tremie ☐ Gravity ☐ Other: ____
Set-up/Hydration Time: ____

Total Water Volume During Construction
Introduced: ____ gallons Recovered: 250 gallons

Comments: ____

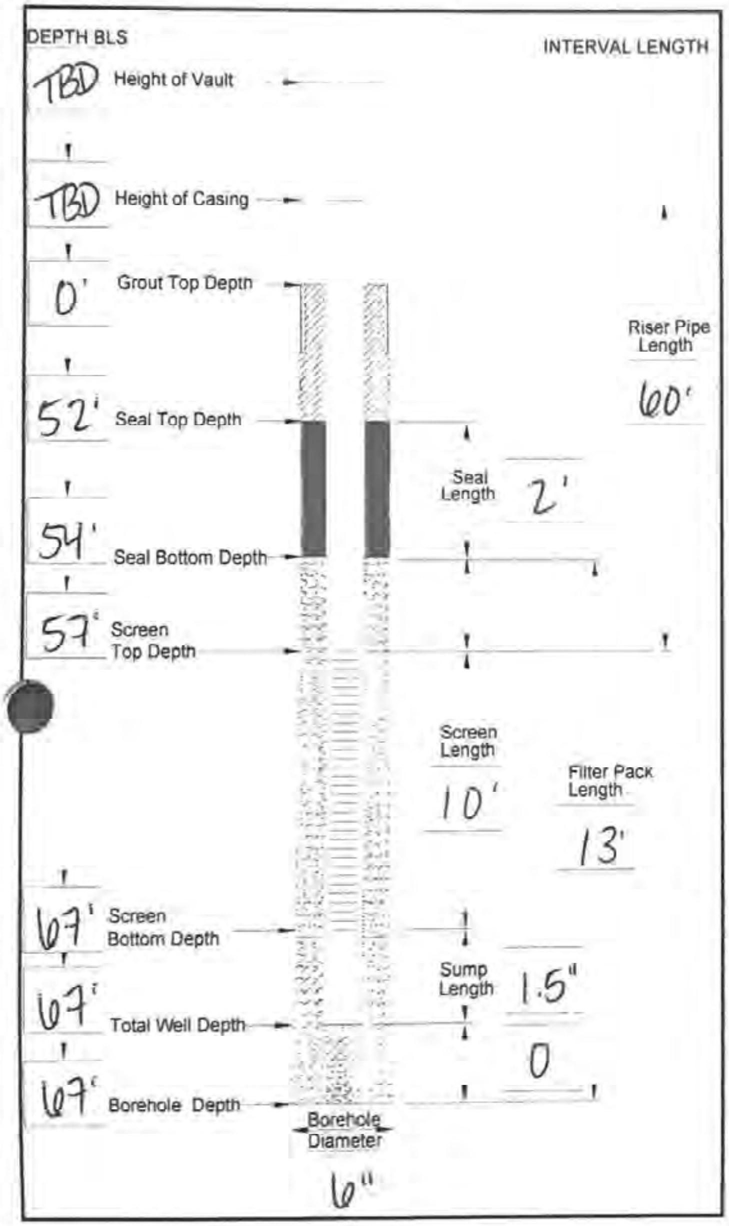
forms/Log.WellConstruction

Geosyntec
consultants

Well Construction Log

Well I.D.: OW-8
Drilling Company: SAEDACCO
Driller: DYLAN FIERST
Geologist/Engineer: Ali VO
Geologic Completion Zone: Black Creek Aqu.
Well Completion Method: Stick up II

Site: Chemours
Installation Method: SONIC
Casing Installation Date: 10/13/2020
Well Type: Monitoring well



DEPTH BLS
INTERVAL LENGTH
TBD Height of Vault
TBD Height of Casing
0' Grout Top Depth
Riser Pipe Length 60'
52' Seal Top Depth
Seal Length 2'
54' Seal Bottom Depth
57' Screen Top Depth
Screen Length 10'
Filter Pack Length 13'
67' Screen Bottom Depth
Sump Length 1.5"
67' Total Well Depth
0
67' Borehole Depth
Borehole Diameter 6"

Notes:
1. Drawing not to scale
2. Units are in feet unless otherwise specified

Well Completion
Bollards: ☑ Yes ☐ No Date Completion finished: 10/15/2020
Surface Pad Size: 2 ft x 2 ft x 4 inches thick

Protective Vault or Cover - ☐ None
Diameter: 3 inches
Type: ☑ Steel ☐ Aluminum ☐
Depth BGS: 1.5' Weep Hole: ☐ Yes ☑ No

Grout – Date: 10/14/2020
Composition/Proportions:
☑ 95/5 Type I/Type II Cement – Bentonite Mix ☑ Other: Aquaguard
Placement Method: ☑ Pressure Tremie ☐ Gravity ☐ Other:

Seal - Date: 10/13/2020
Type: ☐ 3/8" Bentonite Chips ☐ Morie #00 Sand
☑ Coated Bentonite Pellets-Time: 1655 ☐ Other:
Source/Brand: Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1655 /overnight
Placement Method: ☐ Pressure Tremie ☑ Gravity ☐ Other:
Vol. Fluid Added: 0 ☑ gallons ☐ liters ☐ Other:

Filter Pack
Type: ☑ Morie #2 Sand or equiv. ☐ Morie #1 Sand or equiv.
☐ Gravel ☐ Other:
Source/Brand: Southern Product & Silica Co
Amount Used 5 ☑ bags ☐ pounds
Placement Method: ☐ Pressure Tremie ☑ Gravity
☐ Other:

Well Riser Pipe
Material: ☑ Schedule 40 PVC – Flush Threaded Joints
☐ Other:
Casing Inside Diameters: ☑ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other:

Screen
Material: ☑ Schedule 40 PVC – Machine Slotted
☐ Other:
Casing Inside Diameters: ☑ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other:
Screen Slot Size: ☑ 0.010-inch ☐ 0.020-inch ☐ Other:
Percent Open Area: ☑ 3.25% - 2-inch, 0.010 slot ☐ Other:
Sump or Bottom Cap: ☑ Yes ☐ No Length: 1.5"

Backfill Plug ☐ Yes ☑ No
Material: ☐ Grout ☐ Bentonite
Placement Method: ☐ Pressure Tremie ☐ Gravity ☐ Other:
Set-up/Hydration Time:

Total Water Volume During Construction
Introduced: 200 gallons Recovered: 110 gallons

Comments:

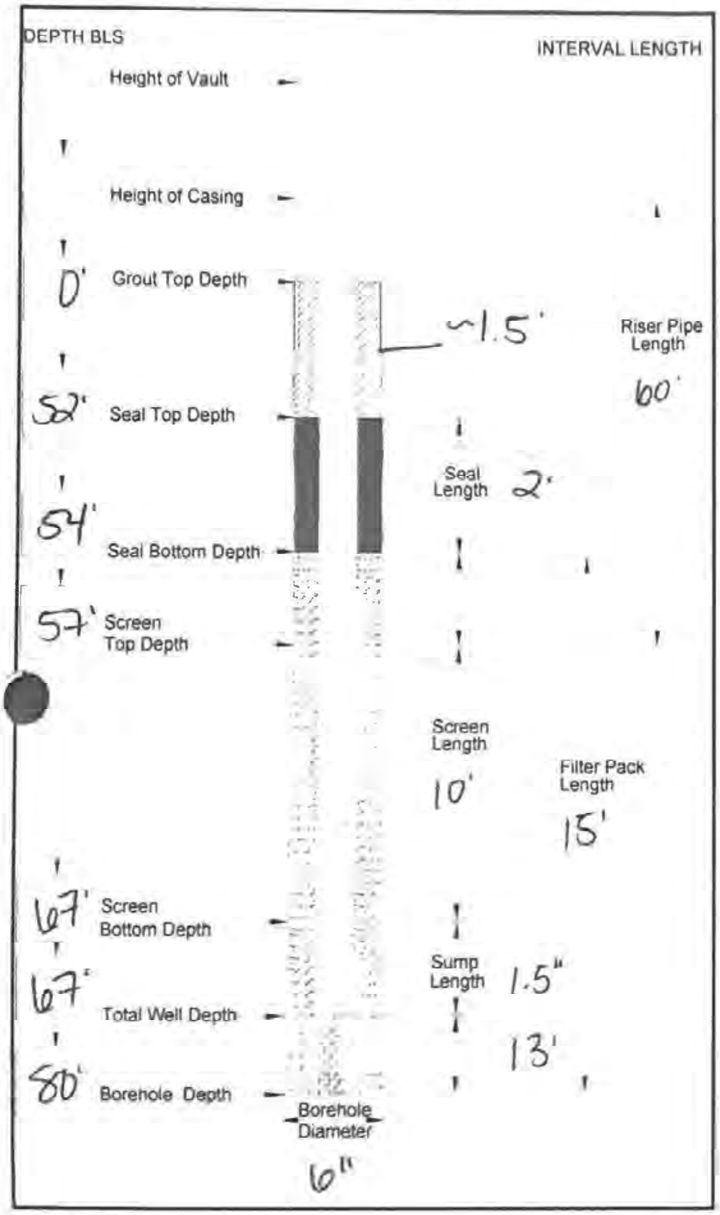
forms/Log.WellConstruction

Geosyntec consultants

Well Construction Log

Well I.D.: OW-7
Drilling Company: SAEDACCO
Driller: Dylan Fierst
Geologist/Engineer: Alli VO
Geologic Completion Zone: Black Creek Aqu
Well Completion Method: Stick up II

Site: Chemours
Installation Method: Sonic
Casing Installation Date: 10/13/2020
Well Type: II (Monitoring Well)



DEPTH BLS
INTERVAL LENGTH
Height of Vault
Height of Casing
0' Grout Top Depth
~1.5'
Riser Pipe Length 60'
52' Seal Top Depth
Seal Length 2'
54' Seal Bottom Depth
57' Screen Top Depth
Screen Length 10'
Filter Pack Length 15'
67' Screen Bottom Depth
Sump Length 1.5"
67' Total Well Depth
13'
80' Borehole Depth
Borehole Diameter 6"

Notes:
1. Drawing not to scale
2. Units are in feet unless otherwise specified

Well Completion
Bollards: ☑ Yes ☐ No Date Completion finished: 10/15/2020
Surface Pad Size: 2 ft x 2 ft x 4 inches thick

Protective Vault or Cover - ☐ None
Diameter: ____ inches
Type: ☑ Steel ☐ Aluminum ☐
Depth BGS: 1.5 Weep Hole: ☐ Yes ☑ No

Grout – Date: 10/13/2020
Composition/Proportions:
☒ 95/5 Type I/Type II Cement – Bentonite Mix ☒ Other Aquaguard
Placement Method: ☒ Pressure Tremie ☐ Gravity ☐ Other:

Seal - Date: 10/13/2020
Type: ☐ 3/8" Bentonite Chips ☐ Morie #00 Sand
☒ Coated Bentonite Pellets-Time: ____ ☐ Other: ____
Source/Brand: Pel-Plug TR30 1/4"
Set-up/Hydration Time: 1120 1.5hr
Placement Method: ☐ Pressure Tremie ☒ Gravity ☐ Other: ____
Vol. Fluid Added: 0 ☒ gallons ☐ liters ☐ Other: ____

Filter Pack
Type: ☒ Morie #2 Sand or equiv. ☐ Morie #1 Sand or equiv.
☐ Gravel ☐ Other: ____
Source/Brand: Southern Products & Silica Co
Amount Used 9 ☒ bags ☐ pounds
Placement Method: ☐ Pressure Tremie ☒ Gravity
☐ Other: ____

Well Riser Pipe
Material: ☒ Schedule 40 PVC – Flush Threaded Joints
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____

Screen
Material: ☒ Schedule 40 PVC – Machine Slotted
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____
Screen Slot Size: ☒ 0.010-inch ☒ 0.020-inch ☐ Other: ____
Percent Open Area: ☒ 3.25% - 2-inch, 0.010 slot ☐ Other: ____
Sump or Bottom Cap: ☒ Yes ☐ No Length: 1.5"

Backfill Plug ☒ Yes ☐ No
Material: ☐ Grout ☒ Bentonite
Placement Method: ☐ Pressure Tremie ☒ Gravity ☐ Other: ____
Set-up/Hydration Time: 1100 0hr

Total Water Volume During Construction
Introduced: 150 gallons Recovered: 110 gallons

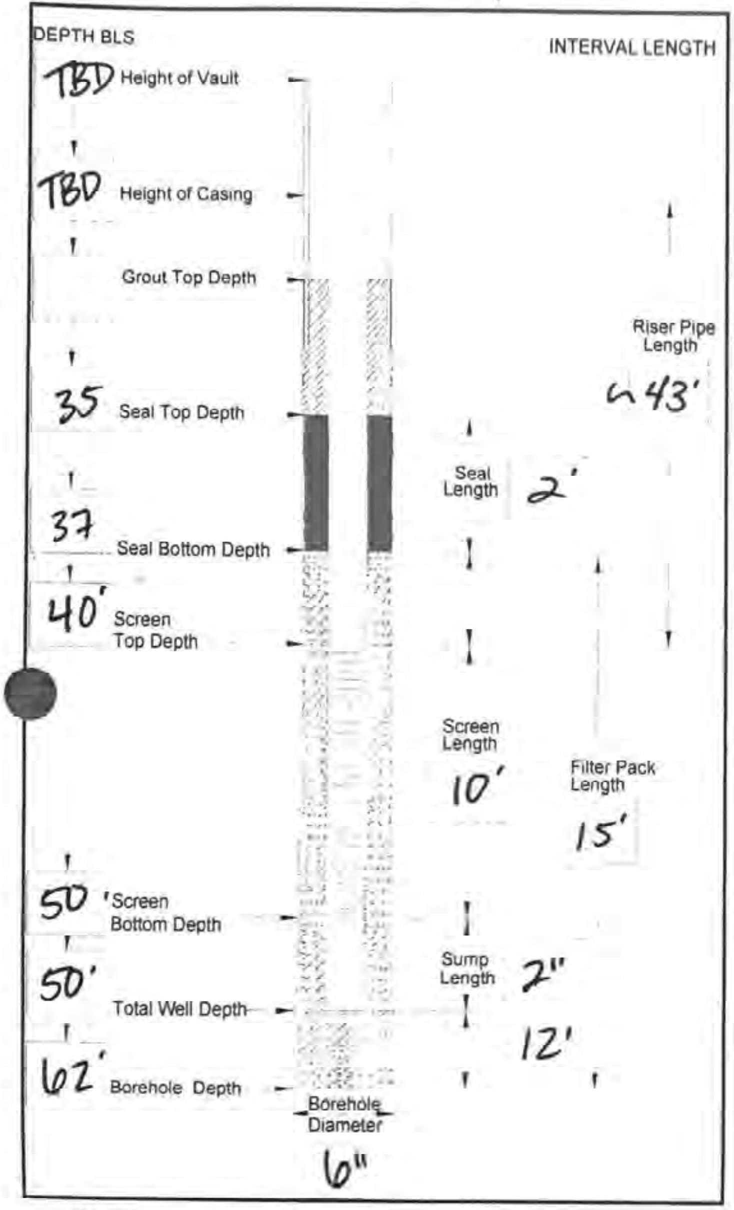
Comments: Place 2' below screen above bentonite backfill
Case off to 27' 3 ft of sand above the screen.

Geosyntec consultants

Well Construction Log

Well I.D.: ~~SA~~ AW OW-10
Drilling Company: SAEDACCO
Driller: WILL KEYES
Geologist/Engineer: AWI VO
Geologic Completion Zone: BCA
Well Completion Method: II stickup

Site: CHEMOURS
Installation Method: SONIC
Casing Installation Date:
Well Type: Monitoring Well



DEPTH BLS | INTERVAL LENGTH

TBD Height of Vault
TBD Height of Casing
Grout Top Depth
Riser Pipe Length ~43'
35 Seal Top Depth
Seal Length 2'
37 Seal Bottom Depth
40' Screen Top Depth
Screen Length 10'
Filter Pack Length 15'
50' Screen Bottom Depth
Sump Length 2"
50' Total Well Depth
12'
62' Borehole Depth
Borehole Diameter 6"

Notes:
1. Drawing not to scale
2. Units are in feet unless otherwise specified

Well Completion
Bollards: ☒ Yes ☐ No Date Completion finished: ____
Surface Pad Size: 2 ft x 2 ft x 4 inches thick

Protective Vault or Cover - ☐ None
Diameter: 3 inches
Type: ☒ Steel ☐ Aluminum ☐
Depth BGS: -1.5 Weep Hole: ☐ Yes ☒ No

Grout – Date: 10/21/2020
Composition/Proportions:
☒ 95/5 Type I/Type II Cement – Bentonite Mix ☐ Other: Aquaguard
Placement Method: ☒ Pressure Tremie ☐ Gravity ☐ Other: ____

Seal - Date: 10/21/2020
Type: ☐ 3/8" Bentonite Chips ☐ Morie #00 Sand
☒ Coated Bentonite Pellets-Time: ____ ☐ Other: ____
Source/Brand: Pel-Plug TR-30 1/4"
Set-up/Hydration Time: 1.5 hr / 1/2 bucket
Placement Method: ☐ Pressure Tremie ☒ Gravity ☐ Other: ____
Vol. Fluid Added: 0 ☒ gallons ☐ liters ☐ Other: ____

Filter Pack
Type: ☒ Morie #2 Sand or equiv. ☐ Morie #1 Sand or equiv.
☐ Gravel ☐ Other:
Source/Brand: Southern Product & Silica Co
Amount Used ____ ☐ bags ☐ pounds
Placement Method: ☐ Pressure Tremie ☐ Gravity
☐ Other: ____

Well Riser Pipe
Material: ☒ Schedule 40 PVC – Flush Threaded Joints
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____

Screen
Material: ☒ Schedule 40 PVC – Machine Slotted
☐ Other: ____
Casing Inside Diameters: ☒ Nominal 2-inch – 2.047-inch I.D.
☐ Nominal 4-inch – 3.998-inch I.D. ☐ Other: ____
Screen Slot Size: ☒ 0.010-inch ☐ 0.020-inch ☐ Other: ____
Percent Open Area: ☒ 3.25% - 2-inch, 0.010 slot ☐ Other: ____
Sump or Bottom Cap: ☒ Yes ☐ No Length: 2"

Backfill Plug ☒ Yes ☐ No
Material: ☐ Grout ☒ Bentonite
Placement Method: ☐ Pressure Tremie ☒ Gravity ☐ Other: ____
Set-up/Hydration Time: 0 hr

Total Water Volume During Construction
Introduced: 200 gallons Recovered: 175 gallons

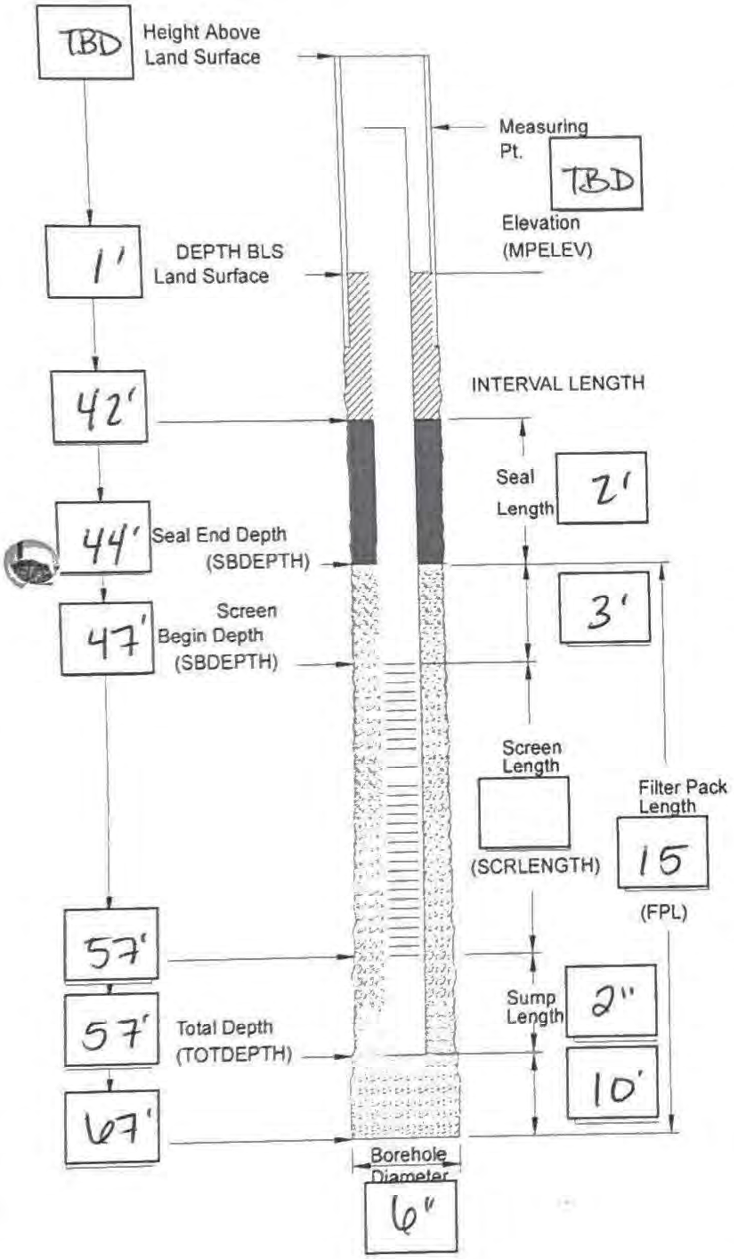
Comments: 2' sand beneath screen. 62-52' is bentonite chip

forms/Log WellConstruction

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-11
Drilling Company: SAEDACCO
Drillers: WILL KEYES | JOHN GOFF | DYLAN FIERST
Geologist/Engineer: AL VO
Signature: Alleyry

Site: Chemours
Project Number: TR0795
Installation Method: SONIC
Casing Installation Date: 8/25/2020
Well Type: II
Well Completion Method: Stick up
Geologic Completion Zone: Upper Cape Fear Transition


Height Above Land Surface: TBD
Measuring Pt. Elevation (MPELEV): TBD
DEPTH BLS Land Surface: 1'
42'
INTERVAL LENGTH
Seal Length: 2'
Seal End Depth (SBDEPTH): 44'
3'
Screen Begin Depth (SBDEPTH): 47'
Screen Length (SCRLENGTH):
Filter Pack Length (FPL): 15
57'
Total Depth (TOTDEPTH): 57'
Sump Length: 2"
10'
67'
Borehole Diameter: 6"

Well Completion
Guard Posts ([✓ Y] / N) Date:
Surface Pad Size: 2 ft x 2 ft
Protective Casing or Cover
Diameter/Type: 2"
Depth BGS: ~1.5' Weep Hole (Y / [✓ N])
Grout
Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 8/25/2020
Type: AV ~~Aquaguard~~ bentonite ~~+ grout~~ pellets
Source: ~~Aquaguard~~ Pel-Plug TR30
Set-up/Hydration Time: 1.5hr
Placement Method: tremie pipe
Vol. Fluid Added:
Filter Pack
Type: 20-30 Sand (typeII)
Source: Southern Products
Amount Used:
Placement Method: tremie
Well Riser Pipe
Casing Material: Sch 40 PVC
Casing Inside Diameters: 2 in.
Screen
Material: Sch 40 PVC
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area:
Sump or Bottom Cap ([✓ Y] / N)
Type/Length: PVC 2"
Backfill Plug ([✓ Y] N)
Material: bentonite pellets TR30 1/4"
Placement Method: gravity
Set-up/Hydration Time: 0hr
Total Water Volume During Construction
Introduced (Gal): ~250 Recovered (Gal):
Reviewed By: Alleyry Date: 8/25/2020

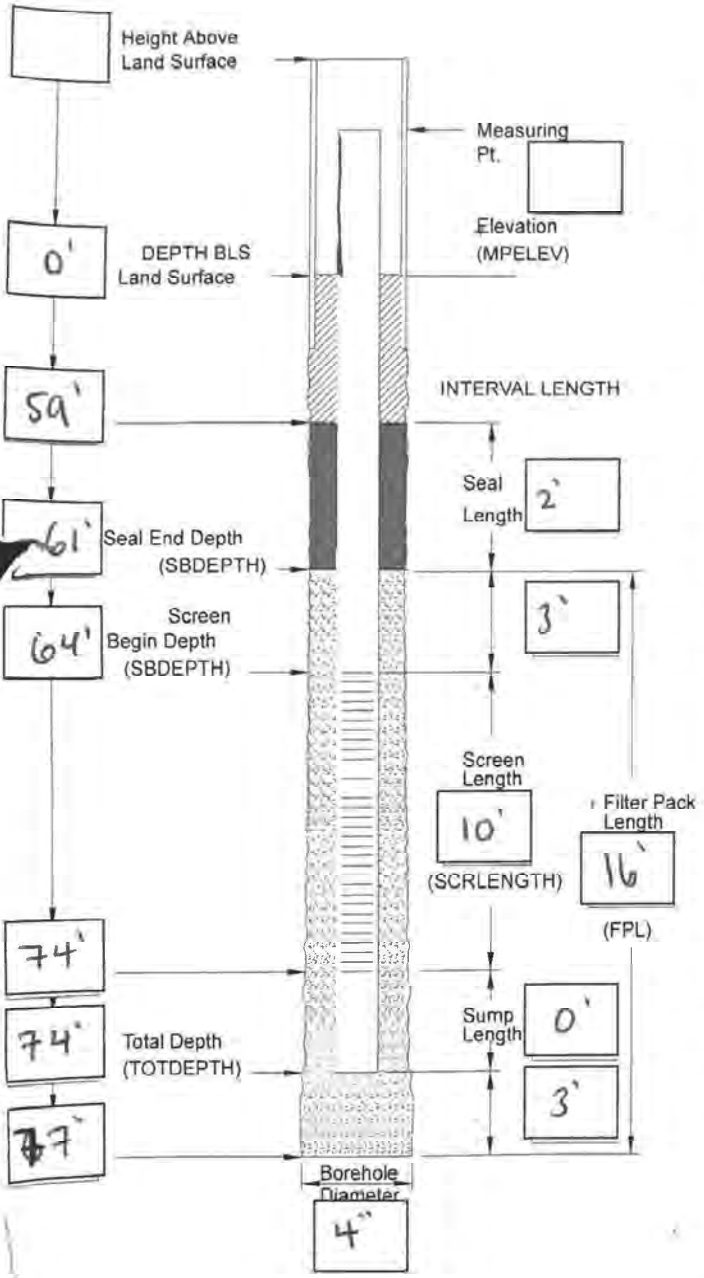
Comments
2' of sand filter pack below screen.

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-12

Drilling Company: SAEDACCO
Drillers: Will Keyes
Geologist/Engineer: Justin Hobart
Signature: Justin Hobart

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 9/1/20
Well Type: Type II monitoring well
Well Completion Method: stick-up
Geologic Completion Zone: Black Creek aquifer



DEPTH BLS Land Surface: 0'
59'
Seal Length: 2'
Seal End Depth (SBDEPTH): 61'
3'
Screen Begin Depth (SBDEPTH): 64'
Screen Length (SCRLENGTH): 10'
Filter Pack Length (FPL): 16'
74'
Sump Length: 0'
Total Depth (TOTDEPTH): 74'
3'
77'
Borehole Diameter: 4"

Well Completion
Guard Posts ([✓ Y] / N) Date: ~~9/2/20~~ 9/8/2020
Surface Pad Size: 2 ft x 2 ft
Protective Casing or Cover
Diameter/Type: 3-inch steel casing
Depth BGS: ~ 1 ft Weep Hole (Y / [✓ N])
Grout
Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 9/1/20
Type: time-release 1/4" bentonite pellets
Source: Pel-Plug TR30, 1/2 bucket
Set-up/Hydration Time: 1.5 hours
Placement Method: gravity/tremie
Vol. Fluid Added: —
Filter Pack
Type: 20/40 sand
Source: Southern Products + Silica Co.
Amount Used: 7 bags
Placement Method: gravity
Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 2 in.
Screen
Material: SCH-40 PVC
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area: —
Sump or Bottom Cap (Y / [✓ N])
Type/Length: 10 ft
Backfill Plug ([✓ Y] / N)
Material: 20/40 sand
Placement Method: gravity
Set-up/Hydration Time: N/A
Total Water Volume During Construction
Introduced (Gal): 450 Recovered
(Gal):
Reviewed
By: Date:

Comments

FLWP/Forms/Field forms/Well Construction/Well Construction Logs

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-13

Drilling Company: SAEDACCO

Drillers: Will Keyes

Geologist/Engineer: Justin Hobart

Signature: Justin Hobart

Site: Chemours

Project Number: TR0795

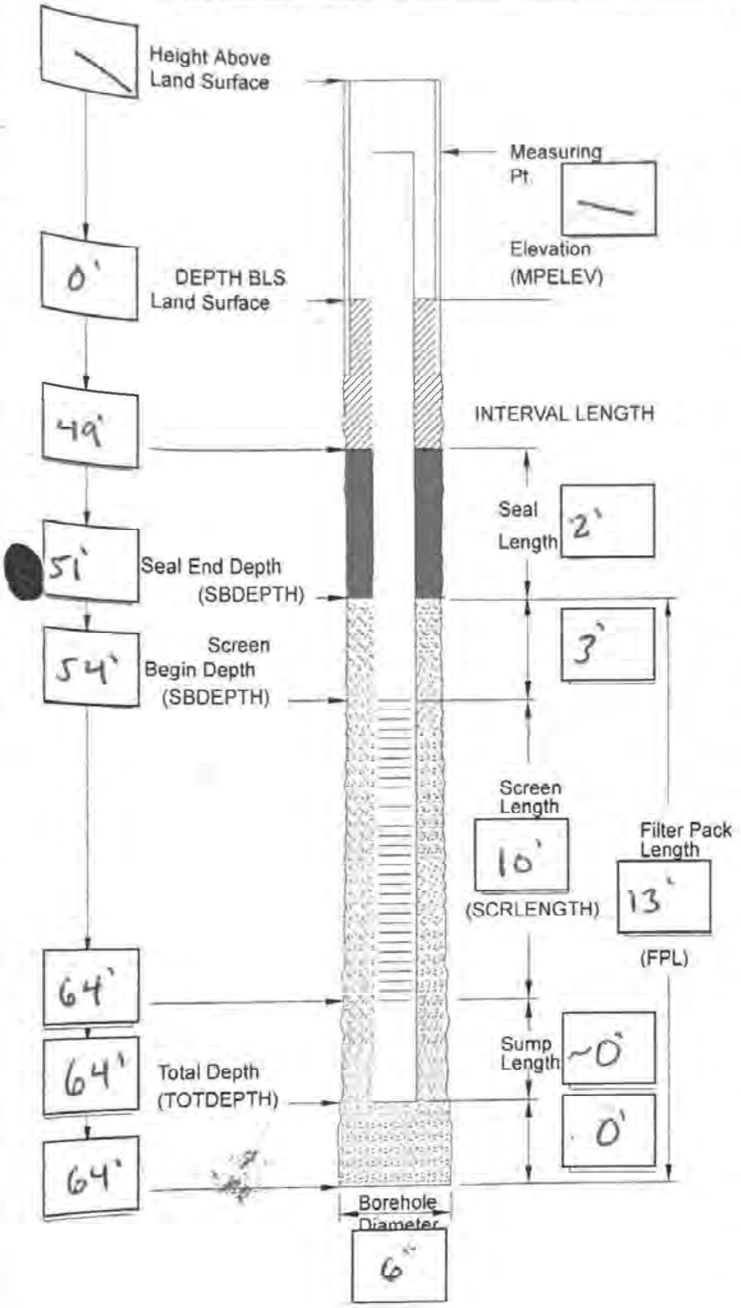
Installation Method: sonic

Casing Installation Date: 9/3/20

Well Type: Type II monitoring

Well Completion Method: stick-up

Geologic Completion Zone: Black Creek aquifer



Well Completion

Guard Posts ([✓ Y] / N) Date: ~~9/4/20~~ AV 9/8/20

Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover

Diameter/Type: 3" steel casing

Depth BGS: Weep Hole (Y / [✓ N])

Grout

Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 9/3/20

Type: bentonite pellets 1/4"

Source: Pel-Plug TR30

Set-up/Hydration Time: 1.5 hours

Placement Method: gravity + tremie pipe

Vol. Fluid Added: —

Filter Pack

Type: 20/40 sand

Source: Southern Products + Silica Co.

Amount Used: 5 bags

Placement Method: gravity

Well Riser Pipe

Casing Material: SCH-40 PVC

Casing Inside Diameters: 2 in.

Screen

Material: SCH-40 PVC

Inside Diameter: 2 in.

Screen Slot Size: 0.010 in.

Percent Open Area: —

Sump or Bottom Cap (Y / [✓ N])

Type/Length: 10-foot

Backfill Plug (Y / [✓ N])

Material:

Placement Method:

Set-up/Hydration Time:

Total Water Volume During Construction

Introduced (Gal): Recovered (Gal):

Reviewed

By: Date:

Comments

FLWP/Forms/Field forms/Well Construction/Well Construction Logs

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-14

Drilling Company: SAEDACCO

Drillers: Will Keyes

Geologist/Engineer: Justin Hobart

Signature: Justin Hobart

Site: Chemours

Project Number: TR0795

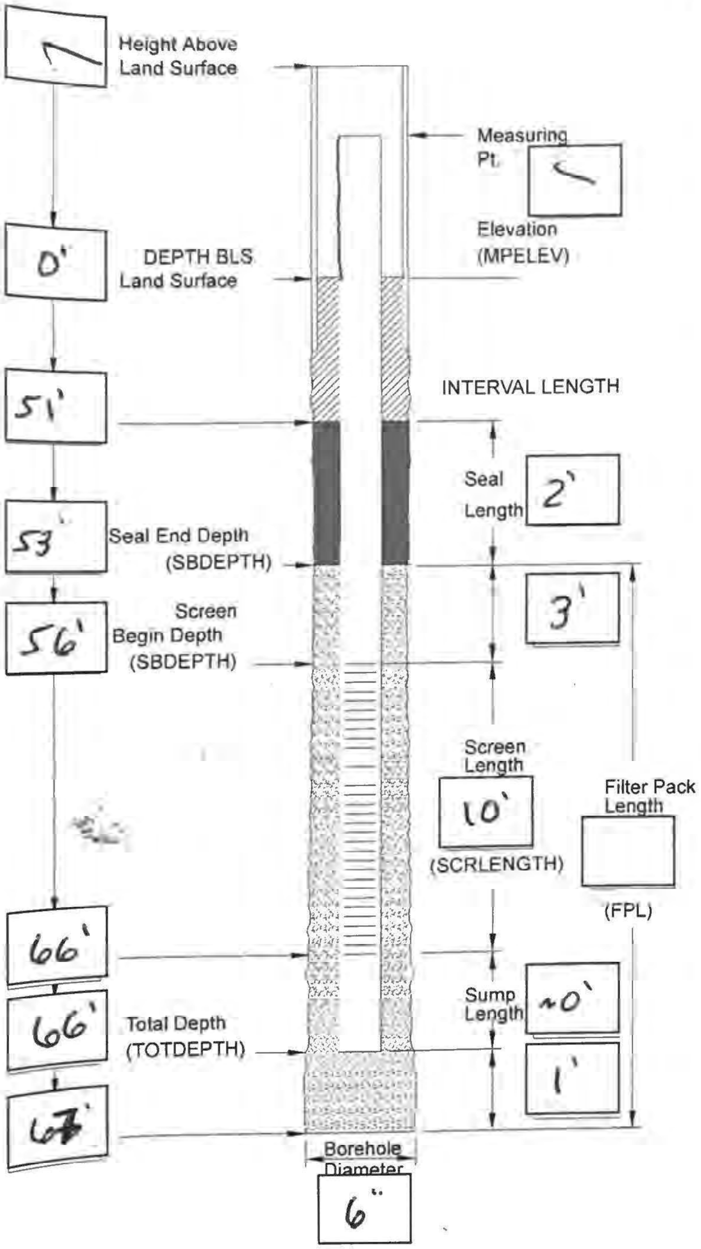
Installation Method: Sonic

Casing Installation Date: 9/4/20

Well Type: Type II, groundwater monitoring

Well Completion Method: Stick-up

Geologic Completion Zone: Black Creek aquifer



1 Height Above Land Surface

Measuring Pt. — Elevation (MPELEV)

0' DEPTH BLS Land Surface

51'

INTERVAL LENGTH

Seal Length 2'

53 Seal End Depth (SBDEPTH)

3'

56' Screen Begin Depth (SBDEPTH)

Screen Length 10' (SCRLENGTH)

Filter Pack Length (FPL)

66'

Sump Length ~0'

66' Total Depth (TOTDEPTH)

1'

67'

Borehole Diameter 6"

Well Completion

Guard Posts ([✓ Y] / N) Date:

Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover

Diameter/Type: 3" Steel protective casing

Depth BGS: ~1 ft Weep Hole (Y / [✓ N])

Grout

Composition/Proportions: Aquaguard (added on ~~9/9/20~~) JH 9/9/2020

Placement Method: tremie pipe

Seal Date: 9/4/20

Type: Bentonite pellets, time-release

Source: Pel-Plug TR30

Set-up/Hydration Time: 1.5 hrs.

Placement Method: gravity

Vol. Fluid Added: —

Filter Pack

Type: 20/40 Sand

Source: Southern Products + Silica Co.

Amount Used:

Placement Method: gravity

Well Riser Pipe

Casing Material: SCH-40 PVC

Casing Inside Diameters: 2 in.

Screen

Material: SCH-40 PVC

Inside Diameter: 2 in.

Screen Slot Size: 0.010 in.

Percent Open Area: —

Sump or Bottom Cap (Y / [✓ N])

Type/Length: 10 ft

Backfill Plug (Y / [✓ N])

Material:

Placement Method:

Set-up/Hydration Time:

Total Water Volume During Construction

Introduced (Gal): Recovered (Gal):

Reviewed

By: Date:

Comments

FLWP/Forms/Field forms/Well Construction/Well Construction Logs

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-15

Drilling Company: SAEDACCO

Drillers: WILL KEYES / DYLAN EIERST / JOHN GOFF

Geologist/Engineer: ALLI VO

Signature:

Site: CHEMOURS

Project Number: TR0795

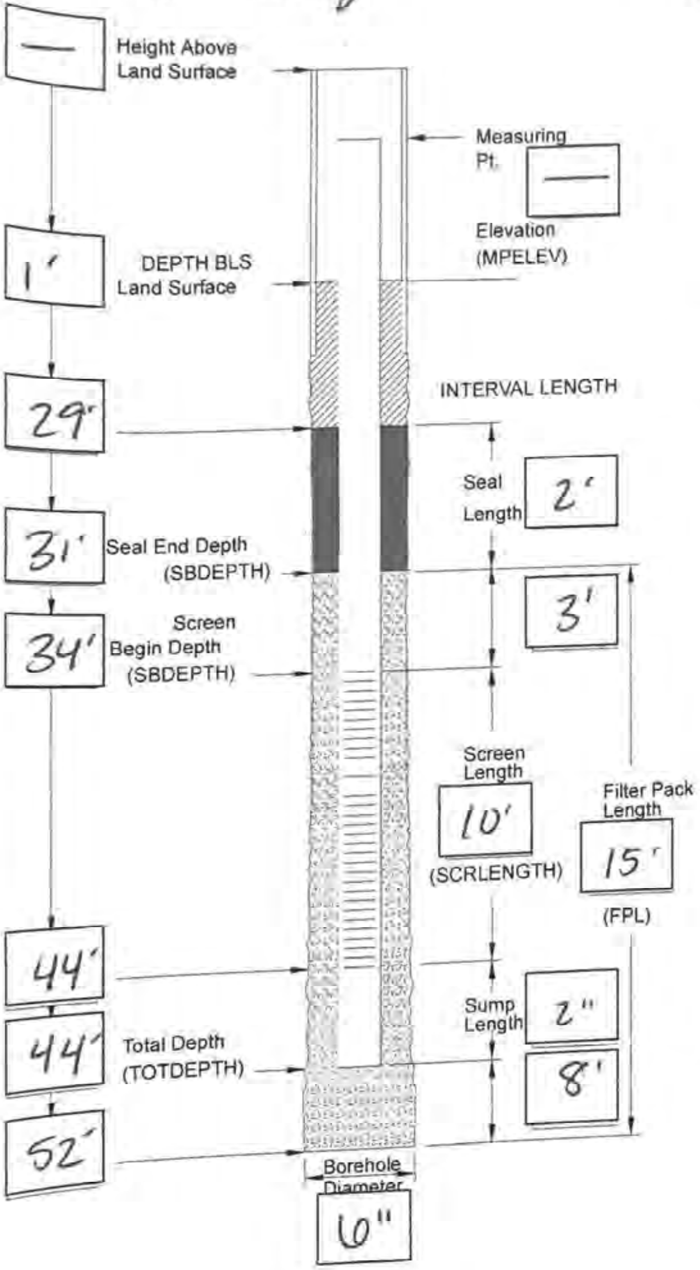
Installation Method: SONIC

Casing Installation Date: 9/9/2020

Well Type: II

Well Completion Method: ~~Hee~~ Stick up

Geologic Completion Zone: UCC / BCA



Height Above Land Surface: —

Measuring Pt. Elevation (MPELEV): —

DEPTH BLS Land Surface: 1'

29'

Seal End Depth (SBDEPTH): 31'

Screen Begin Depth (SBDEPTH): 34'

44'

Total Depth (TOTDEPTH): 44'

52'

Seal Length: 2'

3'

Screen Length (SCRLENGTH): 10'

Filter Pack Length (FPL): 15'

Sump Length: 2"

8'

Borehole Diameter: 6"

Well Completion

Guard Posts ([✓ Y] / N) Date: 9/10/2020

Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover

Diameter/Type: Steel / 3"

Depth BGS: ~2' Weep Hole (Y / [✓ N])

Grout

Composition/Proportions: Aquaguard

Placement Method: tremie pipe

Seal Date: 9/9/2020

Type: bentonite pellet

Source: Pel-Plug 1/4" TR30

Set-up/Hydration Time: 1/2 bucket

Placement Method: gravity

Vol. Fluid Added: 0 gal

Filter Pack

Type: II (20-30)

Source: Southern Products & Silica Co

Amount Used: 6 bags

Placement Method: gravity

Well Riser Pipe

Casing Material: PVC Sch 40

Casing Inside Diameters: 2 in.

Screen

Material: PVC Sch 40

Inside Diameter: 2" in.

Screen Slot Size: 0.010 in.

Percent Open Area: —

Sump or Bottom Cap ([✓ Y] / N)

Type/Length: PVC / 2"

Backfill Plug ([✓ Y] / N)

Material: Pel-Plug 1/4" pellets bentonite

Placement Method: tremie pipe

Set-up/Hydration Time: 0hr / 1545

Total Water Volume During Construction

Introduced (Gal): ______ Recovered (Gal): ______

Reviewed

By: ______ Date: ______

Comments

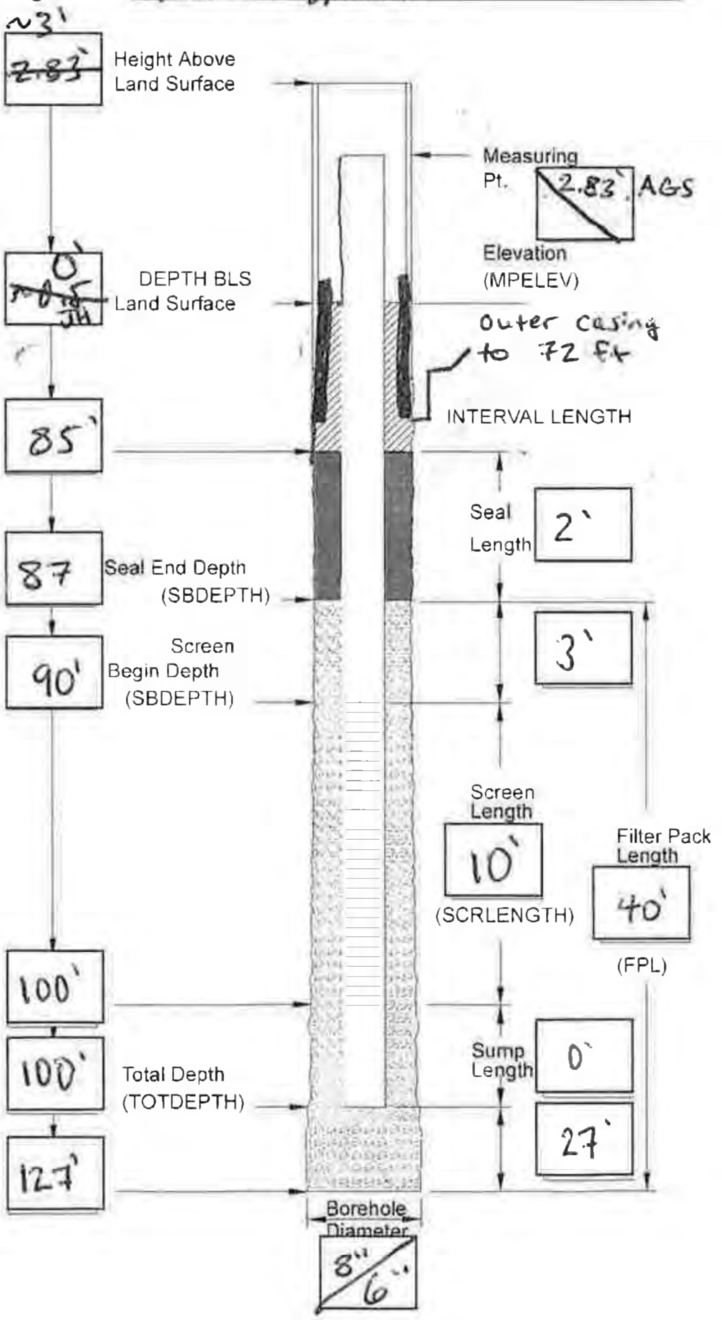
2' of sand below the screen/above bentonite backfill

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-16D

Drilling Company: SAEDACCO
Drillers: Will Keyes
Geologist/Engineer: Justin Hobart
Signature: Justin Hobart

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: Outer = 8/19 main = 8/20/20
Well Type: Type III Monitoring
Well Completion Method: Stick-up
Geologic Completion Zone: Black Creek aquifer



Well Completion
Guard Posts ([✓ Y] / N) Date: 8/20/20
Surface Pad Size: 2 ft x 2 ft

Protective Casing or Cover
Diameter/Type: 3" Steel stick-up
Depth BGS: ~1 ft Weep Hole (Y / [✓ N])

Grout
Composition/Proportions: Aquaguard, Type I Holcim Portland cement added around outer casing to 72 ft
Placement Method: tremie pipe

Seal Date: 8/20/20
Type: Bentonite time-release pellets 1/4"
Source: Pel-Plug TR30 (~1/2 bucket)
Set-up/Hydration Time: 1.5 hrs.
Placement Method: tremie pipe + gravity
Vol. Fluid Added:

Filter Pack
Type: Type II 20/30 sand
Source: Southern Product + Silica Co.
Amount Used: 4 bags sand
Placement Method: gravity

Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 2 in.

Screen
Material: SCH.40 PVC
Inside Diameter: 20 in.
Screen Slot Size: 0.010 in.
Percent Open Area: —
Sump or Bottom Cap (Y / [✓ N])
Type/Length: 10 ft

Backfill Plug ([✓ Y] / N)
Material: Type II 20/30 sand
Placement Method: gravity/tremie
Set-up/Hydration Time: NA

Total Water Volume During Construction
Introduced (Gal): ~2,500 Recovered (Gal): * more water than other wells due to outer casing and depth

Reviewed
By: Date:

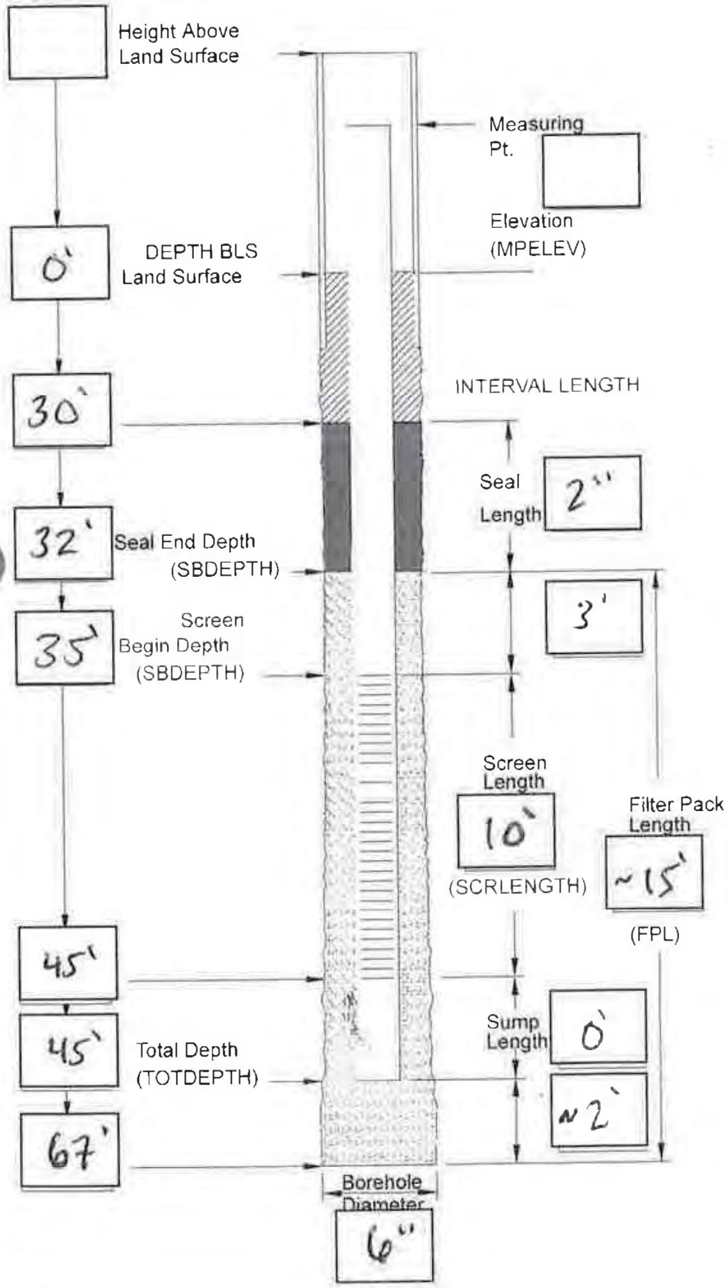
Comments
Outer casing (6" PVC) set at 72', ~3' into Black Creek clay; Backfilled from 100-127' with sand.

WELL CONSTRUCTION LOG
ABOVE GROUND COMPLETION

Well I.D.: PIW-16S

Drilling Company: SAEDACCO
Drillers: Will Keyes, Dylon Fierst
Geologist/Engineer: Justin Hobart
Signature: Justin Hobart

Site: Chemours
Project Number: TR0795
Installation Method: Sonic
Casing Installation Date: 8/18/20
Well Type: II Monitoring
Well Completion Method: stick-up
Geologic Completion Zone: Surficial aquifer



Height Above Land Surface:
Measuring Pt. Elevation (MPELEV):
DEPTH BLS Land Surface: 0'
30'
Seal Length: 2"
Seal End Depth (SBDEPTH): 32'
3'
Screen Begin Depth (SBDEPTH): 35'
Screen Length (SCRLENGTH): 10'
Filter Pack Length (FPL): ~15'
45'
Sump Length: 0'
Total Depth (TOTDEPTH): 45'
~2'
67'
Borehole Diameter: 6"

Well Completion
Guard Posts ([✓ Y] / N) Date:
Surface Pad Size: 2 ft x 2 ft
Protective Casing or Cover
Diameter/Type: ~3" steel stick-up
Depth BGS: ~1 ft Weep Hole (Y / N)
Grout
Composition/Proportions: Aquaguard
1 bag, 25 gallons
Placement Method: tremie pipe

Seal Date: 8/18/20
Type: 1/4" bentonite pellets
Source: Pel-plug TR30
Set-up/Hydration Time: >1.5 hrs
Placement Method: tremie pipe
Vol. Fluid Added: ~1 bucket
Filter Pack
Type: 20/30 sand
Source: Southern Products & Silica ~~Inc~~ Co
Amount Used: 6 bags
Placement Method: gravity
Well Riser Pipe
Casing Material: SCH-40 PVC
Casing Inside Diameters: 2 in.
Screen
Material: SCH-40 PVC
Inside Diameter: 2 in.
Screen Slot Size: 0.010 in.
Percent Open Area: —
Sump or Bottom Cap (Y / [✓ N])
Type/Length: 10'
Backfill Plug ([✓ Y] / N)
Material: 20/30 sand
Placement Method: gravity
Set-up/Hydration Time: N/A
Total Water Volume During Construction
Introduced (Gal): ~350 gall. Recovered (Gal):
Reviewed
By: Date:

Comments
Added 1 bag sand beneath the screen (remaining depth collapsed)

Geosyntec
consultants

DAILY FIELD REPORT

PROJECT NO.: TR0795
PHASE NO.: [illegible]
DATE: 08/04/2020
PAGE 2 of 2
CLIENT NAME: Chemours
GEOSYNTEC REP.: Nick Charles (NC)
Alli Vo (AV)
LOCATION: Fayetteville

0900: NC leaves for Chemours
1300: NC arrives for tailgate safety brief.
1330: NC and AV discuss project plans
1400: NC and AV oversee well completion for OW-2 and OW-3
1700: Everyone off-site

COPY TO: ______ **GEOSYNTEC REP.:** _____ HRS: _____
REVIEWED BY: ____________

NC 08/04/2020

Daily Field Report

Project Name: Chemours
Project Number: TR0745 PDI 40
Field Personnel: Nick Charles (NC)
Recorded By: NC
Weather: Sunny / Cloudy

Date: 08/05/2020
Page ___ of ___
Primary Activities: Well development

Time	Description of Activites
0700	NC and AV give tailgate brief to SAFDACCo
0750	NC and John G. Start development on OW-1
1317	stopped purge on OW-1, successfully developed OW-1
1500	NC and John G. Start development on EW-1
1630	Parameters not met, stopped purge for mobilization off-Site
1700	Everyone off Site

NC 08/05/2020

Daily Field Report

Project Name: Chemours
Project Number: TR0795 PDT 40
Field Personnel: Nick Charles (NC)
Recorded By: NC
Weather: Sunny / cloudy

Date: 08/06/2020
Page ___ of ___
Primary Activities: Well Development

Time	Description of Activites
0700	NC and AV give tailgate brief to SAEDACCO
0745	NC and John G. continue with well development of EW-1
1005	Purge stopped, parameters met, successfully developed EW-1
1100	NC and John G start well development on OW-2
1410	Parameters met, successfully developed OW-2
14:30	Unloaded IDW, "weather issues"
1600	Prepared OW-3 for development
1700	Everyone off-site

NC 08/06/2020

Geosyntec
consultants

Daily Field Report

Project Name: Chemours
Project Number: TR0795 PDI 40
Field Personnel: Nick Charles (NC)
Recorded By: NC
Weather: Sunny

Date: 08/07/2020 Page ___ of ___
Primary Activities: well Development

Time	Description of Activites
0700	NC and AV give tailgate Safety brief to SAEDACCO
0740	NC and John G. Start Development of OW-3
1150	Purge stopped, goal not met but drillers leave early, unload IDW
1200	Everyone off-site, NC drives back to Greenville for the weekend
1700	NC arrives back in Greenville, SC

NC 08/07/2020

Geosyntec consultants

DAILY FIELD REPORT

PROJECT NO.: TR0795
PHASE NO.: PDI/40
DATE: 08/10/20
PAGE 2 of 2
CLIENT NAME: Chemours
GEOSYNTEC REP.: Nick Charles
LOCATION: Fayetteville

0900: NC drives to nearest Enterprise to exchange for a truck to get totes into the backcountry areas on-site
1000: NC meets with Justin Hoban and Alli Vo on-site
1030: Geosyntec mobilizes to EW-3 to start safety meeting with SAEDACCO
1115: SAEDACCO continues drilling efforts at EW-3, NC acts as oversight along with JH and AV while waiting for John G. to get on-site to continue well development at OW-3.
1230: John G on-site and NC and John G continue well development at OW-3.
1605: Stopped developing due to inclement weather, unloaded IDW
1700: Everyone off-site

COPY TO: ______ GEOSYNTEC REP.: _____ HRS: _____
REVIEWED BY: ____________

NC 08/10/2020

Daily Field Report

Project Name: TR0795 - Chemours
Project Number: PDI 40
Field Personnel: Nick Charles (NC)
Recorded By: Nick Charles
Weather: Sunny

Date: 08/11/2020 Page 1 of 1
Primary Activities: Well Development

Time	Description of Activites
0700	Justin Holart (JH) and NC do tailgate brief with Saldacco drillers
0745	NC and John G. continue well development on OW-3
0845	Well successfully developed at OW-3
0950	Start development of EW-4
1645	Stop for the day, development not successful yet.
1700	All off-Site

NC 08/11/2020

Geosyntec
consultants

Daily Field Report

Project Name: Chemours TR0795
Project Number: PDI 40
Field Personnel: Nick Charles (NC)
Recorded By: Nick Charles
Weather:

Date: 08/12/2020 Page ___ of ___
Primary Activities: Well Development

Time	Description of Activites
0700	Justin Hobart (JH) and NC do tailgate brief with Saldacco
	drillers
0830	Development continued at EW-4
1040	EW-4 successfully developed
1330	Development started on OW-5
1600	OW-5 successfully developed, stopped purge
1615	JAW and prep for next well (OW-4)
1700	Everyone off-site

NC 08/12/2020

Geosyntec
consultants

DAILY FIELD REPORT

PROJECT NO.: Chemours - TR0795	**PHASE NO.:**	**DATE:** 08/13/2020	**PAGE 2 of 2**	
CLIENT NAME: PDI - 40	**GEOSYNTEC REP.:** Nick Charles (NC)			
LOCATION: Fayetteville				

0700: Justin Hobart (JH) and NC do tailgate brief with Saedacco
0730: NC and John G. begin development of OW-4
1020: Parameters met, purge stopped, successfully developed OW-4
1420: Began development of EW-3
1630: Goal parameters not yet met, unload IDW
1700: Everyone off-site

COPY TO: ______ **GEOSYNTEC REP.:** ____ HRS: ____
REVIEWED BY: __________

NC 08/13/2020

Geosyntec consultants

DAILY FIELD REPORT

PROJECT NO.: TR 0795
PHASE NO.: PDI 40
DATE: 08/14/2020
PAGE 2 of 2
CLIENT NAME: Chemours
GEOSYNTEC REP.: Nick Charles (NC)
LOCATION: Fayetteville

0700: Justin Holact (JH) and NC do tailgate brief with Saedacco
0745: NC and John G. Continue Development of EW-3
1200: stopped Purge, Parameters met, successfully developed EW-3
1230: Everyone off-site, NC drives back to Greenville
1700: NC arrives back in Greenville, SC.

COPY TO: ________ GEOSYNTEC REP.: _____ HRS: ______
REVIEWED BY: ______________

NC 08/14/2020

Chemours PDI TR0795/40
8/27/2020
Transducer Deployment - Aquifer Testing
Water Level Meter Heron dipper-T # 024738

NOTE: KEN STEWART (Parsons) deployed at delayed for 5PM. 8/27/2020

WELL ID	SERIAL NO	SCREEN	STRING LENGTH	TRANSDUCER DEPTH	(TOC) DTW INITIAL	DTW FINAL	TOC HEIGHT	TIME SET
EW-1	0052123702	40-60'	~~53.33'~~ 49.45'	50.0' bgs	32.84'	32.83'	~~3.3~~ AV -0.55' bgs	1335
+ baro-logger	0012124274	40-60'	25'	25.0'	32.83'	32.83'		1545
OW-1	0052123594	40-50'	48.33'	45'	35.33'	35.32'	3.33	1410
EW-3	0052123692	37-67'	52.50	52'	15.08'	15.06'	0.4'	1445
OW-5	0052123689	54-64	62.48	59'	19.93	19.91	3.48'	1500
EW-2	0052123702	40-65	42.4' ~~43'~~	43'	30.82'	30.81'	-0.60	1525

Project Name: Chemours
Location: Fayetteville
Date: 11/04/20
Project Number: TR0795A
Phase/Task: 07
Personnel: RG/MS/J.

Pumping Well: EW-1
Transducer Depth: 48.5
Serial No: Insitu
Screen Interval (ft) 40-60
Well Diameter (in) 6"
Tubing Diameter (in) 1.5"
Pump/Tubing Setting (ft) 50'
Barometer Serial No: 2124274
DTW (ft) 32.12
DTB (ft) 60.0
Casing Height (ft) 0.0
Measurement Location: TOC
Barometer Depth: 25

Observation Well 1: OW-1
Transducer Depth: 48.3
Serial No:
Observation Well 2: PIW-2D
Transducer Depth: 48
Serial No: 212359
Obs. Well 1 DTW (ft): 35.59
Obs. Well 2 DTW (ft): 36.81
OW-10 34.96

OW-10: set 47.4'
2123700

Test Start Date: 11/4/20
Test Start Time: 1240
Test End Date:
Test End Time:
Water Level Meter Model/Serial #: heron

11/4/2020

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	~~Drawdown~~ Observation Point #3 (ft bgs)	Pumping Rate (gpm)	Comments
		EW-1		OW-1		PIW-2D	OW-10		
1230		32.12		35.58		36.80	34.95		12 gpm started
124050		35.82		37.28		38.17	36.38	5.5	reduced 5gpm,
1300		36.80		37.79		38.69	36.72	6.8	increased flow contr
1310		36.62		37.77		38.73	36.76	6.4	to 28% → 7.4gpm
1320		36.65		37.78		38.78	36.75	6.33	Fine Manifold valve
1330		36.67		37.80		38.79	36.76	6.35	→ 6.4gpm
1350		36.75		37.86		38.82	36.81	6.25	
1420		36.81		37.88		38.85	36.83	6.25	
1440		36.90		37.91		38.88	36.86	6.3	
1500		36.93		37.93		38.91	36.88	6.3	
1530		36.92		37.96		38.93	36.91	6.3	
1600		36.98		37.98		38.95	36.93	6.3	
1630		37.01		37.99		38.96	36.94	6.28	
1700		37.03		38.02		38.99	36.96	6.28	
1730		37.05		38.02		38.99	36.96	6.28	
1800		37.06		38.03		39.00	36.98	6.28	
1830		37.07		38.04		39.01	36.99	6.28	
1900		37.09		38.06		39.02	36.99	6.27	
2010		37.00		38.03		39.00	36.98	6.05	
2013									Stopped process to refuel
2036		37.13		38.03		38.95	36.94	6.4	
2050		37.23		38.16		39.08	37.08	6.6	
2100		37.26		38.17		39.13	37.08	6.6	
2110		37.28		38.19		39.13	37.10	6.5	→ See next page

estart @ 2024

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = (

Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville
Date: 11/4 - 11/5
Project Number: TR0795
Phase/Task:
Well ID: EW-1

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
~~2120~~		EW-1		DW-1		PZ-21D	DW-10	~~6.55~~	
2120		37.30		38.20		39.16	37.11	6.55	
2130		37.31		38.21		39.16	37.12	6.55	
2140		37.33		38.22		39.17	37.12	6.55	
2200		37.35		38.23		39.17	37.14	6.55	
2220		37.37		38.24		39.18	37.14	6.55	
2240		37.39		38.24		39.18	37.15	6.55	
2310		37.41		38.25		39.20	37.16	6.60	
2340		37.43		38.26		39.21	37.17	6.60	
0010		37.44		38.27		39.22	37.17	6.60	
0040		37.45		38.27		39.21	37.18	6.60	
0110		37.47		38.27		39.21	37.17	6.60	
0140		37.48		38.27		39.22	37.18	6.60	
0210		37.48		38.27		39.22	37.18	6.65	
0240		37.49		38.28		39.22	37.19	6.65	
0310		37.50		38.29		39.23	37.19	6.64	
0340		37.51		38.29		39.23	37.20	6.65	
0410		37.53		38.31		39.24	37.21	6.65	
0440		37.51		38.30		39.24	37.21	6.65	
0444	Cut power to refill gas								
0505	Turn power back on. Set flow rate to 6.5 gpm.								
0515		37.31		38.21		39.15	37.12	6.6	
0525		37.32		38.22		39.18	37.14	6.6	
0535		37.34		38.24		39.18	37.15	6.6	
0545		37.35		38.24		39.19	37.16	6.6	
0555		37.36		38.25		39.19	37.16	6.6	
0605		37.37		38.25		39.20	37.16	6.6	
0625		37.37		38.25		39.20	37.17	6.6	
0645		37.42		38.26		39.21	37.18	6.6	
0705		37.40		38.27		39.22	37.19	6.6	
0735		37.42		38.27		39.22	37.19	6.6	
0805		37.44		38.29		39.23	37.20	6.6	Shift change
0830		37.42		38.30		39.24	37.21	6.6	
0900		37.45		38.31		39.25	37.21	6.65	
0930		37.50		38.32		39.25	37.22	6.65	
11/5/2020 10:00		~~38~~37.48		38.32		39.25	37.22	6.65	
1030		37.49		38.32		39.25	37.22	6.65	
1042		37.39		38.28		39.22	37.19	6.55	
1044				~~37.84~~	11/4/2020				Shutdown for refuel
1050		37.32		37.84		38.68	36.77	6.6	startup
1100		37.36		38.2		39.09	37.1	6.65	
1112		37.43		38.28		39.202	37.18	6.65	adjust B-valve from 6.7 to 6.65 gpm

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: *Chemours* Location: *Fayetteville* Date: *11/4 - 11/5*

Project Number: *TR0795* Phase/Task: ______ Well ID: *EW-1*

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
		EW-1		OW-1		PIW-2D	OW-10		
1120	Circuit breaker trip, reset breaker + restart motor								
1128	〃							〃	
1130	Reduce flow controller + increas D-valve								
1142		37.36		38.26	~~39.14~~	39.19	37.16	6.6	
1200		37.38		38.27		39.20	37.18	6.58	
1230		37.35		38.26		39.20	37.17	6.6	
1300		37.39		3826		39.19	37.17	6.6	
1330		37.36		38.26		39.20	37.17	6.6	
1400		37.37		37.26		39.20	37.17	6.6	
1430		37.42		38.27		39.22	37.19	6.7	
1440	Shutdown PUMP								
11/6/2020 0940		32.31		35.69		36.91	35.04		
1005		32.31		35.69		36.91	35.03		
1020		32.31		35.69		36.91	35.03		
1027		32.31		35.68		36.91	35.03		
1031		32.31		35.68		36.91	35.03		
1039		32.31		35.68		36.91	35.03		

Take transducers out from OW-1

Take transducers out from OW-10

Take transducers out from EW-1 and PIW-2D

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville
Date: 11/04/20
Project Number: TR0795A
Phase/Task: 07
Personnel: RG/MS/J

Pumping Well: EW-1
Transducer Depth: 48.5
Serial No: Insitu
Screen Interval (ft) 40-60
Well Diameter (in) 6"
Tubing Diameter (in) 1.5"
Pump/Tubing Setting (ft) 50'
Barometer Serial No: 2124274
DTW (ft) 32.12
DTB (ft) 60.0
Casing Height (ft) 0.0
Measurement Location: TOC
Barometer Depth: 25

Observation Well 1: OW-1
Transducer Depth: 48.3
Serial No:
Observation Well 2: PIW-2D
Transducer Depth: 48
Serial No: 212359
Obs. Well 1 DTW (ft): 35.59
Obs. Well 2 DTW (ft): 36.81 OW-10 34.96

OW-10: set 47.4'
2123700

Test Start Date: 11/4/20
Test Start Time: 1240
Test End Date:
Test End Time:
Water Level Meter Model/Serial #: heron

11/04/2020

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	~~Drawdown~~ Observation Point #3 (ft bgs)	Pumping Rate (gpm)	Comments
		EW-1		OW-1		PIW-2D	OW-10		
1230		32.12		35.58		36.80	34.95		12 gpm started
1240		35.82		37.28		38.17	36.38	5.5	reduced 5gpm,
1300		36.80		37.79		38.69	36.72	6.8	increased flow contr.
1310		36.62		37.77		38.73	36.76	6.4	to 28% → 7.4gpm,
1320		36.65		37.78		38.78	36.75	6.35	Fine Manifold valve
1330		36.67		37.80		38.79	36.76	6.35	→ 6.4gpm
1350		36.75		37.86		38.82	36.81	6.25	
1420		36.81		37.88		38.85	36.83	6.25	
1440		36.90		37.91		38.88	36.86	6.3	
1500		36.93		37.93		38.91	36.88	6.3	
1530		36.92		37.96		38.93	36.91	6.3	
1600		36.98		37.98		38.95	36.93	6.3	
1630		37.01		37.99		38.96	36.94	6.28	
1700		37.03		38.02		38.99	36.96	6.28	
1730		37.05		38.02		38.99	36.96	6.28	
1800		37.06		38.03		39.00	36.98	6.28	
1830		37.07		38.04		39.01	36.99	6.28	
1900		37.09		38.06		39.02	36.99	6.27	
2010		37.00		38.03		39.00	36.98	6.05	
2013									Stopped process to refuel
2036		37.13		38.03		38.95	36.94	6.4	
2050		37.23		38.16		39.08	37.08	6.5	
2100		37.26		38.17		39.13	37.08	6.6	
2110		37.28		38.19		39.13	37.10	6.5	→ See next page

restart @ 2024

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = (

Project Name: Chemours
Location: Fayetteville
Date: 11/4 - 11/5
Project Number: TR0795
Phase/Task:
Well ID: EW-1

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
~~2120~~		EW-1		OW-1		PIW-20	OW-10	~~6.55~~	
2120		37.30		38.20		39.16	37.11	6.55	
2130		37.31		38.21		39.16	37.12	6.55	
2140		37.33		38.22		39.17	37.12	6.55	
2200		37.35		38.23		39.17	37.14	6.55	
2220		37.37		38.24		39.18	37.14	6.55	
2240		37.39		38.24		39.18	37.15	6.55	
2310		37.41		38.25		39.20	37.16	6.60	
2340		37.43		38.26		39.21	37.17	6.60	
0010		37.44		38.27		39.22	37.17	6.60	
0040		37.45		38.27		39.21	37.18	6.60	
0110		37.47		38.27		39.21	37.17	6.60	
0140		37.48		38.27		39.22	37.18	6.60	
0210		37.48		38.27		39.22	37.18	6.65	
0240		37.49		38.28		39.22	37.19	6.65	
0310		37.50		38.29		39.23	37.19	6.69	
0340		37.51		38.29		39.23	37.20	6.65	
0410		37.53		38.31		39.24	37.21	6.65	
0440		37.51		38.30		39.24	37.21	6.65	
0444		Cut power to refill gas							
0505		Turn power back on. Set flow rate to 6.5 gpm.				39.15	37.12	6.6	
0515		37.31		38.21		39.18	37.14	6.6	
0525		37.32		38.22		39.18	37.15	6.6	
0535		37.34		38.24		39.19	37.16	6.6	
0545		37.35		38.24		39.19	37.16	6.6	
0555		37.36		38.25		39.20	37.16	6.6	
0605		37.37		38.25		39.20	37.17	6.6	
0625		37.37		38.25		39.21	37.18	6.6	
0645		38.42		38.26		39.22	37.19	6.6	
0705		37.40		38.27		39.22	37.19	6.6	
0735		37.42		38.27		39.23	37.20	6.6	Shift change
0805		37.44		38.29		39.24	37.21	6.6	
0830		37.42		38.30		39.25	37.21	6.65	
0900		37.45		38.31		39.25	37.22	6.65	
0930		37.50		38.32		39.25	37.22	6.65	
11/5/2020 10:00		~~38~~37.48		38.32		39.25	37.22	6.65	
1030		37.49		38.32		39.22	37.19	6.55	
1042		37.39		38.28					Shutdown for refuel
1044				~~37.84~~ 11/4/2020		38.68	36.77	6.6	startup
1050		37.32		37.84		39.09	37.1	6.65	
1100		37.36		38.2		39.202	37.18	6.65	adjust valve from
1112		37.43		38.28					6.7 to 6.65 gpm

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville
Date: 11/4 - 11/5
Project Number: TR0795
Phase/Task:
Well ID: EW-1

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
		EW-1		OW-1		PIW-2D	OW-10		
1120	Circuit breaker trip, reset breaker + restart motor								
1128	"							"	
1130	Reduce Flow controller + increas D-Valve								
1142		37.36		38.26	~~39.19~~	39.19	37.16	6.6	
1200		37.38		38.27		39.20	37.18	6.58	
1230		37.35		38.26		39.20	37.17	6.6	
1300		37.39		3826		39.19	37.17	6.6	
1330		37.36		38.26		39.20	37.17	6.6	
1400		37.37		37.26		39.20	37.17	6.6	
1430		37.42		38.27		39.22	37.19	6.7	
1440	Shutdown PUMP								
11/6/2020 0940		32.31		35.69		36.91	35.04		
1005		32.31		35.69		36.91	35.03		
1020		32.31		35.69		36.91	35.03		
1027		32.31		35.68		36.91	35.03		
1031		32.31		35.68		36.91	35.03		
1039		32.31		35.68		36.91	35.03		

Take transducers out from ow-1

Take transducers out from ow-10

Take transducers out from Ew-1 and piw-2D

Page ___ of ___

Project Name: Chemours Location: Fayetteville NC Date: 9/3/2020
Project Number: TR0795 Phase/Task: 40 Personnel: A. Vo / R. Gabelman

Pumping Well: EW-1 Screen Interval (ft) 40-60 DTW (ft) 31.51'
Transducer Depth: 44.5' Well Diameter (in) 6" DTB (ft) 60.0'
Serial No: 1050308 Tubing Diameter (in) 1.5" Casing Height (ft) 0.0
Pump/Tubing Setting (ft) ~~500'~~ 48.0' Measurement Location: TOC
Barometer Serial No: 121242474 Barometer Depth: 44.5'

Observation Well 1: OW-1 Transducer Depth: 45.0' TOC Serial No: 0052123594
Observation Well 2: PIW-2D Transducer Depth: 45.0' TOC Serial No: 0052123702
Obs. Well 1 DTW (ft): Obs. Well 2 DTW (ft):

Test Start Date: 9/3/2020 Test Start Time: ~~45.0~~ 0945 Total Volume:
Test End Date: 9/3/2020 Test End Time: 1137 664.9 gal (from flow meter)
Water Level Meter Model/Serial #: Heron # 24738

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
0945	0.0	31.91'	—	35.41	—	36.62	—		
0950	0.0	31.91	—	35.41	—	36.62	—	4.79	Start (S)
0955	5.0	39.82	7.91	36.46	0.5	37.50	1.12	5.16	
1000	10.0	39.81	7.90	36.78	1.37	37.86	1.24	4.98	
1005	15.0	39.76	7.85	36.92	1.51	38.00	1.38	4.60	
1010	20.0	39.81	7.90	36.96	1.55	38.02	1.40	4.79	
1015	25.0	41.41	9.50	36.98	1.57	38.16	1.54	6.10	(S2)
1020	30.0	41.45	9.54	37.28	1.87	38.31	1.69	6.34	
1025	35	41.42	9.51	37.35	1.94	38.39	1.77	6.03	
1030	40	41.41	9.50	37.38	1.97	38.41	1.79	5.75	
1035	45	41.42	9.51	37.41	2.00	38.45	1.83	7.1	(S3)
1040	50	42.96	11.05	37.68	2.27	38.63	2.01	7.23	
1050 ~~1045~~	55	43.07	11.16	37.74	2.33	38.76	2.14	7.59	
1055	60	43.18	11.27	37.81	2.40	38.79	2.17	7.40	
1100	65	43.23	11.32	37.89	2.48	38.88	2.26	7.29	
1105	70	43.41	11.50	37.92	2.51	38.90	2.28	7.34	
1115	80	43.58	11.67	38.02	2.61	38.96	2.34	7.40	
1120	85	43.54	11.63	38.02	2.61	38.98	2.36	7.22	
1135	100	43.81	11.90	38.12	2.71	39.06	2.44	7.65	
1137									Stop
1140	105	34.74	2.83	37.01	1.60	38.27	1.65	0.0	
1155	120	33.56	1.65	36.01	0.60	37.61	0.99	0.0	
1210	135	33.36	1.45	35.84	0.43	37.06	0.44	0.0	
1225	150	33.22	1.31	35.80	0.39	37.02	0.40	0.0	
1255 ~~1240~~	180	32.98	1.07	35.72	0.31	36.84	0.22	0.0	

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (60 feet - 31.51 feet) x 1.47 gallons/foot = 41.88 gal

Well Capacity (gallons/foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (0.16 gal/ft x 60 ft) + NA gallons = NA gallons

Tubing Inside Dia. Capacity (gal/ft): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" =

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville NC
Date: 9/3/2020
Project Number: TR0795
Phase/Task: 40
Well ID: EW-1

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1310	195	32.85	0.94	35.71	0.30	36.87	0.25	0.0	Recover
1325	210	32.76	0.85	35.65	0.24	36.81	0.19	0.0	
1520	335	32.30		35.52		36.73		0.0	
1545	350	32.26		35.51		36.73		0.0	
1555	End	pumping							

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Scanned with CamScanner

Project Name: Chemours
Location: Fayetteville
Date: 11/16/20
Project Number: TR0795 A
Phase/Task: 07
Personnel: RG/LT/SV

Pumping Well : EW-2
Screen Interval (ft) 40 - 65
DTW (ft) 27.42
Transducer Depth: 45'
Well Diameter (in) 6"
DTB (ft) 65
Serial No:
Tubing Diameter (in) 1.5"
Casing Height (ft) Ground
Pump/Tubing Setting (ft) 50'
Measurement Location: TOC
Barometer Serial No: 2123692
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth: ~~31.36~~
Serial No: 2123692
Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594
Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5

Test Start Date: 11/16/2020
Test Start Time: 1035
Test End Date: 11/19/20
Test End Time: 1542
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	OW-10 Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	PIW9D Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
Base:	0.0	27.42	0.0	31.36	0.0	30.5	0.0	0.0	—
1035	Begin	Test						15	
1040	5	36.27	8.35	32.13	+0.23	30.81	0.31	16.2	—
1050	10	36.34	8.47	32.4	1.27	31.03	0.52	16.7	—
1103	18	36.45	9.07	32.52	1.39	31.44	0.91	16.7	—
1120	37	36.55	9.17	32.61	1.25	31.27	0.77	16.7	—
1150	30	36.58	8.66	32.71	1.35	31.35	0.85	16.6	—
1220	30	36.64	8.72	32.78	1.42	31.42	0.92	16.6	—
1250	30	36.75	8.83	32.83	1.47	31.48	0.98	16.6	—
1320	30	36.82	8.9	32.88	1.52	31.52	1.02	16.6	—
1350	30	36.86	8.94	32.91	1.55	31.55	1.05	16.6	—
1420	30	36.88	8.96	32.95	1.59	31.59	1.09	16.55	—
1450	30	36.92	9.00	32.98	1.62	31.64	1.14	16.5	—
1520	30	36.95	9.03	33.00	1.64	31.68	1.18	16.5	—
1550	30	37.00	9.08	33.05	1.69	31.72	1.22	16.5	—
1620	30	37.06	9.14	33.09	1.73	31.75	1.25	16.5	—
1650	30	37.10	9.18	33.13	1.77	31.80	1.30	16.5	—
1720	30	37.15	9.23	33.17	1.81	31.82	1.32	16.5	—
1750	30	37.18	9.26	33.20	1.84	31.86	1.36	16.7	—
1820	30	37.22	9.2	33.24	1.88	31.91	1.41	16.5	—
1850	30	37.25	9.33	33.29	1.93	31.96	1.45	16.5	—
Ow13 1920	30	37.29	9.37	33.33	1.97	32.01	1.51	16.5	—
1950	30	37.34	9.42	33.36	2.0	32.05	1.55	16.5	—
2010	30	37.38	9.46	33.40	2.04	32.08	1.58	16.45	—
2050	30	37.42	9.51	33.45	2.09	32.12	1.62	16.50	—

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0

Project Name: EW-2 CR Test
Location: Fayetteville, NC
Date: 11/16 – 11/17/20

Project Number: TR0795A
Phase/Task: [redacted] 07
Well ID: EW-2

Date/Time	Elapsed Time (min)	EW-2 DTW (ft)	Drawdown in Pumping Well	Observation Point #1 OW-6 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
~~2120~~	—	EW-2	—	OW-6	OW-6	PIW9D	PIW9D	—	—
2120	30	37.46	~~9.49~~ 9.55	33.49	2.13	32.17	1.67	16.45	—
2150	30	37.50	~~10.03~~ 9.54	33.53	2.17	32.21	1.71	16.40	—
2220	30	37.54	~~10.07~~ 9.68	33.58	2.14	32.25	1.75	16.40	—
2250	30	37.59	~~10.12~~ 9.73	33.62	2.26	32.31	1.81	16.40	—
2310	30	37.63	~~10.16~~ 9.77	33.68	2.32	32.36	1.86	16.40	—
2350	30	37.68	~~10.21~~ 9.76	33.72	2.36	32.41	1.91	16.40	—
11-17-20 0020	30	37.72	~~10.25~~ 9.8	33.78	2.42	32.46	1.96	16.50	—
0050	30	37.77	~~10.3~~ 9.85	33.83	2.47	32.51	2.01	16.50	—
0120	30	37.82	~~10.35~~ 9.9	33.88	2.52	32.57	2.07	16.50	—
0150	30	37.87	~~10.4~~ 9.95	33.93	2.57	32.63	2.13	16.50	—
0220	30	37.92	~~10.45~~ 10	33.98	2.62	32.68	2.18	16.50	—
0250	30	37.97	10.05	34.03	2.67	32.73	2.23	16.50	—
0320	30	38.02	10.60	34.08	2.72	32.79	2.29	16.30	—
0350	30	38.07	10.65	34.14	2.78	32.84	2.34	16.40	—
0420	30	38.11	10.69	24.19	2.83	32.90	2.4	16.50	—
0450	30	38.17	10.30	34.24	2.88	32.96	2.46	16.50	—
0520	30	38.22	10.35	34.30	2.94	33.02	2.52	16.40	—
0550	30	38.27	10.40	34.36	3	33.09	2.59	16.40	—
0620	30	38.32	10.46	34.42	3.06	33.15	2.65	16.50	—
0650	30	38.37	10.50	34.47	3.11	33.21	2.71	16.50	—
0720	30	38.43	10.50	34.52	3.16	33.26	2.76	16.50	—
0750	30	38.47	10.55	34.58	3.22	33.32	2.82	16.50	—
0820	30	38.54	10.67	34.64	3.28	33.39	2.89	16.40	—
0850	30	38.59	10.67	34.70	3.34	33.45	2.95	16.40	—
0920	30	38.64	10.72	34.75	3.39	33.51	3.01	16.45	—
0950	30	38.68	10.76	34.81	3.45	33.55	3.05	16.40	—
1020	30	38.74	10.82	34.86	3.5	33.60	3.10	16.40	—
1050	30	38.78	10.86	34.91	3.55	33.65	3.15	16.40	—
1120	30	38.84	10.92	34.96	3.6	33.71	3.21	16.40	—
1150	30	38.87	10.95	35.01	3.65	33.75	3.25	16.40	—
1220	30	38.91	10.99	35.05	3.69	33.80	3.3	16.35	—
1250	30	38.95	11.03	35.10	3.74	33.85	3.35	16.40	—
1320	30	39.00	11.08	35.15	3.79	33.91	3.41	16.34	—
1350	30	39.05	11.13	35.21	3.85	33.97	3.47	16.35	—
1420	30	39.11	11.19	35.27	3.91	34.03	3.53	16.35	—
1450	30	39.17	11.25	35.33	3.97	34.09	3.59	16.35	—
1520	30	39.23	11.31	35.39	4.03	34.15	3.65	16.35	—
1550	30	39.28	11.36	35.42	4.06	34.22	3.72	16.35	—
1620	30	39.34	11.42	35.50	4.14	34.27	3.77	16.35	—
1650	30	39.39	11.47	35.57	4.21	34.34	3.84	16.35	—
1720	30	39.45	11.53	35.63	4.27	34.40	3.9	16.35	—

Geosyntec Consultants
Aquifer Testing

Project Name: Chemours
Location: Fayetteville
Date: 11-17-20 / 11-18-20
Project Number: TR0795A
Phase/Task: 07
Personnel: SV, NC, LT, BW

Pumping Well: EW-2
Screen Interval (ft) 40-65
DTW (ft) 27.92
Transducer Depth: 45'
Well Diameter (in) 6
DTB (ft) 65
Serial No:
Tubing Diameter (in) 1.5
Casing Height (ft) Ground
Pump/Tubing Setting (ft) 50
Measurement Location: TOC
Barometer Serial No: 2123692
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth:
Serial No: 2123192
Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594
Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5

Test Start Date: 11-16-20
Test Start Time: 1035
Test End Date: 11-19-20
Test End Time: 1542
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft) EW-2	Drawdown in Pumping Well	Observation OW-6 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation PIW-9D Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1750	30	39.5	11.58	35.70	4.34	34.45	3.95	16.3	—
1820	30	39.56	11.64	35.76	4.4	34.52	4.02	16.3	—
1850	30	39.61	11.69	35.83	4.47	34.57	4.09	16.3	—
1920	30	39.66	11.74	35.88	4.52	34.65	4.15	16.25	—
1930	~~30~~ 10	39.88	11.96	35.91	4.55	34.68	4.18	16.55	Increase Flow Rate
1940	~~10~~ 10	39.90	11.98	35.94	4.58	34.71	4.21	16.55	—
2010	30	39.96	12.04	36.00	4.64	34.77	4.27	16.55	—
2040	30	40.01	12.09	36.07	4.71	34.83	4.33	16.55	—
2110	30	40.05	12.13	36.12	4.76	34.87	4.37	16.55	—
2140	30	40.10	12.18	36.17	4.81	34.93	4.43	16.55	—
2210	30	40.14	12.22	36.22	4.86	34.97	4.47	16.55	—
2240	30	40.18	12.26	36.27	4.91	35.03	4.53	16.55	—
2310	30	40.22	12.3	36.32	4.96	35.08	4.58	16.55	—
2340	30	40.26	12.34	36.36	5	35.13	4.63	16.55	—
0010	30	40.30	12.38	36.41	5.05	35.18	4.68	16.55	—
0040	30	40.35	12.43	36.45	5.09	35.22	4.72	16.50	—
0110	30	40.38	12.46	36.49	5.13	35.27	4.77	16.50	—
0140	30	40.42	12.5	36.52	5.16	35.31	4.81	16.50	—
0210	30	40.44	12.52	36.56	5.2	35.33	4.83	16.50	—
0240	30	40.48	12.56	36.60	5.24	35.37	4.87	16.50	—
0310	30	40.51	12.59	36.63	5.27	35.41	4.91	16.50	—
0340	30	40.54	12.62	36.66	5.3	35.44	4.94	16.50	—
0410	30	40.57	12.65	36.70	5.34	35.48	4.98	16.45	—
0440	30	40.59	12.67	36.72	5.36	35.51	5.01	16.50	—
0510	30	40.61	12.69	36.75	5.39	35.54	5.04	16.50	—

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06, **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** =

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: Chemours EW-2 CR
Location: Fayetteville
Date: 11-18-20
Project Number: TR0795A
Phase/Task: 07
Personnel: NC, SV, BW, LT

Pumping Well: EW-2
Transducer Depth: 45'
Serial No:
Screen Interval (ft): 46-65
Well Diameter (in): 6
Tubing Diameter (in): 1.5
Pump/Tubing Setting (ft): 50
Barometer Serial No: 2123692
DTW (ft): 27.92
DTB (ft): 65
Casing Height (ft): Ground
Measurement Location: TOC
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth:
Serial No: 2123692
Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594
Observation Well 3:
Transducer Depth:
Serial No:
Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5
Obs. Well 3 DTW (ft):

Test Start Date: 11-16-20
Test Start Time: 1035
Test End Date: 11-19-20
Test End Time: 1542
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft) EW-2	Drawdown in Pumping Well	Observation ~~Point #1~~ OW #6 Water Level (ft bgs)	Drawdown Observation ~~Point~~ OW #6 (ft bgs)	Observation ~~Point #2~~ PIW 9D Water Level (ft bgs)	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
0540	30	40.66	12.74	36.79	5.43	35.57	5.07	16.50	—
0610	30	40.71	12.79	36.82	5.46	35.61	5.11	16.50	—
0640	30	40.74	12.82	36.85	5.49	35.65	5.15	16.50	—
0710	30	40.76	12.84	36.88	5.52	35.68	5.18	16.50	—
0740	30	40.80	12.88	36.91	5.55	35.71	5.21	16.50	—
0810	30	40.84	12.92	36.94	5.58	35.74	5.24	16.50	—
0840	30	40.86	12.94	36.97	5.61	35.78	5.28	16.50	—
0910	30	40.88	12.96	36.99	5.63	35.80	5.3	16.50	—
0940	30	40.92	13.0	37.02	5.66	35.82	5.32	16.50	—
1010	30	40.95	13.03	37.03	5.67	35.84	5.34	16.50	—
1040	30	40.98	13.06	37.05	5.69	35.86	5.36	16.50	—
1110	30	40.99	13.07	37.06	5.7	35.88	5.38	16.55	—
1140	30	41.01	13.09	37.09	5.73	35.90	5.4	16.50	—
1210	30	41.03	13.11	37.1	5.74	35.90	5.4	16.50	—
1240	30	41.05	13.13	37.12	5.76	35.91	5.41	16.55	—
1310	30	41.07	13.15	37.13	5.77	35.92	5.42	16.5	—
1340	30	41.08	13.16	37.15	5.79	35.94	5.44	16.5	—
1410	30	41.10	13.18	37.17	5.81	35.97	5.47	16.5	—
1440	30	41.12	13.2	37.19	5.83	35.98	5.48	16.5	—
1510	30	41.15	13.23	37.21	5.85	~~36.00~~	36.00 5.5	16.5	—
1540	30	41.18	13.26	37.25	5.89	36.02	5.52	16.5	—
1610	30	41.21	13.29	37.26	5.9	36.05	5.55	16.5	—
1623	13	41.22	13.3	37.27	5.91	36.06	5.56	16.5	→ Generator Refuel
1640	17	39.58	11.66	36.92	5.56	35.60	5.1	16.7	—
1645	5	40.84	12.92	37.09	5.73	35.93	5.43	16.7	—

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.01

Project Name: EW-2 CR Test
Location: Fayetteville
Date: 11-18-20
Project Number: TR0795A
Phase/Task: 07
Personnel: LT, SV, NC, AW

Pumping Well: EW-2
Transducer Depth: 45'
Serial No:
Screen Interval (ft) 40-65
Well Diameter (in) 6"
Tubing Diameter (in) 1.5
Pump/Tubing Setting (ft) 50
Barometer Serial No: 2123692
DTW (ft) 27.92
DTB (ft) 65
Casing Height (ft) ground
Measurement Location: TOC
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth:
Serial No: 2123692
Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594
Observation Well 3: —
Transducer Depth:
Serial No: —
Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5
Obs. Well 3 DTW (ft): —

Test Start Date: 11-16-20
Test Start Time: 1035
Test End Date: 11-19-20
Test End Time: 1542
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation OW-6 Water Level (ft bgs)	Drawdown OW-6 Point #1 (ft bgs)	Observation PW-9D Water Level (ft bgs)	Observation PW-9D Water Level (ft bgs)	Pumping Rate (gpm)	Comments
1650	5	40.89	12.97	37.16	5.8	35.98	5.48	16.65	—
1655	5	40.93	12.01	37.19	5.83	36.01	5.51	16.60	—
1700	5	40.95	13.03	37.21	5.85	36.03	5.53	16.65	—
1705	5	40.97	13.05	37.22	5.86	36.04	5.54	16.65	—
1715	10	40.99	13.07	37.25	5.89	36.06	5.56	16.6	—
1725	10	41.01	13.09	37.27	5.91	36.08	5.58	16.65	—
1735	10	41.03	13.11	37.28	5.92	36.09	5.59	16.6	—
1745	10	41.05	13.13	37.29	5.93	36.11	5.61	16.65	—
1755	10	41.05	13.13	37.31	5.95	36.12	5.62	16.65	—
1805	10	41.07	13.15	37.32	5.96	36.11	5.61	16.60	—
1815	10	41.09	13.17	37.32	5.96	36.12	5.62	16.30	—
1825	10	41.10	13.18	37.33	5.97	36.13	5.63	16.50	—
1855	30	41.13	13.21	37.36	6	36.15	5.65	16.55	—
1925	30	41.16	13.24	37.38	6.02	36.18	5.68	16.50	—
1955	30	~~4~~ 41.20	13.28	37.40	6.04	36.20	5.7	16.50	—
2025	30	41.23	13.31	37.43	6.07	36.22	5.72	16.50	—
2055	30	41.26	13.34	37.45	6.09	36.24	5.74	16.50	—
2125	30	41.28	13.36	37.46	6.1	36.26	5.76	16.50	—
2155	30	41.31	13.39	37.49	6.13	36.27	5.77	16.50	—
2225	30	41.34	13.42	37.50	6.14	36.29	5.79	16.50	—
2255	30	41.37	13.45	37.52	6.16	36.31	5.81	16.50	—
2325	30	41.38	13.46	37.52	6.16	36.32	5.82	16.50	—
2355	30	41.40	13.48	37.55	6.19	36.34	5.84	16.50	—
0025	30	41.42	13.5	37.57	6.21	36.35	5.85	16.50	—
0055	30	41.45	13.53	37.58	6.22	36.36	5.86	16.50	—

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.01

Geosyntec Consultants

Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville
Date: 11-19-20

Project Number: TR0795A
Phase/Task: 07
Personnel: SV, LT

Pumping Well: EW-2
Transducer Depth: 45'
Serial No:
Screen Interval (ft) 40-65
Well Diameter (in) 6
Tubing Diameter (in) 1.5
Pump/Tubing Setting (ft) 50
Barometer Serial No: 2123692
DTW (ft) 27.92
DTB (ft) 65
Casing Height (ft) ground
Measurement Location: TOC
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth:
Serial No: 2123692

Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594

Observation Well 3:
Transducer Depth:
Serial No:

Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5
Obs. Well 3 DTW (ft):

Test Start Date: 11-16-20
Test Start Time: 1035

Test End Date: 11-19-20
Test End Time: 1542

Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft) EW-2	Drawdown in Pumping Well	Observation OW #6 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation PIW #9D Water Level (ft bgs)	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
0125	30	41.49	13.57	37.60	6.24	36.39	5.89	16.55	
0155	30	41.51	13.59	37.61	6.25	36.41	5.91	16.55	
0225	30	41.53	13.61	37.63	6.27	36.42	5.92	16.50	
0255	30	41.55	13.63	37.65	6.29	36.43	5.93	16.50	
0325	30	41.57	13.65	37.66	6.3	36.45	5.95	16.55	
0355	30	41.60	13.68	37.68	6.32	36.45	5.95	16.55	
0425	30	41.80	13.88	37.71	6.35	36.46	5.96	16.50	
0455	30	41.82	13.9	37.72	6.36	36.48	5.98	16.50	
0525	30	41.83	13.91	37.74	6.38	36.49	5.99	16.55	
0555	30	41.85	13.93	37.75	6.39	36.50	6	16.55	
0625	30	41.87	13.95	37.78	6.42	36.54	6.04	16.6	
0655	30	41.86	13.94	37.79	6.43	36.55	6.05	16.6	
0725	30	41.87	13.95	37.80	6.44	36.57	6.07	16.6	
0755	30	41.88	13.96	37.82	6.46	36.58	6.08	16.6	
0825	30	41.90	13.98	37.84	6.48	36.60	6.1	16.6	
0855	30	41.95	14.03	37.86	6.5	36.61	6.11	16.6	
0925	30	41.97	14.05	37.87	6.51	36.63	6.13	16.6	
0955	30	41.99	14.07	37.88	6.52	36.66	6.16	16.6	
1025	30	41.99	14.07	37.89	6.53	36.65	6.15	16.6	
1055	30	41.99	14.07	37.90	6.54	36.66	6.16	16.6	
1125	30	42.01	14.09	37.90	6.54	36.66	6.16	16.6	
1155	30	42.01	14.09	37.90	6.54	36.66	6.16	16.6	
1225	30	42.01	14.09	37.91	6.55	36.67	6.17	16.6	
1255	30	42.02	14.1	37.91	6.55	36.68	6.18	16.6	
1325	30	42.03	14.11	37.93	6.57	36.69	6.19	16.6	

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.01

Geosyntec Consultants
Aquifer Testing

Project Name: EW-2 CR Test
Location: Fayetteville
Date: 11/19/20

Project Number: TR0795A
Phase/Task: 07
Personnel: SV, LT

Pumping Well: EW-2
Screen Interval (ft) 40-65
DTW (ft) 27.92

Transducer Depth: 45'
Well Diameter (in) 6
DTB (ft) 65

Serial No:
Tubing Diameter (in) 1.5
Casing Height (ft) ground

Pump/Tubing Setting (ft) 50
Measurement Location: TOC

Barometer Serial No: 2123692
Barometer Depth:

Observation Well 1: OW-6
Transducer Depth:
Serial No: 2123692

Observation Well 2: PIW-9D
Transducer Depth:
Serial No: 2123594

Observation Well 3:
Transducer Depth:
Serial No:

Obs. Well 1 DTW (ft): 31.36
Obs. Well 2 DTW (ft): 30.5
Obs. Well 3 DTW (ft):

Test Start Date: 11-16-20
Test Start Time: 1035

Test End Date: 11-19-20
Test End Time: 1542

Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft) EW-2	Drawdown in Pumping Well	Observation OW-6 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation PIW-9D Water Level (ft bgs)	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
1355	30	42.03	14.11	37.13	6.57	36.70	6.2	16.6	
1425	30	42.03	14.11	37.93	6.57	36.70	6.2	16.6	
1455	30	42.04	14.12	37.94	6.58	36.71	6.21	16.6	
1515	~~30~~ 25	42.05	14.13	37.95	6.59	36.72	6.22	16.6	Remove Transducers
1539	24	42.06	14.14	37.91	6.55	36.69	6.19	16.6	Replace transducer
1542	STOP	TEST							

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.01

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: Chemours
Location: Fayetteville
Date: 09/08/2020
Project Number: TR0795
Phase/Task: 40
Personnel: RG, MS

Pumping Well: EW-2
Transducer Depth: 46'
Serial No: 1050308
Screen Interval (ft) 40-65
Well Diameter (in) 6
Tubing Diameter (in) 1 1/2
Pump/Tubing Setting (ft) 52
Barometer Serial No:
DTW (ft) 30.61 → 34.25 after initial shock
DTB (ft) 65
Casing Height (ft) flush
Measurement Location: TOC
Barometer Depth:

Observation Well 1: OW-6 Transducer Depth: 58 Serial No: 005212 5700
Observation Well 2: PIW-9D Transducer Depth: 45 Serial No: 002123594
Obs. Well 1 DTW (ft):
Obs. Well 2 DTW (ft):

Test Start Date: 09/08/2020 Test Start Time: 1328
Test End Date:
Test End Time:
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft) 34.4	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1328	Begin test	1015		38	—	37.28	—	—	Baseline "New" baseline
S1 1330	2	40.11	5.86	39.83	1.83	37.58	0.30	13	for EW-2 is 34.25
1345	17	39.75	5.5	38.95	0.95	37.71	0.43	1.32	~~Flowmeter reading RL~~
1400	32	39.87	5.62	39.01	1.01	37.81	0.53	12.13	~~"0", will continue~~
1419	51	37.93	6.68	39.03	1.03	37.85	0.57	11.4	
S2 1430	62	41.49	7.23	39.31	1.31	37.92	0.64	16.3	S2
1445	77	42.25	8	39.45	1.45	38.02	0.74	15.6	
1450	92	42.35	8.1	39.52	1.52	38.06	0.78	15.67	
1515	117	42.4	8.15	39.55	1.55	39.07	0.79	16.03	
1530	132	42.40	8.15	39.56	1.56	38.12	0.84	15.9	
S3 1535	137	44.20	9.95	39.83	1.83	38.18	0.90	20	S3
1545	147	45.01	10.76	40.03	2.03	38.29	0.99		Flowmeter reads "0"
1555	157	45.02	10.77	40.09	2.09	38.33	1.05		Valve has not been
1610	172	45.01	10.76	40.12	2.12	38.36	1.08		adjusted, more
1620	182	45.07	10.82	40.14	2.14	38.39	1.1		vibration from valve
1623	Shut	pump off							

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** =

Written by: ______ Date: __/__/__ (DD MM YY) Reviewed by: ______ Date: __/__/__ (DD MM YY)

Client: ______ Project: ______ Project/Proposal No. ______ Task No. ______

EW-3 Constant Rate Test

pumping well EW-3
Transducer Depth ____
Serial # Inwitu

screen interval 37-67
well diam 6"
Tubing dia 1.5"
pump set 52'
Barometer 2124271

DTW 15.24
DTB 67
casing height 0.0
measure loc TOC
Barometer depth OW-9

Observation well 1: OW-4 Transducer depth ____ Serial No. ____ DTW 19.59
Obs. well 2: OW-5 Trans depth ____ Serial No. ____ DTW 20.15
Obs well 3 OW-9 Trans depth ____ Serial No. ____ DTW 19.38

Test start date/Time 11/09/2020 1205

Time/date	EW DTW	OW-4 DTW	OW-5 DTW	OW-9 DTW	Flowrate	comments
1211/11/09/20	19.46	21.30	21.87	20.29		
1220/11/09/20	20.34	22.09	22.59	20.93	19.4	Start up 51-52%
1230/11/09/20	20.67	22.42	22.90	21.23	19.6	MJ
1240/11-09-20	20.98	22.67	23.16	21.49	~~20.4~~ 19.4	
1250 11 09 20	21.20	22.88	23.35	21.69	19.6	
1300/11-09-20	21.35	23.03	23.50	21.82	19.4	
1310/11-09-20	20.98	22.96	23.43	21.77	19.4	1307 Breaker flip
1320/11-09-20	21.43	23.15	23.63	21.45	17.8/1315 19.2	1308 Back on ET
1330/11-09-20	21.58	23.27	23.73	22.06	19.6	1315 52-58% 0pm ~~[illegible]~~ diaphragm flow control
1340/11-09-20	21.66	23.35 ET	23.81	22.16	19.7	1317 58-60% flow control
1350/11-09-20	21.14	23.08	23.56	21.92	19.8	1349 Breaker flip 3x
1400	21.30	23.15	23.64	21.78	19.3	1359 Breaker flip
	17.28	21.71				1402 Breaker flip 1405 Multiple flips

1408 -> unplug pump from generator to see if generator continues to trip out
1418 -> pull pump five feet up and try plugging in and no successful run

1433 -> restart pump -> raised pump 5' -> stopped CCF from slurpping frac tank

1434	19.58	22.22	22.44	20.88	20
1449	20.98	22.84	23.30	21.65	20
1505	21.33	23.16	23.62	21.95	19.9
1520	21.5	23.34	23.79	22.13	19.9

1525 -> immediately after water levels collected -> swapped generators to larger generator

~~1530~~ 1530	21.53	23.37	23.82	22.16	19.8
1545	21.67	23.49	23.94	22.27	20.1
1600	21.74	23.56	24.01	22.35	20
1615	21.81	23.63	24.07	22.39	20.1
1630	21.85	23.66	24.11	22.44	20.1
1645	21.89	23.70	24.14	22.50	19.9
1705	21.94	23.74	24.17	22.52	19.7
1725	21.97	23.76	24.21	22.54	19.9
1745	22.00	23.80	24.24	22.58	20
1805	22.03	23.81	24.24	22.58	19.9

Geosyntec Consultants
Aquifer Testing

Geosyntec consultants

Project Name: EW-3 Constant Rate Test Location: Date: 11/09/20

Project Number: Phase/Task: OW4 DTW OW5 DTW Well ID: OW9 DTW

Date/Time	Elapsed Time (min)	DTW (ft) EW 03	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1835		22.05		23.84	24.28	23.63*		19.9	
1905		22.09		23.87	24.32	23.65*		19.9	
1935		22.11		23.89	24.34	23.67*		20	
2005		22.14		23.90	24.34	22.70		19.9	
2035		22.16		23.91	24.36	22.71		19.9	
2105		22.17		23.92	24.37	22.71		19.9	
2135		22.18		23.94	24.38	22.73		19.9	
2205		22.19		23.95	24.40	22.74		19.9	
2235		22.20		23.96	24.40	22.74		19.9	
2305		22.21		23.96	24.41	22.75		19.9	
2335		22.21		23.97	24.42	22.76		19.9	
11-10-20 0005		22.22		23.98	24.43	22.77		19.9	
0035		22.23		23.99	24.43	22.77		19.9	
0105		22.24		23.99	24.44	22.78		19.9	
0135		22.24		23.99	24.44	22.78		19.9	
0205		22.24		24.00	24.45	22.79		19.9	
0235		22.25		24.00	24.45	22.79		19.9	
0305		22.26		24.01	24.46	22.81		19.9	
0335		22.26		24.02	24.47	22.82		19.9	
0405		22.26		24.02	24.47	22.82		19.9	
0435		22.27		24.02	24.47	22.82		19.9	
0505		22.27		24.03	24.48	22.82		19.9	
0535		22.28		24.03	24.48	22.83		19.9	
0605		22.29		24.04	24.49	22.84		19.9	
0635		22.30		24.05	24.50	22.86		19.9	
0705		22.31		24.06	24.51	22.87		19.9	
0735		22.31		24.07	24.52	22.88		19.9	
0805		22.33		24.09	24.53	22.88		19.9	
0835		22.34		24.10	24.54	22.88		19.8	
0905		22.35		24.10	24.54	22.89		20	
0935		22.35		24.10	24.55	22.89		20.1	
1005		22.35		24.10	24.55	22.89		19.8	
1035		22.36		24.11	24.56	22.90		19.8	
1105		22.36		24.11	24.56	22.90		19.8	
1135		22.36		24.10	24.54	22.89		19.9	
1205		22.36		24.11	24.55	22.89		19.8	
1235		22.36		24.11	24.55	22.89		19.9	
1305		22.35		24.10	24.54	22.88		19.9	
1335		22.35		24.10	24.54	22.88		19.9	
1405		22.34		24.09	24.52	22.85		19.9	
1435		22.34		24.09	24.52	22.85		19.9	
1505		22.34		24.08	24.52	22.85		19.8	

* should be 22' for OW09

Geosyntec consultants

Geosyntec Consultants
Aquifer Testing

Project Name: EW3 Constant Rate
Location: OW4 DTW
Date: 11-10-20
Project Number: TR0795A
Phase/Task:
OW5 DTW
OW-9 DTW
Well ID: EW 3

Date/Time	Elapsed Time (min)	DTW (ft) EW03	Drawdown in Pumping Well	~~Observation Point #1 Water Level (ft bgs)~~	~~Drawdown Observation Point #1 (ft bgs)~~	~~Observation Point #2 Water Level (ft bgs)~~	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
11/10/20 1535	—	22.34	—	24.08	24.52	22.86	—	19.8	
1606		22.34		24.08	24.52	22.86		19.8	
1635		22.35		24.09	24.54	22.87		19.8	
1643		22.35		24.10	24.54	22.88		19.8	

~ 1650 shutdown pump

Page ___ of ____

Written by: ____________ Date: __/__/__ DD MM YY Reviewed by: ____________ Date: __/__/__ DD MM YY

Client: ____________ Project: ____________ Project/Proposal No. ____________ Task No. ____________

EW-3 Constant Rate Test

pumping well EW-3 screen interval 37-67 DTW 15.24
Transducer Depth ______ well diam 6" DTB 67
Serial # [illegible] Tubing dia 1.5" casing height 0.0
pump set 52' measure loc TOC
Barometer 2124274 Barometer depth OW-9

Observation well 1: OW-4 Transducer depth ______ Serial No. ______ DTW 19.59
Obs. well 2: OW-5 Trans depth ______ Serial No. ______ DTW 20.15
Obs well 3 OW-9 Trans depth ______ Serial No. ______ DTW 18.38

Test start date/Time 11/09/2020 1205

Time/date	EW DTW	OW-4 DTW	OW-5 DTW	OW-9 DTW	Flowrate	comments
1211/11/09/20	19.46	21.30	21.87	20.29	19.4	Start up 51-52%
1220/11/09/20	20.34	22.09	22.59	20.93	19.6	MJS
1230/11/09/20	20.67	22.42	22.90	21.23	~~20.4~~ 19.4	
1240/11-09-20	20.98	22.67	23.16	21.49	19.6	
1250 11 09 20	21.20	22.88	23.35	21.69	19.4	
1300/11-09-20	21.35	23.03	23.50	21.82	19.4	1307 Breaker flip
1310/11-09-20	20.98	22.96	23.43	21.77	17.8/1315 19.2	1308 Back on
1320/11-09-20	21.43	23.15	23.63	21.95	19.6	1315 52-58% open diaphragm 1317 58-60% flow control
1330/11-09-20	21.58	23.27	23.73	22.06	19.7	
1340/11-09-20	21.66	23.35	23.81	22.16	19.8	1349 Breaker flip 3x
1350/11-09-20	21.14	23.~~04~~ 08	23.56	21.92	19.3	1359 Breaker flip
1400	21.30	23.15	23.64	21.78		1402 Breaker flip 1405 Multiple flips
	17.28	21.71				

1408 → unplug pump from generator to see if generator continues to trip out
1418 → Pull pump five feet up and try plugging in and no successful run

1433 → restart pump → raised pump 5' → stopped CCF from slurrying frac tank

Time/date	EW DTW	OW-4 DTW	OW-5 DTW	OW-9 DTW	Flowrate	comments
1439	19.58	22.22	22.44	20.88	20	
1449	20.98	22.84	23.30	21.65	20	
1505	21.33	23.16	23.62	21.95	19.9	
1520	21.5	23.39	23.79	22.13	19.9	

1525 → immediately after water levels collected → swapped generators to larger generator

Time/date	EW DTW	OW-4 DTW	OW-5 DTW	OW-9 DTW	Flowrate	comments
~~1530~~ 1530	21.53	23.37	23.82	22.16	19.8	
1545	21.67	23.49	23.94	22.27	20.1	
1600	21.74	23.56	24.01	22.35	20	
1615	21.81	23.63	24.07	22.39	20.1	
1630	21.85	23.66	24.11	22.44	20.1	
1645	21.89	23.70	24.14	22.50	19.9	
1705	21.94	23.74	24.17	22.52	19.7	
1725	21.97	23.76	24.21	22.54	19.9	
1745	22.00	23.80	24.24	22.58	20	
1805	22.03	23.81	24.24	22.58	19.9	

Project Name: EW-3 Constant Rate Test Location: ______ Date: 11/09/20

Project Number: ______ Phase/Task: OW4 OTW, OW5 OTW Well ID: OW9 OTW

Date/Time	Elapsed Time (min)	DTW (ft) GW 03	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1835		22.05		*23.84	24.28	23.63*		19.9	
1905		22.09		*23.87	24.32	23.65*		19.9	
1935		22.11		*23.89	24.34	23.67*		20	
2005		22.14		23.90	24.34	22.70		19.9	
2035		22.16		23.91	24.36	22.71		19.9	
2105		22.17		23.92	24.37	22.71		19.9	
2135		22.18		23.94	24.38	22.73		19.9	
2205		22.19		23.95	24.40	22.74		19.9	
2235		22.20		23.96	24.40	22.74		19.9	
2305		22.21		23.96	24.41	22.75		19.9	
2335		22.21		23.97	24.42	22.76		19.9	
11-10-20 0005		22.22		23.98	24.43	22.77		19.9	
0035		22.23		23.99	24.43	22.77		19.9	
0105		22.24		23.99	24.44	22.78		19.9	
0135		22.24		23.99	24.44	22.78		19.9	
0205		22.24		24.00	24.45	22.79		19.9	
0235		22.25		24.00	24.45	22.79		19.9	
0305		22.26		24.01	24.46	22.81		19.9	
0335		22.26		24.02	24.47	22.82		19.9	
0405		22.26		24.02	24.47	22.82		19.9	
0435		22.27		24.02	24.47	22.82		19.9	
0505		22.27		24.03	24.48	22.82		19.9	
0535		22.28		24.03	24.48	22.83		19.9	
0605		22.29		24.04	24.49	22.84		19.9	
0635		22.30		24.05	24.50	22.86		19.9	
0705		22.31		24.06	24.51	22.87		19.9	
0735		22.31		24.07	24.52	22.88		19.9	
0805		22.33		24.09	24.53	22.88		19.9	
0835		22.34		24.10	24.54	22.88		19.8	
0905		22.35		24.10	24.54	22.89		20	
0935		22.35		24.10	24.55	22.89		20.1	
1005		22.35		24.10	24.55	22.89		19.8	
1035		22.36		24.11	24.56	22.90		19.8	
1105		22.36		24.11	24.56	22.90		19.8	
1135		22.36		24.10	24.54	22.89		19.8	
1205		22.36		24.11	24.55	22.89		19.8	
1235		22.36		24.11	24.55	22.89		19.9	
1305		22.35		24.10	24.54	22.88		19.9	
1335		22.35		24.10	24.54	22.88		19.9	
1405		22.34		24.09	24.52	22.85		19.9	
1435		22.34		24.09	24.52	22.85		19.9	
1505		22.34		24.08	24.52	22.85		19.8	

* should be 22' for OW09

Page ___ of ___

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Aquifer Testing

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Project Name: EW3 Constant Rate
Project Number: TR0795A
Location: OW4 DTW
Phase/Task: OW5 DTW
Date: 11-10-20
OW-9 DTW
Well ID: EW 3

Date/Time	Elapsed Time (min)	DTW (ft) EW03	Drawdown in Pumping Well	~~Observation Point #1 Water Level (ft bgs)~~	~~Drawdown Observation Point #1 (ft bgs)~~	~~Observation Point #2 Water Level (ft bgs)~~	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
11/10/20 1535	—	22.34	—	24.08	24.52	22.86	—	19.8	
1605		22.34		24.08	24.52	22.86		19.8	
1635		22.35		24.09	24.54	22.87		19.8	
1643		22.35		24.10	24.54	22.88		19.8	
~ 1650	shutdown pump								

Daily Field Report

Project Name: Chemours
Project Number: TR0795
Field Personnel: RG / MW
Recorded By: RG
Weather: Clear

Date: 11/6/2020 Page 1 of __
Primary Activities: Transducer deployment @ EW-3

Time	Description of Activites
12:10	deploy transducers for baseline readings @ EW-3 Cluster

Well ID	Initial DTW	Final DTW	Set depth	Serial #
OW-4	19.54'	19.51	52'	2123692
OW-5	20.10	20.09	59	2123594
OW-9	18.34	18.32	59	2123700
EW-3	15.16	15.15	52	Insitu
Barologger (OW-9)		N/A	21.5'	

Project Name: Chemours Location: Fayetteville, NC Date: 9/4/20

Project Number: TR0795 Phase/Task: 40 Personnel: RG, AV

Pumping Well: EW-3 Screen Interval (ft) ~~40-85~~ 37-67 DTW (ft) 15.11'
Transducer Depth: 50 Well Diameter (in) 6 DTB (ft) 107.0'
Serial No: 0051050308 Tubing Diameter (in) 1.5 Casing Height (ft) Flush
Pump/Tubing Setting (ft) 52 Measurement Location: TOC
Barometer Serial No: See previous Barometer Depth: see previous

Observation Well 1: OW-5 Transducer Depth: 59 TOC Serial No: 0053623689
Observation Well 2: OW-4 Transducer Depth: 52 TOC Serial No: ~~2~~ 2123702
Obs. Well 1 DTW (ft): ~~#4~~ 20.03 Obs. Well 2 DTW (ft): 19.46

Test Start Date: 9/4/20 Test Start Time: ~~0840~~ 0922
Test End Date: 9/4/2020 Test End Time: 1432
Water Level Meter Model/Serial #: Heron Little dipper 2

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
0835	0.0	15.12	0.0	20.03	—	19.46	—	—	
0922	0.0	PUMP						15gpm	Start (51)
0925	3.0	19.81	4.69	21.48	1.45	20.79	1.33	14 gpm	
0930	8.0	20.32	5.20	21.79	1.76	21.29	1.83	14.5	
0935	13.0	20.62	5.5	22.14	2.11	21.64	2.18	14.80	
0940	18.0	20.84	5.72	22.32	2.29	21.85	2.39	14.80	
0950	28.0	21.14	6.02	22.60	2.57	22.12	2.66	14.62	
0955	33.0	21.03	5.91	22.69	2.66	22.19	2.73	–	
1000	38.0	21.04	5.92	22.76	2.73	22.24	2.78	–	
1005	43.0	21.22	6.10	22.85	2.82	22.34	2.88	13.69	
1010	48.0	21.28	6.16	22.90	2.87	22.39	2.92	13.31	
1020	58.0	21.42	6.30	23.01	2.98	22.48	3.02	14.20	
1025	63.0	21.46	6.34	23.05	3.02	22.55	3.09	14.50	
1030	68.0	21.47	6.35	23.03	3.00	22.55	3.09	14.50	
1035	73.0	21.44	6.32	23.09	3.06	22.61	3.14	14.52	
1040	78.0	21.45	6.33	23.11	3.08	22.62	3.15	14.62	
1045	83.0	23.05	7.93	—	—	—	—	20.52	(52)
1050	88.0	23.20	8.08	23.64	3.61	23.16	3.70	20.77	some vibration
1055	93.0	23.29	8.17	23.74	3.71	23.24	3.78	20.03	in diaphragm
1100	98.0	23.51	8.39	23.89	3.86	23.38	3.92	20.09	valve
1105	103.0	23.46	8.34	23.93	3.90	23.44	3.98	18.00	readjust valve
1110	108.0	24.32	9.20	24.11	4.08	23.62	4.16	20.12	← no vibration
1120	118.0	24.46	9.34	24.29	4.26	23.82	4.36	20.46	
1125	123.0	24.54	9.42	24.42	4.39	23.94	4.48	21.40	
1130	128	24.60	9.48	24.50	4.47	24.01	4.55	21.65	

Vw / drd
275

6' drdwn x1.
465 gallon
= 0.018

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** =

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Aquifer Testing

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Project Name: Chemours Location: Fayetteville, NC Date: 9/4/2020

Project Number: TR0795 Phase/Task: 40 Well ID: EW-3

Date/Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1135	133	24.66	7.54	24.54	4.51	24.07	4.61	21.21	
1140	138	24.70	9.58	24.59	4.56	24.12	4.52	21.40	
1150	148	24.74	9.62	24.62	4.59	24.14	4.68	21.40	
1155	153	24.89	9.77	24.70	4.67	24.19	4.93	21.52	
1210	163	25.04	9.92	24.34	4.31	24.85	5.39	20.77	
1220	173	25.16	10.09	24.88	4.85	24.41	4.95	20.59	
1230	183	25.42	10.3	24.95	4.92	24.49	5.03	22.02	vibrating in
1240	193	25.30	10.18	25.00	4.97	24.51	5.05	22.1	diaphragm valve
1250	203	25.32	10.20	25.01	4.98	24.52	5.06	—	+ transducer cable vibrate
1300	213	25.28	10.70	25.01	4.99	24.52	5.06	21.89	
1310	223	28.14	13.02	25.40	5.37	25.90	5.63	29.99	(S3)
1320	233	28.48	13.48	26.24	6.21	25.77	6.31	29.97	
1330	243	28.60	13.48	26.40	6.37	25.94	6.48	29.48	
1340	253	28.62	13.50	26.48	6.45	26.02	6.56	30.10	
1350	263	28.78	13.66	26.53	6.50	26.09	6.63	30.50	
1400	273	28.93	13.81	26.65	6.62	26.22	6.76	30.42	
1420	283	28.92	13.80	26.75	6.72	26.29	6.83	30.42	
1430	293	28.97	13.85	26.77	6.74	26.81	6.85	30.10	

Page 2 of 2

Project Name: Chemours Location: Fayetteville Date: 12/09/2020

Project Number: TR0795A Phase/Task: 07/02 Personnel: A.VO | L.TArt / N.Charl B.

Pumping Well : EW-4
Transducer Depth: 63
Serial No: WINSITU LIVE
Screen Interval (ft) 53-73'
Well Diameter (in) 6"
Tubing Diameter (in) 1 1/2"
Pump/Tubing Setting (ft) 63.0'
OW-2 Barometer Serial No: 12124274
DTW (ft) 30.28
DTB (ft) 73'
Casing Height (ft) ~0'
Measurement Location: TOC
Barometer Depth: 20'

Observation Well 1: OW-2 Transducer Depth: 71.25 Serial No: 52123692
Observation Well 2: OW-3 Transducer Depth: 71.25 Serial No: 52123689
Obs. Well 1 DTW (ft): 34.22 Obs. Well 2 DTW (ft): 34.68

Test Start Date: 12/9/2020 Test Start Time: 945
Test End Date: Test End Time:
Water Level Meter Model/Serial #:

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
0940		30.28		34.22		34.68			
0945	0	37.35	~~37.35~~	34.71	~~34.71~~	35.93	~~35.93~~	16.0	
0950	5	45.14	14.86	40.39	6.17	39.26	4.58	16.5	
0955	10	46.68	16.40	41.88	7.66	40.38	5.70	16.5	
1000	15	48.67	18.39	43.02	8.80	41.16	6.48	16.4	Adjust
1010	25	48.51	18.23	43.89	9.67	41.90	7.22	16.5	
1020	35	49.02	18.74	44.42	10.20	42.37	7.69	16.4	Adjust
1030	45	49.44	19.16	44.84	10.62	42.74	8.06	16.3	
1045	60	49.87	19.59	45.28	11.06	43.13	8.45	16.3	
1100	75	50.13	19.85	45.65	11.43	43.32	8.64	16.3	
1130	105	50.54	20.26	46.01	11.79	43.66	8.98	16.3	
1200	135	50.79	20.50	46.36	12.14	43.87	9.19	16.3	
1230	165	50.98	20.70	46.48	12.26	44.01	9.23	16.3	
1300	195	51.09	20.81	46.60	12.38	44.10	9.42	16.3	
1330	225	51.18	20.90	46.71	12.49	44.17	9.49	16.2	Adjust
1400	255	51.25	20.97	46.76	12.54	44.22	9.54	16.2	
1430	285	51.32	21.04	46.81	12.59	44.26	9.58	16.2	
1500	315	51.37	21.09	46.90	12.68	44.29	9.61	16.2	
1530	345	51.43	21.15	46.92	12.70	44.32	9.64	16.2	
1600	375	51.46	21.18	46.96	12.74	44.36	9.68	16.2	
1630	415	51.49	21.21	46.99	12.77	44.39	9.71	16.2	
1700	445	51.54	21.26	47.04	12.82	44.41	9.73	16.2	
1730	475	51.56	21.28	47.08	12.88	44.43	9.75	16.1	
1800	515	51.59	21.31	47.08	12.88	44.44	9.76	16.1	
1830	545	51.62	21.34	47.12	12.92	44.46	9.78	16.1	

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): **0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88**

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" =**

Geosyntec Consultants

Aquifer Testing

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Project Name: Chemours
Location: Fayetteville, NC
Date: 12/9 - 12/10

Project Number: TR0795A
Phase/Task: 07/02
Well ID: EW-4

Date/Time	Elapsed Time (min)	EW-4 DTW (ft)	Drawdown in Pumping Well	OW-7 Observation Point #1 Water Level (ft bgs)	Drawdown Observation Point #1 (ft bgs)	OW-3 Observation Point #2 Water Level (ft bgs)	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
1900	575	51.66	21.38	47.14	12.94	44.48	9.80	16.1	
1930	605	51.68	21.40	47.16	12.96	44.50	9.82	16.1	
2000	635	51.70	21.42	47.18	12.98	44.51	9.83	16.1	
2030	665	51.72	21.44	47.21	13.01	44.53	9.85	16.1	
2100	695	51.76	21.48	47.23	13.03	44.55	9.87	16.05	
2130	725	51.78	21.50	47.25	13.05	44.57	9.89	16.05	
2200	755	51.80	21.52	47.26	13.06	44.57	9.89	16.05	
2230	785	51.82	21.54	47.28	13.08	44.58	9.90	16.1	
2300	815	51.84	21.56	47.30	13.10	44.59	9.91	16.1	
2330	845	51.85	21.57	47.32	13.12	44.61	9.93	16.1	
0000	875	51.86	21.58	47.32	13.12	44.61	9.93	16.05	
0030	905	51.88	21.60	47.35	13.15	44.61	9.93	16.05	
0100	935	51.88	21.60	47.35	13.15	44.62	9.94	16.05	
0130	965	51.90	21.62	47.35	13.15	44.62	9.94	16.05	
0200	995	51.91	21.63	47.35	13.15	44.63	9.95	16.05	
0230	1025	51.92	21.64	47.38	13.18	44.64	9.96	16.05	
0300	1055	51.94	21.66	47.38	13.18	44.65	9.97	16.05	
0330	1085	51.94	21.66	47.39	13.19	44.65	9.97	16.05	
0400	1115	51.96	21.68	47.40	13.20	44.66	9.98	16.05	
0430	1145	51.97	21.69	47.41	13.21	44.67	9.99	16.05	
0500	1175	51.98	21.70	47.42	13.22	44.67	9.99	16.05	
0530	1205	52.00	21.72	47.44	13.24	44.68	10.00	16.05	
0600	1235	52.01	21.73	47.46	13.26	44.70	10.02	16.05	
0630	1265	52.01	21.73	47.46	13.26	44.70	10.02	16.05	
0700	1295	52.01	21.73	47.46	13.26	44.70	10.02	16.00	
0730	1325	52.00	21.72	47.44	13.24	44.70	10.02	16.00	
0800	1355	52.02	21.74	47.46	13.26	44.71	10.03	16.00	
0830	1385	52.03	21.75	47.46	13.26	44.73	10.05	16.00	
0900	1315	52.04	21.76	47.48	13.28	44.74	10.06	16.00	
0930	1345	52.09	21.81	47.51	13.31	44.76	10.08	16.00	
1000	1375	52.11	21.83	47.53	13.33	44.77	10.09	16.00	
1030	1405	52.12	21.84	47.54	13.34	44.77	10.09	16.00	
1100	1435	52.13	21.85	47.55	13.35	44.78	10.10	16.00	
1130	1465	52.13	21.85	47.54	13.34	44.78	10.10	16.00.	
1200	1495	52.13	21.85	47.54	13.34	44.77	10.09	16.00	
1230	1525	52.13	21.85	47.53	13.33	44.77	10.09	16.00	

Scanned with CamScanner

Project Name: Chemours PDI	Location: Fayetteville, NC	Date: 11-30-2020
Project Number: TR0795A	Phase/Task: 07/02	Personnel: A.Vol/L.Tart

Pumping Well: EW-5	Screen Interval (ft) 37-67'	DTW (ft) 32.96
Transducer Depth: 50'	Well Diameter (in) 6"	DTB (ft) 67'
Serial No: INSITU LIVE	Tubing Diameter (in) 1 1/2"	Casing Height (ft) 0'
	Pump/Tubing Setting (ft) 52'	Measurement Location: TOC
	Barometer Serial No: 0012124274	Barometer Depth:

Observation Well 1: OW-7	Transducer Depth: 64.8	Serial No: # 0052123594
Observation Well 2: OW-8	Transducer Depth: 64.8	Serial No: # 0052123700
Obs. Well 1 DTW (ft): 35.94	Obs. Well 2 DTW (ft): 37.55	

Test Start Date: 11-30-2020 Test Start Time: 1045AM
Test End Date: 12-1-2020 Test End Time: 1410 PM
Water Level Meter Model/Serial #: Solinist 101 / Heron T-Dipper

Date/ Time	*Elapsed Time (min)*	*DTW (ft)*	*Drawdown in Pumping Well*	*Observation Point #1 Water Level (ft bgs)* OW-7	*Drawdown Observation Point #1 (ft bgs)*	*Observation Point #2 Water Level (ft bgs)* OW-8	*Drawdown Observation Point #2 (ft bgs)*	*Pumping Rate (gpm)*	*Comments*
11/30/20	1040	32.96		35.94		37.55	Gom:	26gpm	Ugpm
11/30/20	1055	37.16	4.20	36.65	0.71	39.35	1.80	26.5	
11/30/20	1110	37.28	4.32	36.66	0.72	38.40	1.85	26.7	
11/30/20	1125	37.35	4.39	36.70	0.76	38.44	1.89	27.1	Adjust rate
11/30/20	1140	37.36	4.40	36.71	0.77	38.45	1.90	26.3	
11/30/20	1155	37.32	4.36	36.71	0.77	38.45	1.90	26.0	
11/30/20	1210	37.35	4.39	36.73	0.79	38.48	1.93	26.0	
11/30/20	1240	37.40	4.44	36.75	0.81	38.51	1.96	26.0	
11/30/20	1310	37.43	4.47	36.78	0.84	38.51	1.96	26.0	
11/30/20	1340	37.46	4.50	36.79	0.85	38.53	1.98	26.1	
11/30/20	1410	37.48	4.52	36.80	0.86	38.55	2.00	26.2	
11/30/20	1440	37.50	4.54	36.82	0.88	38.56	2.01	26.1	
11/30/20	1510	37.52	4.56	36.83	0.89	38.58	2.03	26.1	
11/30/20	1540	37.55	4.59	36.85	0.91	38.59	2.04	26.0	
11/30/20	1610	37.58	4.63	36.86	0.92	38.61	2.06	26.0	
11/30/20	1640	37.58	4.63	36.87	0.93	38.62	2.07	26.1	
11/30/20	1710	37.60	4.65	36.88	0.94	38.63	2.08	26.1	
11/30/20	1740	37.61	4.66	36.88	0.94	38.63	2.08	26.0	
~~11/30/20~~	~~1810~~								
11/30/20	1840	37.63	4.68	36.91	0.97	38.64	2.09	26.1	
11/30/20	1910	37.64	4.69	36.91	0.97	38.65	2.10	26.1	
11/30/20	1940	37.66	4.71	36.92	0.98	38.66	2.11	26.0	
11/30/20	2010	37.67	4.72	36.92	0.98	38.66	2.11	26.1	
11/30/20	2040	37.67	4.72	36.92	0.98	38.67	2.12	26.1	
11/30/20	2110	37.68	4.73	36.93	0.99	38.68	2.13	26.1	

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
=(67 feet - 32.96 feet) x 1.47 gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
=(gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** =

12/2/2020 DFR

0700 CCI onsite. unwrap hose. at road crossing.
0800 Brandon (Parsons) onsite to supervise.
CCI attempt to empty hose. Mob generator and pump to EW-4. Safety tailgate.

1030 A.VO onsite. Talk with Tim Palker (CCI). - empty pit for Chemours wait for skidsteer

1130 Brandon leave site.
All @ new treatment plant. Check out sump/pit to empty.
Will wait for details for Bill/Jake.

1231 CCI mob to lunch. Alli wait for skidsteer.

1330 CCI / Alli mob to EW-5. (2 new trenches in road.)
CCI begin to empty/roll hose. Empty into tote.
Alli check DTW in EW-5 cluster.

OW-8 @ 1346 37.77' TOC
OW-7 @ 1348 36.06' TOC
EN-5 @ 1349 33.18' TOC
] not fully recovered.

1359 Pull transducers and barologger from OW-8. Download/Reset

DTW 37.77' TOC
OW-8 [#0052123700 - Stop at 1401. Restart at 1406
#0012124274 - Stop at 1407. Restart at 1412.

Rename recovery logs
OW-8_CRTest_Recover
OW-8_CRTest_Recover_BARO

Deploy at 1440.

1421 Pull transducer from OW-7.
DTW 36.06' TOC
OW-7 #0052123594 - Stop at 1425. Restart at ~~1429~~ 1429.
Redeploy at 1432.

1432 Start downloading data from Winsitu logger in EW-5.

EW-5 DTW 33.17 @ 1449
OW-8 DTW 37.76 @ 1450
OW-7 DTW 36.16 @ 1451

1600 CCI roll up hose and load onto pallet to take to EW-4. Begin rolling up hose for united pick up.

Geosyntec consultants

Page ___ of ___

Written by: ALLI VO Date: 12/03/20 (DD MM YY) Reviewed by: ALLI VO Date: 12/03/20 (DD MM YY)

Client: CHEMOURS Project: TR0795A Project/Proposal No. ______ Task No. 07/02

DFR 12/3/2020

750 A.VO get work permit. Call Les to confirm accept H_2O.
800 A.VO mob to EW-2 area. Wait for parsons/CCI.
Luke Tart call to help with mobilization.
815 Brandon Weidner (Parsons) onsite. CCI onsite. Safety
tailgate. – emphasize ongoing adjacent work.
835 Luke Tart (Parsons) onsite. Discuss plan safety.
0900 A.VO/CCI mob to EW-1 to empty frac (1 load OR
3000 gal). A.VO check road condition on LTW road.
Bladed but no gravel. Culvert fixed somewhat.
Alli call Ryan to check OK to pull pump today.
WL within 0.19' baseline. Pull later today.
1000 Mob to EW-5 to roll out lay flat hose to end of
LTW turnaround.
1130 Surge rock onsite at Bill Hall blacktop. Alli mob to
escort them to Billy at LTW road. CCI/Parsons to lunch.
1200 Alli mob to South entrance to meet more rock
trucks. Expect CCI/Parsons to return at 1300.
Luke/Brandon onsite. Download MW-9S barologger.
1300 CCI onsite at EW-5. Roll up the hose. Alli supervise.
Wait for call from Bill

1340 DTW
33.11' TOC @ EW-5 Pull transducer 1345
36.06' TOC @ OW-7 Pull transducer 1350
1354 37.70' TOC @ OW-8 Pull transducer 1355

1600 OW-2 Place transducer/baro DTW 34.05' TOC
EW-4 Insitu transducer placed DTW 30.09' TOC
1601 OW-3 Place transducer DTW 34.50' TOC

1400 Alli mob to sign off on EW-3 frac tank
purge. Mob back to EW-4 / Check on LTW road cond.
Mob to sign off another load (see manifest). Mob
to EW-4 to start insitu transducer. All data for
EW-5 CR Test downloaded to Alli's computer.

Task Planning

Standard Equipment Requirements

generator, wash pump

Example: Back Hoe-Cherry Picker -Compressor-Crane-Forklift-Tractor Trailer ____NONE

Special Equipment / Tools

vac truck

Example: Radios-Special Testing Meters-Special Tools-Bead Blaster-SCBA ____NONE

Other Crafts or Companies Working on This Job

CCI
Parsons

Example: Equipment Vendor-Laborers-Special Hole Drilling-Testing Co. ____NONE

Risk Management

Safe Work Practices

- ☐ Asbestos Abatement Procedure
- ☐ Lead Abatement Procedure
- ☐ Confined Space Entry
- ☐ Crane Critical Lift Plan
- ☐ Close Proximity Permit
- ☐ Excavation Permit
- ☐ Hot Taps
- ☐ Line Breaking/Equipment Opening
- ☐ Lock-Out / Tag-Out
- ☐ SDS & Labeling
- ☐ Other ____________
- ☒ N/A

Basic Safeguards

- ☐ Arc Shields
- ☒ Barricade - Complies with Work Permit?
- ☐ Fire Extinguishers Located
- ☐ Fire Watch
- ☐ Hole Covers w/ Labels
- ☐ Hole Watch
- ☒ Housekeeping
- ☐ Lighting - Additional
- ☐ Scaffolding
- ☒ Tools/Equip. in good condition
- ☐ Ventilation / Exhaust Systems
- ☐ Other
- ☐ N/A

PPE Required

- ☐ Nomex
- ☐ Acid Suit
- ☐ FaceShield
- ☐ Goggles
- ☐ Foot Wear (Metatarsal Guards)
- ☐ Static Protection
- ☐ Knee Pads
- ☐ Hearing Protection
- ☐ Respirator (APR / SCBA)
- ☐ Butyl Gloves for the area
- ☐ Full Body Harness (anchor points identified)
- ☐ Other ____________
- ☒ N/A

Gloves Required

- ☒ Leather
- ☐ Cut / Puncture Resistant
- ☐ Chemical Resistant
- ☐ Dorsal Protection Gloves
- ☐ Welders Gloves
- ☐ Electrical Voltage
- ☐ Other ____________

MANDATORY COACH QUESTIONS (PLACE A CHECK MARK NEXT TO EACH QUESTION ANSWERED)

(1) Am I fit to work today? ✓
(2) Do I have the right tools and equipment to complete my task? ✓
(3) Am I committed to "Zero Harm 24/7?" ✓
(4) Do I have all the PPE? ✓
(5) Does my STA identify the potential risks and how to deal with my task safely? ✓
(6) Can I get hurt performing this task? ✓
(7) Do I have the proper training to do this job? ✓
(8) Do you know how to contact your supervisor? ____
(9) Am I comfortable with the STOP Work process? ✓
(10) What would it mean if I got hurt today? ✓

I acknowledge receiving and understanding these instructions, I will fully comply with the assigned tasks and control measures.

Signature	Badge
	10473
	5952
Lamont Evans	
	6391

Foreman, Employee Comments / Changes in conditions

Field audit review:

Critical Job Review (Brown & Root Only)

Two up signatures required ? Y N (if yes, circle activity below)

Chemical Suit	Group Lock-Out	Opening and Isolation of Equipment
Confined Space	Excavation	Elevated Work Outside of approved platform
D&R Electrical	Line Break	
D&R Process Piping	Critical Lift	

Supervisor Review / Authorization of STA @ Task Location

(Signature) ____________ (Print) ____________

Two Up Approver Signature: ____________ **Date** ____________

Project Name: Chemours
Location: FayetteVille NC
Date: 11/30/2020
Project Number: TR0795A
Phase/Task: 07/02
Well ID: EW-5

Date/Time	Elapsed Time (min)	DTW (ft) EW-5	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs) OW-7	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs) OW-8	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
11-30-20	2140	37.69	4.74	36.93	0.99	38.68	2.13	26.1	
	2210	37.69	4.74	36.94	1.00	38.68	2.13	26.1	
	2240	37.70	4.75	36.94	1.60	38.68	2.13	26.1	
	2310	37.71	4.76	36.94	1.00	38.68	2.13	26.1	
	2340	37.71	4.76	36.94	1.00	38.68	2.13	26.1	
12-1-20	0010	37.72	4.77	36.95	1.01	38.69	2.14	26.1	
	0040	37.72	4.77	36.95	1.01	38.69	2.14	26.1	
	0110	37.73	4.78	36.96	1.02	38.70	2.15	26.1	
	0140	37.74	4.79	36.96	1.02	38.70	2.15	26.1	
	0210	37.75	4.80	36.97	1.03	38.71	2.16	26.1	
	0240	37.76	4.81	36.97	1.03	38.71	2.16	26.1	
	0310	37.76	4.81	36.98	1.04	38.72	2.17	26.1	
	0340	37.77	4.82	36.98	1.04	38.72	2.17	26.1	
	0410	37.78	4.83	36.98	1.04	38.73	2.18	26.1	
	0440	37.79	4.84	36.98	1.04	38.74	2.19	26.1	
	0510	37.79	4.84	36.99	1.05	38.75	2.20	26.1	
	0540	37.81	4.86	37.00	1.06	38.76	2.21	26.1	
	0610	37.81	4.86	37.01	1.07	38.75	2.20	26.0	
	0640	37.81	4.86	37.01	1.07	38.76	2.21	26.0	
	0710	37.83	4.88	37.02	1.08	38.78	2.23	26.1	
	0740	37.84	4.89	37.02	1.08	38.80	2.25	26.1	
	0810	37.84	4.89	37.03	1.09	38.78	2.23	26.1	
	0840	37.85	4.90	37.04	1.10	38.79	2.24	26.1	
	0910	37.85	4.90	37.03	1.09	38.78	2.23	26.1	
	0940	37.86	4.91	37.05	1.11	38.80	2.25	26.1	
	1010	37.86	4.91	37.05	1.11	38.81	2.26	26.1	
	1040	37.87	4.92	37.04	1.10	38.80	2.25	26.1	
	1110	37.87	4.92	37.03	1.09	38.81	2.26	26.1	
	1140	37.86	4.91	37.03	1.09	38.79	2.24	26.1	
	1210	37.86	4.91	37.03	1.09	38.79	2.24	26.1	
	1240	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1310	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1340	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1410	37.86	4.91	37.02	1.08	38.79	2.24	SHUTDOWN	

Geosyntec Consultants
Aquifer Testing

Project Name: Chemours PDI
Location: Fayetteville, NC
Date: 11-30-2020
Project Number: TR0795A
Phase/Task: 07/02
Personnel: A.VO / L. Tart

Pumping Well: EW-5
Transducer Depth: 50'
Serial No: INSITU LIVE
Screen Interval (ft) 37-67'
Well Diameter (in) 6"
Tubing Diameter (in) 1 1/2"
Pump/Tubing Setting (ft) 52'
Barometer Serial No: 0012124274
DTW (ft) 32.96
DTB (ft) 67'
Casing Height (ft) 0'
Measurement Location: TOC
Barometer Depth:

Observation Well 1: OW-7
Transducer Depth: 64.8
Serial No: # 0052123594
Observation Well 2: OW-8
Transducer Depth: 64.8
Serial No: # 0052123700
Obs. Well 1 DTW (ft): 35.94
Obs. Well 2 DTW (ft): 37.55

Test Start Date: 11-30-2020
Test Start Time: 1045AM
Test End Date:
Test End Time:
Water Level Meter Model/Serial #: Solinist 101 / Heron T-Dipper

Date/ Time	Elapsed Time (min)	DTW (ft)	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs) OW-7	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs) OW-8	Drawdown Observation Point #2 (ft bgs)	Pumping Rate (gpm)	Comments
11/30/20	1040	32.96		35.94		37.55	Goal:	26gpm	0gpm
11/30/20	1055	37.16	4.20	36.65	0.71	39.35	1.80	26.5	
11/30/20	1110	37.28	4.32	36.66	0.72	38.40	1.85	26.7	
11/30/20	1125	37.35	4.39	36.70	0.76	38.44	1.89	27.1	Adjust rate
11/30/20	1140	37.36	4.40	36.71	0.77	38.45	1.90	26.3	
11/30/20	1155	37.32	4.36	36.71	0.77	38.45	1.90	26.0	
11/30/20	1210	37.35	4.39	36.73	0.79	38.48	1.93	26.0	
11/30/20	1240	37.40	4.44	36.75	0.81	38.51	1.96	26.0	
11/30/20	1310	37.43	4.47	36.78	0.84	38.51	1.96	26.0	
11/30/20	1340	37.46	4.50	36.79	0.85	38.53	1.98	26.1	
11/30/20	1410	37.48	4.52	36.80	0.86	38.55	2.00	26.2	
11/30/20	1440	37.50	4.54	36.82	0.88	38.56	2.01	26.1	
11/30/20	1510	37.52	4.56	36.83	0.89	38.58	2.03	26.1	
11/30/20	1540	37.55	4.59	36.85	0.91	38.59	2.04	26.0	
11/30/20	1610	37.58	4.63	36.86	0.92	38.61	2.06	26.0	
11/30/20	1640	37.58	4.63	36.87	0.93	38.62	2.07	26.1	
11/30/20	1712	37.60	4.65	36.88	0.94	38.63	2.08	26.1	
11/30/20	1740	37.61	4.66	36.88	0.94	38.63	2.08	26.0	
~~11/30/20~~	~~1810~~								
11/30/20	1840	37.63	4.68	36.91	0.97	38.64	2.09	26.1	
11/30/20	1910	37.64	4.69	36.91	0.97	38.65	2.10	26.1	
11/30/20	1940	37.66	4.71	36.92	0.98	38.66	2.11	26.0	
11/30/20	2010	37.67	4.72	36.92	0.98	38.66	2.11	26.1	
11/30/20	2040	37.67	4.72	36.92	0.98	38.67	2.12	26.1	
11/30/20	2110	37.68	4.73	36.93	0.99	38.68	2.13	26.1	

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (67 feet - 32.96 feet) x 1.47 gallons/foot = gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0

Geosyntec Consultants
Aquifer Testing

Project Name: Chemours
Location: FayettevilleNC
Date: 11/30/2020
Project Number: TR0795A
Phase/Task: 07/02
Well ID: EW-5

Date/Time	Elapsed Time (min)	DTW (ft) EW-5	Drawdown in Pumping Well	Observation Point #1 Water Level (ft bgs) OW-7	Drawdown Observation Point #1 (ft bgs)	Observation Point #2 Water Level (ft bgs) OW-8	Observation Point #3 Water Level (ft bgs)	Pumping Rate (gpm)	Comments
11-30-20	2140	37.69	4.74	36.93	0.99	38.68	2.13	26.1	
	2210	37.69	4.74	36.94	1.00	38.68	2.13	26.1	
	2240	37.70	4.75	36.94	1.60	38.68	2.13	26.1	
	2310	37.71	4.76	36.94	1.00	38.68	2.13	26.1	
	2340	37.71	4.76	36.94	1.00	38.68	2.13	26.1	
12-1-20	0010	37.72	4.77	36.95	1.01	38.69	2.14	26.1	
	0040	37.72	4.77	36.95	1.01	38.69	2.14	26.1	
	0110	37.73	4.78	36.96	1.02	38.70	2.15	26.1	
	0140	37.74	4.79	36.96	1.02	38.70	2.15	26.1	
	0210	37.75	4.80	36.97	1.03	38.71	2.16	26.1	
	0240	37.76	4.81	36.97	1.03	38.71	2.16	26.1	
	0310	37.76	4.81	36.98	1.04	38.72	2.17	26.1	
	0340	37.77	4.82	36.98	1.04	38.72	2.17	26.1	
	0410	37.78	4.83	36.98	1.04	38.73	2.18	26.1	
	0440	37.79	4.84	36.98	1.04	38.74	2.19	26.1	
	0510	37.79	4.84	36.99	1.05	38.75	2.20	26.1	
	0540	37.81	4.86	37.00	1.06	38.76	2.21	26.1	
	0610	37.81	4.86	37.01	1.07	38.75	2.20	26.0	
	0640	37.81	4.86	37.01	1.07	38.76	2.21	26.0	
	0710	37.83	4.88	37.02	1.08	38.78	2.23	26.1	
	0740	37.84	4.89	37.02	1.08	38.80	2.25	26.1	
	0810	37.84	4.89	37.03	1.09	38.78	2.23	26.1	
	0840	37.85	4.90	37.04	1.10	38.79	2.24	26.1	
	0910	37.85	4.90	37.03	1.09	38.78	2.23	26.1	
	0940	37.86	4.91	37.05	1.11	38.80	2.25	26.1	
	1010	37.86	4.91	37.05	1.11	38.81	2.26	26.1	
	1040	37.87	4.92	37.04	1.10	38.80	2.25	26.1	
	1110	37.87	4.92	37.03	1.09	38.81	2.26	26.1	
	1140	37.86	4.91	37.03	1.09	38.79	2.24	26.1	
	1210	37.86	4.91	37.03	1.09	38.79	2.24	26.1	
	1240	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1310	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1340	37.86	4.91	37.02	1.08	38.79	2.24	26.1	
	1410	37.86	4.91	37.02	1.08	38.79	2.24	SHUTDOWN	

Page ___ of ___

Geosyntec consultants

Written by: R. Grabelman Date: 23 / 10 / 20 (DD MM YY) Reviewed by: ____________ Date: __ / __ / __ (DD MM YY)

Client: Chemours Project: ____________ Project/Proposal No. ____________ Task No. ____________

0900 RG onsite, mob to EW-5 to Place transducers

well:	Screen: (bgs)	initial DTW (TOC)	Transducer depth (TOC)	Final DTW (TOC
OW-8	57-67'	38.19	62 + 2.8' = 64.8'	38.18 @1038
OW-7	57-67	36.60	62 +2.8 = 64.8'	36.57 @1043
EW-5	37-67	33.55	52	33.57 @1028

Barologger set in OW-8 @ ~19.5' BTOC.

Scanned with CamScanner

10/6/2020 - 10/7/2020
ALLI VO/RYAN GABELMAN

PFM Deployment

WELL ID	DATE	TIMEIN	(BOT.) PFM 1	(TOP) PFM 2	~~TOC~~ DTB	(TOC) DTW_I	(TOC) DTW_F	(top of PFM 1) DTB_A
PIW-10DR	10/6	1545	PFM-1	PFM-2	58.0' bgs	14.46'	—	47.5' bgs
PIW-9D	10/6	1618	PFM-3	~~PFM~~	46.2 toc	36.94'	37.01	40.79' toc
PIW-8D	10/7	0905	PFM-4	—	40.10' bgs	6.98'	6.82'	34.7' bgs
* remove transducer at 905. Replace at 0915.								
PIW-7D	10/7	0945	PFM-5	—	34.3 bgs	5.54	5.60'	29.42' bgs
PIW-11	10/7	1050	PFM-6	PFM-7	64.55 bgs	31.61	31.61	54.80' bgs
* Remove Transducer @ 1022. replace 1037								
PW-10R	10/7	1115	PFM-8	PFM-9	67.85 bgs	27.26	27.34	59.15
PIW-4D	10/7	1130	PFM-10	—	38.15 TOC	10.76' TOC	10.76	33.32
* Remove Transducer @ 1146 replace @ 1156.								
PIW-3D	10/7	1205	PFM-11	—	24.0 bgs	17.0'	17.01	19.10
transducer out@ 1209 in@ 1217								
PIW-2D	10/7	1240	PFM-12	PFM-13	50.1 bgs	36.73	34.54 ~~50.1~~ RG	41.09
screen 40-50'								
PIW-1D	10/7	1307	PFM-14	—	29	18.05	18.06	24.19
Transducer removed@ 1311 returned 1317								
PIW-11	10/7	1350	PFM-15	PFM-16	57.2	23.5	20.24'	47.3' bgs
PIW-12	10/7	1402	PFM-17	PFM-18	74.7	49.35	49.34	65.35
PIW-13	10/7	1425	PFM-19	PFM-20	65.3	48.7	48.73	55.3
PIW-14	10/7	1455	PFM-29	PFM-30	57.5	52.4	54.39	58.38
* skinny 1.5" PFMs								
OIW-15	10/7	1530	PFM-21	PFM-22	45.1 bgs ~~33.18~~	33.98 ~~45.1'~~ RG	34.01	36.2
PIW-6S	10/7	1607	PFM-23	PFM-24	28.75	13.94'	13.26'	
Transducer removed 1603								
PIW-7S	10/7		PFM-25	PFM-26	17.5'	6.3' toc	5.2	7.8

1445

Geosyntec consultants

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Written by: R. Gubelman Date: 21/10/20 (DD MM YY) Reviewed by: ___ Date: ___/___/___ (DD MM YY)

Client: ___ Project: ___ Project/Proposal No. ___ Task No. ___

1000 RG onsite join NC to develop OW-8
1400 Finish developing OW-7
1300 CCI + RFR drop Frac tank at EW-5
1509 Begin PFM sampling at PIW-10DR

1545 sample PIW-10DR PFM
1655 mobilize to PIW-9D
1630 Sample PIW-9D PFM

1700 RG + NC offsite

RG

Page ___ of ___

Geosyntec consultants

Written by: R. Grabelman Date: 22/10/20 (DD MM YY) Reviewed by: ________ Date: __/__/__ (DD MM YY)

Client: Chemours Project: ________ Project/Proposal No. ________ Task No: ________

0815 RG onsite, coordinate w/ AlliVo.
0840 meet NC at PIW-8D to sample PFM
0859 PIW 8D Transducer removed, PFM pulled, Transducer replaced (0900)
0930 mob to PIW-7S/D
1040 Remove Transducer in PIW-11, PFM Pulled / Transducer replaced (1042)

1208 Remove transducer at PIW-6S @ 1208, replace @ 1211

1243 Remove transducer at PIW-4D @ 1243, replace @ 1244

1307 Remove transducer at PIW-3D @ 1307, replace @ 1308

1425 Remove transducer at PIW-1D @ 1425, replace @ 1426

Page ___ of ___

Geosyntec consultants

Written by: R. Cabelnes Date: __/__/__ (DD MM YY) Reviewed by: ________ Date: __/__/__ (DD MM YY)

Client: Chemours Project: PFM Sampling Project/Proposal No. ________ Task No. ________

PFM SAMPLING

well:	(TOC) initial DTW	Depth interval	Sample ID	Sample Time	(TOC) Final DTW	Date
PIW-10DR	14.45'	48-58'	PIW-10DR-48-58-G	1545	14.45	10/21/20
			PIW-10DR-48-58R	1550		
PIW-9D	37.29'	40-45	PIW-9D-40-45-G	1630	37.29'	10/21/20
			PIW-9D-40-45-R	1635		
PIW-8D	7.30	35-40	PIW-8D-35-40-G	0910	7.30	10/22/20
			PIW-8D-35-40-R	0915		
PIW-7D	5.72	29-34	PIW-7D-29-34-G	0940	5.72	10/22/20
			PIW-7D-29-34-R	0945		
PIW-7S	5.45	7-17	PIW-7S-7-17-G	1000	5.50	10/22/20
			PIW-7S-7-17-R	1005		
PW-10R	27.35	57-67	PW-10R-57-67-G	1140	27.47	10/22/20
			PW-10R-57-67-R	1145		
PIW-11	31.18	54-64	PIW-11-5464-G	1050	31.18	
			PIW-11-54-64-R	1055		10/22/2020
PIW-6S	14.14	18-28	PIW-6S-18-28-G	1210	15.9	10/22/2020
			PIW-6S-1828-R	1215		
PIW-4D	10.77	32-37	PIW-4D-32-37-G	1245	10.77	10/22/2020
			PIW-4D-3237-R	1250		10/22/2020
PIW-3D	16.80	20-25	PIW-3D-20-25-G	1310	16.80	10/22/2020
			PIW-3D-20-25-R	1315		10/22/2020
PIW-14	52.63	56-66	PIW-14-56-66-G	1055	52.63	10/22/20
			PIW-14-56-66-R	1100		10/22/2020
PIW-2D	37.80	40-50	PIW-2D-40-50-G	1400	39.19	10/22/20
			PIW-2D-40-50R	1405		10/22/2020
PIW-1D	~~25-30~~ 18.0	25-30	PIW-1D-25-30-G	1425	18.01	10/22/20
			~~R~~ PIW-1D-25-30R	1430		10/22/2020
PIW-11	22.3	47-57	PIW-11-47-57-G	1500	27.75	10/22/2020
			PIW-11-47-57-R	1505		10/22/2020
PIW-12	49.43	64-74	PIW-12-64-74-G	1530	49.45	10/22/2020
			PIW-12-64-74-R	1535		
PIW-13	48.80	54-64	PIW-13-54-64-G	1550	48.83	10/22/20
			PIW-13-54-64-R	1555		
PIW-15	34.03	34-44	PIW-15-34-44-G	1625	34.04	
			PIW-15-34-44-R	1625		
			PIW-15-34-44-G MS	1630		
			PIW-15-34-44-G MS[illegible]	1631		
			PIW-15-34-44-R MS	1630		
			PIW-15-34-44-R MSREP	1631		
			DUP-1G	1200		
			DUP-1R	1200		

Scanned with CamScanner

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours
Location: Fayetteville, NC
Date: 9/29/2020
Project Number: TR0795
Phase/Task: 40
Personnel: A.V8 / N. Charles

Well ID: PIW-11
Screen Interval (ft) 47-57'
Pump/Tubing Setting (ft) 52'
Well Diameter (in) 2"
Tubing Diameter (in) 1/4"
DTW (ft) 23.61
DTB (ft) 57.0
Depth To Product (ft) N/A
Water Quality Meter Model #: Heron-Dipper T 5615
Measurement Location: TOC

Time	Purge Rate (mL min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
900	200	23.61	PURGE	—					
905	200	25.29	6.59	126.0	18.5	697	-38.8	0.34	-
910	200	26.33	6.58	120.9	18.6	711	-52.3	0.30	-
915	200	27.63	6.58	120.9	18.5	662	-56.4	0.26	-
920	200	28.87	6.58	127.0	18.6	623	-60.0	0.22	-
925	200	29.78	6.57	125.9	18.6	737	-61.4	0.22	-
930	200	29.93	6.57	124.6	18.8	644	-65.3	0.19	-
935	200	31.21	6.57	125.0	18.8	641	-65.1	0.17	-
940	200	31.59	6.57	126.1	19.3	660	-67.9	0.16	-
945	200	31.98	6.58	127.7	19.3	658	-69.4	0.15	-
950	200	31.99	6.59	127.3	19.5	645	-70.4	0.15	-
955	200	32.02	6.56	127.3	19.8	605	-68.5	0.14	-
1000	200	32.09	6.58	125.7	19.9	662	-69.9	0.16	-
1005	200	32.10	6.58	125.7	19.9	647	-72.8	0.14	-
1010	200	32.14	6.58	124.8	19.9	640	-74.1	0.14	-
1015	175	32.17	6.58	125.1	20.1	645	-75.4	0.14	-
1020	175	32.19	6.58	125.0	20.1	675	-765	0.14	-
1025	SAMPLE								

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbidity	10% or < 10 NTU	none
DO	10% or 0.2 mg L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis
PIW-11-20200929 @ 1025

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (57 feet - 23.61 feet) x 0.16 gallons/foot = 5.34 gal

Well Capacity (gallons foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6" = 1.47; 12" = 5.**

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

Geosyntec consultants

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours Location: Fayetteville, NC Date: 9/29/2020 9/30/2020/10/01/2020

Project Number: TR0795 Phase/Task: 40 Personnel: A. Vo | N Charles

Well ID: PIW-12

Screen Interval (ft) 64-74'

Pump/Tubing Setting (ft) 69'

Well Diameter (in) 2"

Tubing Diameter (in) 1/4"

DTW (ft) 49.24

DTB (ft) 74

Depth To Product (ft) NA

Water Quality Meter Model #: Heron Dipper-T 5615

Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1105	200	Begin	purge	Stop.	Too	much head	for	peri	pump
~~09/30/2020 1355~~	~~Purge~~	~~Started~~							
10/01/2020 1350	Purge	Started							
1355	250	49.28	6.26	301.6	18.7	459	54.5	7.52	
1400	250	49.69	6.00	303.5	18.6	126	75.8	6.93	
1405	250	49.01	4.88	318.5	18.4	82.8	121.4	3.27	
1410	250	49.03	4.54	333.7	18.4	54	130.4	1.08	
1415	250	49.20	4.40	338.4	18.3	48	138.4	0.60	
1420	250	49.00	4.28	343.1	18.3	119	148.9	0.37	
1425	250	49.00	4.21	345.4	18.2	47.6	152.2	0.43	
1430	250	49.02	4.15	349.0	18.3	31.8	155.0	0.29	
1435	250	49.02	4.12	350.2	18.3	19.8	154.3	0.22	
1440	250	49.02	4.11	351.4	18.3	20.9	152.7	0.19	
1445	250	49.03	4.13	352.2	18.2	35.2	150.5	0.16	
1450	250	49.02	4.06	354.3	18.1	19.9	151.5	0.14	
1455	250	49.02	4.10	353.8	18.2	9.4	149.6	0.14	
1500	250	49.02	4.04	354.1	18.2	7.9	150.7	0.14	
1505	Samples	taken							
1510	Purge	stopped							

Bladder pump cycle setting
7s inlet
3s discharge

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbidity	10% or < 10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

PIW-20201001 PFAS
10/01/2020

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (74 feet - 49.24 feet) x 0.16 gallons/foot 3.96 gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (0.0026 gal/ft x 69 ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; 1/2

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours
Location: Fayetteville, NC
Date: 10/01/2020

Project Number: TR0795
Phase/Task: 40
Personnel: N. Charles, M. Wang

Well ID: PIW-13
Screen Interval (ft) 54' - 64'
Pump/Tubing Setting (ft) 59'
Well Diameter (in) 2"
Tubing Diameter (in) 1/4"
DTW (ft) 48.39
DTB (ft) 65
Depth To Product (ft) NA
Water Quality Meter Model #: Heron Dipper - T 5615
Measurement Location: TOC

Time	Purge Rate (mL min)	DTW (ft)	pH (S.U.)	Specific Conductance (μS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1540	Purge	Start							
1545	350	48.39	3.84	344.1	18.8	75.4	267.5	0.54	
1550	350	48.38	3.74	382.2	18.3	29.0	259.3	0.26	
1555	350	48.38	3.68	418.6	18.1	39.3	251.1	0.16	
1600	350	48.41	3.68	448.5	17.8	50.1	249.3	0.12	
1605	350	48.42	3.69	406.2	18.0	30.7	245.4	0.10	
1610	350	48.38	3.70	403.8	17.8	24.0	242.1	0.10	
1615	350	48.39	3.71	395.2	18.0	19.0	240.1	0.09	
1620	350	48.43	3.72	390.3	17.7	20.5	238.5	0.07	
1625	350	48.43	3.72	384.7	18.0	12.2	236.8	0.06	
1630	350	48.42	3.73	380.3	17.8	14.1	235	0.06	
1635	350	48.41	3.73	378.8	17.8	10.6	235.3	0.05	
1640	350	48.41	3.74	378.0	17.9	11.5	234.2	0.05	
1645	350	48.39	3.74	376.4	18.1	4.47	235.1	0.05	
1650	350	48.44	3.74	372.5	18.0	4.17	233.3	0.04	
1655	Samples	taken							

Bladder pump cycle setting: 7s inlet 3s discharge

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or < 10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

PIW-13-20201001

10/01/2020 1655

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY

= (64 feet - 48.39 feet) x 0.16 gallons/foot = 2.49 gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME

= (0.0021 gal/ft x 59 ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours Location: Fayetteville, NC Date: 10/02/20

Project Number: TR0795 Phase/Task: Personnel: M Wang; M Schott

Well ID: PIW15 Screen Interval (ft) 34-44 DTW (ft) 33.55

Pump/Tubing Setting (ft) 39 DTB (ft) 47.76

Well Diameter (in) 2 Depth To Product (ft) —

Tubing Diameter (in) 1/4

Water Quality Meter Model #: YSI Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (μS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
~~1150~~	~~Purge~~	~~started~~							
1130	Started purging. bladder pump. 7s, 3s cycle.								
1135	440	33.57	4.33	133.1	17.5	448	78.7	0.26	
1140	440	33.57	4.34	132.4	17.4	385	87.0	0.17	
1145	440	33.56	4.32	131.9	17.4	231	91.6	0.14	
1150	440	33.56	4.33	131.8	17.4	168	94.4	0.15	
1155	440	33.58	4.31	132.4	17.4	126	96.0	0.26	
1200	not R	33.58	4.31	131.6	17.5	92.9	95.3	0.20	
1205	NR	33.59	4.31	133.6	17.4	67.5	95.0	0.15	
1211	NR	33.58	4.29	134.2	17.5	76.3	94.4	0.12	
1217	440	33.60	4.32	132.0	17.5	52.5	93.4	0.11	
1225	NR	33.60	4.31	133.0	17.4	39.8	91.4	0.10	
1230	NR	33.60	4.30	133.4	17.4	49.8	87.6	0.10	
1235	NR	33.60	4.30	132.4	17.3	40.7	88.9	0.09	
1240	440	33.59	4.30	132.8	17.3	32.2	86.1	0.09	
1245	440	33.61	4.31	132.1	17.4	35.5	85.3	0.11	
1250	440	33.60	4.29	132.0	17.4	33.8	84.0	0.11	
1255	440	33.59	4.29	132.6	17.4	30.9	82.9	0.09	
1300		33.60				31.5			

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbitiy	10% or <10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis

PIW-15-20201002
@ 1300
FBLK-GW-3-20201002
@ 1305

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (47.76 feet - 33.55 feet) x 0.16 gallons/foot = 2.27 gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

Daily Field Report

ect Name: Chemours
Project Number: TR0795
Field Personnel: MWang - M.Schott
Recorded By: MWang
Weather: Sunny 60-70
Date: 10/02/20
Page 1 of 1
Primary Activities: GW sampling

Time	Description of Activites
0830	MWang & M. Schott (Geosyntec) arrived onsite
0835	MW & MS got temperature checked at the main gate.
0855	MW get the work permit for 10/02/20.
0905	MW & MS mob to PZW-14.
0955	YSI is malfunctioning and PZW-14 well casing is bended, can't put bladder pump in. Left site to get some tools.
1035	Back onsite and fixed YSI.
1045	Mob to PZW-15.
1300	Finished sampling @ PZW-15.
1330	Packed & left site.

MWang

ph 7 = initial read = 7.0 calibrate to 7.0

ph 4 = initial read = 4.10 calibrate to 4.02

ph 10 = initial read = 10.0 calibrate to 10.03

Cond = initial read = 1430 calibrate to 1413

ORP = initial read = 238.5 cal to 240

DO = intial read = 9.08 calibrate to 8.99 mg/L

90% [illegible] 97%

Turbidity Cal.

Standard	Actual
20	20.6
100	219
800	886

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours
Location: Fayetteville
Date: 9/28/2020
Project Number: TR0795/40
Phase/Task: 40 / GW sampling
Personnel: RG, NC

Well ID: PIW-16D
Screen Interval (ft) 90-100
Pump/Tubing Setting (ft) 95
Well Diameter (in) 2"
Tubing Diameter (in) 1/4"
Water Quality Meter Model #: YSI Pro Plus
DTW (ft) 21.56
DTB (ft) ~103 TOC
Depth To Product (ft) N/A
Measurement Location: TOC

Time	*Purge Rate (mL/min)*	*DTW (ft)*	*pH (S.U.)*	*Specific Conductance (µS/cm)*	*Temp (°C)*	*Turbidity (NTU)*	*ORP (mV)*	*DO (mg/L)*	*Comments*
1325	BEGIN PURGING								
1330	200	21.60	6.23	62.6	19.5	8.52	-62.7	0.20	
1335	200	21.61	6.21	62.4	19.7	4.80	-63.7	0.16	
1340	200	21.65	6.21	61.5	19.6	5.99	-63.5	0.13	
1345	200	21.64	6.21	60.4	19.5	7.20	-63.4	0.14	
1350	200	21.69	6.21	61.4	19.5	4.01	-63.7	0.15	
1355	200	21.69	6.21	61.3	19.4	2.05	-63.9	0.22	
1355	Start Sampling								
1407	Purge Stopped								

Stabilization Criteria	*EPA Region 4*	*ASTM D 6771-02*
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbidity	10% or < 10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis
PIW-16D-20200928 @ 1400
PIW-16D-20200928-MS @ 1405
PIW-16D-20200928-MSD @ 1355
DUP-1-20200928 @ 1200

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (100 feet - 21.56 feet) x 0.16 gallons/foot = 12.55 gal

Well Capacity (gallons/foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (0.0026 gal/ft x 100 ft) + 0.06 gallons = 0.32 gallons

Tubing Inside Dia. Capacity (gal/ft): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2**

Geosyntec Consultants
Groundwater Sampling Log

Project Name: Chemours
Location: Fayetteville
Date: 09/28/2020
Project Number: TR0795
Phase/Task: 40/GW
Personnel: RG/NC

Well ID: PIW-16S
Screen Interval (ft) 35-45
Pump/Tubing Setting (ft) 40
Well Diameter (in) 2
Tubing Diameter (in) 1/4
DTW (ft) 16.69
DTB (ft) 47.56
Depth To Product (ft) N/A
Water Quality Meter Model #: YSI Pro DSS
Measurement Location: TOC

Time	Purge Rate (mL/min)	DTW (ft)	pH (S.U.)	Specific Conductance (µS/cm)	Temp (°C)	Turbidity (NTU)	ORP (mV)	DO (mg/L)	Comments
1420	Begin		PURGE						
1425	200	17.09	5.23	81.9	18.9	13.3	135.7	1.42	
1430	200	17.10	5.25	82.2	18.7	13.9	159.4	1.32	
1435	200	17.10	5.25	82.6	18.8	11.4	172.8	1.21	
1440	200	17.08	5.27	82.5	18.7	14.0	180.6	1.14	
1445	200	17.09	5.26	83.3	18.7	19.0	184.7	0.89	
1450	200	17.06	5.22	84.4	18.7	22.5	190.9	0.67	
1455	200	17.07	5.20	84.8	18.7	18.7	193.9	0.57	
1500	200	17.07	5.20	84.8	18.6	11.8	196.5	0.53	
1505	200	17.07	5.20	84.9	18.6	10.2	197.3	0.51	
1510	200	17.06	5.19	84.7	18.7	5.19	198.5	0.49	
1515	Samples started								
1520	Purge stopped								

Stabilization Criteria	EPA Region 4	ASTM D 6771-02
pH	0.1	0.2
Sp. Cond.	5%	3%
Turbidity	10% or 10 NTU	none
DO	10% or 0.2 mg/L	10% or 0.2 mg/L
ORP	none	20 mV

Sample ID with Time and Analysis
PIW-16S-20200928 @ 1515

Well Volume = (TOTAL WELL DEPTH - STATIC DEPTH TO WATER) x WELL CAPACITY
= (feet - feet) x gallons/foot = gal

Well Capacity (gallons/foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.

Equipment Volume = (TUBING CAPACITY x TUBING LENGTH) + FLOW CELL VOLUME
= (gal/ft x ft) + gallons = gallons

Tubing Inside Dia. Capacity (gal/ft): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2

Surface Water Samples 09/30/2020

Geosynt
consulta

Daily Field Report

Project Name: Chemours
Project Number: TR0795
Field Personnel: N. Charles, M. WAng
Recorded By: NAC
Weather: Sunny

Date: 09/30/2020 Page 1 of 1
Primary Activities: GW/SW Sampling

Time	Description of Activites
0930	WC-1 YSI Temp: 20.5°C DO: 6.08 mg/L SPC: 186.2 µS/cm PH: 6.36 ORP: 174.4 mV
~~0955~~	~~WC-IP-1-20200930 YSI Reading~~ ~~Temp 20.6°C DO: 7.47 mg/L SPC: 71.5 µS/cm PH: 6.12~~ ~~ORP 133.5 mV~~
0955	WC-IP-1-20200930 YSI Reading. Temp: 20.6°C DO: 5.77 mg/L SPC: 65.2 µS/cm PH: 6.03 ORP: 152.1 mV
1020	WC-IP-2-20200930 YSI Readings Temp: 20.7°C DO: 6.08 mg/L. SPC: 64.8 µS/cm PH: 6.09 ORP: 153.5
1045	WC-IP-3-20200930 YSI Readings Temp: 20.8°C DO: 6.71 mg/L SPC: 64.4 µS/cm PH: 6.11 ORP: 141.4 mV
1100	WC-IP-4-20200930 Temp: 20.8°C DO: 6.55 mg/L SPC: 64.4 µS/cm PH: 6.12 ORP: 148.3
1120	WC-2-20200930 Temp: 20.9°C DO: 6.17 mg/L SPC: 64.6 µS/cm PH: 6.13 ORP: 149.6 mV
•	Dup taken at WC-2
•	MSD taken at WC-2

Dup taken at WC-2
MSD at WC-2

Project Name TR0795A

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

12/11/2020

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/11/2020	0920	1	EW-4	3,000	Nicholas Charles / Geosyntec	N.	Les Nash	
12/11/2020	1130	2	EW-4	3,000	Nicholas Charles / Geosyntec	N.	Les Nash	
12/11/2020	1345	3	Between EW-1 & EW-2	3,000	Nicholas Charles / Geosyntec	N.	Les Nash	
12/11/2020	1415	4	Between EW-1 & EW-2	3,000	Nicholas Charles / Geosyntec	N.	Les Nash	
12/11/2020	1445	5	Between EW-1 & EW-2	3,000	Nicholas Charles / Geosyntec	N.	Brent J. Israel	
~~12/11/2020~~	—	~~6~~	~~EW-3~~	~~3,000~~	~~Nicholas Charles / Geosyntec~~	~~N.~~	—	—

N.

Project Name Chemours EW-2 CR Test

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
11/19/20	0742	1	EW-2	3,000	Lamont Evans (CCI)	Lamont Evans	Abe Adger	
"	0810	2	"	3,000	"	Lamont Evans	Abe Adger	
"	0844	3	"	3,000	"	Lamont Evans	Les Nash	Les Nash
"	0910	4	"	3,000	"	Lamont Evans	Abe Adger	
"	0959	5	"	3,000	"	Lamont Evans	Les Nash	Les Nash
"	1033	6	"	3,000	"	Lamont Evans	Les Nash	Les Nash
"	1215	7	"	3,000	"	Lamont Evans	Abe Adger	
"	1250	8	"	3,000	"	Lamont Evans	Abe Adger	
"	1319	9	"	3,000	"	Lamont Evans	Les Nash	Les Nash
"	1350	10	"	3,000	"	Lamont Evans	Les Nash	Les Nash
"	1424	11	"	3,000	"	Lamont Evans	Abe Adger	
"	1505	12	"	3,000	"	Lamont Evans	Abe Adger	
"	1634	13	"	3,000	"	Lamont Evans	Ron Campbell	
"	1705	14	"	3,000	"	Lamont Evans	Ron Campbell	

Projec Name Chemours

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/10	1005	1	EW-4	3000	Lamont Evans CCI		Les Nash	
12/10	1120	2	EW-4	3000	Lamont Evans CCI		Les Nash	
12/10	1330	3	EW-4	3000	Lamont Evans		~~Les Nash~~ Abe Alex	
12/10	1440	4	EW-4	3000	Lamont Evans		Les Nash	
12/10	1600	5	EW-4	3000	Lamont Evans		Les Nash	
					Lamont Evans		Les Nash	
					Lamont Evans			
					Lamont Evans			

Projec Name Chemours

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/9		1	EW-4	3000	Lamont Evans (CCI)		Les Nash	

Projec Name Chemours
Outfall 003 Treatment System Discharge Log
Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/7/20	1205	1	EW-3	3000	CCI (Lamont)	Lamont Evans	Les Nash	
12/7		2	EW-4	3000	CCI (Lamont)	Lamont Evans		

Project Name Chemours

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/3	0955	1	EW-1	3000	Lamont (CCI)	Lamont Evans	Les Nash	[illegible] Nash
12/3	1440	2	EW-3	3000	Lamont (CCI)	Lamont Evans	Les Nash	[illegible] Nash
12/3	1540	3	EW-3	3000	Lamont (CCI)	Lamont Evans	Les Nash	[illegible] Nash
12/3	1605	4	EW-3	3000	Lamont (CCI)	Lamont Evans	Les Nash	[illegible] Nash
						Lamont Evans		
						Lamont Evans		

Project Name EW-2 CR Test
Outfall 003 Treatment System Discharge Log
Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
11/19	1735	15	EW-2	3,000	LAMONT EVANS (CC.)	LAMONT EVANS	RON CAMPBELL	
11/20	0925	1	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1000	2	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1050	3	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1125	4	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1210	5	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1240	6	EW-2	3,000	LAMONT EVANS	LAMONT EVANS	Les Nash	Nash
11/20	1315	7	EW-2	3,000	Michael Whitaker	Michael Whitaker	Les Nash	Nash
11/20	1345	8	EW-2	3,000	Michael Whitaker	Michael Whitaker	Les Nash	Nash

Projec Name Chemours - PDI
Outfall 003 Treatment System Discharge Log
Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/14	0915	1	EW-1	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1010	2	EW-1	3000	Lamont Evans CCI	Lamont Evans	Abe Adger	
12/14	1105	3	EW-1	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1150	4	EW-1	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1250	5	EW-1	3000	Lamont Evans CCI	Lamont Evans	Abe Adger	
12/14	1355	6	EW-2 sub	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1455	7	EW2 sub	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1535	8	EW-2 sub	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1620	9	EW-2 sub	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1700	10	EW-2 sub	3000	Lamont Evans CCI	Lamont Evans	~~Les Nash~~	
12/14	1740	11	EW-2 sub	3000	Lamont Evans CCI	Lamont Evans	Les Nash	
12/14	1800	12	EW-2	3000	Lamont Evans CCI	Lamont Evans	Abe Adger	
12/14	1840	13	EW-2	3000	Lamont Evans CCI	Lamont Evans	Abe Adger	
12/14	1920	14	EW-2	3000	Lamont Evans CCI	Lamont Evans	Ron Campbell	
12/14		15	EW-2	3000	Lamont Evans CCI			

Projec Name Chemours-PDI

Outfall 003 Treatment System Discharge Log

Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
12/14	1940	15	EW-2	3000	Lamont Evans CCI	Lamont Evan	Omar Al-Jubouri	
12/15	0840	16	EW-7	2600	Lamont Evans (CCI)	Lamont Evans	Us Nash	

Projec Name Chemours
Outfall 003 Treatment System Discharge Log
Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
~~12/22~~	~~1330~~	~~1~~	~~Discharge offsite~~	~~3000~~	~~Lamont Evans~~ - CCI		~~Les Nash~~ aww	
~~12/22~~	~~1430~~	~~2~~	~~offsite discharge~~	~~3000~~	~~Lamont Evans~~ - CCI		~~Les Nash~~ aww	
12/22	1400	1	offsite discharge	3000	Lamont Evans (CCI)	Lamont Evans	Brent Israel	
12/22	1505	2	offsite poly tank	3000	Lamont Evans (CCI)	Lamont Evans	Abe Adgar	

Project Name Chemours PDI
Outfall 003 Treatment System Discharge Log
Fayetteville, North Carolina

Date	Time 24hr	Load No.	Origin (Frac Tank)	Volume (gal)	Discharger Printed Name and Company	Discharger Signature	Suez Printed Name	Suez Signature
11/30	1140	1	EW-2	3000	Lamont (CCI)	Lamont Evans	Les Nash	Nash
11/30	1800	2	EW-2	3000	Lamont (CCI)	Lamont Evans	Les Nash	Nash
11/30	1830	3	EW-2	3000	Lamont (CCI)	Lamont Evans	Brent Israel	Brent Israel
12/1	0920	4	EW-2	3000	Lamont (CCI)	Lamont Evans	Les Nash	Nash
12/1	0945	5	EW-2	3000	Lamont CCI	Lamont Evans	Les Nash	Nash
~~12/1~~	~~1010~~	~~6~~	~~EW-2~~	~~3000~~	~~Lamont CCI~~	Lamont Evans		
~~12/1~~	~~1035~~	~~7~~	~~EW-2~~	~~3000~~	~~Lamont CCI~~	Lamont Evans		
						Lamont Evans		
						Lamont Evans		

3

Geosyntec consultants

Daily Field Report

Project Name: TR0795A
Date: 03/01/2021
Page 1 of 1
Project Number: Chemours Company
Field Personnel: ALLI VO, MARSHALL GUILLOT (GeoServices
HUNTER, DRILL CREW
Primary Activities: GEOTECHNICAL DRILLING
Recorded By: ALLI VO
Weather: overcast, 64°F, raining

Time	Description of Activites
1000	A.VO onsite. Covid-19 temp check at contract admin (Susan/Ziggy).
1025	A.VO meet with Marshall Guillot (GeoServices) and Hunter
	(Geoservices). wait for drums to arrive and excavation permit
	from Ziggy. Raining wait in trucks.
	Plan drill B-8 to B-1 (new laydown area off
	barrier wall road to crest near treatment plant.
	Meet with drillers (Hunter (lead), Bishop, Max, Bill). wait for drums
1155	Bill needs Safety/Site Orientation (Summit can provide now)
	Setup for drilling on B-8
	Hunter Lewis
	Bishop Casey — Drillers
	Max Lewis
	Jacob Prickard
1230	Jake Fancher onsite. Marshall consult with Jake about road
	materials preventing rig from advancing. Rip rap causing
	stop. - OK to offset hole by 20-30' in mulch dredge area.
	Skid steer prep area.
	Set up on new B-8 location Begin advancing split spoon.
	Sample every 2.5' for 0-10' bgs then every 5'
	until 85' bgs. Terminate boring at 85' OR 2 samples in
	ucc. See boring log and photos
1800	Terminate boring at 85' bgs.
1815	A.VO mob offsite.

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Daily Field Report

Project Name: Chemours
Project Number: TR0795A
Field Personnel: ALLI VO / MARSHALL GUILLOT (GEOServices + Independent Drilling)
Recorded By: A VO
Weather: partly cloudy / 40-50°F

Date: 3/2/2021
Page 1 of 1
Primary Activities: Additional geotechnical drilling B-1 to B-8

Time	Description of Activites
0700	A.VO onsite. Marshall Guillot (GEOServices) and drillers
	(Hunter, Jacob, Max, and Bishop) meet at B-8.
0715	Safety tailgate for A.VO. Jake Fancher (GEOServices) to move
	work under new STA. GEOServices holding permits, etc.
0810	Finish abandoning B-8. Hunter out of work area. Marshall
	temporarily leave work area.
0900	Alli meet w/ Jake F. (GeoServices) and Scott (Summit)
	to sign in under Summit work permit. Agree that Alli
	will hold daily work permit / tailgate as well.
0910	Begin advancing boring at B-7.
1310	Terminate boring at 85 bgs. Shelby tube at 85 (hydrate 30 min)
1315	Alli mob to check out seeps. Drillers / Marshall grout
	B-7. Return to B-7 at 1320.
1325	Hunter / Marshall mob elsewhere. Alli oversee drillers
	grout B-7. Max, Bishop, and Jacob mob to refill water.
1446	Ziggy stops by to check in.
1510	GEOServices and independence drillers return to B-7.
	Continue filling B-7 with grout. Issue with water tank.
1620	Alli mob offsite after GEOServices / Independence decide to
	set up rig at next location and drill in the morning.

Daily Field Report

Project Name: Chemours
Project Number: TR0795A
Field Personnel: ALLI VO / GEOServices / Independence
Date: 3/3/2021
Page 1 of 1
Primary Activities: Additional geotechnical drilling B-1 to B-8
Recorded By: ALLI VO
Weather: raining/50°F/overcast

Time	Description of Activites
0700	AVO arrive onsite. Join Summit safety tailgate.
0710	Geoservices (Marshall) and Independence drilling (Hunter, Max,
	Bishop, and Jacob) join. Sign work permit / tailgate.
0720	All mob to crest of hill B-6 location. Set up rig.
	Crew sets up / perform maintenance on rig. 2 crew
	members mob to get cones to set exclusion work area.
0900	Continue rig maintence.
1055	Advance B-6 boring to 2.5'. Stop to place secondary
	containment / get water.
1310	Stop after run S13 to get more water from onsite. Alli talks
	with Ken Stewart (Parsons)
1330.	Resume at 1330.
1400	Mob to get more water. Return at 1430 (Bishop / Jacob)
1512	Terminate boring at 85' after 2 samples of UCC transition.
15:30	Alli mob offsite.

Daily Field Report

Project Name: TR0795A
Project Number: Chemours PDI 2021
Field Personnel: A.Vo + GeoServices + MW Drilling

Recorded By: A.Vo
Weather: clear, 55 - 77°F

Date: 4/13/2021
Page 1 of 1

Primary Activities:
sonic drilling - soil logging with GEOServices

Time	Description of Activites
0700	A.Vo onsite. Join daily Summit tailgate. Note snakes out. snake chaps required in forested areas. High vis. drilling hazards. Sign in. MW drillers go through orientation. Expect to start work @ 900 AM.
0815	A.Vo and Jeremy Haley (GEOServices Engineer/drilling supervisor) talk about plan: · 7 boreholes on northern part of wall · 4 boreholes 30-40 ft for mixing contractors (2 behind treatment plant; 2 to the north?)
0815	Alli talk with Kevin Garon (Chemours). Drillers unloading equipment. Alli talk with Ziggy.
0915	All drillers/Jeremy/Alli mob to B-16 behind new treatment plant ~200' from waste pile fence. Set up rig.
1140	Drillers mob for lunch and pick up quik-crete. Jeremy mob to get sample bags. Alli mob to front of plant to eat lunch/wait to mob to next location.
1430	Drillers get back from Lowes/lunch. Complete abandonment of B-16 and mob to next location on Barrier wall road (B-15). B-15 is northernmost boring. Go back to laydown to get drums/water.
1705	Begin drilling B-15.
1830	Stop drilling at 60' for today. Mob to Summit trailer to sign out.
1855	Alli Vo offsite.

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Daily Field Report

Project Name: Chemours
Project Number: TR0795A
Field Personnel: A VO / GEOS / MW Drilling

Recorded By: A VO
Weather: clear

Date: 4/14/2021
Page 1 of 1

Primary Activities:
sonic drilling · soil logging

Time	Description of Activites
0700	A VO onsite. Join Summit safety tailgate.
0720	A VO mob to B-15 with drillers and Jeremy (GEOS)
0735	Drillers refill water totes.
0830	Finish drilling B-15. Terminate at 70' bgs. Drillers abandon well.
0915	Mob to B-14. Set up rig. Mob to get more water
1050	Beau Hodge (Geosyntec), Sebastian (Chemours), and GEOS stop by to
	observe
1130	Crew breaks for lunch.
1240	Resume drilling. R7 (60-70'). Abandon B-14 (quik crete + gel mix)
	Mob to B-13.
1430	Set up on B-13.
1635	Terminate boring B-13 at 90' bgs.
1655	Crew sign out. Mob offsite.

Daily Field Report

Project Name: Chemours
Project Number: TR0795A
Field Personnel: A VO / A Hadley-Moore

Recorded By: A VO
Weather: clear / 45-70°F

Date: 4/16/2021
Page 1 of 1

Primary Activities: Sonic drilling

Time	Description of Activites
0700	A.VO onsite. Join safety tailgate. Allison Hadley-Moore onsite.
0715	Allison does Chemours / Summit training and HASP Crew mobs
	to location to resume drilling.
0735	Alli / Allison mob to B-11 to logg soils.
	Rig won't run - broken hydraulic hose. Crew mob to Fayetteville:
	to get replacement hose Alli / Allison mob to intro around site.
	Mob offsite for lunch. Return onsite at 1130.
12 50	Drillers attach hose. Resume drilling.
1415	Alli and Allison mob offsite Sign out w/ Summit

Appendix C
Borehole Logs and Borehole Photolog

Geosyntec consultants
Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

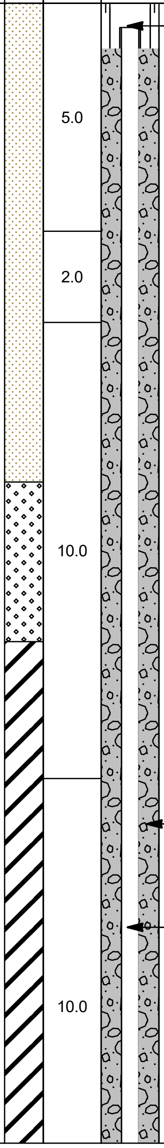
Geosyntec Consultants of NC, PC
2501 Blue Ridge Rd, Ste 430
Raleigh, NC
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *EW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399934.65*
EASTING: *2051297.51*
GROUND ELEVATION: *91.86 (feet NAVD88)*
TOC ELEVATION: *91.33 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *60 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine grained SAND with silt (SP); brownish yellow; loose; dry; clay laminations throughout			Well Cover	Post-hole dig to 5'
90				5.0		
	-5	Fine grained SAND with silt (SP); brownish yellow; loose; moist		2.0		
85						
		Fine to medium grained SAND (SP); yellowish red; loose; moist				
		Fine grained SAND with silt (SP); reddish brown; loose; wet; trace mica				
	-10	Fine grained SAND (SP); white to light grayish; loose; wet; trace mica				
		Fine to medium grained SAND (SW); dark gray; dense; wet; trace mica				
80				10.0		
		FAT CLAY (CH); dark gray; soft to medium stiff; moist; high plasticity; trace mica				
	-15					
75		FAT CLAY (CH); dark gray; soft to medium stiff; moist; trace mica and lignite				
					Cement grout	
	-20				2-inch PVC casing	
70				10.0		

(Continued Next Page)

All depths referenced to ground surface.

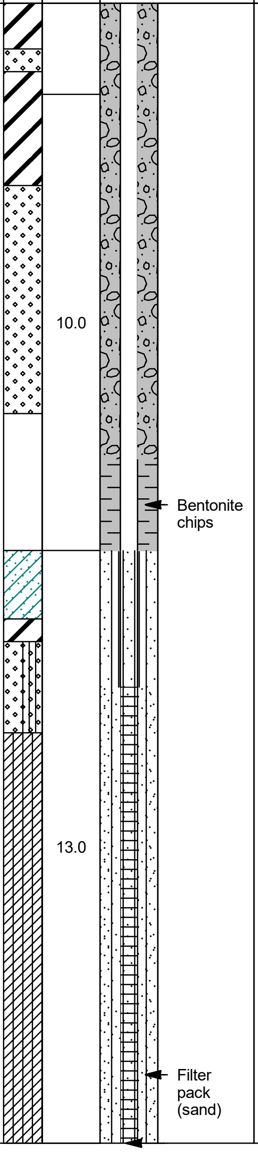
Total Depth: 60 ft bgs

BORING LOG

BOREHOLE ID: *EW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399934.65*
EASTING: *2051297.51*
GROUND ELEVATION: *91.86 (feet NAVD88)*
TOC ELEVATION: *91.33 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *60 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Well Construction	Comments
		FAT CLAY (CH); dark gray; soft to medium stiff; moist; trace mica and lignite *(continued)*			
		Medium grained SAND (SW); dark gray; loose; moist; trace lignite and mica			
65					
		FAT CLAY (CH); dark gray; soft to medium stiff; moist; medium plasticity; trace mica and lignite			
		FAT CLAY (CH); dark gray to medium gray; medium stiff; moist; medium plasticity; trace mica			
		SAND (SW); light gray to medium gray			
	-30				
60			10.0		
	-35				
				Bentonite chips	
55					~3 ft clay (BCCU) stuck in rod from previous run
		Fine to medium grained Clayey SAND (SC); dark gray; dense to loose; moist; trace mica			
		FAT CLAY with sand (CH); dark gray; medium stiff; moist; medium plasticity; trace mica			
		Coarse grained SAND (SW-SM); dark gray; loose to dense; wet; trace lignite and mica			
	-40				
		LEAN CLAY some silt (CL-ML); dark gray to medium gray; medium stiff; moist; low plasticity			
50					
			13.0		
	-45				
45					
		LEAN CLAY some silt (CL-ML); dark gray to medium gray; medium stiff; moist; low plasticity			
				Filter pack (sand)	

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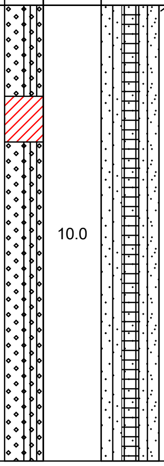
BORING LOG

BOREHOLE ID: *EW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399934.65*
EASTING: *2051297.51*
GROUND ELEVATION: *91.86 (feet NAVD88)*
TOC ELEVATION: *91.33 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *60 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Medium to coarse grained SAND with silt (SW-SM); dark gray to medium gray; dense; wet; trace mica and lignite			6-inch scree stainless steel wire wrap (0.020 inch)	
40						
		LEAN CLAY (CL); dark gray to gray; stiff to hard; moist; low plasticity; trace mica				
		Coarse grained SAND with silt (SW-SM); medium gray; loose; wet; trace lignite and mica				
	-55			10.0		
35						
	-60					

End of Boring at 60.0 feet bgs.

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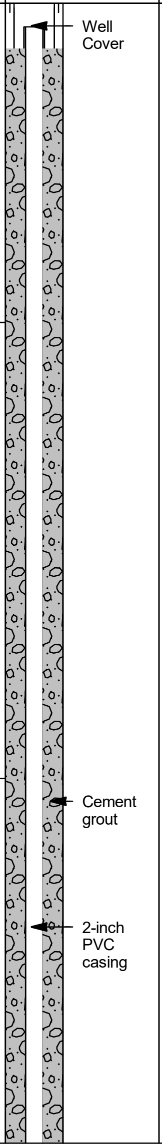
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *EW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/28/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396164.48*
EASTING: *2052232.61*
GROUND ELEVATION: *77.77 (feet NAVD88)*
TOC ELEVATION: *77.25 (feet NAVD88)*
TOTAL WELL DEPTH: *65 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine to medium grained Sandy SILT (ML); light brown; slightly dense; dry to moist			Well Cover	Post-hole dig to 5'
75						
				7.0		
		Fine to medium grained Sandy LEAN CLAY (CL); brownish gray to brown; soft; moist; low plasticity				
	-5					
		Slightly dense				
70						
	-10					
				2.5		
65						
		Fine to medium grained Silty SAND little clay (SW); light brown and dark yellowish orange; loose to slightly dense; moist; micaceous, trace tree roots				
	-15					
60					Cement grout	
	-20				2-inch PVC casing	
				4.5		
55		Fine grained Silty SAND little clay (SP); light brown and dark yellowish orange; loose to slightly dense; moist; micaceous, trace tree roots				

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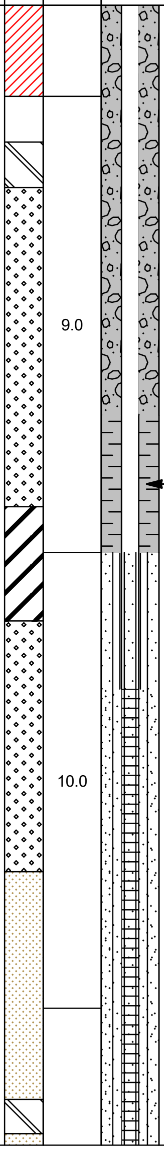
BORING LOG

BOREHOLE ID: *EW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/28/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396164.48*
EASTING: *2052232.61*
GROUND ELEVATION: *77.77 (feet NAVD88)*
TOC ELEVATION: *77.25 (feet NAVD88)*
TOTAL WELL DEPTH: *65 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Sandy FAT CLAY (CL); dark gray; stiff; moist; low plasticity; mica, trace organics in upper 1 ft				
						No recovery from 27-28 ft
50						
		Fine grained FAT CLAY little sand (CL); dark gray; stiff; moist; low plasticity; mica				
		Fine to medium grained SAND (SW); gray and dark yellowish orange; slightly dense to loose; moist to wet; micaceous				
	-30					
		Fine to medium grained SAND (SW); grayish orange and dark yellowish orange; loose; moist to wet; mica, trace woody organics in bottom 3 inches				
				9.0		
45						
	-35					
					Bentonite chips	
		CLAY (CH); dark gray; stiff; moist; medium plasticity; trace mica, organics in upper 3 inches				
		CLAY (CH); dark gray; stiff; moist; medium plasticity; trace mica, organics in upper 3 inches				
40						
		Fine to medium grained SAND (SW); dark yellowish orange and pale yellowish brown; loose; moist to wet; micaceous, organics in upper 1 ft,				
	-40					
		Very fine to fine grained SAND (SW); pale yellowish brown and dark yellowish orange; slightly dense; moist; < 1 cm clay lenses in upper 6 inches, mica				
		Fine to medium grained SAND (SW); pale yellowish brown and dark yellowish orange; loose; moist to wet; mica		10.0		
35						
		Fine grained SAND (SP); gray; slightly dense; moist; micacious, significant organics in upper 0.75 feet				
	-45					
		Fine grained SAND (SP); gray; slightly dense; moist; micacious, organics in lower ~3 inches				
30						
		Fine grained Sandy FAT CLAY (CL-CH); dark gray; stiff; moist; low plasticity; trace organics, micaceous				

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All depths referenced to ground surface.

Total Depth: 67 ft bgs

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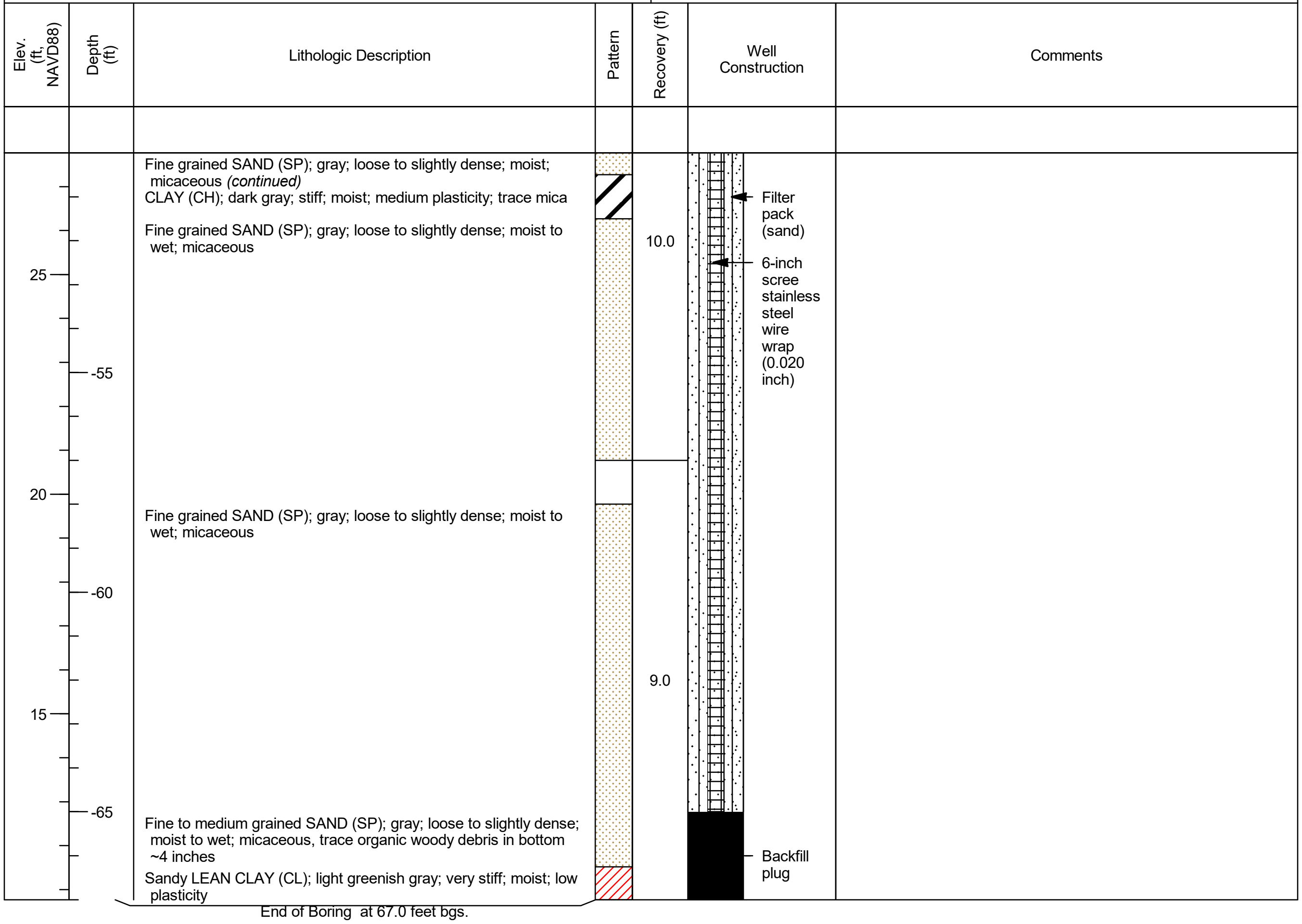
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *EW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/24/2020 to 8/28/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396164.48*
EASTING: *2052232.61*
GROUND ELEVATION: *77.77 (feet NAVD88)*
TOC ELEVATION: *77.25 (feet NAVD88)*
TOTAL WELL DEPTH: *65 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Fine grained SAND (SP); gray; loose to slightly dense; moist; micaceous *(continued)*
CLAY (CH); dark gray; stiff; moist; medium plasticity; trace mica

Fine grained SAND (SP); gray; loose to slightly dense; moist to wet; micaceous

Fine grained SAND (SP); gray; loose to slightly dense; moist to wet; micaceous

Fine to medium grained SAND (SP); gray; loose to slightly dense; moist to wet; micaceous, trace organic woody debris in bottom ~4 inches
Sandy LEAN CLAY (CL); light greenish gray; very stiff; moist; low plasticity

End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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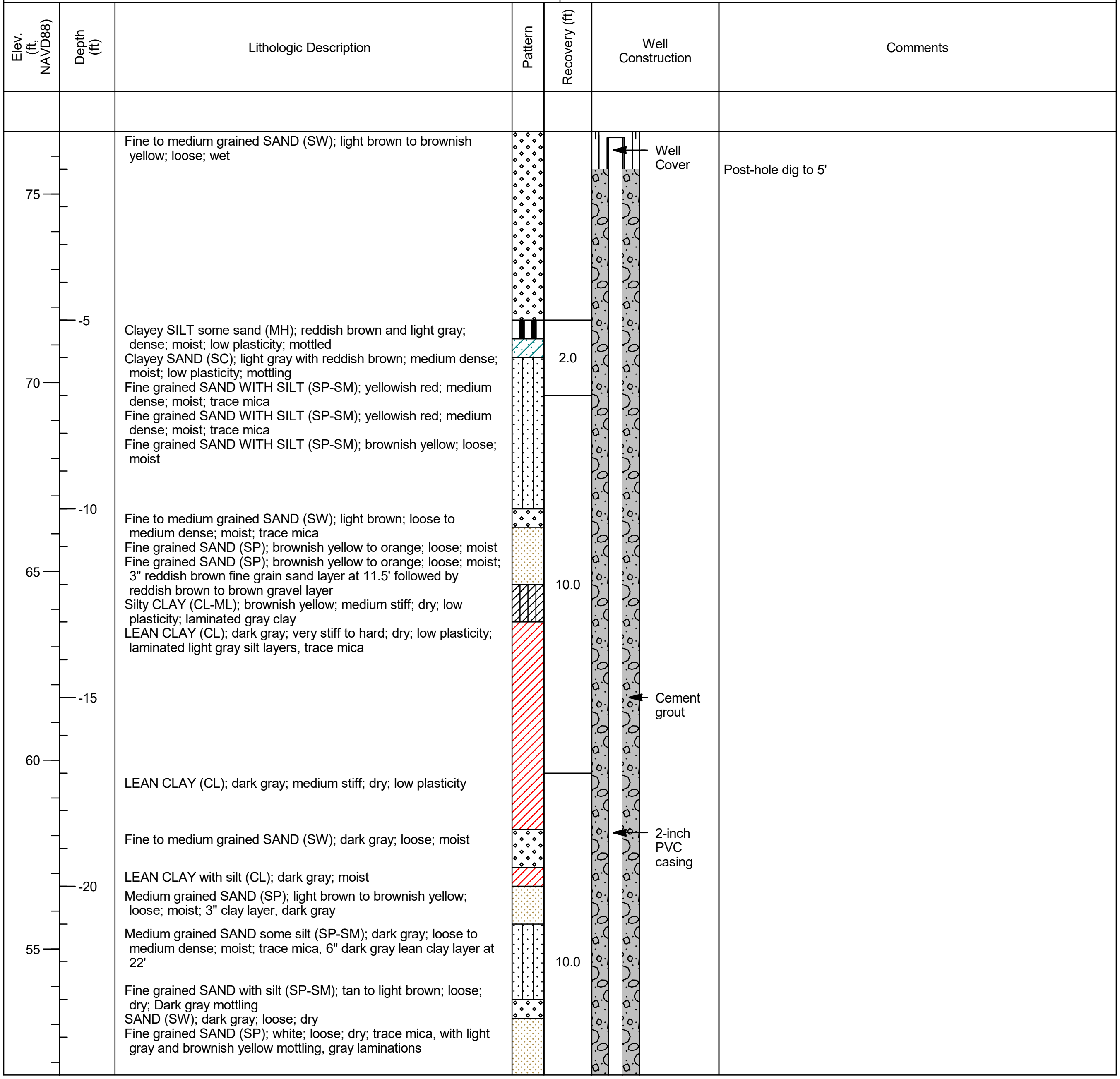
BORING LOG

BOREHOLE ID: *EW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/11/2020 to 8/12/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395059.78*
EASTING: *2052214.66*
GROUND ELEVATION: *76.66 (feet NAVD88)*
TOC ELEVATION: *76.48 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Fine to medium grained SAND (SW); light brown to brownish yellow; loose; wet

Clayey SILT some sand (MH); reddish brown and light gray; dense; moist; low plasticity; mottled

Clayey SAND (SC); light gray with reddish brown; medium dense; moist; low plasticity; mottling

Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica

Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica

Fine grained SAND WITH SILT (SP-SM); brownish yellow; loose; moist

Fine to medium grained SAND (SW); light brown; loose to medium dense; moist; trace mica

Fine grained SAND (SP); brownish yellow to orange; loose; moist

Fine grained SAND (SP); brownish yellow to orange; loose; moist; 3" reddish brown fine grain sand layer at 11.5' followed by reddish brown to brown gravel layer

Silty CLAY (CL-ML); brownish yellow; medium stiff; dry; low plasticity; laminated gray clay

LEAN CLAY (CL); dark gray; very stiff to hard; dry; low plasticity; laminated light gray silt layers, trace mica

LEAN CLAY (CL); dark gray; medium stiff; dry; low plasticity

Fine to medium grained SAND (SW); dark gray; loose; moist

LEAN CLAY with silt (CL); dark gray; moist

Medium grained SAND (SP); light brown to brownish yellow; loose; moist; 3" clay layer, dark gray

Medium grained SAND some silt (SP-SM); dark gray; loose to medium dense; moist; trace mica, 6" dark gray lean clay layer at 22'

Fine grained SAND with silt (SP-SM); tan to light brown; loose; dry; Dark gray mottling

SAND (SW); dark gray; loose; dry

Fine grained SAND (SP); white; loose; dry; trace mica, with light gray and brownish yellow mottling, gray laminations

Comments: Post-hole dig to 5'

(Continued Next Page)

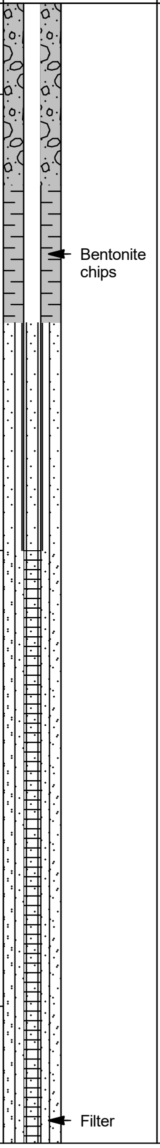
BORING LOG

BOREHOLE ID: *EW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/11/2020 to 8/12/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395059.78*
EASTING: *2052214.66*
GROUND ELEVATION: *76.66 (feet NAVD88)*
TOC ELEVATION: *76.48 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine grained SAND (SP); white; loose; dry; trace mica, with light gray and brownish yellow mottling, gray laminations *(continued)*				
50						
		Fine to medium grained SAND (SW); gray to dark gray; loose; wet; trace mica				
	-30	FAT CLAY (CH); dark gray; stiff; moist; medium plasticity; greasy, greenish gray silt laminations frequent throughout			Bentonite chips	
45				10.0		
	-35					
40						
		Fine to medium grained SAND (SW); light brown to gray; loose to slightly dense; wet				
	-40					
35		FAT CLAY (CH); dark gray; medium stiff; moist; medium plasticity; greasy		10.0		
	-45					
30						
					Filter	



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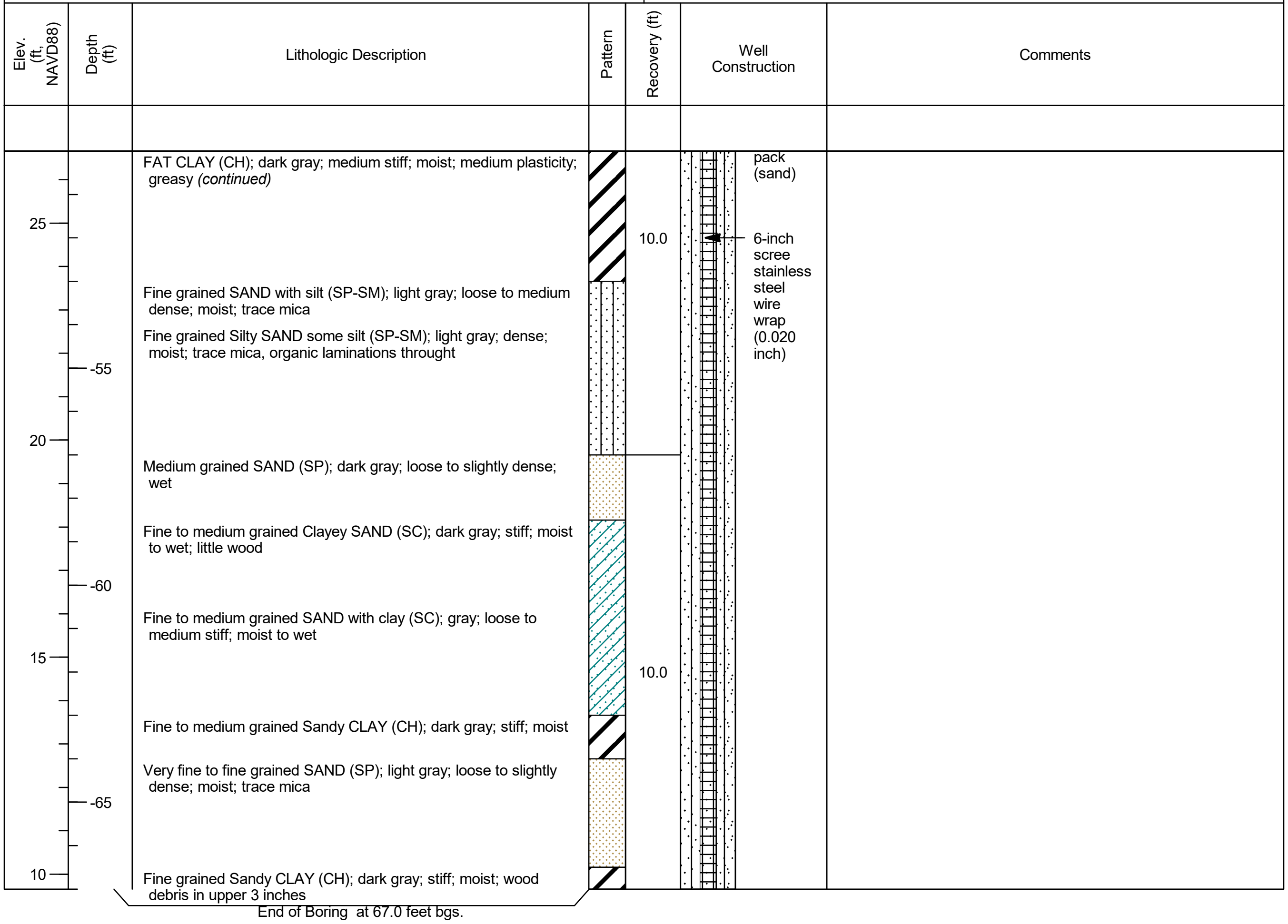
BORING LOG

BOREHOLE ID: *EW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/11/2020 to 8/12/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395059.78*
EASTING: *2052214.66*
GROUND ELEVATION: *76.66 (feet NAVD88)*
TOC ELEVATION: *76.48 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



FAT CLAY (CH); dark gray; medium stiff; moist; medium plasticity; greasy *(continued)*

Fine grained SAND with silt (SP-SM); light gray; loose to medium dense; moist; trace mica

Fine grained Silty SAND some silt (SP-SM); light gray; dense; moist; trace mica, organic laminations throught

Medium grained SAND (SP); dark gray; loose to slightly dense; wet

Fine to medium grained Clayey SAND (SC); dark gray; stiff; moist to wet; little wood

Fine to medium grained SAND with clay (SC); gray; loose to medium stiff; moist to wet

Fine to medium grained Sandy CLAY (CH); dark gray; stiff; moist

Very fine to fine grained SAND (SP); light gray; loose to slightly dense; moist; trace mica

Fine grained Sandy CLAY (CH); dark gray; stiff; moist; wood debris in upper 3 inches

End of Boring at 67.0 feet bgs.

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Telephone: 910-870-0576

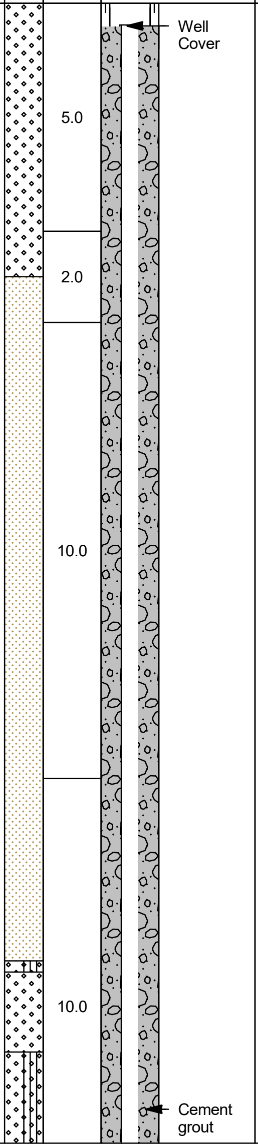
BORING LOG

BOREHOLE ID: *EW-4*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/30/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398581.51*
EASTING: *2051805.58*
GROUND ELEVATION: *81.13 (feet NAVD88)*
TOC ELEVATION: *80.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		SAND (SW); light brown to brownish yellow; loose; dry		
80				Post-hole dig to 5'
			5.0	
	-5	Fine grained SAND WITH SILT (SW); brown; loose; dry		
75		Fine grained SAND (SP); reddish brown; loose; dry	2.0	
		Fine to medium grained SAND (SP); brown to light brown; loose; dry		
	-10			
70		Fine to medium grained SAND (SP); brownish yellow; loose; dry to moist	10.0	
	-15			
65				
		Medium grained SAND (SP); brownish yellow; loose; moist; gray sand pockets throughout		
	-20			
60		Fine grained SAND with silt (SW-SM); dark gray; loose; moist; trace mica		
		Fine to medium grained SAND (SW); yellowish red; loose; moist; trace mica	10.0	
		Fine to medium grained SAND some silt (SW-SM); gray to dark gray; loose; moist; trace mica, 2" layer of lignite at 25.5-26', dark gray clay layer at 27' (3" thick)		



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BORING LOG

BOREHOLE ID: *EW-4*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/30/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398581.51*
EASTING: *2051805.58*
GROUND ELEVATION: *81.13 (feet NAVD88)*
TOC ELEVATION: *80.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
55		Fine to medium grained SAND some silt (SW-SM); gray to dark gray; loose; moist; trace mica, 2" layer of lignite at 25.5-26', dark gray clay layer at 27' (3" thick) *(continued)*			2-inch PVC casing	
		Fine to medium grained SAND (SW); gray; loose; moist to wet; trace mica				
	-30					
50						
				10.0		
	-35					
45						
		Fine to medium grained SAND (SW); gray; loose; moist to wet; trace mica				
		FAT CLAY (CH); gray; medium stiff; moist; medium plasticity				
		CLAY (CL); gray; stiff; moist; low plasticity; trace mica and silt				
		FAT CLAY (CH); gray; medium stiff; moist; medium plasticity; silt partings at 43' and 41'				
	-40					
40						
				10.0		
		Medium grained SAND (SP); gray; dense; moist; trace mica				
	-45					
		Clayey SAND (SC); gray; medium dense; moist; trace mica, 3" clay layer at 45' (CL) (hard, lean, trace silt)				
35		FAT CLAY (CH); gray; stiff; moist; medium plasticity; trace mica				
		Fine to medium grained SAND (SW); gray; loose; moist; trace mica				
		Fine to medium grained SAND (SW); gray; loose; wet; trace mica				
					Bentonite chips	

(Continued Next Page)

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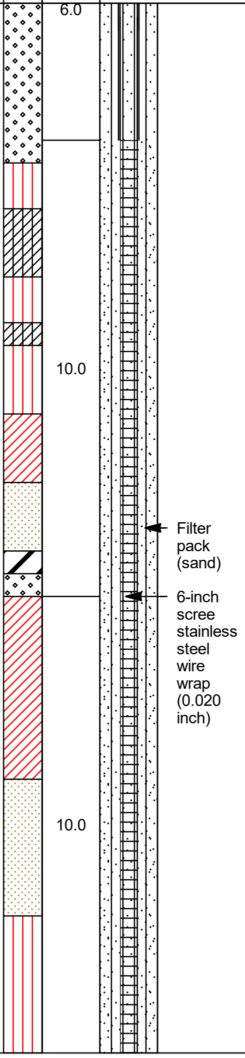
BORING LOG

BOREHOLE ID: *EW-4*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/30/2020 to 8/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398581.51*
EASTING: *2051805.58*
GROUND ELEVATION: *81.13 (feet NAVD88)*
TOC ELEVATION: *80.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine to medium grained SAND (SW); gray; loose; wet; trace mica *(continued)*	6.0	
30				
		Fine to medium grained SAND (SW); gray; loose; wet; trace mica		
		SILT some clay (ML); light gray to gray; dense; moist; trace mica		
	-55	Silty CLAY (CL-ML); gray; medium stiff to soft; moist; low plasticity; trace mica		
25		SILT (ML); gray; loose; moist; trace mica		
		Silty CLAY (CL-ML); gray; soft; moist; low plasticity; trace mica		
		SILT (ML); gray; loose; moist; trace mica	10.0	
		CLAY trace silt (CL); gray; moist; low plasticity		
	-60			
20		Fine grained SAND (SP); gray; loose to medium dense; wet		
		Fat CLAY (CH); gray; medium stiff; moist; trace mica		
		Fine to medium grained SAND (SW); gray; loose; wet; trace mica		
		LEAN CLAY (CL); gray; stiff; moist; low plasticity; with some sand and silt		
	-65			
15				
		Medium grained SAND (SP); light gray to medium gray; loose; moist; trace mica	10.0	
	-70	SILT with clay (ML); gray; dense; moist; trace mica		
10		SILT with clay (ML); gray; dense; moist; trace mica		



End of Boring at 73.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 73 ft bgs

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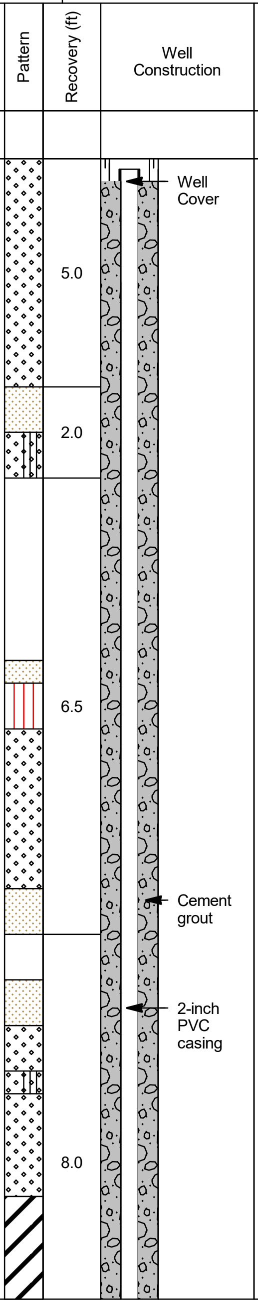
Raleigh, NC
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *EW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397200.16*
EASTING: *2052052.65*
GROUND ELEVATION: *78.28 (feet NAVD88)*
TOC ELEVATION: *78.50 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
75		Fine to medium grained SAND (SW); light brown to brownish yellow; loose to very loose; moist to dry	5.0	Post-hole dig to 5'
	-5	Fine grained SAND (SP); brownish yellow to dark yellowish orange; very loose; dry; trace mica	2.0	
		Very fine to fine grained SAND with silt and clay (SW-SM); dark yellowish orange; dense to loose; dry; trace mica		
70	-10	(NO CORE)		
		Fine grained SAND (SP); light brown to orangeish yellow; very loose; dry; trace mica	6.5	
		SILT with some sand (ML); dark yellowish orange to brownish yellow; medium dense; dry; trace mica		
65		Very fine to fine grained SAND (SW); brownish yellow; very loose; dry; trace mica		
	-15	Fine to coarse grained SAND (SW); brownish yellow; loose; wet; trace lignite		
		Medium grained SAND (SP); dark gray; dense to loose; wet; trace mica		
60		Coarse grained SAND (SP); light brown to brownish yellow; loose to very loose; wet	8.0	
		Fine to medium grained SAND (SW); dark gray; loose; moist; fat clay partings occassional throughout, trace mica and lignite		
	-20	Fine to coarse grained SAND with some silt (SW-SM); pale orange to light brown; very loose; moist; 0.25" brown clay seam, orange in upper 0.25'		
		Fine to coarse grained SAND (SW); pale orange to light brown; loose; moist; trace mica, fines upward		
55		FAT CLAY (CH); dark gray; medium stiff to stiff; dry; medium plasticity; trace mica and silt		
		FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity;		

(Continued Next Page)

All depths referenced to ground surface.

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Telephone: 910-870-0576

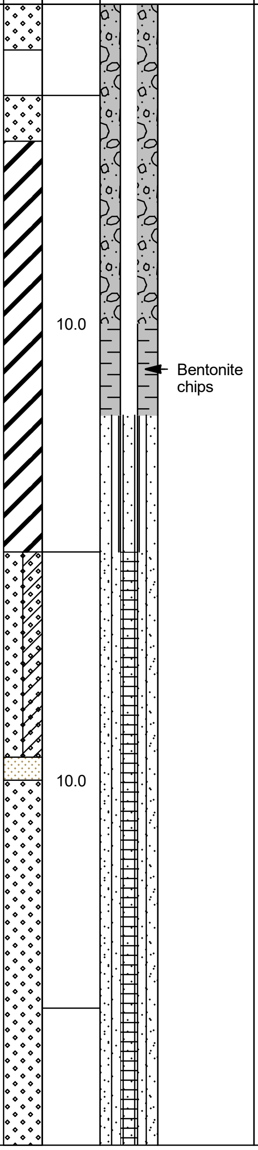
BORING LOG

BOREHOLE ID: *EW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397200.16*
EASTING: *2052052.65*
GROUND ELEVATION: *78.28 (feet NAVD88)*
TOC ELEVATION: *78.50 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Comments
		trace mica, clay seams occassional	
		Fine to medium grained SAND (SW); pale orange with gray; loose; moist; trace mica, 0.5" clay layer (SW); dark gray	
50		FAT CLAY (CH); dark gray to very dark gray; medium stiff to stiff; dry; medium plasticity; greenish gray silt laminations frequent, 1.5" coarse grained sand layer at 34'	
	-30		
45			
	-35		
		Fine to medium grained SAND with some silt (SW-SC); brownish yellow to dark yellowish orange; loose; moist; light brown clay seams occassional throughout	
40			
	-40		
		Fine grained SAND (SP); loose; moist; trace mica Fine to medium grained SAND (SW); gray to light gray; very loose; moist; dark gray clay seams occassional in 44-47', lignite traces	
35			
	-45		
30			



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All depths referenced to ground surface.

Total Depth: 67 ft bgs

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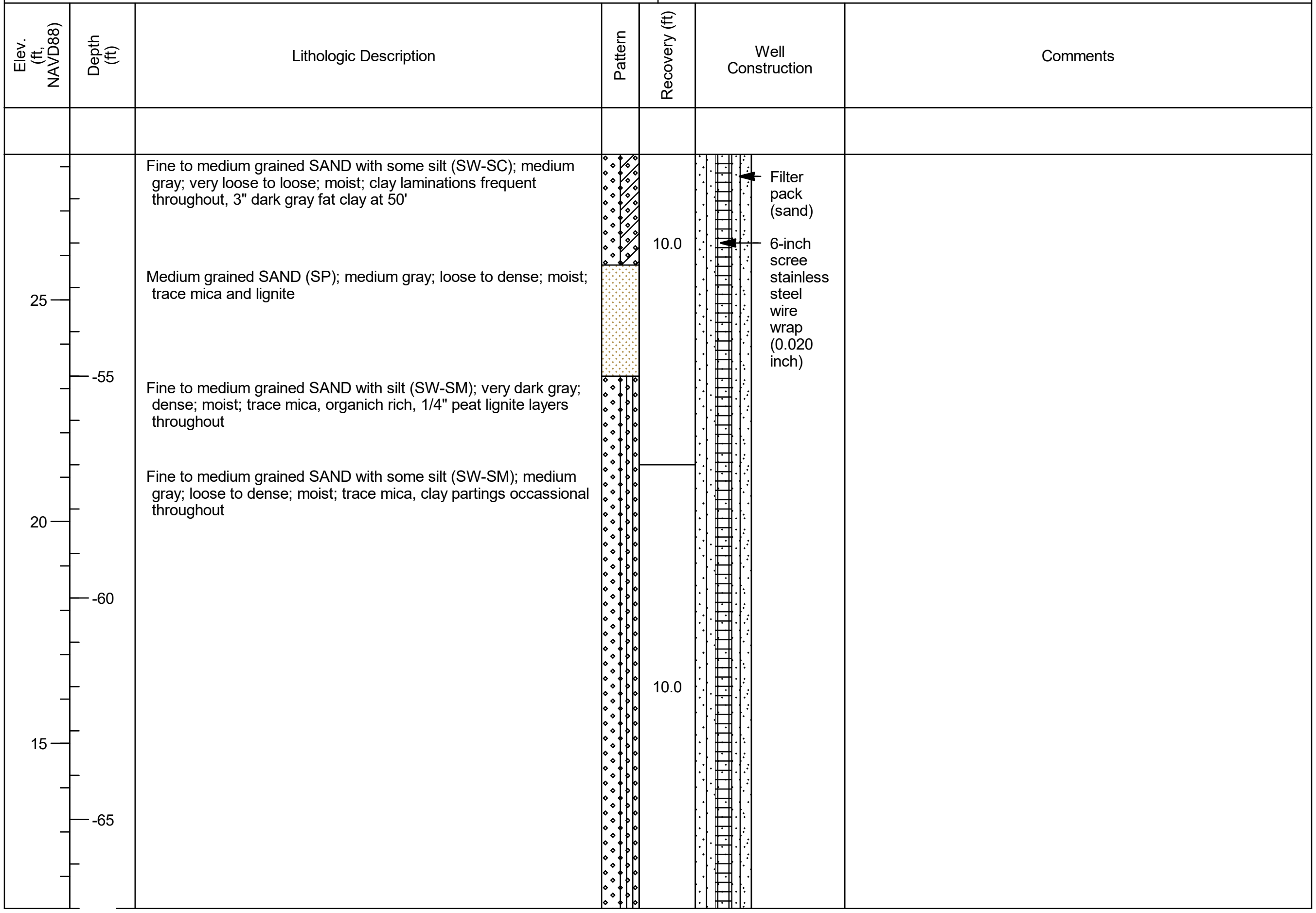
BORING LOG

BOREHOLE ID: *EW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *10"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397200.16*
EASTING: *2052052.65*
GROUND ELEVATION: *78.28 (feet NAVD88)*
TOC ELEVATION: *78.50 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Lithologic Description

Fine to medium grained SAND with some silt (SW-SC); medium gray; very loose to loose; moist; clay laminations frequent throughout, 3" dark gray fat clay at 50'

Medium grained SAND (SP); medium gray; loose to dense; moist; trace mica and lignite

Fine to medium grained SAND with silt (SW-SM); very dark gray; dense; moist; trace mica, organich rich, 1/4" peat lignite layers throughout

Fine to medium grained SAND with some silt (SW-SM); medium gray; loose to dense; moist; trace mica, clay partings occassional throughout

End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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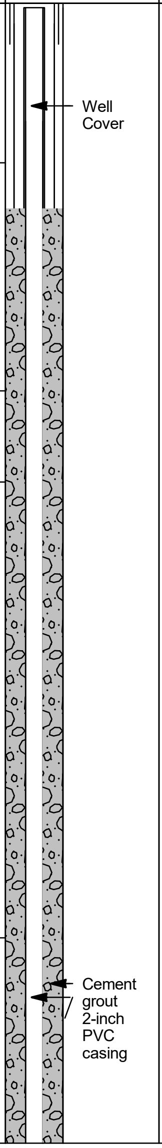
BORING LOG

BOREHOLE ID: *OW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/23/2020 to 7/23/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399930.53*
EASTING: *2051287.87*
GROUND ELEVATION: *91.61 (feet NAVD88)*
TOC ELEVATION: *95.01 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
90	0	Fine to medium grained SAND (SP); brownish yellow; loose; dry; trace mica	5.0	Post-hole dig to 5'
	-5	Fine to medium grained SAND with some silt (SW-SM); brownish yellow; loose; moist	2.0	
		Coarse grained SAND (SP); reddish brown; loose; moist		
85		Fine grained SAND with some silt (SW-SM); reddish brown; loose; dry; trace mica, lense of clay (2" gray fat)	10.0	
		Fine to medium grained SAND with some silt (SW-SM); brownish yellow; loose; moist; trace mica, 1.5" clay lense gray (N5)		
	-10	Fine to coarse grained SAND (SW); yellowish red; loose; moist; trace mica		
80		Fine to medium grained SAND (SW); yellowish red; loose; moist; trace mica, frequent clay seams		
		Fine grained Silty SAND (SM); yellowish red; loose; wet; trace mica		
		Fine to medium grained Silty SAND (SM); light gray; loose; wet; trace mica		
		Silty LEAN CLAY (CL-ML); dark gray to medium gray; medium stiff; moist; low plasticity; trace mica		
	-15			
75		(NO CORE)		
	-20			



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All depths referenced to ground surface.

Total Depth: 67 ft bgs

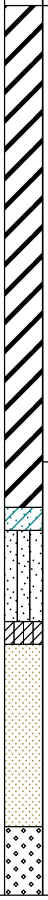
BORING LOG

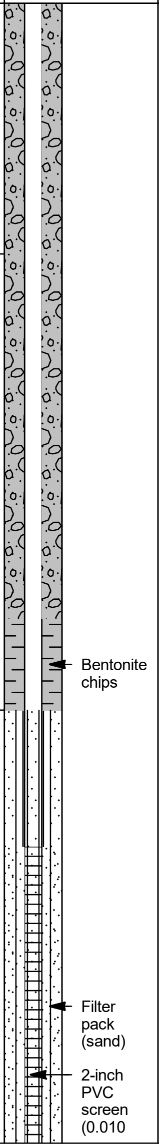
BOREHOLE ID: *OW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/23/2020 to 7/23/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399930.53*
EASTING: *2051287.87*
GROUND ELEVATION: *91.61 (feet NAVD88)*
TOC ELEVATION: *95.01 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		(NO CORE) *(continued)*	10.0	
	-25			
65				
		FAT CLAY (CH); medium gray; medium stiff; moist; medium plasticity; greasy, trace mica, seams (frequent of silty SAND, fine grained, trace mica, gray (N5)		
	-30			
60			10.0	
	-35			
55				
		FAT CLAY (CH); dark gray to medium gray; stiff; moist; medium plasticity; trace mica		
		Clayey SAND (SC); medium gray to dark gray; very dense; moist; trace mica		
		Fine grained Silty SAND (SM); medium gray; loose; wet; trace mica		
	-40			
		LEAN CLAY with some silt (CL-ML); medium gray; stiff; moist; low plasticity		
50		Medium grained SAND (SP); dark gray to medium gray		
			10.0	
	-45	Medium to coarse grained SAND (SW); dark gray to medium gray; dense; wet		





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All depths referenced to ground surface.

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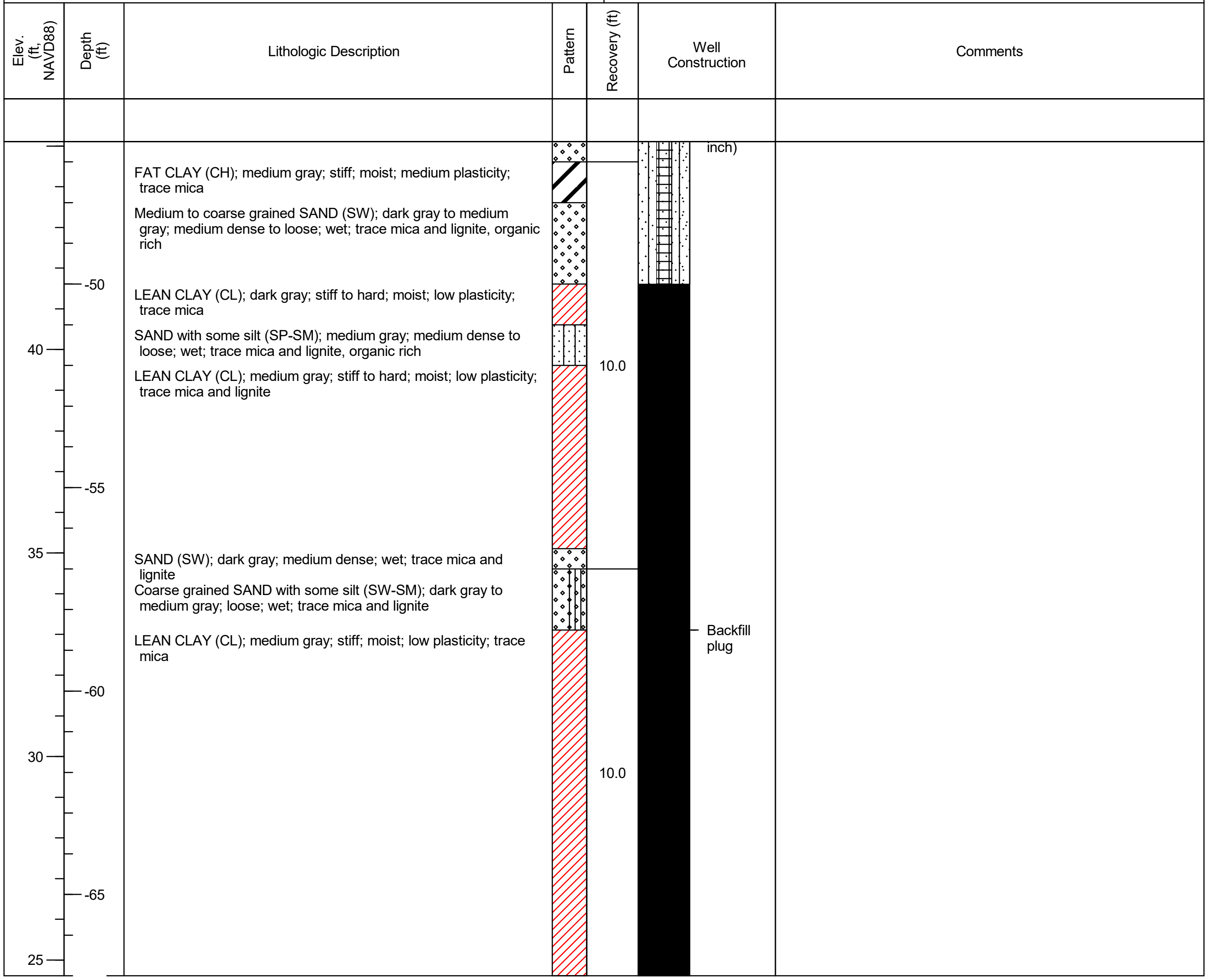
BORING LOG

BOREHOLE ID: *OW-1*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/23/2020 to 7/23/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399930.53*
EASTING: *2051287.87*
GROUND ELEVATION: *91.61 (feet NAVD88)*
TOC ELEVATION: *95.01 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



FAT CLAY (CH); medium gray; stiff; moist; medium plasticity; trace mica

Medium to coarse grained SAND (SW); dark gray to medium gray; medium dense to loose; wet; trace mica and lignite, organic rich

LEAN CLAY (CL); dark gray; stiff to hard; moist; low plasticity; trace mica

SAND with some silt (SP-SM); medium gray; medium dense to loose; wet; trace mica and lignite, organic rich

LEAN CLAY (CL); medium gray; stiff to hard; moist; low plasticity; trace mica and lignite

SAND (SW); dark gray; medium dense; wet; trace mica and lignite

Coarse grained SAND with some silt (SW-SM); dark gray to medium gray; loose; wet; trace mica and lignite

LEAN CLAY (CL); medium gray; stiff; moist; low plasticity; trace mica

End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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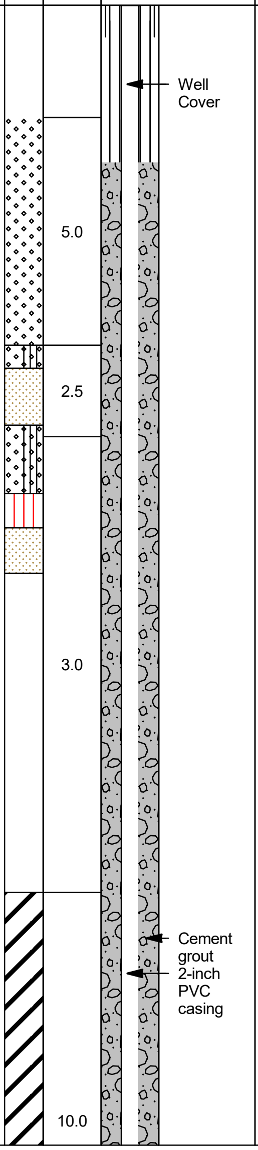
BORING LOG

BOREHOLE ID: *OW-10*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Brian Thomas*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399948.17*
EASTING: *2051291.21*
GROUND ELEVATION: *91.94 (feet NAVD88)*
TOC ELEVATION: *94.39 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *62 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
	0	Fine to medium grained SAND (SW); brownish yellow to dark yellowish orange; very loose; dry; trace organics		Post-hole dig to 5'
90			5.0	
	-5	Fine to medium grained SAND with silt (SW-SM); light brown to brownish yellow; very loose; dry; organics present		
		Medium grained SAND (SP); pale yellowish orange; very loose; dry; 2" reddish brown sand layer at 6'	2.5	
85		Fine to medium grained Silty SAND with some clay (SW-SM); reddish brown to light brown; medium dense; moist to dry; 1/4" clay seam at 6.75'		
		Fine to medium grained SAND with silt (SW-SM); brownish yellow; loose to very loose; moist; 3" clayey sand at 7', trace mica		
		SILT (ML); pale yellowish orange; medium dense; dry; trace mica		
		Silty SAND (SP); pale yellowish orange to light brown; dense; moist; clay partings throughout, trace mica		
	-10	(NO CORE)		
80			3.0	
	-15			
75		FAT CLAY (CH); dark gray to medium gray; medium stiff to soft; dry; high plasticity; greenish gray micaceous silt partings frequent throughout, trace mica		
	-20			
70			10.0	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 62 ft bgs

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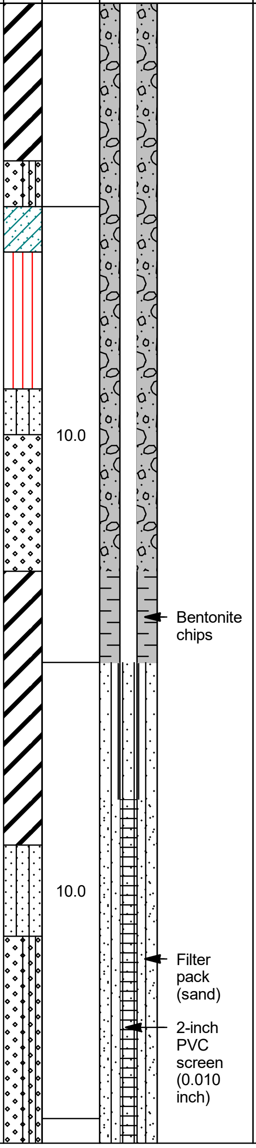
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *OW-10*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Brian Thomas*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399948.17*
EASTING: *2051291.21*
GROUND ELEVATION: *91.94 (feet NAVD88)*
TOC ELEVATION: *94.39 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *62 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
	-25	FAT CLAY (CH); dark gray to medium gray; medium stiff to soft; dry; high plasticity; greenish gray micaceous silt partings frequent throughout, trace mica *(continued)*		
65		Fine to medium grained SAND with silt (SW-SM); dark gray; loose; wet; trace mica		
		Clayey SAND trace mica (SC); brown to gray; very soft; wet		
	-30	SILT some sand (ML); medium gray; medium dense; moist; trace mica		
60		SAND some silt (SP-SM); medium gray; very loose; wet; trace mica and lignite	10.0	
		Medium to coarse grained SAND (SW); medium gray to dark gray; very loose; wet; trace mica and lignite		
	-35	FAT CLAY (CH); dark gray; medium stiff to stiff; moist; medium to high plasticity; greenish gray silt partings frequent throughout, trace mica		
55	-40	FAT CLAY (CH); dark gray; medium stiff to stiff; moist; medium to high plasticity; greenish gray silt partings frequent throughout, trace mica, 2" coarse grained sand layer at 40'		
50		Fine grained SAND with silt (SP-SM); medium gray; loose; moist; trace mica	10.0	
45	-45	Fine to medium grained SAND with some silt (SW-SM); dark gray to medium gray; very loose; wet; trace mica, 2" clayey sand layer at 44'. 1" lignite and peat layer at 46.75'		

(Continued Next Page)

BORING LOG

BOREHOLE ID: *OW-10*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/14/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Brian Thomas*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *399948.17*
EASTING: *2051291.21*
GROUND ELEVATION: *91.94 (feet NAVD88)*
TOC ELEVATION: *94.39 (feet NAVD88)*
TOTAL WELL DEPTH: *50 ft BLS*
TOTAL BORING DEPTH: *62 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		FAT CLAY (CH); dark gray; medium stiff; moist; medium plasticity; trace mica		5.0		
	-50	Fine grained SAND (SP); gray; very loose; moist; trace lignite				
40		FAT CLAY with some sand (CH); dark gray; medium stiff; moist; medium plasticity; trace mica				
	-55	SILT (ML); medium gray; loose; moist; trace mica, dark gray clay partings throughout			Backfill plug	
35		Fine grained SAND with silt (SP-SM); medium gray to dark gray; medium dense to loose; moist; 2" coarse grained sand layers at 60', clay partings throughout		10.0		
	-60					
30		FAT CLAY (CH); dark gray; stiff; dry; medium plasticity; trace mica and silt				

End of Boring at 62.0 feet bgs.

Geosyntec consultants
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Telephone: 910-870-0576

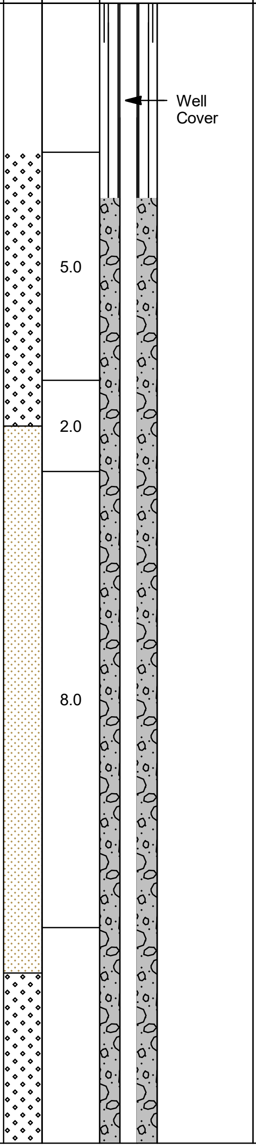
BORING LOG

BOREHOLE ID: *OW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/28/2020 to 7/28/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398572.28*
EASTING: *2051801.62*
GROUND ELEVATION: *81.11 (feet NAVD88)*
TOC ELEVATION: *84.37 (feet NAVD88)*
TOTAL WELL DEPTH: *77 ft BLS*
TOTAL BORING DEPTH: *87 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
	0	Fine grained SAND with some silt (SW-SM); light brown; loose; dry	5.0	
80				Post-hole dig to 5'
	-5	Fine grained SAND with some silt (SW-SM); brown; loose; dry	2.0	
75		Fine grained SAND (SP); reddish brown; loose; dry		
		Fine to medium grained SAND (SW); brown to light brown; loose; dry	8.0	Appears wet at top of run due to introduced H20
	-10			
70		Fine to medium grained SAND (SW); brownish yellow		
	-15			
65				
		Medium grained SAND (SP); blackish yellow to yellowish red; loose; moist		
		Fine to medium grained SAND (SW); dark gray to medium gray; loose to medium dense; moist; trace mica		BCA
	-20			case off to 25' with 8" tooling
60				



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BORING LOG

BOREHOLE ID: *OW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/28/2020 to 7/28/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398572.28*
EASTING: *2051801.62*
GROUND ELEVATION: *81.11 (feet NAVD88)*
TOC ELEVATION: *84.37 (feet NAVD88)*
TOTAL WELL DEPTH: *77 ft BLS*
TOTAL BORING DEPTH: *87 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine to medium grained SAND (SW); dark gray to medium gray; loose to medium dense; moist; trace mica *(continued)*		10.0		
55	-25	Fine to medium grained SAND with some silt (SW-SM); medium gray; loose; wet; trace mica				
		Fine to medium grained SAND (SW); dark gray; loose; wet; trace mica				
	-30	SILT (ML); dark brown to dark gray; very dense; moist; trace mica and lignite, organic rich			Cement grout 2-inch PVC casing	BCCU transitions
50		FAT CLAY (CH); dark gray; medium stiff to soft; moist; medium plasticity; trace mica				
		Elastic SILT (MH); medium gray; medium dense to loose; moist; trace mica		10.0		
45	-35	FAT CLAY (CH); dark gray; medium dense to loose; moist to dry; medium plasticity; trace mica				
		Coarse grained SAND (SP); dark gray to gray; loose; wet; trace mica				
		LEAN CLAY trace silt (CL); medium gray; very stiff; moist; low plasticity; trace mica				
40	-40	Fine grained Clayey SAND (SC); medium gray to dark gray; dense; moist; trace mica and lignite, clay partings and seams				
		Fine grained SAND (SP); medium gray; very loose; moist; trace mica		10.0		
35	-45	Fine to coarse grained SAND (SW); medium gray; loose; moist to wet; trace mica, 1/2" layer of lignite at 45.5'				

(Continued Next Page)

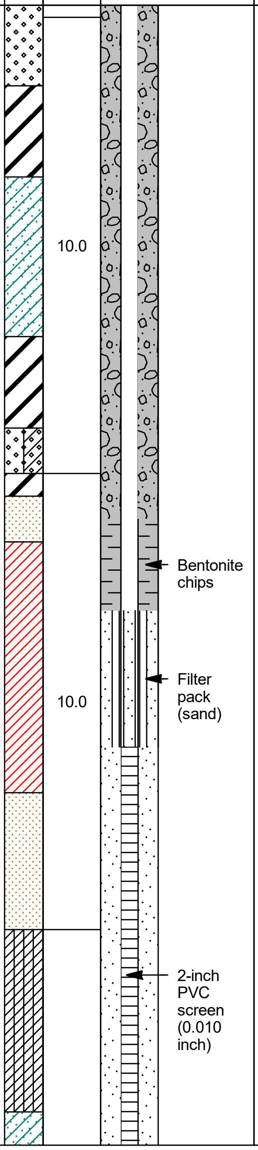
BORING LOG

BOREHOLE ID: *OW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/28/2020 to 7/28/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398572.28*
EASTING: *2051801.62*
GROUND ELEVATION: *81.11 (feet NAVD88)*
TOC ELEVATION: *84.37 (feet NAVD88)*
TOTAL WELL DEPTH: *77 ft BLS*
TOTAL BORING DEPTH: *87 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine to coarse grained SAND (SW); medium gray; loose; moist to wet; trace mica, 1/2" layer of lignite at 45.5' *(continued)*		
	-50	FAT CLAY (CH); medium gray; stiff; moist; medium plasticity		
30		Fine to medium grained Clayey SAND (SC); light gray to gray; loose to medium dense; moist; clay seams frequent 50.5-53, 6" clay at 53-53.5'	10.0	
	-55	FAT CLAY (CH); medium gray; medium stiff; moist; medium plasticity		
25		Fine to medium grained Silty SAND with clay (SW-SC); medium gray; very loose to loose; moist; trace mica, clay seams frequent		
		FAT CLAY trace mica (CH); medium gray; medium stiff; moist; medium plasticity		
		Fine grained SAND trace mica (SP); medium gray to dark gray; very loose; moist		
20	-60	LEAN CLAY with sand and silt (CL); medium gray; stiff; moist; low plasticity	10.0	
15	-65	Medium grained SAND (SP); light gray to medium gray; loose; moist; 2" clay layer at 66'		
	-70	Silty CLAY with sand (CL-ML); medium gray; medium stiff; moist; low to medium plasticity; trace mica		
10		Clayey SAND (SC); medium gray; dense; moist; trace mica		



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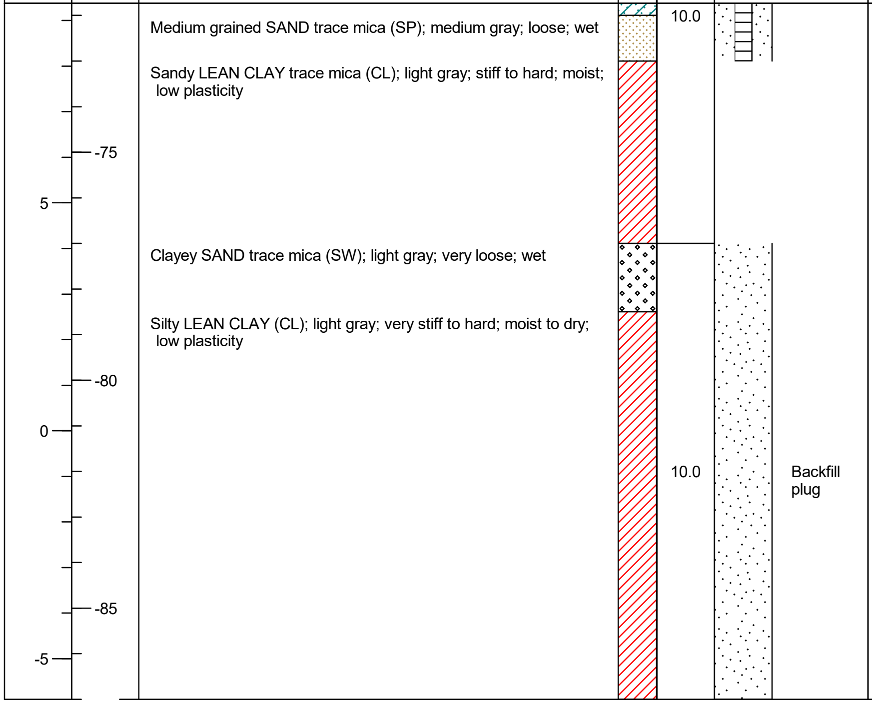
BORING LOG

BOREHOLE ID: *OW-2*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/28/2020 to 7/28/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398572.28*
EASTING: *2051801.62*
GROUND ELEVATION: *81.11 (feet NAVD88)*
TOC ELEVATION: *84.37 (feet NAVD88)*
TOTAL WELL DEPTH: *77 ft BLS*
TOTAL BORING DEPTH: *87 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments



Medium grained SAND trace mica (SP); medium gray; loose; wet

Sandy LEAN CLAY trace mica (CL); light gray; stiff to hard; moist; low plasticity

Clayey SAND trace mica (SW); light gray; very loose; wet

Silty LEAN CLAY (CL); light gray; very stiff to hard; moist to dry; low plasticity

End of Boring at 87.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 87 ft bgs

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BORING LOG

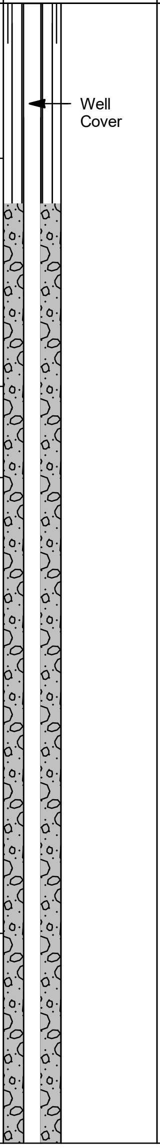
BOREHOLE ID: *OW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/29/2020 to 7/29/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398601.08*
EASTING: *2051812.32*
GROUND ELEVATION: *81.26 (feet NAVD88)*
TOC ELEVATION: *84.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
	0	Fine grained SAND some silt (SW); light brown; loose; dry		
				Post-hole dig to 5'
80				
			5.0	
	-5			Case off to 20'
		Fine grained SAND with silt (SW); brown; loose; dry		
			2.0	
75		Fine grained SAND (SP); reddish brown; loose; dry		
		Fine to medium grained SAND (SP); brown to light brown; loose; dry		
	-10			
70		Fine to medium grained SAND (SP); brownish yellow; loose; dry to moist		
			10.0	
	-15			
65				
		Medium grained SAND (SP); brownish yellow to yellowish red; loose; moist		
		Fine to medium grained SAND (SW); medium gray to dark gray; loose to medium dense; wet; trace mica		
	-20			
60				

Well Construction



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All depths referenced to ground surface.

Total Depth: 73 ft bgs

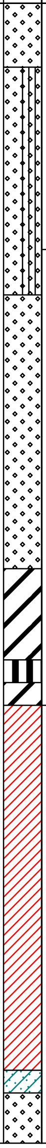
BORING LOG

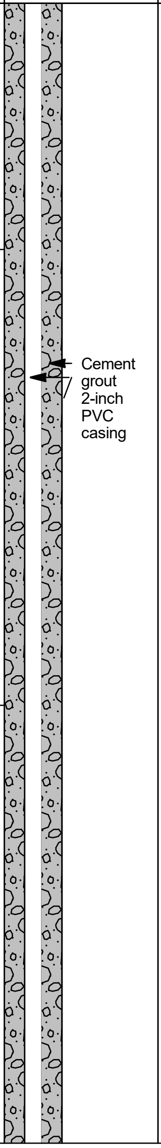
BOREHOLE ID: OW-3

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: TR0795A
SITE LOCATION: Fayetteville, NC
BORING DATE: 7/29/2020 to 7/29/2020
GEOLOGIST: Allison Vo
DRILLING CONTRACTOR: SAEDACCO
DRILLER NAME: Will Keyes
DRILLING METHOD: Sonic Drilling

RIG TYPE: Geoprobe 8150LS
BOREHOLE DIA: 6" **SAMPLING METHOD:** Dual Tube
NORTHING: 398601.08
EASTING: 2051812.32
GROUND ELEVATION: 81.26 (feet NAVD88)
TOC ELEVATION: 84.64 (feet NAVD88)
TOTAL WELL DEPTH: 73 ft BLS
TOTAL BORING DEPTH: 73 ft BLS

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine to medium grained SAND (SW); medium gray to dark gray; loose to medium dense; wet; trace mica *(continued)*	10.0	
		Fine to medium grained SAND some silt (SW-SM); gray; loose; wet; trace mica		
	-25			
55				
		Fine to medium grained SAND some silt (SW-SM); gray; loose; wet; trace mica		
		Fine to medium grained SAND (SW); dark gray; loose; wet; trace mica		
		Fine to medium grained SAND (SW); dark gray; loose to very loose; moist; trace mica		
	-30	Fine to medium grained SAND (SW); gray to dark gray; very loose to loose; moist; trace mica		
50				
			10.0	
		FAT CLAY (CH); dark gray to gray; medium stiff to medium stiff; moist; medium plasticity; trace mica, frequent silt partings throughout		
	-35			
45		Elastic SILT (MH); gray; medium dense to loose; moist; trace mica		
		FAT CLAY (CH); dark gray to gray; medium stiff; moist; medium plasticity; trace mica		
		CLAY (CL); gray; very stiff to stiff; moist; low to medium plasticity; trace mica and silt		
	-40			
40				
			10.0	
	-45	Medium grained Clayey SAND (SC); gray; dense; moist; trace mica		
		Fine to coarse grained SAND (SW); gray; loose; moist to wet; trace mica and lignite		
35				





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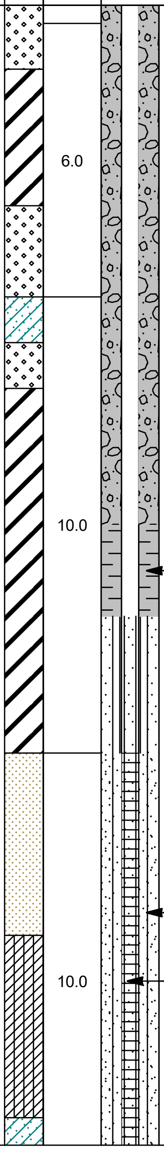
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *OW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/29/2020 to 7/29/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398601.08*
EASTING: *2051812.32*
GROUND ELEVATION: *81.26 (feet NAVD88)*
TOC ELEVATION: *84.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine to coarse grained SAND (SW); gray; loose; moist to wet; trace mica and lignite				
		FAT CLAY (CH); gray; soft to medium stiff; moist; medium plasticity; trace mica, two 6" sand layers at 48.5 - 49 and 49.5 - 50				
	-50			6.0		
30		Fine to medium grained SAND (SW); loose; wet; trace mica				
		Clayey SAND (SC); gray; dense; wet; trace mica				
		Fine to medium grained SAND with silt (SW); medium gray; loose; wet				
	-55	FAT CLAY (CH); gray; medium stiff; moist; medium plasticity; trace mica				
25						
				10.0		
					Bentonite chips	
	-60					
20						
		Fine grained SAND (SP); gray to dark gray; very loose; moist; trace mica				
		Medium grained SAND (SP); light gray to medium gray; very loose; wet				
	-65					
15					Filter pack (sand)	
		Silty CLAY with sand (CL-ML); gray; medium stiff; moist; low to medium plasticity; trace mica				
				10.0	2-inch PVC screen (0.010 inch)	
	-70					
10		Clayey SAND (SC); gray; moist; low plasticity; trace mica, lenses				

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BORING LOG

BOREHOLE ID: *OW-3*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *7/29/2020 to 7/29/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *398601.08*
EASTING: *2051812.32*
GROUND ELEVATION: *81.26 (feet NAVD88)*
TOC ELEVATION: *84.64 (feet NAVD88)*
TOTAL WELL DEPTH: *73 ft BLS*
TOTAL BORING DEPTH: *73 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Medium grained SAND (SP); gray; loose; wet; trace mica	▨			

End of Boring at 73.0 feet bgs.

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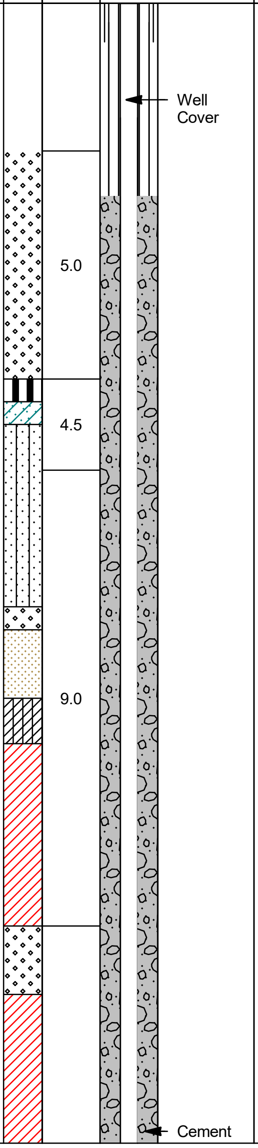
BORING LOG

BOREHOLE ID: OW-4

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: TR0795A
SITE LOCATION: Fayetteville, NC
BORING DATE: 8/5/2020 to 8/6/2020
GEOLOGIST: Allison Vo
DRILLING CONTRACTOR: SAEDACCO
DRILLER NAME: Will Keyes
DRILLING METHOD: Sonic Drilling

RIG TYPE: Geoprobe 8150LS
BOREHOLE DIA: 6" **SAMPLING METHOD:** Dual Tube
NORTHING: 395049.16
EASTING: 2052210.81
GROUND ELEVATION: 77.62 (feet NAVD88)
TOC ELEVATION: 80.85 (feet NAVD88)
TOTAL WELL DEPTH: 57 ft BLS
TOTAL BORING DEPTH: 80 ft BLS



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Comments
80			
	0	Fine to medium grained SAND (SW); light brown to brownish yellow; loose; wet	Post-hole dig to 5'
75			
	-5	Clayey SILT some sand (MH); reddish brown and light gray; dense; moist; mottled; low plasticity Clayey SAND (SC); light gray with reddish brown; medium dense; moist; mottled; low plasticity Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica Fine grained SAND WITH SILT (SP-SM); brownish yellow; loose; moist	
70			
	-10	Fine to medium grained SAND (SW); light brown; loose to medium dense; moist; trace mica Fine grained SAND (SP); brownish yellow to orange; loose; moist Fine grained SAND (SP); brownish yellow to orange; loose; moist; 3" reddish brown fine grain sand layer at 11.5" followed by reddish brown to brown gravel layer Silty CLAY (CL-ML); brownish yellow; medium stiff; dry; low plasticity; laminated gray clay LEAN CLAY (CL); dark gray; very stiff to hard; dry; low plasticity; with laminated light gray silt layers with trace mica throughout	
65			
	-15		
		Fine to medium grained SAND (SW); yellowish red; loose; wet	
60			
		LEAN CLAY (CL); dark gray; very stiff; dry; low plasticity; light gray clay/silt laminations, 3" brownish yellow sand layer	
	-20		

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All depths referenced to ground surface.

Total Depth: 80 ft bgs

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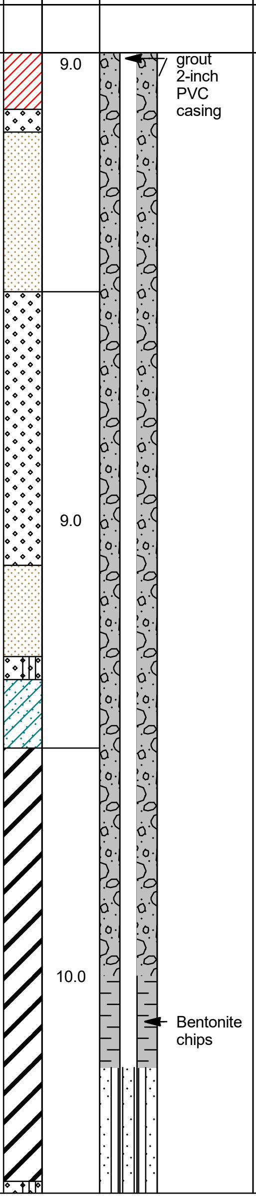
BORING LOG

BOREHOLE ID: *OW-4*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/5/2020 to 8/6/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395049.16*
EASTING: *2052210.81*
GROUND ELEVATION: *77.62 (feet NAVD88)*
TOC ELEVATION: *80.85 (feet NAVD88)*
TOTAL WELL DEPTH: *57 ft BLS*
TOTAL BORING DEPTH: *80 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Comments
55			
		LEAN CLAY (CL); dark gray; stiff; dry; low plasticity	
		SAND (SW); dark gray; loose; dry	
		Fine grained SAND (SP); white; loose; dry; trace mica, with ilght gray and brownish yellow mottling, gray laminations	Stop drilling 8/5/2020
	-25		
		Fine to medium grained SAND trace silt (SW); brown; very loose; wet; brownish yellow mottling at 30.5	Continue drilling 8/6/2020
50			
	-30		
		Fine to medium grained SAND trace silt (SW); tan to light brown; loose; moist; trace mica	
45			
		Fine grained SAND (SP); brownish yellow to orange; loose; moist to dry; 1" light gray layer at 33.5'	
		Medium grained SAND (SP); gray; loose; moist; trace mica	
	-35		
		Fine to medium grained SAND with silt (SW-SM); gray; loose; moist; trace mica	
		Clayey SAND trace silt (SC); gray; dense; moist; 4" lignite layer, trace mica, trace lignite present	
		FAT CLAY (CH); dark gray; medium stiff; moist; high plasticity; trace mica, greenish gray silt laminations frequent at 37' to 46'	
40			
	-40		
35			
	-45		



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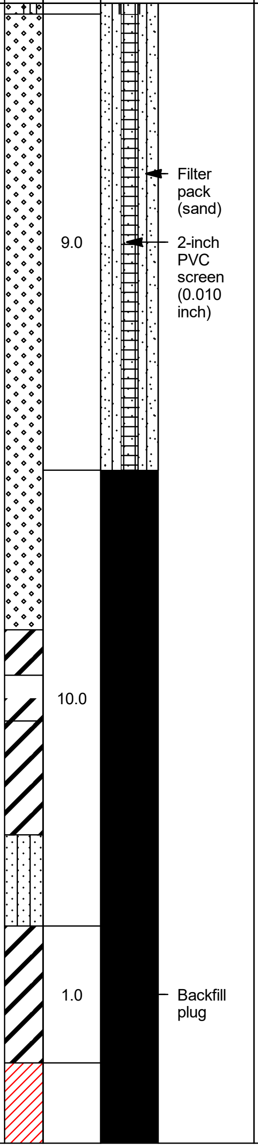
All depths referenced to ground surface.

Total Depth: 80 ft bgs

BORING LOG

BOREHOLE ID: *OW-4*

PROJECT NAME: Groundwater Pre-design Investigation	**RIG TYPE:** *Geoprobe 8150LS*
PROJECT NO: *TR0795A*	**BOREHOLE DIA:** *6"* **SAMPLING METHOD:** *Dual Tube*
SITE LOCATION: *Fayetteville, NC*	**NORTHING:** *395049.16*
BORING DATE: *8/5/2020 to 8/6/2020*	**EASTING:** *2052210.81*
GEOLOGIST: *Allison Vo*	**GROUND ELEVATION:** *77.62 (feet NAVD88)*
DRILLING CONTRACTOR: *SAEDACCO*	**TOC ELEVATION:** *80.85 (feet NAVD88)*
DRILLER NAME: *Will Keyes*	**TOTAL WELL DEPTH:** *57 ft BLS*
DRILLING METHOD: *Sonic Drilling*	**TOTAL BORING DEPTH:** *80 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
30		Fine to medium grained SAND with silt (SW-SM); gray; loose; moist; 0.5" lignite layer at 46.5' *(continued)* Fine to medium grained SAND (SW); gray to dark gray; very loose; moist; trace mica		
	-50			
25			9.0	
	-55			
20		Fine to medium grained SAND (SW); gray to dark gray; very loose; moist; trace mica		
		Fine to medium grained SAND (SW); gray to dark gray; very loose; moist; trace mica, trace lignite throughout, frequent gray clay seams throughout		
	-60	FAT CLAY (CH); gray; medium stiff; moist; medium plasticity; 0.5" lignite layer at 60.75'; sand seams 60.5' to 61'		
15		FAT CLAY (CH); gray; medium stiff; moist; medium plasticity; trace mica	10.0	
	-65	Fine grained SAND with silt (SP-SM); light gray to gray; medium dense; moist; trace mica		
10		Sandy FAT CLAY (CH); gray to dark gray; medium stiff; moist; medium plasticity; 4" brown petrified wood	1.0	
	-70	Sandy LEAN CLAY (CL); light gray; very stiff; moist		

(Continued Next Page)

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Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *OW-4*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/5/2020 to 8/6/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395049.16*
EASTING: *2052210.81*
GROUND ELEVATION: *77.62 (feet NAVD88)*
TOC ELEVATION: *80.85 (feet NAVD88)*
TOTAL WELL DEPTH: *57 ft BLS*
TOTAL BORING DEPTH: *80 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
5		Sandy LEAN CLAY (CL); light gray; very stiff; moist *(continued)*	▨		■	
	-75	LEAN CLAY (CL); light gray; very stiff; moist; occasional silt seams throughout	▨	10.0	■	
0			▨		■	
	-80					

End of Boring at 80.0 feet bgs.

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Telephone: 910-870-0576

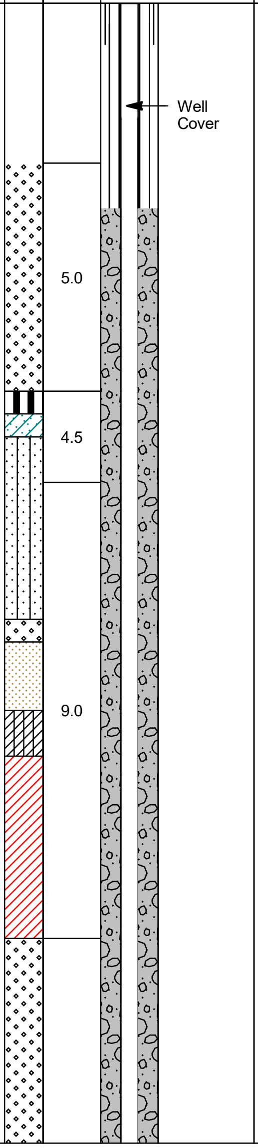
BORING LOG

BOREHOLE ID: *OW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/6/2020 to 8/6/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395070.03*
EASTING: *2052196.97*
GROUND ELEVATION: *78.12 (feet NAVD88)*
TOC ELEVATION: *81.61 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
80				
	0	Fine to medium grained SAND (SW); light brown to brownish yellow; loose; wet	5.0	Post-hole dig to 5'
75				
	-5	Clayey SILT some sand (MH); reddish brown and light gray; dense; moist; mottled; low plasticity Clayey SAND (SC); light gray with reddish brown; medium dense; moist; mottled; low plasticity Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica Fine grained SAND WITH SILT (SP-SM); yellowish red; medium dense; moist; trace mica Fine grained SAND WITH SILT (SP-SM); brownish yellow; loose; moist	4.5	Case off at 20'
70				
	-10	Fine to medium grained SAND (SW); light brown; loose to medium dense; moist; trace mica Fine grained SAND (SP); brownish yellow to orange; loose; moist Fine grained SAND (SP); brownish yellow to orange; loose; moist; 3" reddish brown fine grain sand layer at 11.5" followed by reddish brown to brown gravel layer Silty CLAY (CL-ML); brownish yellow; medium stiff; dry; low plasticity; laminated gray clay LEAN CLAY (CL); dark gray; very stiff to hard; dry; low plasticity; with laminated light gray silt layers with trace mica throughout	9.0	
65				
	-15			
		Fine to medium grained SAND (SW); brownish yellow; very loose; very wet		Wet likely due to top of run. Lost ~3" sand (likely at bottom of run)
60				
	-20			



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All depths referenced to ground surface.

Total Depth: 67 ft bgs

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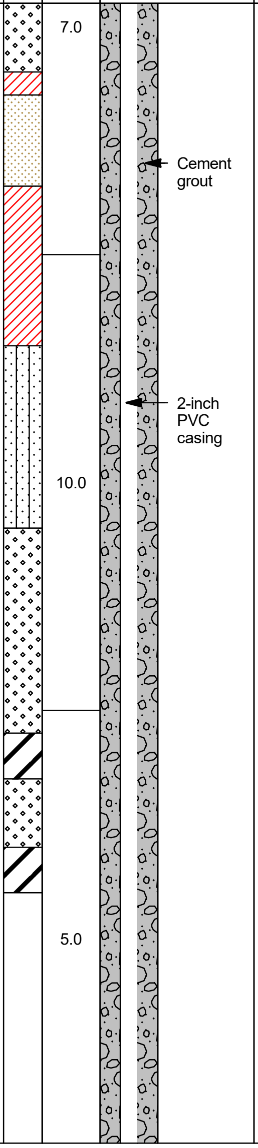
BORING LOG

BOREHOLE ID: *OW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/6/2020 to 8/6/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395070.03*
EASTING: *2052196.97*
GROUND ELEVATION: *78.12 (feet NAVD88)*
TOC ELEVATION: *81.61 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine to medium grained SAND (SW); brownish yellow; very loose; very wet *(continued)*	7.0	
55				
		LEAN CLAY (CL); dark gray; stiff; moist; low plasticity; trace mica, brownish yellow mottling		
		Fine grained SAND (SP); brownish yellow; loose; moist		
	-25			
		LEAN CLAY (CL); dark gray; stiff; moist; low plasticity; light gray silt with trace mica, laminations frequently throughout		
		LEAN CLAY (CL); dark gray; stiff; moist; low plasticity; light gray silt with trace mica, laminations frequently, 3" silt layer at bottom		
50				
		Fine grained SAND some silt (SP-SM); gray; loose; dry; trace mica		
	-30			
			10.0	
45		Fine to medium grained SAND (SW); gray; loose; dry; trace mica		
	-35			
				Heaving sands (tan) on top of run missing sands
		Fine grained SAND (SW); gray; loose; dry; trace mica		
		FAT CLAY with sand (CH); gray to dark gray; medium stiff; moist; medium plasticity; trace mica		
40				
		Fine to medium grained SAND (SW); dark gray; loose; moist; trace mica, 0.5" clay seams at 39'		
	-40			
		FAT CLAY (CH); dark gray to gray; medium stiff; moist		
			5.0	
35				
	-45			



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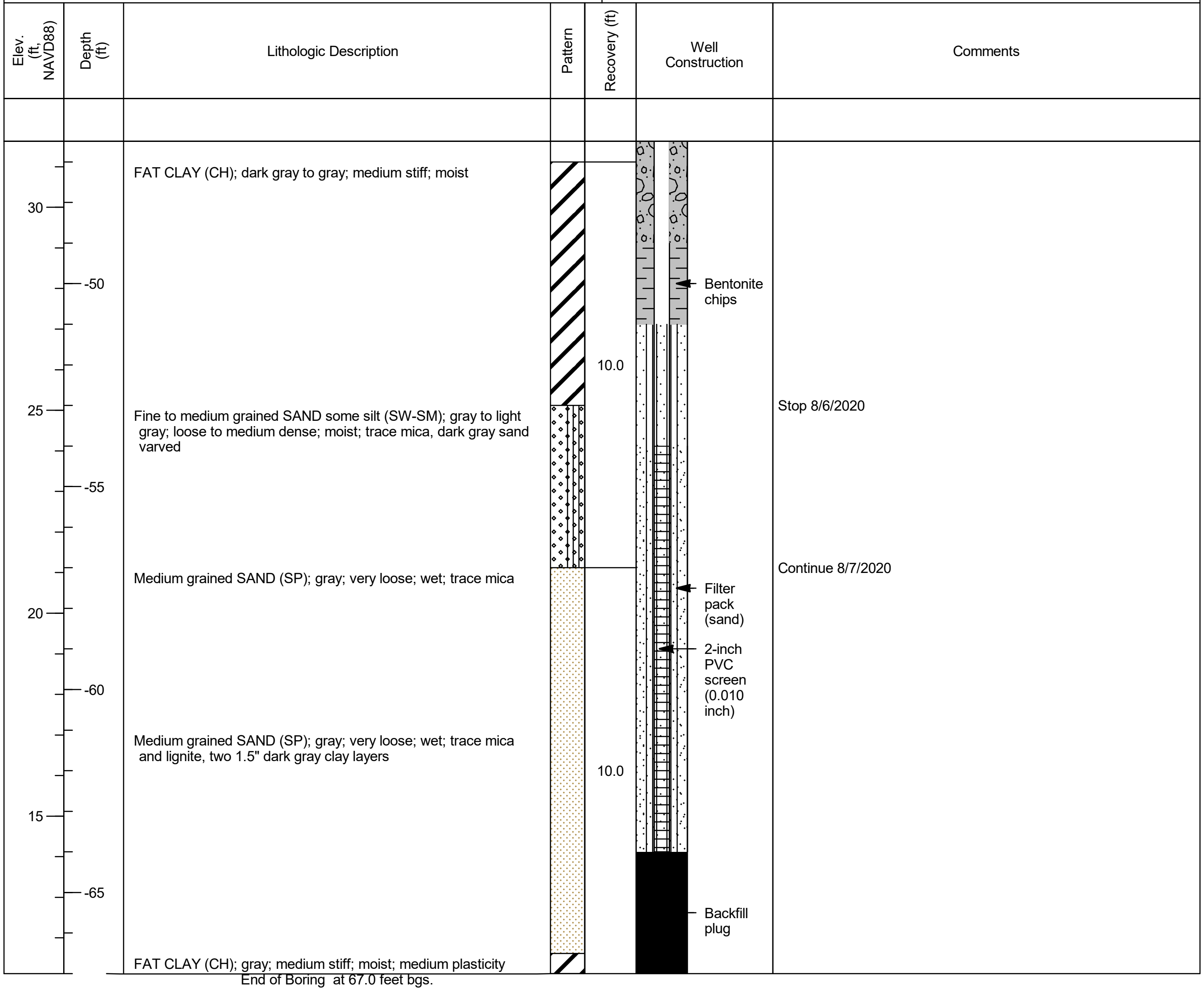
BORING LOG

BOREHOLE ID: *OW-5*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/6/2020 to 8/6/2020*
GEOLOGIST: *Allison Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic Drilling*

RIG TYPE: *Geoprobe 8150LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395070.03*
EASTING: *2052196.97*
GROUND ELEVATION: *78.12 (feet NAVD88)*
TOC ELEVATION: *81.61 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



FAT CLAY (CH); dark gray to gray; medium stiff; moist

Fine to medium grained SAND some silt (SW-SM); gray to light gray; loose to medium dense; moist; trace mica, dark gray sand varved

Medium grained SAND (SP); gray; very loose; wet; trace mica

Medium grained SAND (SP); gray; very loose; wet; trace mica and lignite, two 1.5" dark gray clay layers

FAT CLAY (CH); gray; medium stiff; moist; medium plasticity
End of Boring at 67.0 feet bgs.

Stop 8/6/2020

Continue 8/7/2020

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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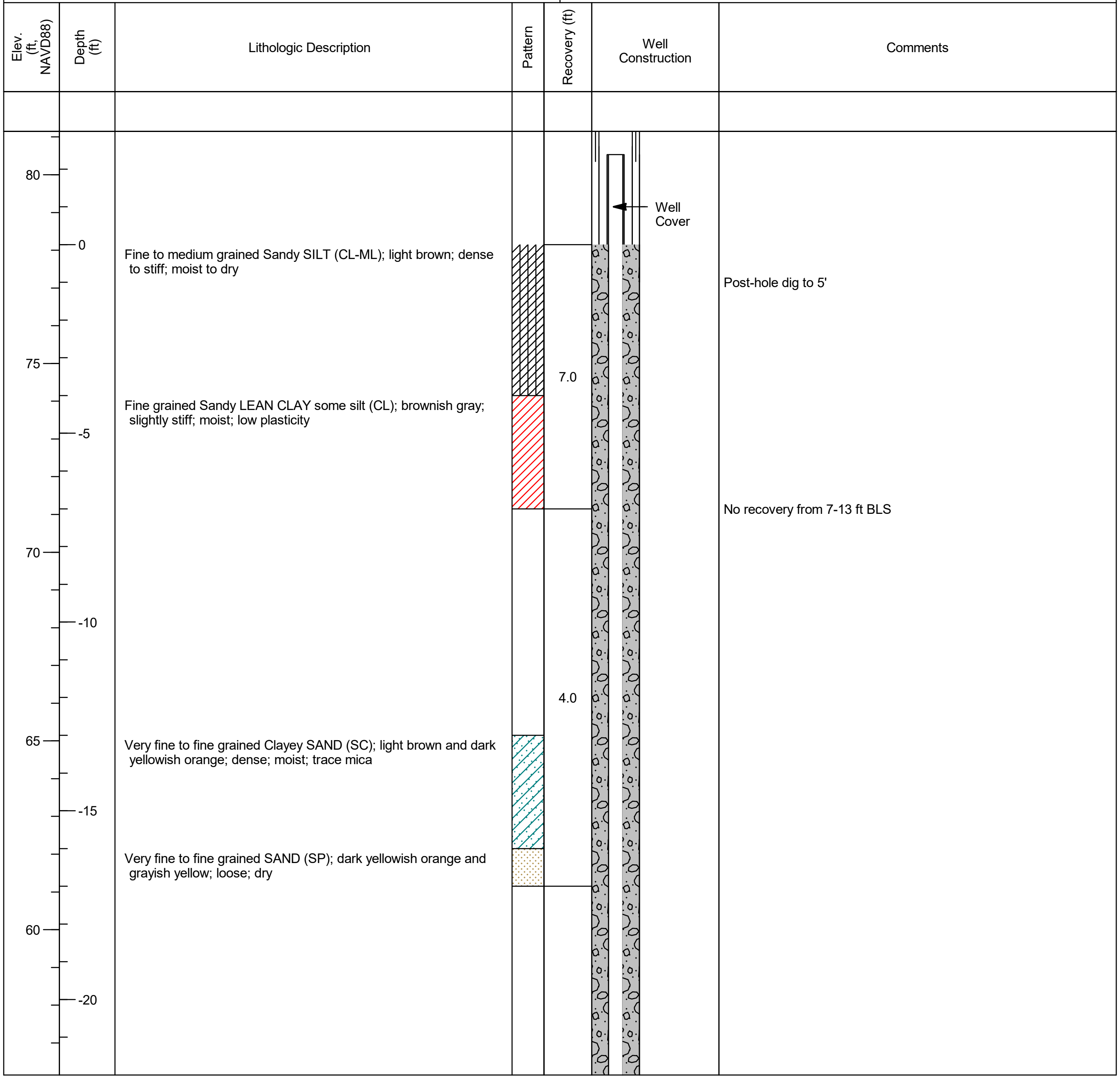
BORING LOG

BOREHOLE ID: *OW-6*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/12/2020 to 8/14/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396168.41*
EASTING: *2052223.54*
GROUND ELEVATION: *78.15 (feet NAVD88)*
TOC ELEVATION: *80.53 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*



Fine to medium grained Sandy SILT (CL-ML); light brown; dense to stiff; moist to dry

Fine grained Sandy LEAN CLAY some silt (CL); brownish gray; slightly stiff; moist; low plasticity

Very fine to fine grained Clayey SAND (SC); light brown and dark yellowish orange; dense; moist; trace mica

Very fine to fine grained SAND (SP); dark yellowish orange and grayish yellow; loose; dry

Post-hole dig to 5'

No recovery from 7-13 ft BLS

(Continued Next Page)

All depths referenced to ground surface.

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BORING LOG

BOREHOLE ID: *OW-6*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/12/2020 to 8/14/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396168.41*
EASTING: *2052223.54*
GROUND ELEVATION: *78.15 (feet NAVD88)*
TOC ELEVATION: *80.53 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
55		Very fine to fine grained SAND (SP); light olive brown; loose; moist to wet; trace mica		4.5	Cement grout	
		Very fine to fine grained SAND (SP); reddish brown; loose; moist to wet; trace mica			2-inch PVC casing	
	-25	Fine to medium grained SAND (SP); dark yellowish orange; loose; moist; trace mica				
		Fine to medium grained SAND (SP); dark yellowish orange; loose; moist; trace mica, `1" dark gray layer in basal 2-3"				
50						
	-30	Medium grained Sandy LEAN CLAY (CH); dark gray; medium stiff; moist; low plasticity				
		Medium grained SAND little clay (SP); dark yellowish orange; loose; wet				
		Medium grained Sandy CLAY (CL); dark gray; stiff; moist; low plasticity		10.0		
45		Medium grained SAND (SW); dark gray; loose; wet; trace mica				
		FAT CLAY (CH); dark gray; stiff; moist; high plasticity; trace organics				
		Fine to medium grained SAND (SW); dark yellowish orange; loose; moist; trace mica				
	-35					
		Fine to medium grained SAND (SW); light brown to dark yellowish olive; slightly dense to loose; moist; trace mica, thin organic layer (~1 cm) at ~37.5 ft				
40						
		FAT CLAY (CH); dark gray; stiff; moist; high plasticity				
	-40					
		Fine grained SAND (SP); grayish yellow and dark yellowish orange; loose to slightly dense; moist; mica, thin clay lenses		10.0		
35		SAND (SP); gray; medium dense; moist to wet; mica, organics in upper 1ft				
	-45					
					Bentonite chips	

(Continued Next Page)

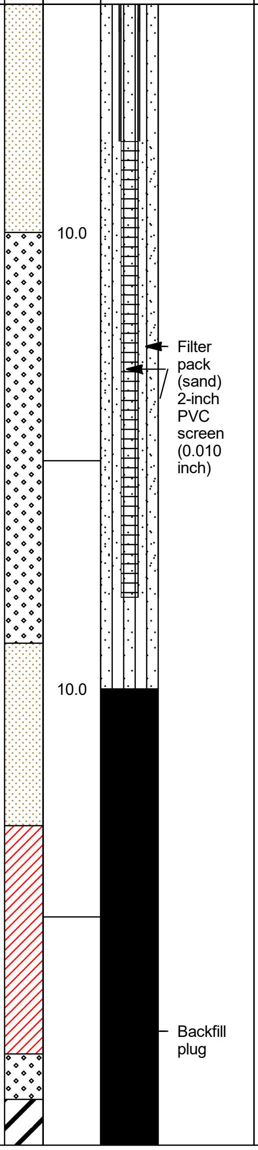
BORING LOG

BOREHOLE ID: *OW-6*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/12/2020 to 8/14/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396168.41*
EASTING: *2052223.54*
GROUND ELEVATION: *78.15 (feet NAVD88)*
TOC ELEVATION: *80.53 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		SAND (SP); gray; medium dense; moist to wet; mica		
30				
		SAND (SP); gray; medium dense; moist to wet; mica		
	-50			
		SAND (SP); gray; medium dense; moist to wet; mica, thin beds of clay and organics	10.0	
		Fine to medium grained SAND (SW); gray; slightly dense to medium dense; moist to wet; mica		
25				
	-55			
		Fine to medium grained SAND (SW); gray; slightly dense to medium dense; moist to wet; mica		
20				
	-60			
		Fine grained SAND (SP); gray; medium dense; moist; mica, organics in lower 1"	10.0	
15				
	-65	Fine to medium grained Sandy LEAN CLAY (CL); gray; stiff; moist; low plasticity; micaceous		
		Fine to medium grained Sandy LEAN CLAY (CL); light gray; stiff; moist; low plasticity; micaceous		
10				
	-70	Clayey SAND (SW); light gray; dense; moist to wet; trace mica		
		LEAN CLAY (CH); light gray; very stiff; moist; medium plasticity; trace mica		



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All depths referenced to ground surface.

Total Depth: 77 ft bgs

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BORING LOG

BOREHOLE ID: *OW-6*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/12/2020 to 8/14/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396168.41*
EASTING: *2052223.54*
GROUND ELEVATION: *78.15 (feet NAVD88)*
TOC ELEVATION: *80.53 (feet NAVD88)*
TOTAL WELL DEPTH: *60 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
5	-75	LEAN CLAY (CH); light gray; very stiff; moist; medium plasticity; trace mica *(continued)*	▨	10.0	■	

End of Boring at 77.0 feet bgs.

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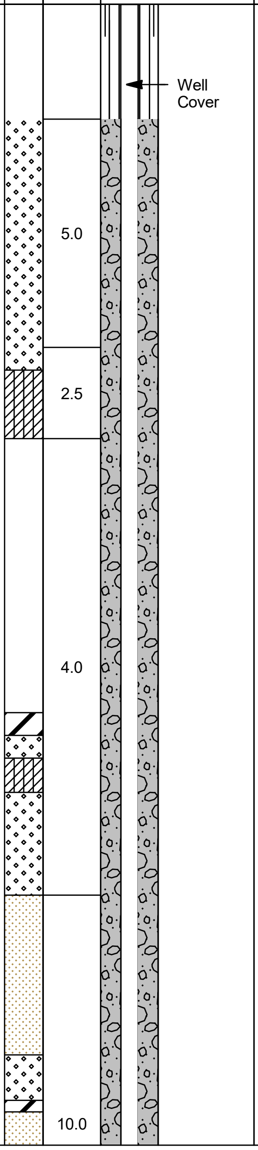
BORING LOG

BOREHOLE ID: *OW-7*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397180.06*
EASTING: *2052052.69*
GROUND ELEVATION: *81.45 (feet NAVD88)*
TOC ELEVATION: *78.94 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
	0	Fine to medium grained SAND (SW); light brown to brownish yellow; loose to very loose; moist to dry	5.0	Post-hole dig to 5'
80				
	-5	Silty LEAN CLAY (CL-ML); light brown; medium stiff; dry; low plasticity; light gray and brownish yeloow partings , trace mica	2.5	
75		Silty LEAN CLAY (CL-ML); light brown and brownish yellow; stiff; dry; low plasticity; trace lignite and mica, yellowish red mottling throughout (NO CORE)		
	-10			
70			4.0	
		CLAY (CH); grayish orange; soft; moist; medium to high plasticity; trace mica Fine to coarse grained SAND with silt (SW); light brown to grayish orange; loose; dry Silty LEAN CLAY (CL-ML); yellowish brown; medium stiff; dry; low to medium plasticity; orange clay partings frequent		
	-15	Fine to coarse grained SAND (SW); orange to brownish yellow; dense; dry; fines upward, trace mica, occassionally laminated		
65		Medium to coarse grained SAND (SW); dark gray to very dark gray; loose to medium dense; dry; trace lignite and mica Fine to coarse grained SAND with some silt (SP); brownish yellow; loose; wet; occassional dark gray silt seams		
		Fine grained SAND with some clay (SP); dark gray; loose; moist; some organic debris		
	-20	Coarse grained SAND (SP); orange to brownish yellow; very loose to loose; wet; gray clay seams at 20.25-20.5' Fine to coarse grained SAND (SW); yellowish gray pale orangeish gray; loose; moist; trace mica		
60		Medium to coarse grained SAND with some gravel (SW); dark gray; loose; wet; trace mica and organics FAT CLAY (CH); dark gray; medium stiff; dry to moist; medium to	10.0	

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 80 ft bgs

BORING LOG

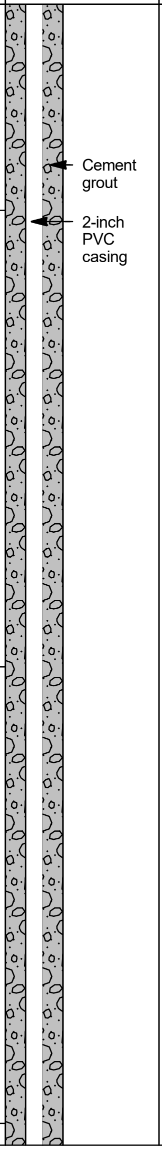
BOREHOLE ID: *OW-7*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397180.06*
EASTING: *2052052.69*
GROUND ELEVATION: *81.45 (feet NAVD88)*
TOC ELEVATION: *78.94 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		high plasticity; trace mica and lignite Medium grained SAND trace silt (SP); orange to brownish yellow; medium dense; moist; light gray clay seams frequent throughout *(continued)*		
	-25			
55		Medium to coarse grained SAND trace silt (SW); light brown; medium dense to loose; moist; trace mica		
		(NO CORE)		
		Medium to coarse grained SAND trace silt (SW); light brown; medium dense to loose; moist; trace mica		
		Fine grained SAND (SP); dark gray; medium dense; moist; trace lignite and mica		
	-30	FAT CLAY (CH); dark gray; medium stiff; dry; medium to high plasticity; greenish gray silt laminations frequent throughout, trace mica		
50			9.0	
	-35	Sandy LEAN CLAY (CL-ML); dark gray; dense to medium stiff; moist; low to medium plasticity; trace mica		
		Sandy FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity; trace mica		
45		Sandy FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity; trace mica		
		FAT CLAY (CH); dark gray; stiff; dry; medium plasticity; trace mica		
	-40	Fine to medium grained SAND (SW); orange to brownish yellow; loose; moist; fines upward		
40			10.0	
		Fine grained SAND with some silt (SP); light gray; loose to very loose; moist; trace mica, 0.5-1" dark gray clay layers in upper 0.5', 3" clay layer at 46'		
	-45			
35				

Well Construction



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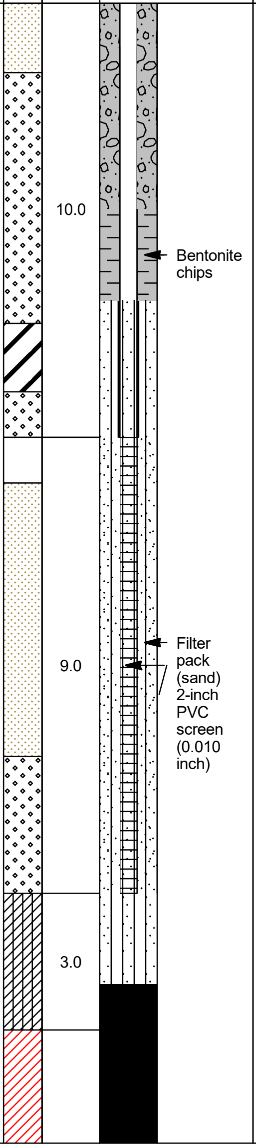
BORING LOG

BOREHOLE ID: *OW-7*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397180.06*
EASTING: *2052052.69*
GROUND ELEVATION: *81.45 (feet NAVD88)*
TOC ELEVATION: *78.94 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine grained SAND with some silt (SP); light gray; loose to very loose; moist; trace mica, dark gray fat clay lenses throughout *(continued)*		
		Fine to medium grained SAND with some silt (SW); medium gray; loose to medium dense; moist; trace mica		
	-50			
30				
			10.0	
	-55	FAT CLAY (CH); dark gray; stiff; dry to moist; medium to high plasticity; trace mica, 0.5-1" sand seams throughout		
25		Fine to medium grained SAND with some silt (SW); medium gray to dark gray; loose to medium dense; moist; trace mica and lignite		
		(NO CORE)		
		Medium grained SAND (SP); medium gray; medium dense; moist; trace mica		
	-60			
20				
			9.0	
		Medium to coarse grained SAND (SW); medium gray to dark gray; loose to medium dense; moist; trace mica and lignite		
	-65	Fine to medium grained SAND (SW); medium gray; loose; moist; trace mica and lignite		
15				
		Sandy LEAN CLAY (CL-ML); light gray; stiff to very stiff; dry; low to medium plasticity; trace mica		
			3.0	
	-70	LEAN CLAY (CL); light gray; very stiff; dry; low plasticity; trace mica		
10				

(Continued Next Page)

BORING LOG

BOREHOLE ID: *OW-7*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397180.06*
EASTING: *2052052.69*
GROUND ELEVATION: *81.45 (feet NAVD88)*
TOC ELEVATION: *78.94 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		LEAN CLAY (CL); light gray; very stiff; dry; low plasticity; trace mica *(continued)*	▨		■	
	-75		▨	10.0	■ Backfill plug	
5			▨		■	
	-80					

End of Boring at 80.0 feet bgs.

Geosyntec consultants

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Telephone: 910-870-0576

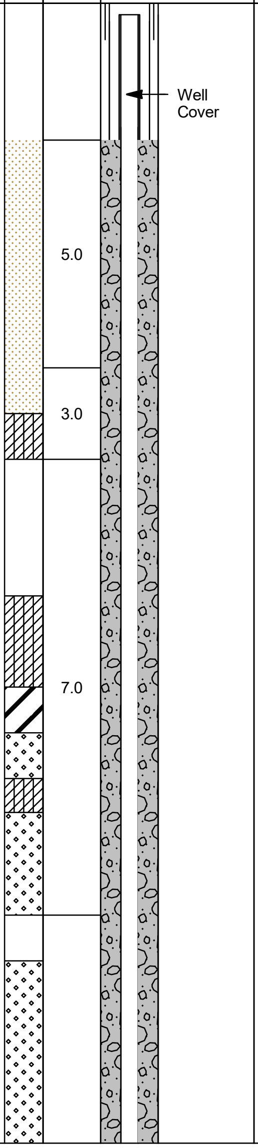
BORING LOG

BOREHOLE ID: *OW-8*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397202.33*
EASTING: *2052041.98*
GROUND ELEVATION: *82.3 (feet NAVD88)*
TOC ELEVATION: *79.57 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
85						
	0	Fine grained SAND (SP); light brown; very loose to loose; dry; organic debris in upper 3'		5.0		Post-hole dig to 5'
80						
	-5					
		Silty CLAY (CL-ML); light brown to brownish yellow; stiff; dry; low plasticity; light gray and orange partings frequent throughout, some sand in lower 0.5', trace mica and lignite (NO CORE)		3.0		
75						
	-10	Silty CLAY (CL-ML); light brown to brownish yellow; stiff; dry; low plasticity; light gray and orange partings frequent throughout, some sand in lower 0.5', trace mica and lignite		7.0		
70		FAT CLAY (CH); grayish orange; medium stiff to stiff; moist to dry; medium plasticity; trace mica, soft at 12.75'				
		Fine to medium grained SAND with some silt (SW); light brown to grayish orange; very loose to loose; dry				
		Silty CLAY with some sand (CL-ML); pale yellowish brown to light brown; medium stiff; dry; low plasticity; trace mica, clay partings frequent				
	-15	Fine to coarse grained SAND (SW); brownish yellow; dense to medium dense; dry; fines upward, fine orange and gray partings frequent, trace mica				
65		Medium to coarse grained SAND trace gravel (SW); very dark gray; dense; moist; trace mica (NO CORE)				
		Fine to medium grained SAND (SW); brownish yellow; loose; moist; trace mica and organics				
	-20	Fine to coarse grained SAND (SW); very dark gray to dark gray; loose to medium dense; moist to wet; trace mica, 0.5-1.5" lignite and peat layers at 23'				



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BORING LOG

BOREHOLE ID: *OW-8*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397202.33*
EASTING: *2052041.98*
GROUND ELEVATION: *82.3 (feet NAVD88)*
TOC ELEVATION: *79.57 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Well Construction	Comments
60		Fine to coarse grained SAND (SW); very dark gray to dark gray; loose to medium dense; moist to wet; trace mica, 0.5-1.5" lignite and peat layers at 23' *(continued)*	9.0	Cement grout 2-inch PVC casing	
		FAT CLAY (CH); dark gray; medium stiff to stiff; dry; medium plasticity; trace mica			
	-25	Medium to coarse grained SAND (SW); yellowish gray and light brown; loose; wet; laminated; 1/2" clay dark gray clay layer at 26'			
		Coarse grained SAND (SP); brownish yellow; loose; wet; 4" dark gray clay layer at 26.5'			
55		FAT CLAY (CH); dark gray; medium stiff to stiff; dry; medium plasticity; thin silt greenish gray seams frequent throughout, trace mica			
	-30				
50			10.0		
	-35	Sandy FAT CLAY (CH); dark gray; medium dense; moist; medium plasticity; coarse grained sand seams throughout, trace mica			
45		Medium to coarse grained SAND trace gravel (SW); grayish brown to dark gray; very loose; wet; trace mica			
	-40				
40			10.0		
	-45			Bentonite chips	

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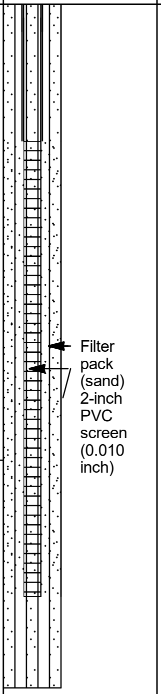
BORING LOG

BOREHOLE ID: *OW-8*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/13/2020 to 10/15/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *397202.33*
EASTING: *2052041.98*
GROUND ELEVATION: *82.3 (feet NAVD88)*
TOC ELEVATION: *79.57 (feet NAVD88)*
TOTAL WELL DEPTH: *67 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
35		Medium to coarse grained SAND trace gravel (SW); grayish brown to dark gray; very loose; wet; trace mica *(continued)*				
		FAT CLAY (CH); dark gray; medium stiff; dry; medium to high plasticity; light gray silt laminations frequent throughout, trace mica				
	-50					
				10.0		
30		Fine grained SAND (SP); orange to brownish yellow; loose to medium dense; moist; trace mica				
		Fine to medium grained SAND (SW); light gray; loose; moist; clay partinngs frequent throughout				
	-55					
		FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity; light gray silt partings, trace mica, 3" sand layer at 56.75'				
25		Fine to medium grained SAND with some silt (SW); medium gray; medium dense; moist; trace mica				
	-60					
		Fine to medium grained SAND (SW); dark gray; medium dense; moist; lignite seams and partings frequent throughout, trace mica				
				10.0		
20						
		Fine to medium grained SAND (SW); dark gray; loose; moist; clay partings occassional, upper 1' medium to coarse grained, trace mica				
	-65					



End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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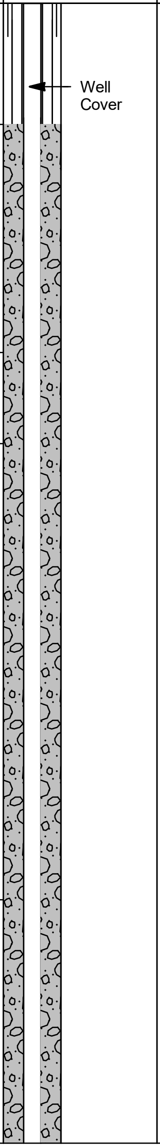
BORING LOG

BOREHOLE ID: *OW-9*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/16/2020 to 10/19/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395075.14*
EASTING: *2052211.07*
GROUND ELEVATION: *79.78 (feet NAVD88)*
TOC ELEVATION: *77.13 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *64 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
80	0	Fine to medium grained SAND (SW); light brown to brownish yellow; loose; wet	5.0	Post-hole dig to 5'
75	-5	Clayey SILT with some sand (MH); light gray to light brown; dense to loose; wet; low plasticity Clayey SAND (SC); light brown; dense to medium dense; moist; low plasticity; reddish brown mottling SAND with silt (SP-SM); light brown to orangeish gray; medium dense; moist; trace mica and slit laminations (NO CORE)	3.0	
70	-10	SAND with silt (SP-SM); light brown to orangeish gray; medium dense; wet; organic debris, trace mica		
		Fine to medium grained SAND with some silt (SW-SM); light brown; very loose; wet; trace organic debris		
		Fine grained SAND (SP); brownish yellow to orange; loose; moist	8.0	
		Fine grained SAND (SP); grayish orange to reddish brown; moist; 1" reddish brown sand layer at 15'. 1" clay layer at 14.5'		
65	-15	LEAN CLAY (CL); dark gray; stiff to very stiff; dry; medium plasticity; trace mica, greenish gray silt partings frequent throughout		
		(NO CORE)		
		Fine to medium grained SAND (SW); yellowish red to orange; loose; moist		
60	-20	FAT CLAY (CH); dark gray; medium stiff to stiff; dry; medium plasticity; 1/2" coarse grained dark gray sand layer at 20', sand seams throughout		
		Very fine to fine grained SAND with some silt (SP-SM); dark gray; loose; dry; trace mica	9.0	



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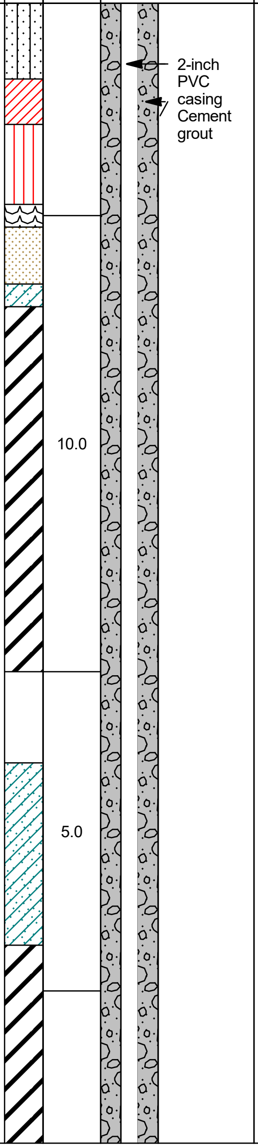
BORING LOG

BOREHOLE ID: *OW-9*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/16/2020 to 10/19/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395075.14*
EASTING: *2052211.07*
GROUND ELEVATION: *79.78 (feet NAVD88)*
TOC ELEVATION: *77.13 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *64 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Very fine to fine grained SAND with some silt (SP-SM); dark gray; loose; dry; trace mica *(continued)*		
		LEAN CLAY (CL); dark gray; medium stiff; dry; silt laminations frequent		
55	-25			
		SILT (ML); light gray to gray; loose to medium dense; dry; trace mica, clay partings frequent throughout		
		PEAT (OH); dark brown		
		Coarse grained SAND (SP); dark gray; very loose; wet; trace mica		
		Coarse grained Sandy CLAY (SC); dark gray; dense; moist; trace mica		
		FAT CLAY (CH); dark gray; medium stiff; moist; medium plasticity; greenish gray silt partings frequent throughout		
50	-30			
			10.0	
45	-35			
		(NO CORE)		
		Medium to coarse grained Clayey SAND (SC); dark gray to very dark gray; medium dense to loose; wet; trace lignite		
40	-40			
			5.0	
		FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity, trace mica		
		FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity; trace mica		
35	-45			



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Telephone: 910-870-0576

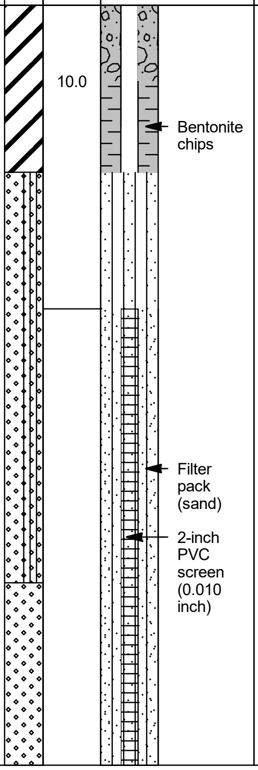
BORING LOG

BOREHOLE ID: *OW-9*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *10/16/2020 to 10/19/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 7822DT*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *395075.14*
EASTING: *2052211.07*
GROUND ELEVATION: *79.78 (feet NAVD88)*
TOC ELEVATION: *77.13 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *64 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		FAT CLAY (CH); dark gray; medium stiff; dry; medium plasticity; trace mica *(continued)*		10.0		
30	-50				Bentonite chips	
		Very fine to fine grained SAND (SW-SM)				
		Fine to medium grained SAND (SW-SM); gray to dark gray; very loose; moist; trace mica				
25	-55					
					Filter pack (sand)	
		Fine to medium grained SAND (SW-SM); dark gray; very loose; moist; trace mica and lignite			2-inch PVC screen (0.010 inch)	
20	-60	Fine to medium grained SAND (SW); medium gray to dark gray; loose to very loose; moist; trace mica and lignite				



End of Boring at 64.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 64 ft bgs

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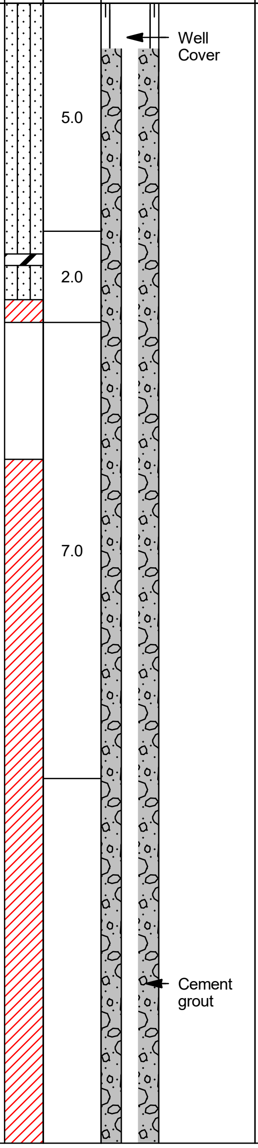
BORING LOG

BOREHOLE ID: *PIW-11*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/25/2020 to 8/26/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401911.03*
EASTING: *2050416.29*
GROUND ELEVATION: *64.95 (feet NAVD88)*
TOC ELEVATION: *67.02 (feet NAVD88)*
TOTAL WELL DEPTH: *57 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine grained Silty SAND (SP-SM); light brown to tan; loose to very loose; moist; trace organics (rootlets)		5.0	Well Cover	Post-hole dig to 5'
60	-5	Fine grained Silty SAND (SP-SM); light brown to tan; loose to very loose; moist; trace organics (rootlets) FAT CLAY (CH); light gray and brownish yellow; medium stiff; moist; laminated Very fine to fine grained SAND some silt (SP-SM); brownish yellow; loose; moist; trace mica, occasional tan clay seams LEAN CLAY (CL); light gray; medium stiff; moist to dry; frequent yellowish red silt seams		2.0		
55	-10	LEAN CLAY (CL); light gray; stiff; moist; trace mica, frequent yellowish red to brownish yellow silt steams		7.0		
50	-15	CLAY (CL); gray to dark gray; medium stiff; trace mica, reddish brown silt partings				
		LEAN CLAY (CL); dark gray to dark brown; soft to very soft; moist; interbedded yellowish brown silt seams throughout, 3" clayey sand brown layer				Depths are approximate due to low recovery
45	-20				Cement grout	



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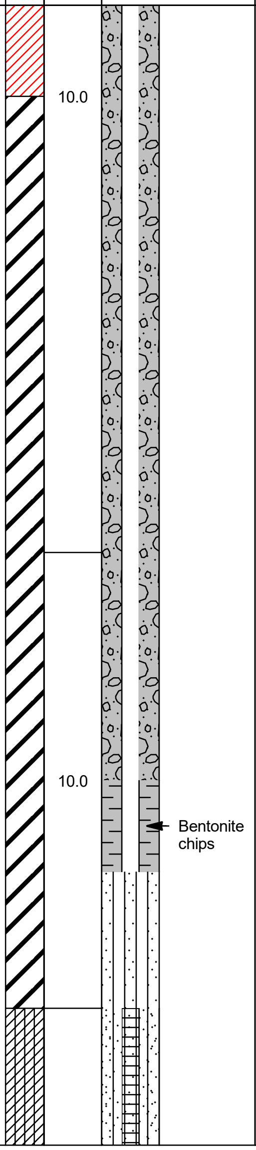
BORING LOG

BOREHOLE ID: *PIW-11*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/25/2020 to 8/26/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401911.03*
EASTING: *2050416.29*
GROUND ELEVATION: *64.95 (feet NAVD88)*
TOC ELEVATION: *67.02 (feet NAVD88)*
TOTAL WELL DEPTH: *57 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		LEAN CLAY (CL); dark gray to dark brown; soft to very soft; moist; interbedded yellowish brown silt seams throughout, 3" clayey sand brown layer *(continued)*				
		FAT CLAY (CH); dark gray; stiff; dry to moist; medium to high plasticity; trace mica		10.0		
35	-30					
30	-35					
		FAT CLAY (CH); dark gray; stiff; dry to moist; light gray silt with trace mica partings throughout				
25	-40			10.0	Bentonite chips	
20	-45					
		Clayey SILT (CL-ML); light gray; medium stiff; moist to dry; low plasticity; moist clay on outside, dry inside; trace mica				



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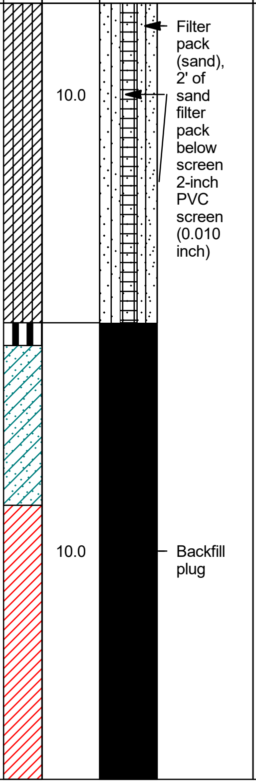
BORING LOG

BOREHOLE ID: *PIW-11*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/25/2020 to 8/26/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401911.03*
EASTING: *2050416.29*
GROUND ELEVATION: *64.95 (feet NAVD88)*
TOC ELEVATION: *67.02 (feet NAVD88)*
TOTAL WELL DEPTH: *57 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Clayey SILT (CL-ML); light gray; medium stiff; moist to dry; low plasticity; moist clay on outside, dry inside; trace mica *(continued)* Silty CLAY (CL-ML); light gray; medium dense to stiff; moist; low plasticity; trace mica	10.0	
10	-55			
		Fine grained Elastic SILT with sand (MH); light gray; dense; moist; trace mica Clayey SAND with silt (SC); light gray; dense; moist; trace mica		
5	-60			
		LEAN CLAY (CL); light gray; stiff to very stiff; dry to moist; low plasticity	10.0	
0	-65			



End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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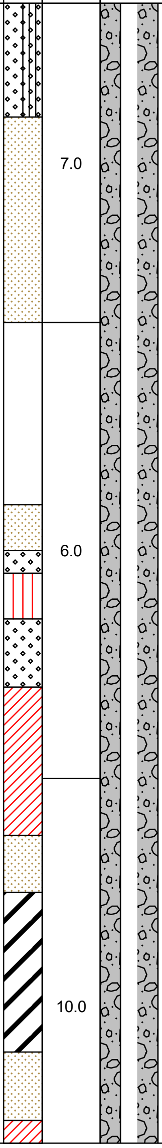
BORING LOG

BOREHOLE ID: *PIW-12*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/1/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *4"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401703.1*
EASTING: *2051025.77*
GROUND ELEVATION: *81.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *74 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
80		Very fine to fine grained Silty SAND trace clay (SW-SM); dark yellowish orange; loose; dry to moist; micaceous				Post-hole dig to 5'
		Very fine grained Silty SAND (SP); grayish orange; loose; dry to moist; micaceous		7.0		
75	-5	Very fine grained Silty SAND (SP); grayish orange and grayish yellow; loose; dry to moist; micaceous				
	-10					
70		Very fine grained Silty SAND trace clay (SP); very pale orange and medium light gray; loose; dry to moist		6.0		
		Very fine to fine grained SAND (SW); dark yellowish orange; dense to loose; dry to moist; mica				
		Very fine grained Sandy SILT (ML); very pale orange to grayish orange; loose; moist; mica				
		Very fine to fine grained SAND (SW); dark yellowish orange; loose to slightly dense; moist; mica				
65	-15	LEAN CLAY (CL); pale yellowish brown to light olive gray; stiff; moist; medium plasticity; micaceous; very thin iron oxide staining/lenses				
		LEAN CLAY trace sand (CL); dark gray; stiff to very stiff; moist; mica; plastic				
		Very fine grained SAND (SP); dark yellowish orange; loose; moist; mica				
60	-20	FAT CLAY (CH); dark gray; stiff to very stiff; moist; high plasticity; mica		10.0		
		Very fine to fine grained SAND (SP); dark yellowish orange and grayish yellow; loose; dry; mica				
		LEAN CLAY (CL); brown; slightly stiff; moist; low plasticity; mica				

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All depths referenced to ground surface.

Total Depth: 77 ft bgs

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Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *PIW-12*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/1/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *4"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401703.1*
EASTING: *2051025.77*
GROUND ELEVATION: *81.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *74 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Very fine grained SAND (SP); grayish yellow and dark yellowish orange; loose; dry; mica; brown clay lenses at 26' and 27'				
55		Fine grained SAND (SP); yellowish gray; loose; dry; micaceous				
		Fine grained SAND (SP); brown; loose; dry; micaceous				
		Sandy LEAN CLAY (CL); light olive brown and dusky brown; soft; moist; micaceous; plastic				
		FAT CLAY (CH); brownish gray; stiff; moist; high plasticity; mica				
					Cement grout	
	-30					
50		LEAN CLAY trace sand (CL); brownish gray; soft; moist; mica		10.0		
		Fine grained Clayey SILT trace sand (CL-ML); light brown; loose; moist; mica				
	-35					
		Fine grained SAND (SP); grayish yellow; loose; dry; mica				
45						
	-40	Fine grained SAND (SP); grayish yellow; loose; dry; mica				
		Very fine grained SAND (SP); grayish yellow to yellowish gray; loose; dry; mica				
40		Very fine grained SAND (SW); grayish yellow and dark yellowish orange; loose; dry; mica; yellow-brown clay lenses at ~42.5-43.5 ft		7.0		
		Very fine grained SAND (SP); grayish yellow to medium orangeish pink; loose; dry; mica				
	-45					
35		Very fine to fine grained SAND (SW); dark yellowish orange; loose; moist; mica				
		FAT CLAY (CH); dark gray to brownish gray; stiff; moist; trace mica; plastic				

(Continued Next Page)

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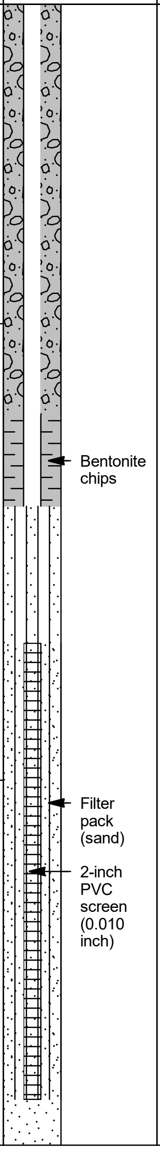
BORING LOG

BOREHOLE ID: *PIW-12*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/1/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *4"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401703.1*
EASTING: *2051025.77*
GROUND ELEVATION: *81.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *74 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		FAT CLAY (CH); dark gray to brownish gray; stiff; moist; trace mica; plastic *(continued)*		
30			9.0	
	-55			
25				
		FAT CLAY (CH); dark gray to brownish gray; stiff; moist; trace mica; plastic		
	-60			
20			9.5	
		Very fine to fine grained SAND (SW); dark gray to brownish black; loose; saturated; mica; trace organics		
	-65	Fine grained SAND (SP); light gray to light brownish gray; loose to dense; wet to moist; trace mica; thin-bedded black coloration throughout		slight odor in material, like sulfar. Possibly biologic. Similar to swamp water smell.
15		Fine grained Silty SAND (SP); light gray to light brownish gray; dense; dry to moist; trace mica; thin-bedded black coloration throughout		Odor from ~67-68'
		Fine to medium grained Sandy LEAN CLAY (CL); light gray to yellowish gray; very stiff; moist; low plasticity		
	-70			
10			10.0	
		LEAN CLAY (CL); yellowish gray; very stiff; moist to dry; mica; plastic		



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All depths referenced to ground surface.

Total Depth: 77 ft bgs

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BORING LOG

BOREHOLE ID: *PIW-12*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/1/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *4"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401703.1*
EASTING: *2051025.77*
GROUND ELEVATION: *81.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *74 ft BLS*
TOTAL BORING DEPTH: *77 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
5		LEAN CLAY (CL); yellowish gray; very stiff; moist to dry; mica; plastic *(continued)*	▨		⁘ ← Backfill plug	

End of Boring at 77.0 feet bgs.

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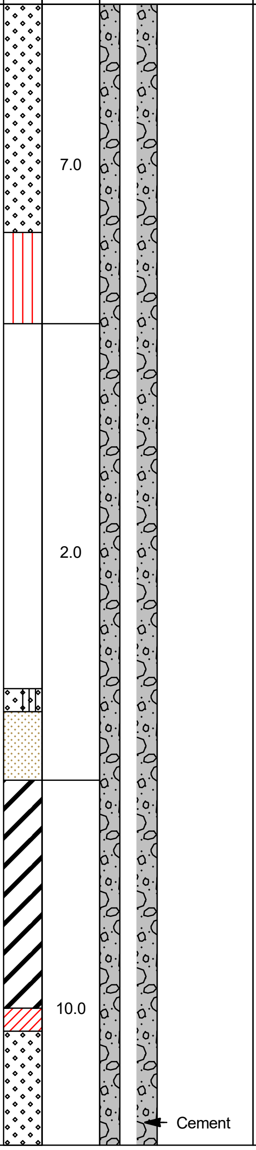
BORING LOG

BOREHOLE ID: *PIW-13*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/3/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401464.29*
EASTING: *2051122.6*
GROUND ELEVATION: *81.4 (feet NAVD88)*
TOC ELEVATION: *83.18 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Very fine to fine grained SAND (SW); grayish orange; loose; dry; trace mica		Post-hole dig to 5'
80				
			7.0	
	-5	Sandy SILT (ML); dark yellowish orange; dense; dry to moist		
75				
	-10			
70				
			2.0	
	-15	Very fine to fine grained Silty SAND (SW-SM); light brown and dark yellowish orange; loose; dry to wet; wet from drill fluid Very fine to fine grained SAND (SP); grayish yellow; loose; dry; trace mica		
65				
		FAT CLAY (CH); dark gray; stiff; moist; plastic; yellow green thin lenses of micaceous silt in lower 2 feet		
	-20			
60				
		Sandy LEAN CLAY (CL); dark gray; stiff; moist; plastic	10.0	
		SAND (SW); dark yellowish orange and yellowish gray; loose; dry; mica; some clay clods		



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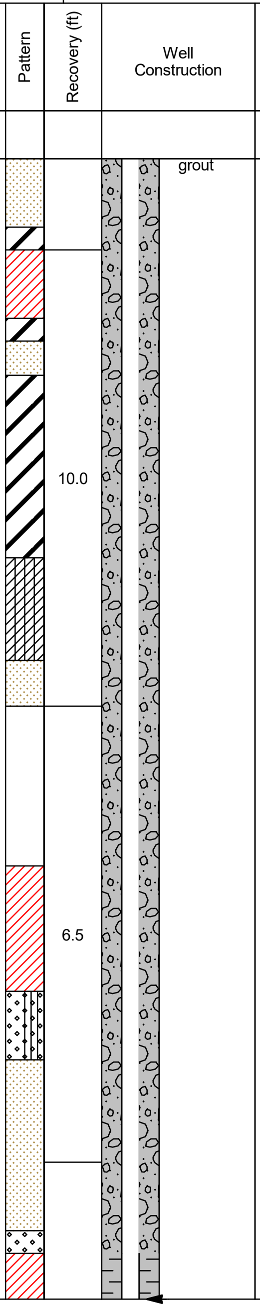
BORING LOG

BOREHOLE ID: *PIW-13*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/3/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401464.29*
EASTING: *2051122.6*
GROUND ELEVATION: *81.4 (feet NAVD88)*
TOC ELEVATION: *83.18 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine grained SAND (SP); dark yellowish orange; loose; moist; some brown clay lenses		
55		Very fine grained SAND (SP); yellowish gray to grayish yellow; loose; dry to moist; some brown clay lenses		
		FAT CLAY (CH); dark gray; stiff; moist; mica; plastic		
		Very fine grained Sandy LEAN CLAY (CL); brownish gray; very soft; wet; wet from drill fluid		
		FAT CLAY (CH); dark gray; stiff; moist; mica; plastic		
		SAND (SP); light brown to dark yellowish orange; loose; moist; trace mica		
	-30	FAT CLAY (CH); dark gray; stiff; moist; mica; plastic		
50			10.0	
		Silty LEAN CLAY (CL-ML); brownish gray; very stiff; dry to moist; mottled; low plasticity; mica		
	-35			
45		Very fine grained SAND (SP); dark yellowish orange and grayish yellow; loose; dry; mica		
	-40			
40		Very fine to fine grained Sandy LEAN CLAY (CL); olive gray and dark yellowish orange; soft; wet to moist; non plastic; wet-moist due to drill fluid	6.5	
		Very fine to fine grained Silty SAND (SW-SM); light olive gray and dark yellowish orange; loose; moist		
	-45	Very fine grained SAND (SP); yellowish gray to grayish yellow; loose; dry; mica		
35				
		Fine grained SAND (SP); grayish orange; loose; moist; moist from drill fluid		
		Very fine grained Silty SAND (SW); light brown; loose; moist; mica		
		Silty LEAN CLAY with sand (CL); soft to slightly stiff; moist; low plasticity; mica		



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All depths referenced to ground surface.

Total Depth: 67 ft bgs

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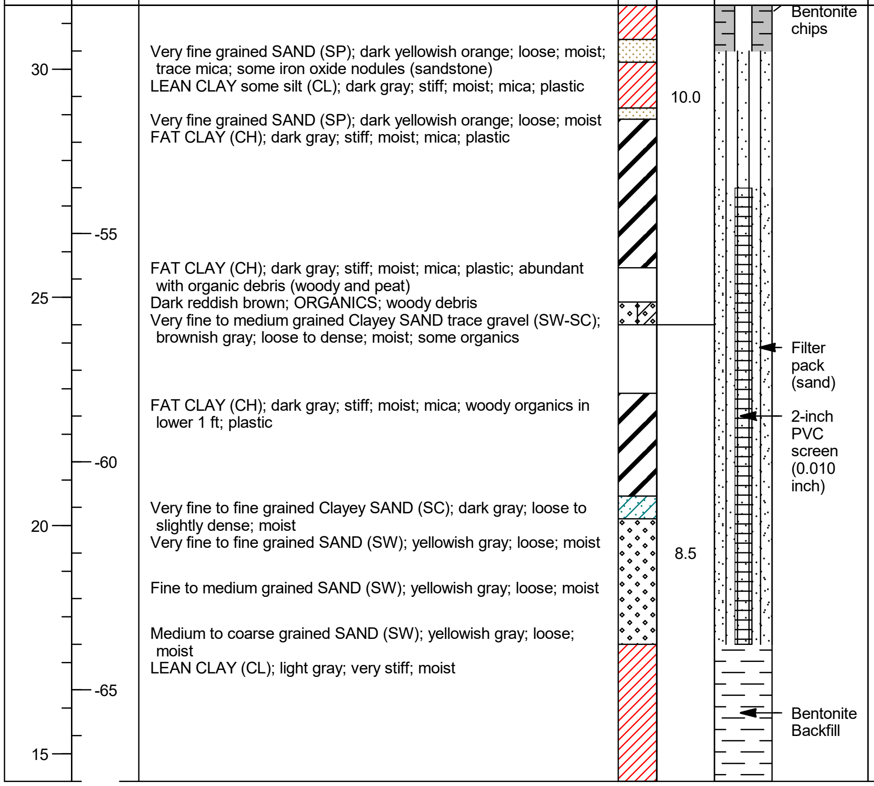
BORING LOG

BOREHOLE ID: *PIW-13*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/3/2020 to 9/8/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401464.29*
EASTING: *2051122.6*
GROUND ELEVATION: *81.4 (feet NAVD88)*
TOC ELEVATION: *83.18 (feet NAVD88)*
TOTAL WELL DEPTH: *64 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Lithologic Description	Recovery (ft)	Comments
Very fine grained SAND (SP); dark yellowish orange; loose; moist; trace mica; some iron oxide nodules (sandstone)		
LEAN CLAY some silt (CL); dark gray; stiff; moist; mica; plastic	10.0	
Very fine grained SAND (SP); dark yellowish orange; loose; moist		Sulfur-like odor in clay
FAT CLAY (CH); dark gray; stiff; moist; mica; plastic		
FAT CLAY (CH); dark gray; stiff; moist; mica; plastic; abundant with organic debris (woody and peat)		
Dark reddish brown; ORGANICS; woody debris		Sulfur-like odor
Very fine to medium grained Clayey SAND trace gravel (SW-SC); brownish gray; loose to dense; moist; some organics		No recovery 57-58.5'
FAT CLAY (CH); dark gray; stiff; moist; mica; woody organics in lower 1 ft; plastic		
Very fine to fine grained Clayey SAND (SC); dark gray; loose to slightly dense; moist		Sulfur-like odor
Very fine to fine grained SAND (SW); yellowish gray; loose; moist	8.5	
Fine to medium grained SAND (SW); yellowish gray; loose; moist		
Medium to coarse grained SAND (SW); yellowish gray; loose; moist		Stronger sulfur-like odor
LEAN CLAY (CL); light gray; very stiff; moist		

End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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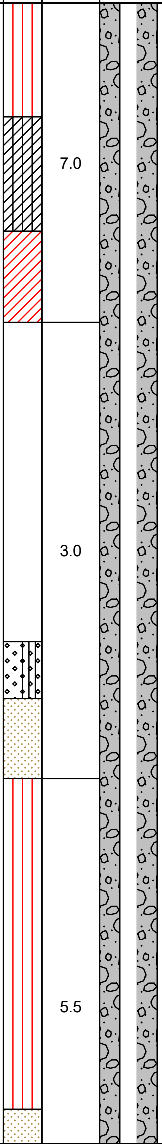
BORING LOG

BOREHOLE ID: *PIW-14*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/4/2020 to 9/9/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401163.98*
EASTING: *2051186.57*
GROUND ELEVATION: *84.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *66 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Very fine to fine grained Sandy SILT trace clay (ML); dark yellowish orange; loose to dense; dry to moist; mica		Post-hole dig to 5'
		Silty LEAN CLAY (CL-ML); pale yellowish brown; slightly stiff to stiff; moist to dry; very low plasticity; mica	7.0	
80	-5	LEAN CLAY (CL); pale yellowish brown; stiff; moist; low plasticity; mica; dark yellow-orange silt lenses		
75	-10		3.0	
70	-15	Very fine grained Silty SAND little clay (SW-SM); grayish yellow and light reddish brown; loose; dry; trace mica; some brown organics at 14.5 ft		
		Very fine grained SAND (SP); grayish yellow and dark yellowish orange; loose; dry to moist; mica		
		Very fine grained Sandy SILT (ML); grayish yellow and light red; loose; dry; and pale yellowish orange; mic		
65	-20		5.5	
60				

(Continued Next Page)

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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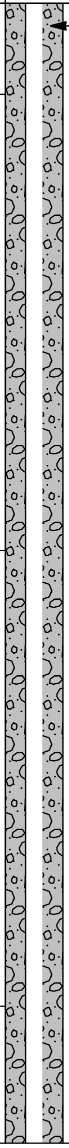
BORING LOG

BOREHOLE ID: *PIW-14*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/4/2020 to 9/9/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401163.98*
EASTING: *2051186.57*
GROUND ELEVATION: *84.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *66 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Very fine grained SAND (SP); pale yellowish orange and yellowish gray; loose; dry; and dark yellow-orange; mica *(continued)*			 Cement grout	
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic				
55	-30					
				9.0		
50	-35					
45	-40					
		Very fine to fine grained SAND (SW); grayish orange and brown; loose; wet; wet from drill fluid; mica		4.5		
		Very fine grained Clayey SAND (SC); brownish gray and dark yellowish orange; loose; moist; mica				
		Very fine grained Sandy LEAN CLAY (CL); brownish gray; soft; moist; mica				
40	-45	FAT CLAY (CH); dark gray; stiff; moist; mica; plastic				
		FAT CLAY (CH); dark gray; stiff; moist; mica; plastic				
35						

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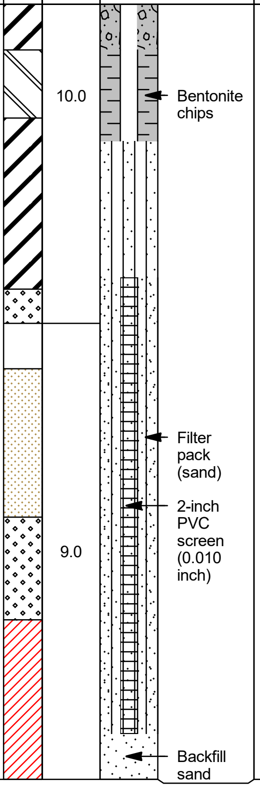
BORING LOG

BOREHOLE ID: *PIW-14*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/4/2020 to 9/9/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *401163.98*
EASTING: *2051186.57*
GROUND ELEVATION: *84.65 (feet NAVD88)*
TOC ELEVATION: *87.43 (feet NAVD88)*
TOTAL WELL DEPTH: *66 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		FAT CLAY (CH); dark gray; stiff; moist; mica; plastic *(continued)*		
		LEAN CLAY with sand (CL-CH); dark gray; stiff; moist; mica; ~1" very fine gray sand lense at 51 ft; ~3" medium sand lense at 52.25 ft; plastic	10.0	
		FAT CLAY (CH); dark gray and brownish gray; stiff; trace mica; dark yellow-orange fine-medium sand lenses (~0.5 to 1 inch) in lower 2.25 ft; trace organics in upper 2 ft		
30	-55			
		Very fine to fine grained SAND (SW); grayish yellow and pale yellowish brown; loose to slightly dense; dry		
		Very fine grained SAND (SP); yellowish gray to light gray; loose; wet; wet from drill fluid; micaceous; trace organics		
25	-60			
		Very fine to fine grained SAND (SW); yellowish gray to light gray; loose; wet; wet from drill fluid; micaceous; trace organics; little pyrite-cemented sandstone	9.0	
		Fine to medium grained SAND (SW); yellowish gray to light gray; loose; wet; wet from drill fluid; micaceous; trace organics; little pyrite-cemented sandstone		
		LEAN CLAY (CL); light brownish gray to light gray; very stiff; moist; low plasticity		
20	-65			



End of Boring at 67.0 feet bgs.

All depths referenced to ground surface.

Total Depth: 67 ft bgs

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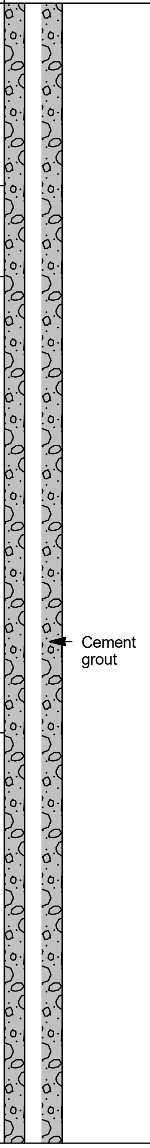
BORING LOG

BOREHOLE ID: *PIW-15*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/9/2020 to 9/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *400706.51*
EASTING: *2051532.8*
GROUND ELEVATION: *65.16 (feet NAVD88)*
TOC ELEVATION: *67.85 (feet NAVD88)*
TOTAL WELL DEPTH: *44 ft BLS*
TOTAL BORING DEPTH: *52 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine grained SAND trace fine gravel (SP); light brown; very loose; dry *(continued)*	5.0	Post-hole dig to 5'
		LEAN CLAY with sand and silt (CL-ML); yellowish gray; medium stiff; dry; low plasticity; friable		
60	-5			
		LEAN CLAY (CL); pale yellowish brown; medium stiff; dry; low plasticity; trace mica with brownish yellow mottling throughout	1.0	
		LEAN CLAY (CL); pale yellowish brown; medium stiff; dry; low plasticity; brownish yellow seams of clay/mottling throughout		
55	-10			
			9.0	
50	-15			
		LEAN CLAY (CL); pale yellowish brown; medium stiff; dry; low plasticity; brownish yellow seams of clay/mottling throughout		
		LEAN CLAY (CL); light brown; medium dense; dry; low plasticity; brownish yellow seams of clay/mottling throughout		
45	-20			
		SILT (ML); brownish yellow; dense to very dense; dry; ****		
		FAT CLAY (CH); dark gray; medium stiff; dry to moist; medium plasticity; trace mica	10.0	
40	-25			



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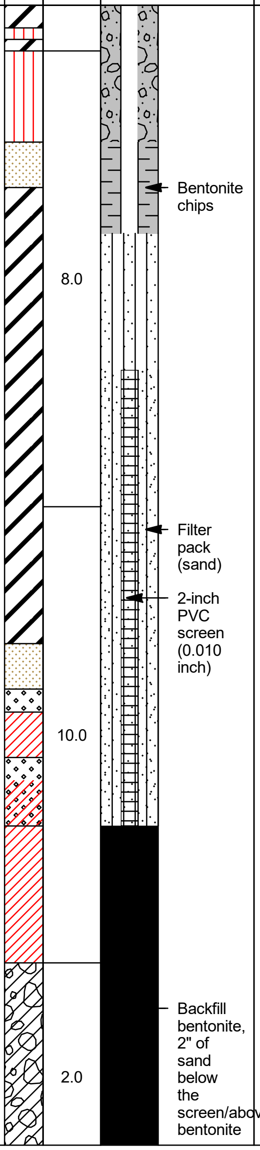
BORING LOG

BOREHOLE ID: *PIW-15*

PROJECT NAME: Groundwater Pre-design Investigation	**RIG TYPE:** *Geoprobe 8150 LS*
PROJECT NO: *TR0795A*	**BOREHOLE DIA:** *6"* **SAMPLING METHOD:** *Dual Tube*
SITE LOCATION: *Fayetteville, NC*	**NORTHING:** *400706.51*
BORING DATE: *9/9/2020 to 9/10/2020*	**EASTING:** *2051532.8*
GEOLOGIST: *Alli Vo*	**GROUND ELEVATION:** *65.16 (feet NAVD88)*
DRILLING CONTRACTOR: *SAEDACCO*	**TOC ELEVATION:** *67.85 (feet NAVD88)*
DRILLER NAME: *Will Keyes*	**TOTAL WELL DEPTH:** *44 ft BLS*
DRILLING METHOD: *Sonic*	**TOTAL BORING DEPTH:** *52 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Well Construction	Comments
		SILT (ML); grayish green; loose; dry; trace mica 4" layer			
		FAT CLAY (CH); dark gray; medium stiff; dry to moist; medium plasticity; trace mica			
		SILT with clay (ML); gray; very soft; wet; trace mica			
		Very fine grained SAND (SP); gray; loose; moist; micaceous			
35	-30	FAT CLAY (CH); gray; stiff; dry; medium plasticity; 1" organic/petrified wood layer at 34' (dark brown)		Bentonite chips	
			8.0		
30	-35				
		FAT CLAY (CH); gray; stiff; dry; medium plasticity		Filter pack (sand)	
				2-inch PVC screen (0.010 inch)	
25	-40	Fine to medium grained SAND (SP); very pale orange to tan; loose; micaceous; light brown laminations			
		Fine to coarse grained SAND some silt (SW); brownish yellow to dark yellowish orange; loose; moist			
		Sandy LEAN CLAY (CL); dark gray; dense; dry; low plasticity; with lignite/peat 6" layer that is loose/friable	10.0		
		Fine to medium grained SAND (SW); dark gray; loose; moist; micaceous			
		LEAN CLAY (CL); light gray; very stiff to hard; dry; low plasticity; trace mica and silt			
20	-45				
		Clayey GRAVEL with silt (GC); light gray; hard to very hard; dry; low plasticity			
				Backfill bentonite, 2" of sand below the screen/above bentonite	
			2.0		
15	-50				

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Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *PIW-15*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *9/9/2020 to 9/10/2020*
GEOLOGIST: *Alli Vo*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *400706.51*
EASTING: *2051532.8*
GROUND ELEVATION: *65.16 (feet NAVD88)*
TOC ELEVATION: *67.85 (feet NAVD88)*
TOTAL WELL DEPTH: *44 ft BLS*
TOTAL BORING DEPTH: *52 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Clayey GRAVEL with silt (GC); light gray; hard to very hard; dry; low plasticity *(continued)*	▨		■ backfill	Refusal at 52'

End of Boring at 52.0 feet bgs.

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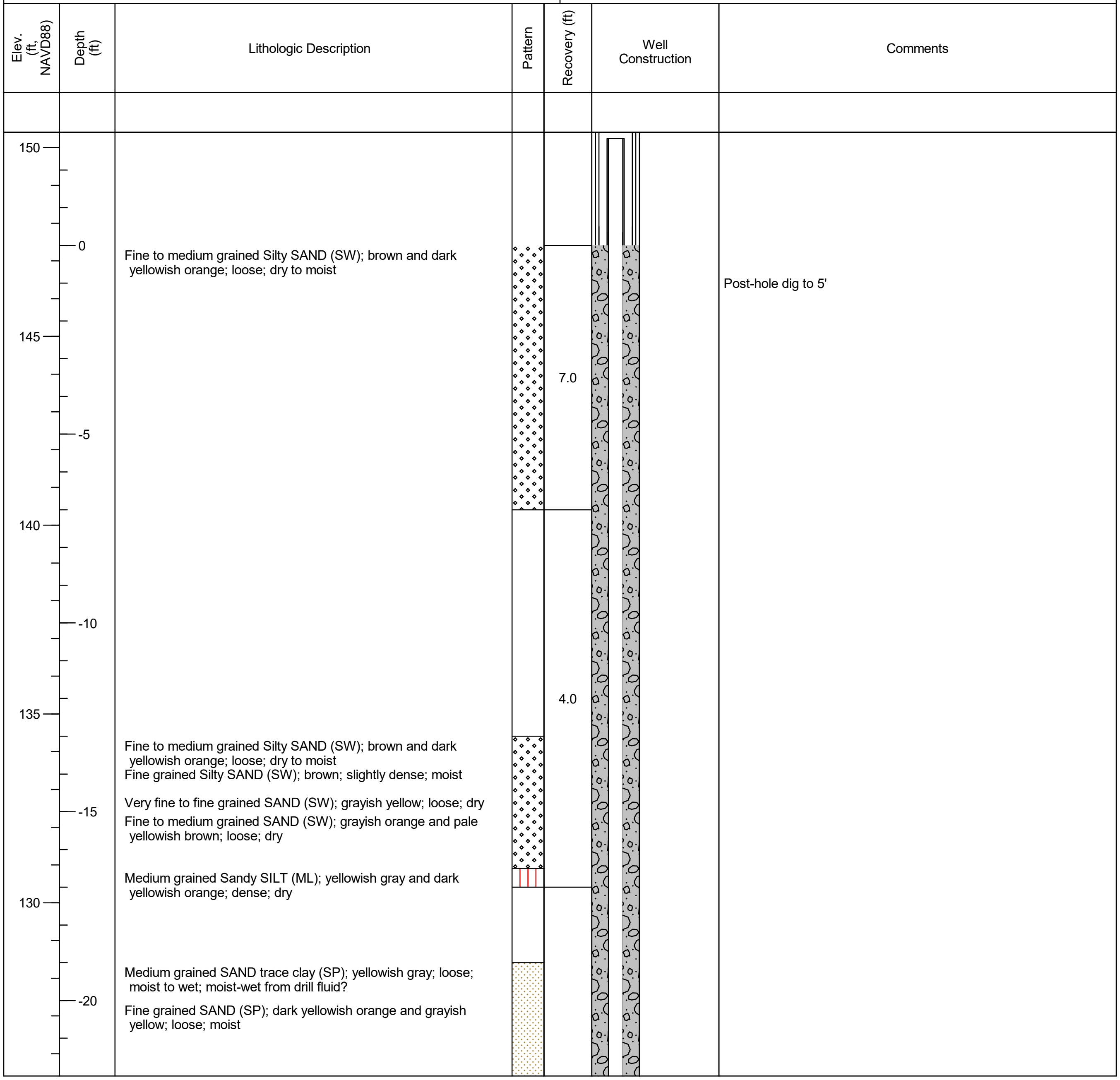
Telephone: 910-870-0576

BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*



Fine to medium grained Silty SAND (SW); brown and dark yellowish orange; loose; dry to moist

Post-hole dig to 5'

Fine to medium grained Silty SAND (SW); brown and dark yellowish orange; loose; dry to moist

Fine grained Silty SAND (SW); brown; slightly dense; moist

Very fine to fine grained SAND (SW); grayish yellow; loose; dry

Fine to medium grained SAND (SW); grayish orange and pale yellowish brown; loose; dry

Medium grained Sandy SILT (ML); yellowish gray and dark yellowish orange; dense; dry

Medium grained SAND trace clay (SP); yellowish gray; loose; moist to wet; moist-wet from drill fluid?

Fine grained SAND (SP); dark yellowish orange and grayish yellow; loose; moist

(Continued Next Page)

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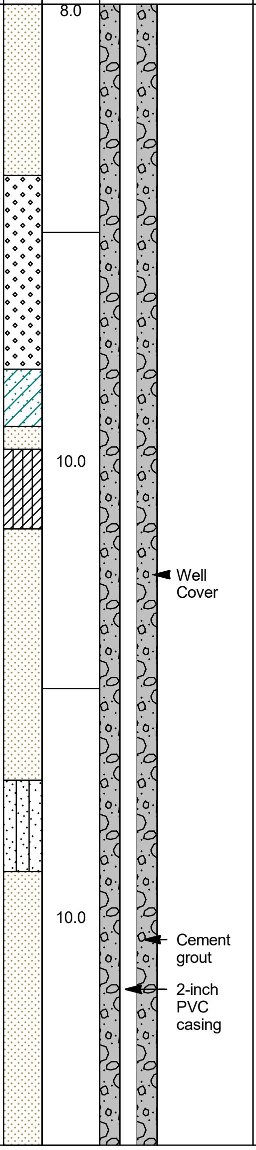
BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
125		Fine grained SAND (SP); dark yellowish orange and grayish yellow; loose; moist *(continued)*	8.0	
	-25			
		Medium grained SAND (SP); dark yellowish olive and yellowish gray; loose; moist; trace clay in lower 2 inches		
		Fine to medium grained SAND (SW); yellowish gray; loose; moist		
120		Fine to medium grained SAND (SW); yellowish gray; loose; moist		
	-30	Fine to coarse grained SAND trace clay (SW); yellowish gray; loose; moist to wet		
		Clayey SAND (SC); yellowish gray; loose; moist		
		Very fine to fine grained SAND trace clay (SP); yellowish gray; loose to slightly dense; moist to wet	10.0	
115		Clayey SILT (CL-ML); grayish orange; slightly dense to dense; moist; micaceous		
		Very fine to fine grained SAND trace clay (SP); yellowish gray; slightly dense; moist; mica		
		Very fine to fine grained SAND trace clay (SP); very pale orange; slightly dense; moist; mica		
	-35	Very fine to fine grained SAND trace clay (SP); dark yellowish orange; slightly dense; moist; mica		
110		Very fine to fine grained SAND trace clay (SP); dark yellowish orange; slightly dense; moist; mica		
		Very fine grained Silty SAND (SM); yellowish gray; loose to slightly dense; moist to wet; micaceous		
	-40			
		Very fine grained SAND (SP); dark yellowish orange; loose; moist; mottled; mica; dark gray at ~31.75-32 ft	10.0	
105				
		Fine grained SAND (SP); gray; loose; moist; mica		
		Very fine grained SAND (SP); gray; loose to slightly dense; moist		
	-45			



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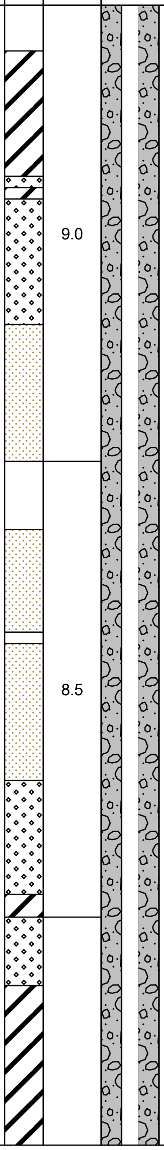
BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
100				
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic		
	-50			
		Very fine to fine grained SAND (SW); gray; loose; moist; micaceous FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic Very fine to fine grained SAND (SW); gray to yellowish gray; loose; moist; mica; ~2 inch clay layer at 53.5 ft	9.0	
95				
		Very fine grained SAND (SP); gray to light gray; loose to slightly dense; moist; mica; thin clay lenses throughout		
	-55			
90				
		Very fine grained SAND (SP); gray to light gray; loose to slightly dense; moist; mica; thin clay lenses throughout		
	-60			
		Brownish black; ORGANICS; woody Fine grained SAND (SP); light gray; loose; moist; mica	8.5	
85				
		Fine to medium grained SAND (SW); light gray and light brownish gray; loose; moist; mica		
	-65			
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; rich with woody organics; plastic Fine to medium grained SAND (SW); light gray to light brownish gray; loose; moist; mica		
80				
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic		6" PVC outer casing set at 72'
	-70			

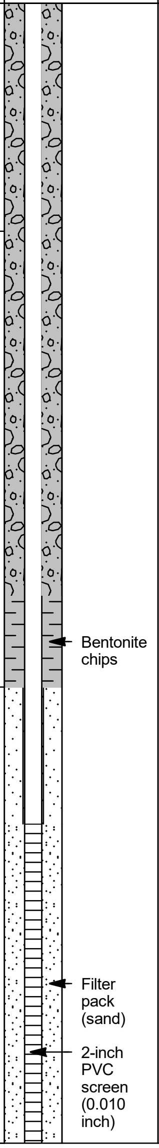
(Continued Next Page)

BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
75		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic *(continued)*		10.0		
	-75					
70		Fine to medium grained SAND (SW); light brownish gray; loose; wet; wet from drill fluid; mica				
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic				
	-80					
65				10.0		
	-85					
60						
		Fine to coarse grained SAND (SW); gray; loose; wet; wet from drill fluid; micaceous				
	-90					
		Fine to medium grained SAND (SW); gray; loose; moist; woody organics in upper 3 inches; ~2 inch clays at 91.5 and 92 ft				
55				8.0		
		Fine grained SAND (SW); light brownish gray to gray; loose; moist to wet; mica; organics (wood) in upper ~3 inches and lower ~6 inches				
		Fine grained SAND (SW); light brownish gray to gray; loose; moist to wet; mica; very few organics				
	-95					
		Very fine grained SAND (SP); gray to light gray; loose to slightly dense; moist; micaceous; few organics in lower 6 inches				

(Continued Next Page)

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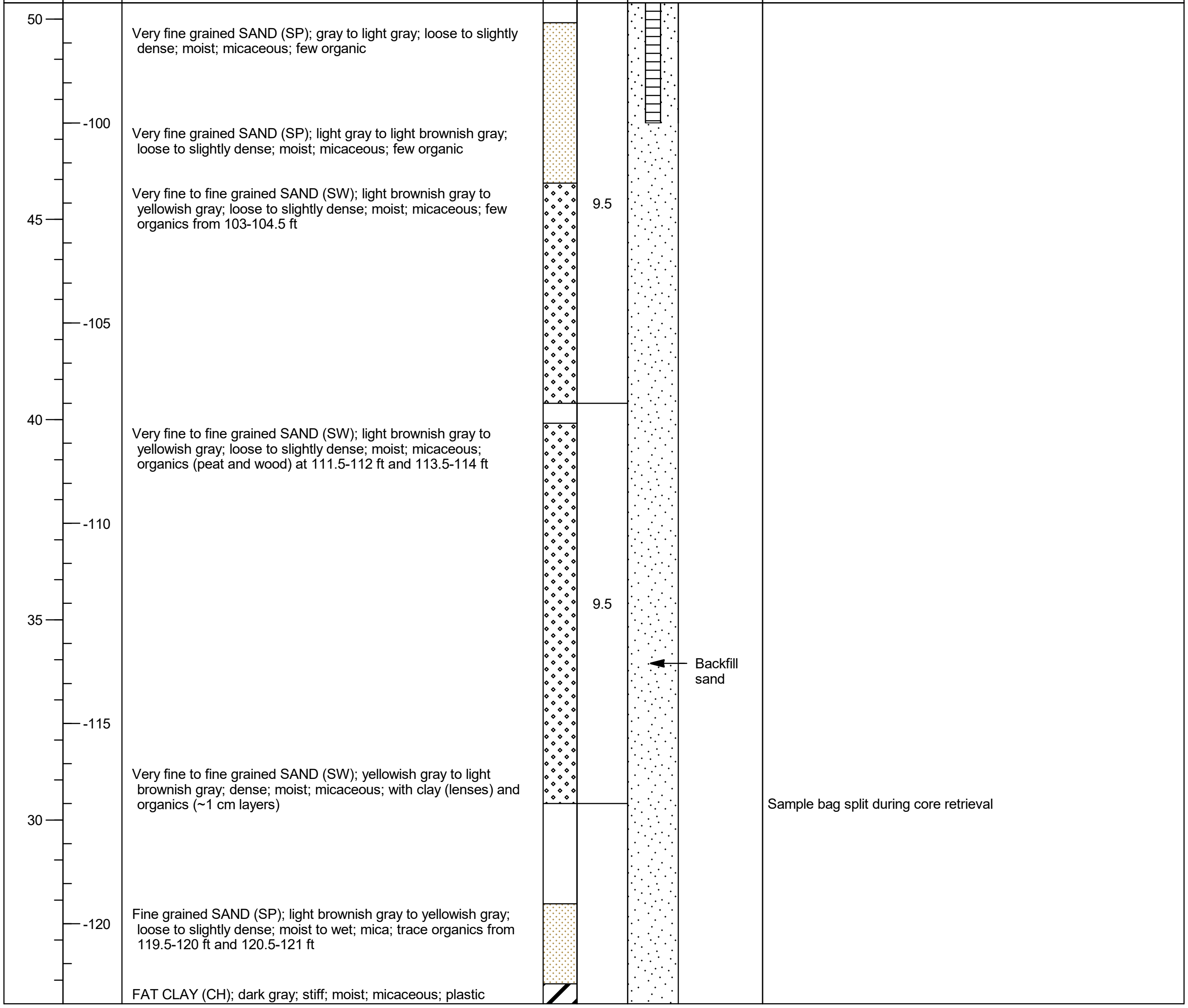
BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments



Very fine grained SAND (SP); gray to light gray; loose to slightly dense; moist; micaceous; few organic

Very fine grained SAND (SP); light gray to light brownish gray; loose to slightly dense; moist; micaceous; few organic

Very fine to fine grained SAND (SW); light brownish gray to yellowish gray; loose to slightly dense; moist; micaceous; few organics from 103-104.5 ft

Very fine to fine grained SAND (SW); light brownish gray to yellowish gray; loose to slightly dense; moist; micaceous; organics (peat and wood) at 111.5-112 ft and 113.5-114 ft

Very fine to fine grained SAND (SW); yellowish gray to light brownish gray; dense; moist; micaceous; with clay (lenses) and organics (~1 cm layers)

Sample bag split during core retrieval

Fine grained SAND (SP); light brownish gray to yellowish gray; loose to slightly dense; moist to wet; mica; trace organics from 119.5-120 ft and 120.5-121 ft

FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic

(Continued Next Page)

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BORING LOG

BOREHOLE ID: *PIW-16D*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/19/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396257.96*
EASTING: *2046587.07*
GROUND ELEVATION: *147.41 (feet NAVD88)*
TOC ELEVATION: *150.06 (feet NAVD88)*
TOTAL WELL DEPTH: *100 ft BLS*
TOTAL BORING DEPTH: *127 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
25		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic *(continued)*	▨	7.5	░	
		Fine grained SAND (SP); light brownish gray to yellowish gray; loose; moist; micaceous	░			Ran out of drill rods
	-125	FAT CLAY (CH); dark gray; stiff; moist; mica; plastic	▨			

End of Boring at 127.0 feet bgs.

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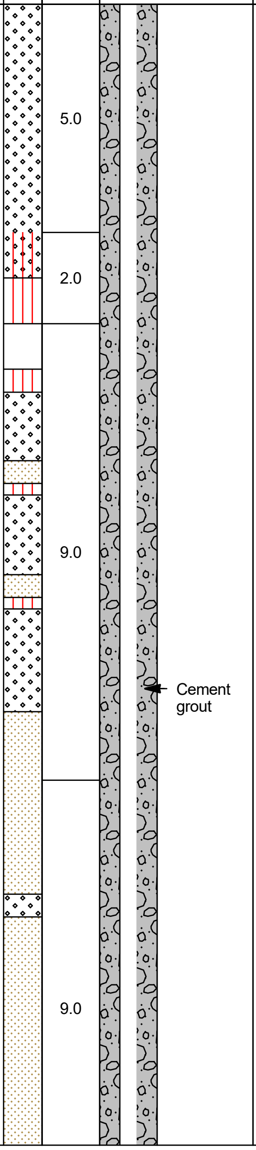
BORING LOG

BOREHOLE ID: *PIW-16S*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/18/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396267.84*
EASTING: *2046586.09*
GROUND ELEVATION: *147.26 (feet NAVD88)*
TOC ELEVATION: *149.74 (feet NAVD88)*
TOTAL WELL DEPTH: *45 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*

Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Recovery (ft)	Comments
		Fine to medium grained Silty SAND (SW); brown and dark yellowish orange; loose; dry to moist		Post-hole dig to 5'
145			5.0	
	-5	Sandy SILT (ML); dark yellowish orange; dense; moist	2.0	
140				No recovery from 7'-8'
		Sandy SILT (ML); dark yellowish orange; dense; moist; some brown mottling		
		Fine to medium grained Silty SAND (ML); brown; loose; moist to wet; wet from drill fluid		
	-10	Medium grained SAND (SP); grayish yellow; loose; wet		
		Fine to medium grained Sandy SILT (ML); medium reddish brown and grayish orange; dense; dry		
		Very fine to medium grained SAND (SW); grayish orange and grayish yellow; loose; dry to moist		
135			9.0	
		Fine grained SAND (SP); yellowish gray; loose; dry to moist		
		Fine grained Sandy SILT (ML); yellowish gray; dense to very dense; dry		
		Very fine to fine grained SAND (SW); grayish orange; loose; moist		
	-15			
		Very fine grained SAND (SP); yellowish gray and grayish orange; slightly dense; moist		
		Fine grained SAND (SP); dark yellowish orange; slightly dense; moist; yellow-gray sand in bottom ~1"		
130		Fine grained SAND (SP); yellowish gray and dark yellowish orange; slightly dense; moist		
	-20	Fine to medium grained SAND (SW); dark yellowish orange and yellowish gray; loose to slightly dense; moist to wet		
		Very fine grained SAND (SP); dark yellowish orange and grayish yellow; loose to slightly dense; moist		
		Fine grained SAND (SP); grayish orange; loose; moist		
125		Fine grained SAND (SP); yellowish gray; loose	9.0	
		Coarse grained SAND (SP); yellowish gray; loose		



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All depths referenced to ground surface.

Total Depth: 67 ft bgs

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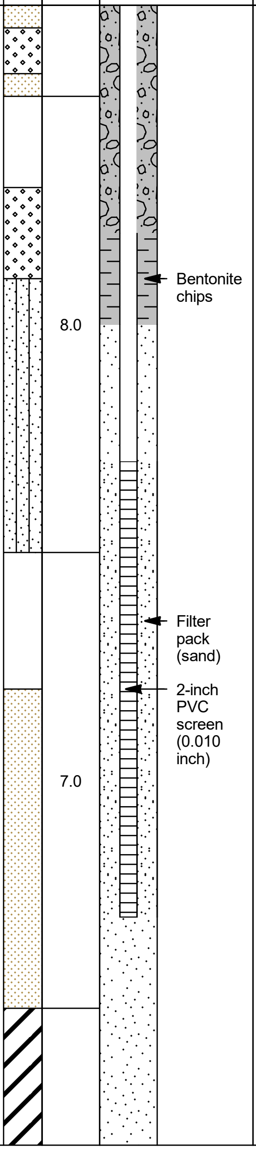
BORING LOG

BOREHOLE ID: *PIW-16S*

PROJECT NAME: Groundwater Pre-design Investigation
PROJECT NO: *TR0795A*
SITE LOCATION: *Fayetteville, NC*
BORING DATE: *8/18/2020 to 8/20/2020*
GEOLOGIST: *Justin Hobart*
DRILLING CONTRACTOR: *SAEDACCO*
DRILLER NAME: *Will Keyes*
DRILLING METHOD: *Sonic*

RIG TYPE: *Geoprobe 8150 LS*
BOREHOLE DIA: *6"* **SAMPLING METHOD:** *Dual Tube*
NORTHING: *396267.84*
EASTING: *2046586.09*
GROUND ELEVATION: *147.26 (feet NAVD88)*
TOC ELEVATION: *149.74 (feet NAVD88)*
TOTAL WELL DEPTH: *45 ft BLS*
TOTAL BORING DEPTH: *67 ft BLS*



Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		Fine to coarse grained Clayey SAND (SW); yellowish gray; loose; moist to wet; some near-pea-sized sand/gravel				
		Fine grained SAND (SP); yellowish gray; loose; moist to wet				
120						
		Fine to medium grained SAND little clay (SW); yellowish gray; loose; wet; wet from drill fluid				
	-30					
		Very fine grained Silty SAND (SM); yellowish gray; loose; moist to wet; micaceous			Bentonite chips	
115				8.0		
	-35					
		Very fine grained Silty SAND (SM); grayish orange to dark yellowish orange; loose; moist to wet; mottled; micaceous				
110						
					Filter pack (sand)	
	-40	Very fine grained SAND some silt (SP); dark yellowish orange; loose; moist to wet; mottled; micaceous			2-inch PVC screen (0.010 inch)	
105				7.0		
		Very fine grained SAND some silt (SP); pale reddish brown; loose; wet; mottled; micaceous				
		Very fine grained SAND (SP); dark gray; loose to slightly dense; moist to wet; micaceous; organics in upper 1-inch				
	-45					
100		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic				

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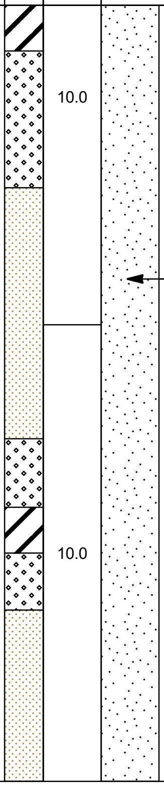


Elev. (ft, NAVD88)	Depth (ft)	Lithologic Description	Pattern	Recovery (ft)	Well Construction	Comments
		FAT CLAY (CH); dark gray; stiff; moist; micaceous; plastic *(continued)*				
95		Fine to medium grained SAND (SW); dark gray; loose; moist to wet; mica; ~3-inch clay (SAA) at 52.5 ft and 53.5 ft		10.0		
	-55	Very fine grained SAND (SP); gray; slightly dense; moist to wet; micaceous; clay lenses in upper 3 inches and lower 3 inches			Backfill sand	
90		Very fine grained SAND (SP); gray; slightly dense; moist to wet; micaceous; clay lenses in upper 3 inches and lower 3 inches				
	-60	Fine to medium grained SAND (SW); dark gray; loose; moist to wet				
		FAT CLAY (CH); dark gray; stiff; micaceous; plastic				
85		Medium grained SAND (SW); dark gray; loose; moist to wet; micaceous; with clay lense (~1 inch) at ~61.5 ft		10.0		
	-65	Very fine grained SAND (SP); brownish gray; loose to slightly dense; moist to wet; micaceous; thin clay lenses (<= 1 cm) in upper 1 ft				

End of Boring at 67.0 feet bgs.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 1

Date: 7/22/2020 4:21 PM

Direction: SW

Comments:
Sonic Drill Rig
GEOPROBE 8150LS

Photograph 2

Date: 7/23/2020 2:57 PM

Direction: N/A

Comments:
Surficial sands observed at 5-7’ from EW-1 soil boring

Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 3

Date: 7/23/2020 3:03 PM

Direction: N/A

Comments:
Surficial Confining Unit observed at approximately 8-9' from EW-1 soil boring

Photograph 4

Date: 7/23/2020 3:04 PM

Direction: N/A

Comments:
Transition from surficial aquifer to Black Creek Confining Unit observed at approximately 15' from EW-1 soil boring

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 5

Date: 7/23/2020 4:10 PM

Direction: N/A

Comments:
Black Creek Aquifer observed at 45’ bgs in EW-1 soil boring

Photograph 6

Date: 8/5/2020 4:48 PM

Direction: N/A

Comments: Black Creek Confining Unit observed at 25’ bgs in OW-4 soil boring

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 7

Date: 8/5/2020 4:48 PM

Direction: N/A

Comments:
Surficial sand observed at 17-27’ bgs in OW-4 soil boring.

Photograph 8

Date: 8/6/2020 8:15 AM

Direction: N/A

Comments:
Black Creek Confining Unit observed at 37-47’ bgs in OW-4 soil boring.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company | **Project Number: TR0795A**

Site Name: Fayetteville Works | **Site Location: Fayetteville, North Carolina**

Photograph 9

Date: 8/6/2020 8:42 AM

Direction: N/A

Comments:
Black Creek Aquifer sands observed at 59-60' bgs in OW-4.

Photograph 10

Date: 8/6/2020 8:42 AM

Direction: N/A

Comments:
Lignite and peat layers below Black Creek Aquifer sands observed at 62-63' bgs in OW-4

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 11

Date: 8/6/2020 8:43 AM

Direction: N/A

Comments:
Upper Cape Fear Confining Unit transition observed at 65-67’ bgs in OW-4

Photograph 12

Date: 8/6/2020 9:08 AM

Direction: N/A

Comments:
Upper Cape Fear Confining unit observed at 70’ bgs in OW-4

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company

Project Number: TR0795A

Site Name: Fayetteville Works

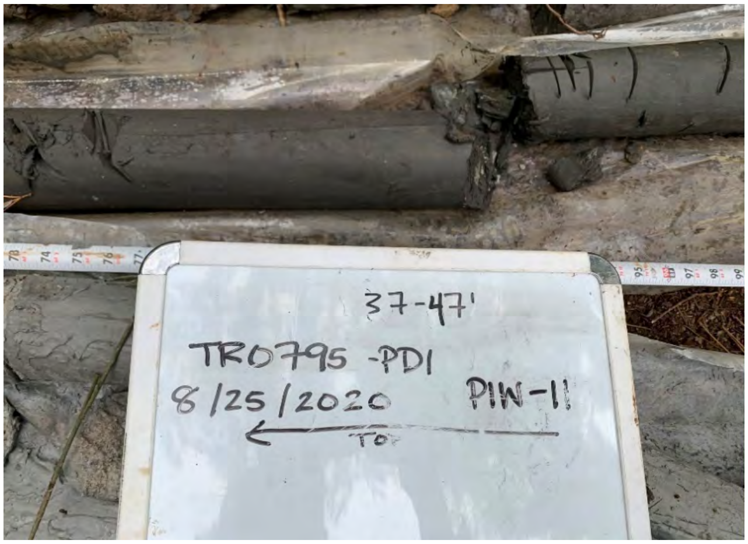
Site Location: Fayetteville, North Carolina

Photograph 13

Date: 8/25/2020 11:45 AM

Direction: N/A

Comments:
Black Creek Confining Unit observed at 37-37' bgs in PIW-11



Photograph 14

Date: 8/25/2020 11:46 AM

Direction: N/A

Comments:
Upper Cape Fear Confining Unit transition observed at 53' bgs from PIW-11 soil boring

GEOSYNTEC CONSULTANTS
Photographic Record

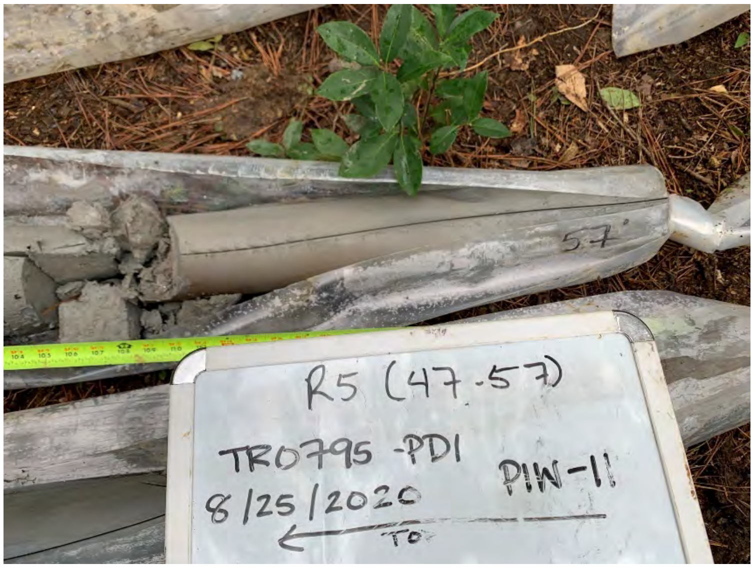
Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 15

Date: 8/25/2020 11:46 AM

Direction: N/A

Comments:
Upper Cape Fear Confining Unit observed at 57' bgs from PIW-11 soil boring



Photograph 16

Date: 9/9/2020 2:44 PM

Direction: N/A

Comments:
Surficial sands and lignite layer observed at 23' bgs in PIW 15.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company | **Project Number: TR0795A**

Site Name: Fayetteville Works | **Site Location: Fayetteville, North Carolina**

Photograph 17

Date: 9/9/2020 2:45 PM

Direction: N/A

Comments:
Upper Cape Fear Confining Unit clay observed at 47' bgs in PIW-15

Photograph 18

Date: 10/16/2020 9:12 AM

Direction: N/A

Comment:
Peat layer observed at 27' bgs above Black Creek Confining Unit observed in 27-37' bgs from OW-9

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 19

Date: 10/21/2020 10:30 AM

Direction: N/A

Comments:
Black Creek Aquifer sands observed at 27-37’ bgs from OW-10 soil boring

Photograph 20

Date: 10/21/2020 10:31 AM

Direction: N/A

Comments:
Black Creek Aquifer sands observed in 37-47’ bgs from OW-10 soil boring

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 21

Date: 10/21/2020 10:30 AM

Direction: N/A

Comments:
Black Creek Aquifer sands observed in 37-47' bgs from OW-10 soil boring

Photograph 22

Date: 10/21/2020 10:31 AM

Direction: N/A

Comments:
Black Creek Aquifer sands observed in 37-47' bgs from OW-10 soil boring

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company **Project Number: TR0795A**

Site Name: Fayetteville Works **Site Location: Fayetteville, North Carolina**

Photograph 23

Date: 4/14/2021 11:00 AM

Direction: N/A

Comments: Boring B-2[1]. Black Creek Confining clay observed in 28.5’-30’ bgs. Boring ID was originally B-3, changed to B-2.

Photograph 24

Date: 4/14/2021 4:44 PM

Direction: N/A

Comments: Boring B-2[1]. Black Creek Aquifer sands observed in 58.5-60’-bgs. Boring ID was originally B-3, changed to B-2.

---

[1] Boreholes advanced in 2021 were re-numbered following field work. Boring ID in associated photograph is not accurate.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 25

Date: 3/4/2021 2:04 PM

Direction: N/A

Comments: Boring B-3[1]. Black Creek Confining clay observed in 23.5’-25’ bgs. Boring ID was changed from B-4 to B3.

Photograph 26

Date: 3/6/2021 12:04 PM

Direction: N/A

Comments: Boring B-3[1]. Upper Cape Fear Confining sandy clay observed in 67- bgs to borehole termination at 85’ bgs. Boring ID was changed from B-4 to B3.

---

[1] Boreholes advanced in 2021 were re-numbered following field work. Boring ID in associated photograph is not accurate.

Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 27

Date: 4/16/2021 08:14 AM

Direction: N/A

Comments: Boring B-9[1]. Black Creek Confining clay observed in 20'-30' bgs. Boring ID was changed from B-11 to B-9.

Photograph 28

Date: 4/16/2021 12:59 PM

Direction: N/A

Comments: Boring B-9[1]. Black Creek Aquifer sand observed in 40'-50' bgs. Boring ID was changed from B-11 to B-9.

---

[1] Boreholes advanced in 2021 were re-numbered following field work. Boring ID in associated photograph is not accurate.

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Chemours Company

Project Number: TR0795A

Site Name: Fayetteville Works

Site Location: Fayetteville, North Carolina

Photograph 29

Date: 4/14/2021 4:10 PM

Direction: N/A

Comments: Boring B-10[1]. Black Creek Aquifer zone with fine sediments observed in 50'-60' bgs. Boring ID was changed from B-13 to B-10.

Photograph 30

Date: 4/14/2021 4:44 PM

Direction: N/A

Comments: Boring B-10[1]. Upper Cape Fear Confining clay observed in 80-90'-bgs. Boring ID was changed from B-13 to B-10.

---

[1] Boreholes advanced in 2021 were re-numbered following field work. Boring ID in associated photograph is not accurate.

Client: Chemours Company	**Project Number: TR0795A**
Site Name: Fayetteville Works	**Site Location: Fayetteville, North Carolina**

Photograph 31

Date: 4/14/2021 11:00 AM

Direction: N/A

Comments: Boring B-11[1]. Black Creek Confining clay observed in 40'-50' bgs. Boring ID was changed from B-14 to B-11.

Photograph 32

Date: 4/14/2021 4:44 PM

Direction: N/A

Comments: Boring B-11[1]. Black Creek Aquifer sands observed in 50-60'-bgs. Boring ID was changed from B-14 to B-11.

---

[1] Boreholes advanced in 2021 were re-numbered following field work. Boring ID in associated photograph is not accurate.

Appendix D
GEOServices Report of Geotechnical Exploration

GEOServices, LLC, Geotechnical and Materials Engineers

June 16, 2021

The Chemours Company FC, LLC
1007 Market Street
Wilmington, DE 19899

ATTENTION: Mr. Sebastian Bahr, Project Director CRG
Sebastian.Bahr@chemours.com

Subject: **ADDENDUM TO REPORT OF GEOTECHNICAL EXPLORATION – ADDITIONAL EXPLORATION**
Chemours Barrier Wall
Fayetteville, North Carolina
GEOS Project Number 41-20500

Dear Mr. Bahr:

This document serves as an addendum to the GEOServices, LLC (GEOS) *Report of Geotechnical Exploration,* dated December 7, 2020. *The Report of Geotechnical Exploration* provides preliminary recommendations for the proposed barrier wall construction at the Chemours Fayetteville works in Fayetteville, North Carolina. During the original PDI exploration, the subsurface conditions along the proposed barrier wall alignment were explored with a series of integrated electronic seismic piezocone penetration test (CPT) soundings and traditional mud rotary borings. The borings and CPT soundings were alternated and spaced at increments of 250 feet along the proposed alignment to generate the best coverage. This resulted in a total of nineteen (19) CPT soundings (C-1 through C-19) and nineteen (19) traditional mud rotary borings (S-1 through S-19).

At the conclusion of the initial exploration phase, GEOS and Geosyntec Consultants, Inc. (Geosyntec) collaboratively identified areas of interest for additional exploration. GEOS was directed by Chemours to proceed with exploring these identified areas in support of the barrier wall and groundwater extraction design. During this additional exploration, the subsurface conditions along the barrier wall were explored with a series of seven (7) mud rotary borings (B-1 through B-7) and five (5) sonic borings (B-8 through B-12). These exploration methodologies were selected in an effort to obtain additional Shelby Tube samples (mud-rotary) and to obtain full length samples for mix design purposes (sonic). The boring locations and depths were selected by GEOServices personnel in conjunction with the proposed barrier wall alignment (at time of exploration) and in anomalous areas from the previous exploration. Approximate boring locations are shown on the Boring Location Plans attached to this letter. The boring locations were located and staked in the field by GEOServices utilizing a handheld GPS unit. Mud rotary borings were performed between March 1 and March 7, 2021, and the sonic borings were performed between April 13 and April 16, 2021. The depths on boring logs reference the ground surface elevations that existed at the time of the exploration. Detailed soil boring logs for each of the supplementary boring locations can be found in the attachments to this letter.

This addendum has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The boring logs are for geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in the original PDI *Report of Geotechnical Exploration* (dated December 7, 2020) remain our preliminary recommendations based upon applicable standards of our practice in this geographic area at the time the report and this addendum were prepared. No other warranty, express or implied, is made.

We appreciate the opportunity to have been of service to you on this project. Please contact us with any questions you may have regarding this letter.

Sincerely,
GEOServices, LLC

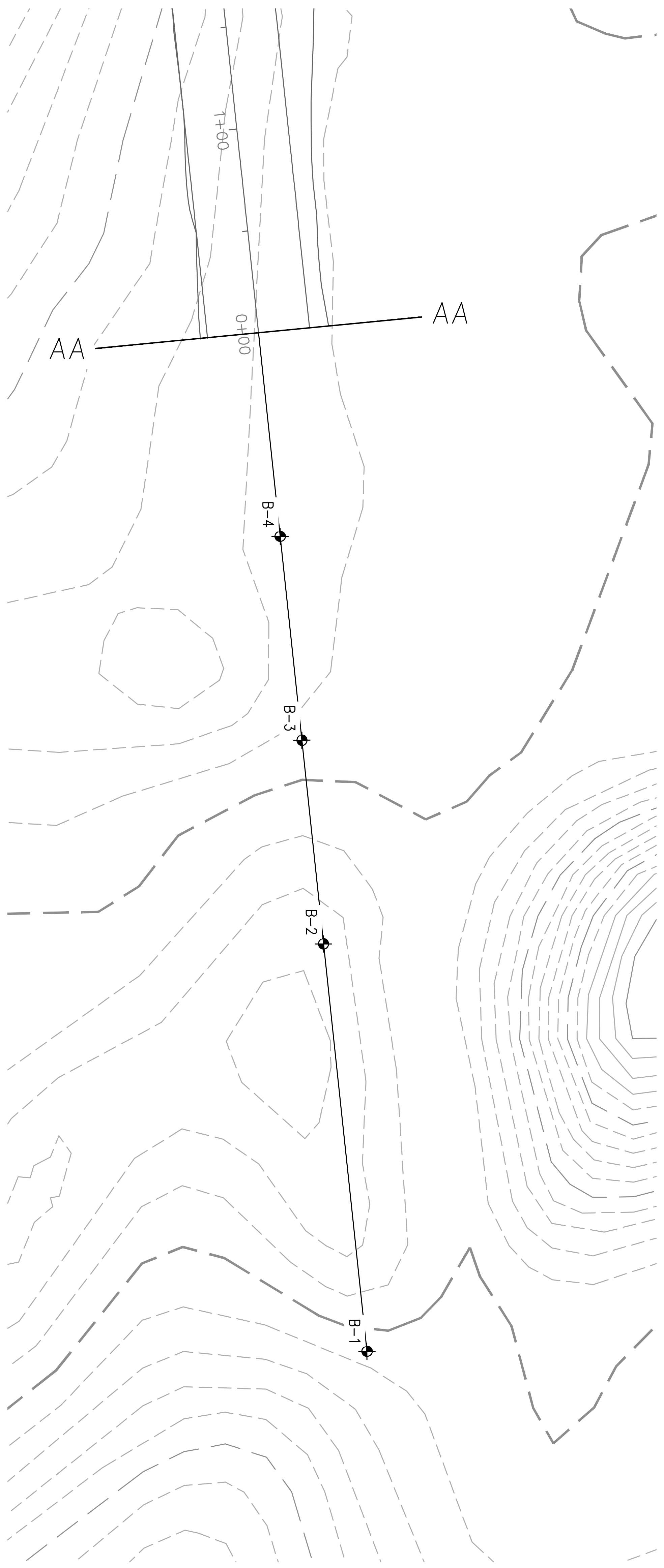
Derek Kilday

NORTH CAROLINA PROFESSIONAL ENGINEER
SEAL 032829
DENNIS ALLEN HUCKABA
6-17-21

Derek K. Kilday, P.E.
V.P. – Chattanooga Branch Manager

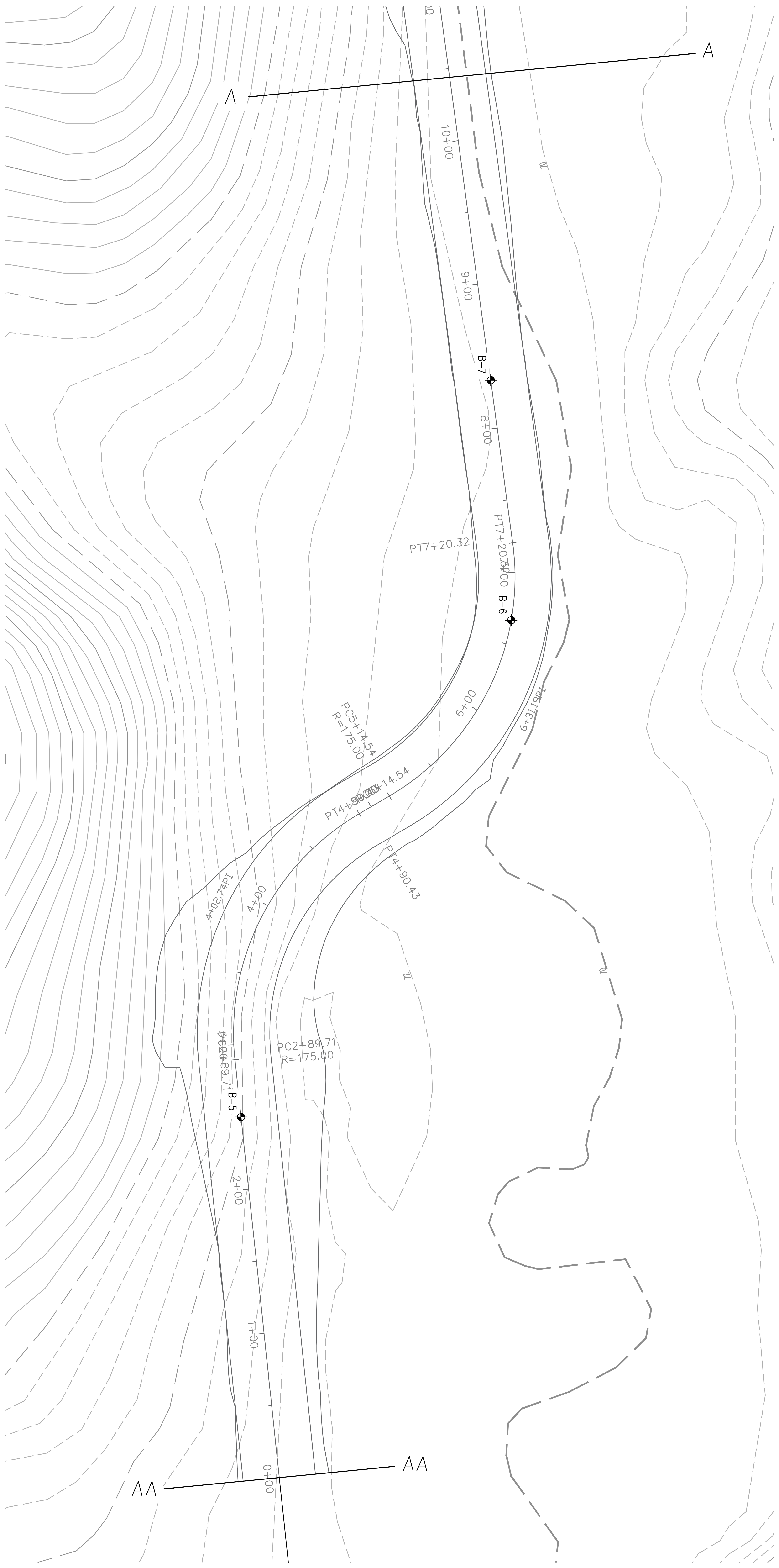
Dennis A. Huckaba, P.E.
Principal
NC 032829

Attachments:
Boring Log Map
Boring Logs

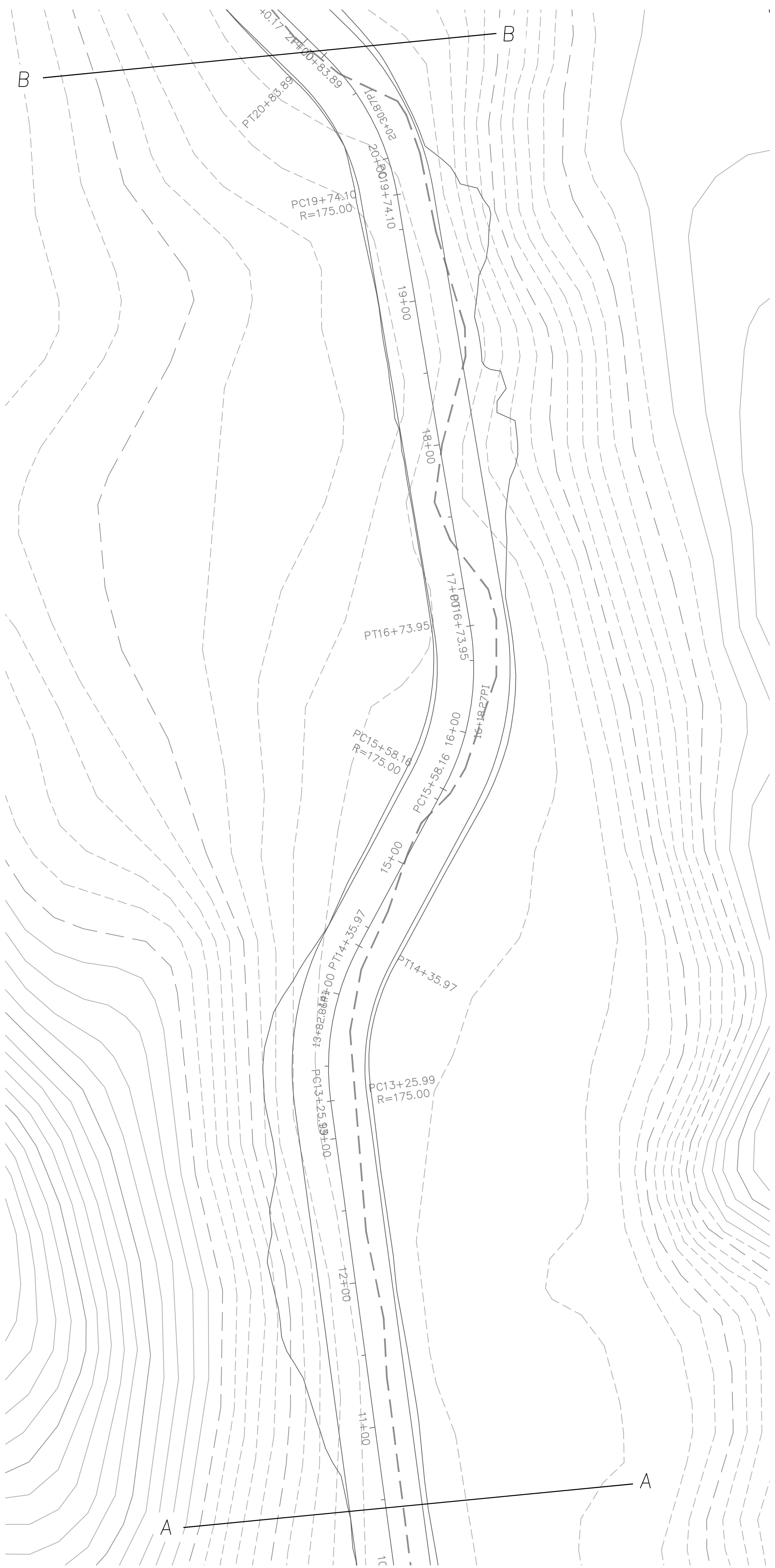


1
B-1
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

BORING LOCATIONS	
#	STATION
B-1	-5 + 0.0
B-2	-3 + 0.0
B-3	-2 + 0.0
B-4	-1 + 0.0
B-5	2 + 50.0
B-6	6 + 66.7
B-7	8 + 33.3
B-8	41 + 75.0
B-9	43 + 25.0
B-10	53 + 75.0
B-11	55 + 83.3
B-12	59 + 86.3



2
B-1
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'



3
B-1
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

GEOS
Geotechnical, Environmental and Materials Engineers

Barrier Wall Layout

Chemours Barrier Wall Grading
Fayetteville, North Carolina

DRAWN BY: NSS	REVIEWED BY: DKK
DESIGNED BY: TJD	APPROVED BY: DAH
SCALE: AS SHOWN	
DATE: June 17, 2021	

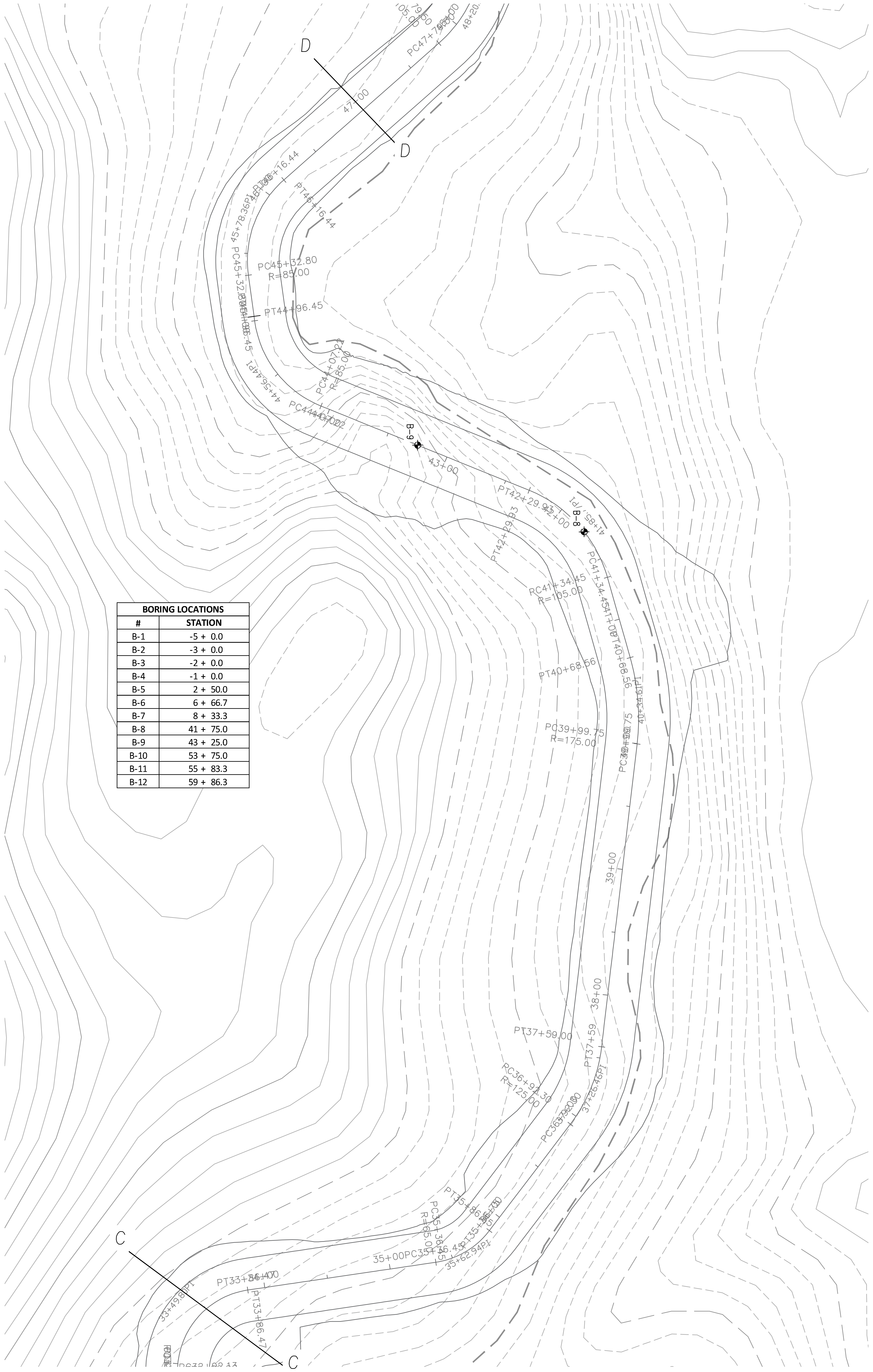
Revisions

No.	Date	Description	By:
1			
2			
3			
4			
5			
6			

DRAWING:
B-1

PROJECT NUMBER:
41-20500

1 B-2 BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'



BORING LOCATIONS	
#	STATION
B-1	-5 + 0.0
B-2	-3 + 0.0
B-3	-2 + 0.0
B-4	-1 + 0.0
B-5	2 + 50.0
B-6	6 + 66.7
B-7	8 + 33.3
B-8	41 + 75.0
B-9	43 + 25.0
B-10	53 + 75.0
B-11	55 + 83.3
B-12	59 + 86.3

2 B-2 BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

GEOS
Geotechnical, Environmental and Materials Engineers

Barrier Wall Layout

Chemours Barrier Wall Grading
Fayetteville, North Carolina

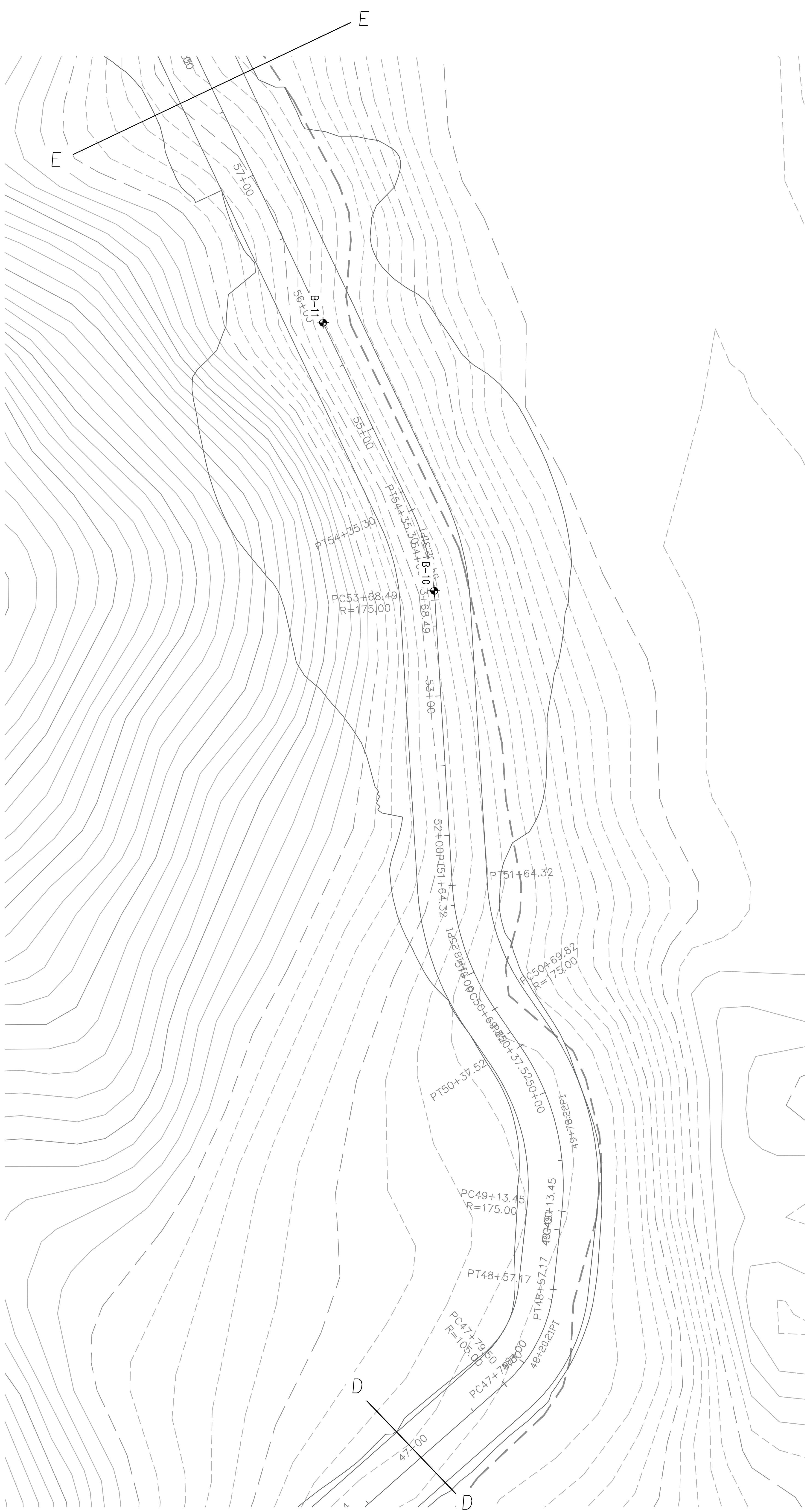
DRAWN BY: NSS	REVIEWED BY: DKK
DESIGNED BY: TJD	APPROVED BY: DAH
SCALE: AS SHOWN	
DATE: June 17, 2021	

Revisions

No.	Date	Description	By:
1			
2			
3			
4			
5			
6			

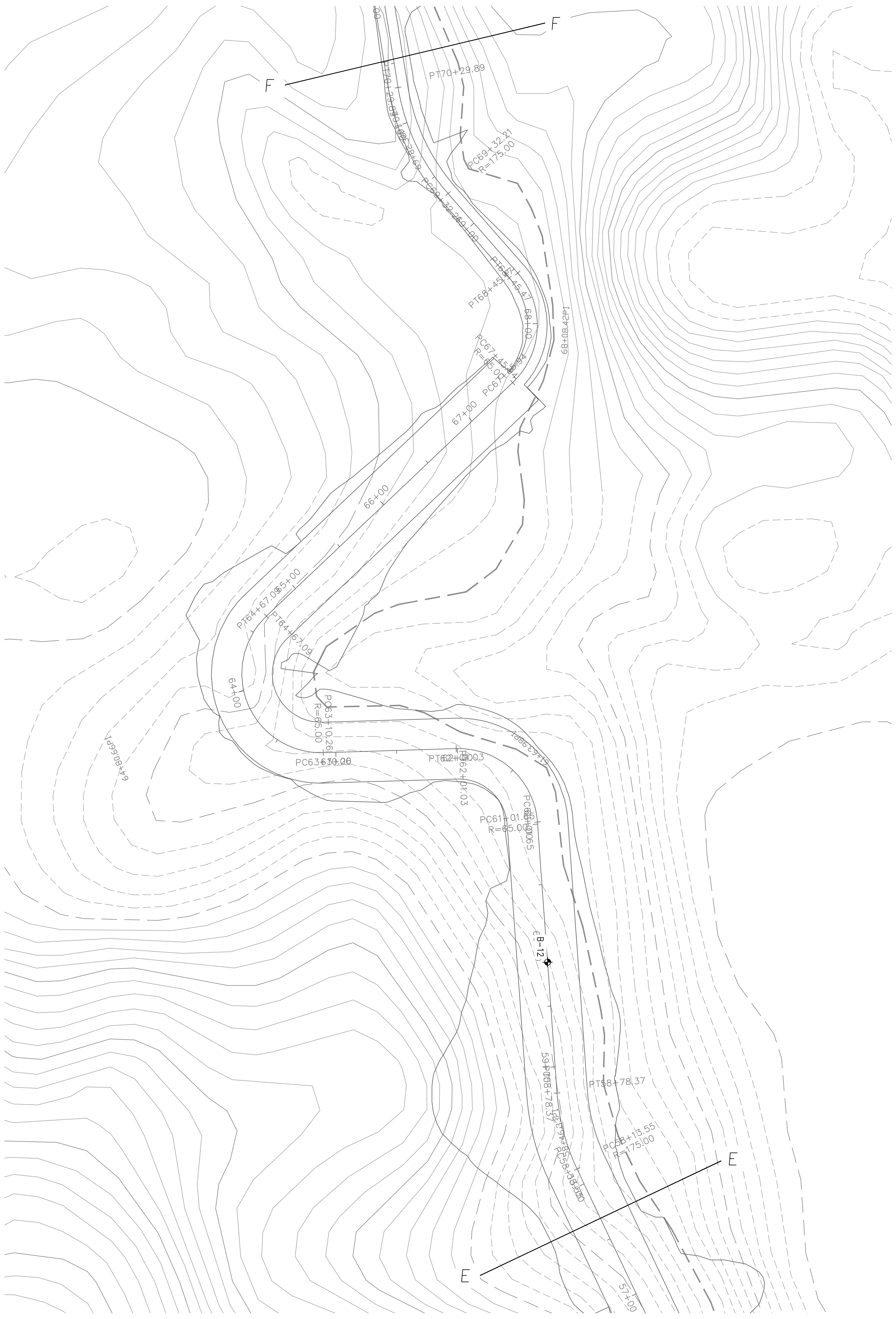
DRAWING:
B-2

PROJECT NUMBER:
41-20500



1 B-3 BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

BORING LOCATIONS	
#	STATION
B-1	-5 + 0.0
B-2	-3 + 0.0
B-3	-2 + 0.0
B-4	-1 + 0.0
B-5	2 + 50.0
B-6	6 + 66.7
B-7	8 + 33.3
B-8	41 + 75.0
B-9	43 + 25.0
B-10	53 + 75.0
B-11	55 + 83.3
B-12	59 + 86.3



2 B-3 BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

GEOS
Geotechnical, Environmental and Materials Engineers

Barrier Wall Layout

Chemours Barrier Wall Grading
Fayetteville, North Carolina

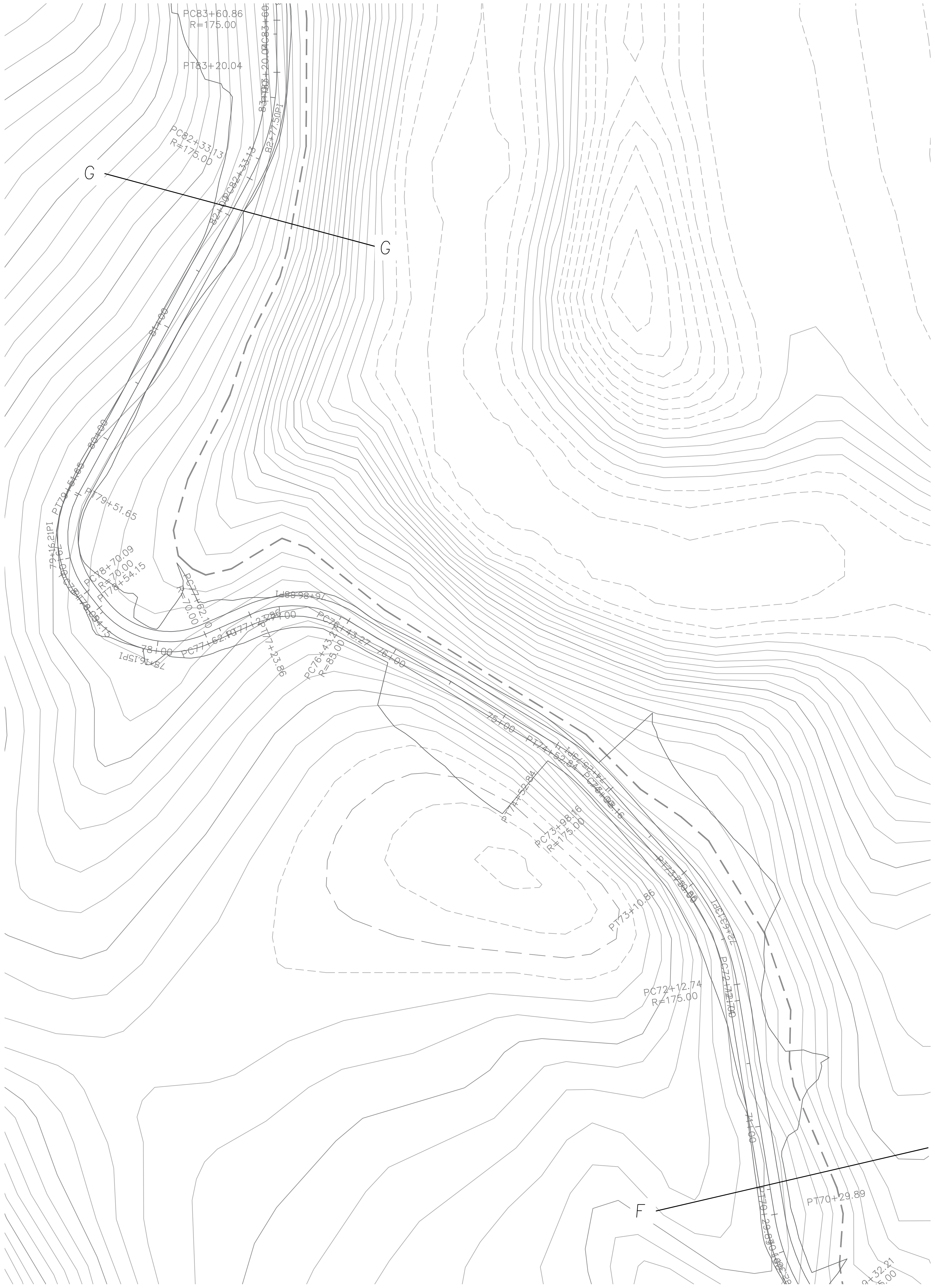
DRAWN BY: NSS	REVIEWED BY: DKK
DESIGNED BY: TJD	APPROVED BY: DAH
SCALE: AS SHOWN	
DATE: June 17, 2021	

Revisions

No.	Date	Description	By:
1			
2			
3			
4			
5			
6			

DRAWING:
B-3

PROJECT NUMBER:
41-20500



1
B-4
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

BORING LOCATIONS	
#	STATION
B-1	-5 + 0.0
B-2	-3 + 0.0
B-3	-2 + 0.0
B-4	-1 + 0.0
B-5	2 + 50.0
B-6	6 + 66.7
B-7	8 + 33.3
B-8	41 + 75.0
B-9	43 + 25.0
B-10	53 + 75.0
B-11	55 + 83.3
B-12	59 + 86.3

2
B-4
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

GEOS
Geotechnical, Environmental and Materials Engineers

Barrier Wall Layout

Chemours Barrier Wall Grading
Fayetteville, North Carolina

DRAWN BY: NSS	REVIEWED BY: DKK
DESIGNED BY: TJD	APPROVED BY: DAH
SCALE: AS SHOWN	
DATE: June 17, 2021	

Revisions

No.	Date	Description	By:
1			
2			
3			
4			
5			
6			

DRAWING:
B-4

PROJECT NUMBER:
41-20500

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-1

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/7/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION -5+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 87.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
0		░	SILTY SAND (SM) - orange brown; loose to very loose; moist (ALLUVIUM)						
				SS 1	100	5-4-3 (7)			
				SS 2	56	1-0-1 (1)			
5		▨	FAT CLAY (CH) with sand - dark gray; very soft to stiff; moist (ALLUVIUM)						
				SS 3	72	5-6-5 (11)			
		░	SAND (SP) - brown; medium dense; moist (ALLUVIUM)						
10				SS 4	61	4-6-7 (13)			
		▨	CLAYEY SAND (SC) - orange and light brown; loose; moist (ALLUVIUM)						
15				SS 5	78	4-5-5 (10)			
		▨	FAT CLAY (CH) - dark gray with light gray; firm to very stiff; moist (ALLUVIUM)						
20				SS 6	72 (10)	1-2-3 (5)			
25				SS 7	100 (21)	4-5-9 (14)			
30				SS 8	100 (22)	4-7-9 (16)			

NOTES:

(Continued Next Page)

BORING NUMBER B-1

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/7/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION ---
PROPOSED FFE ---
NORTHING / EASTING ---
REFUSAL ---
STATION -5+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 87.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30			FAT CLAY (CH) - dark gray with light gray; firm to very stiff; moist (ALLUVIUM) *(continued)*						
35				SS 9	100 (19)	5-7-10 (17)			
40				SS 10	94 (25)	7-8-12 (20)			
45				SS 11	100 (25)	6-9-12 (21)			
50				SS 12	100 (22)	5-7-10 (17)			
			SILTY SAND (SM) - gray and dark gray; medium dense; moist (ALLUVIUM)						
55				SS 13	100 (11)	5-8-14 (22)			
			FAT CLAY (CH) with sand at depth - gray to dark gray; stiff to very stiff; moist (ALLUVIUM)						
60				SS 14	100 (22)	4-5-8 (13)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-1

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/7/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION -5+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 87.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60			FAT CLAY (CH) with sand at depth - gray to dark gray; stiff to very stiff; moist (ALLUVIUM) *(continued)*						
65				SS 15	100 (18)	4-7-18 (25)			
			SANDY CLAY (CL) - gray to light gray; very stiff; moist (ALLUVIUM)						
70				SS 16	100 (19)	7-12-17 (29)			
75				SS 17	72 (13)	6-10-12 (22)			
			SANDY SILT (MLS) - light gray; very dense; moist (ALLUVIUM)						
80				SS 18	94 (17)	16-20-32 (52)			
			SANDY CLAY (CL) - light blue gray; very stiff; moist (ALLUVIUM)						
85				SS 19	100 (25)	7-8-16 (24)			
				ST 1	0				

Bottom of borehole at 87.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-2

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/6/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION ---
PROPOSED FFE ---
NORTHING / EASTING ---
REFUSAL ---
STATION -3+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 80.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0			SANDY CLAY (CL) - brown and red brown to light gray; stiff to very stiff; moist (ALLUVIUM)						
				SS 1	100 (13)	7-7-8 (15)			
5				SS 2	94 (17)	6-9-11 (20)			
			CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM)	SS 3	89 (19)	4-11-13 (24)			
10				SS 4	89 (18)	5-11-15 (26)			
			SAND (SP) - orange and light gray; medium dense; moist (ALLUVIUM)						
15				SS 5	89	7-10-17 (27)			
20				SS 6	67	5-7-6 (13)			
25				SS 7	61	4-5-6 (11)			
30			FAT CLAY (CH) - dark gray and light gray; stiff; moist (ALLUVIUM)	SS 8	83 (14)	2-3-10 (13)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-2

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/6/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION ---
PROPOSED FFE ---
NORTHING / EASTING ---
REFUSAL ---
STATION -3+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 80.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30			FAT CLAY (CH) - dark gray and light gray; stiff; moist (ALLUVIUM) *(continued)*						
			SAND (SP) - light brown to orange to gray; medium dense; very moist to moist (ALLUVIUM)						
35				SS 9	67	6-9-12 (21)			
40				SS 10	72	7-9-12 (21)			
			SILTY SAND (SM) with a clay seam - gray to orange brown; loose; moist (ALLUVIUM)						
45				SS 11	89	3-4-5 (9)			
			GRAVELLY SAND (SPG) with a clay seam - dark gray; medium dense; moist (ALLUVIUM)						
50				SS 12	100	7-10-20 (30)			
			FAT CLAY (CH) with sand seams - dark gray; hard; moist (ALLUVIUM)						
55				SS 13	100 (19)	6-10-21 (31)			
60				SS 14	56 (18)	11-13-24 (37)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-2

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall

DATE 3/6/21

DRILLING CONTRACTOR Independence Drilling

DRILLING METHOD Mud Rotary

GROUND ELEVATION --- **PROPOSED FFE** ---

REFUSAL ---

TOP OF ROCK ---

BEGAN CORING ---

FOOTAGE CORED (LF) ---

BOTTOM OF HOLE Depth 80.0 ft

GEOServices PROJECT# 41-20500

PROJECT LOCATION Fayetteville, NC

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

LATITUDE / LONGITUDE ---

NORTHING / EASTING ---

STATION -3+00

GROUND WATER LEVELS:

AT END OF DRILLING ---

AFTER 1 HOUR ---

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60		▨	FAT CLAY (CH) with sand seams - dark gray; hard; moist (ALLUVIUM) *(continued)*						
65		▨		☒ SS 15	100 (13)	3-8-24 (32)			
		▨	SANDY CLAY (CL) - light gray; very stiff to stiff; moist (ALLUVIUM)						
70		▨		☒ SS 16	100 (21)	7-7-16 (23)			
75		▨		☒ SS 17	100 (13)	3-5-8 (13)			
80		▨		☒ SS 18	100 (22)	4-6-9 (15)			

Bottom of borehole at 80.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-3

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/4/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION -2+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0		▨	CLAYEY SAND (SC) - brown; medium dense; moist (ALLUVIUM)						
		▨		☒ SS 1	94	6-13-17 (30)			
		⁙	SAND (SP) - light brown; medium dense; moist (ALLUVIUM)						
5		⁙		☒ SS 2	78	5-8-9 (17)			
		⁙		☒ SS 3	67	7-9-11 (20)			
10		⁙		☒ SS 4	83	7-9-9 (18)			
		▨	CLAYEY SAND (SC) - brown to light gray and orange; medium dense to loose; moist (ALLUVIUM)						
15		▨		☒ SS 5	72	5-7-9 (16)			
20		▨		☒ SS 6	61	2-2-5 (7)			
25		▨		☒ SS 7	94 (11)	4-4-5 (9)			
		▩	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)						
		⁙	SAND (SP) - light gray and orange; medium dense to loose; moist (ALLUVIUM)						
30		⁙		☒ SS 8	61	4-7-8 (15)			

NOTES:

(Continued Next Page)

BORING NUMBER B-3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/4/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION -2+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30			SAND (SP) - light gray and orange; medium dense to loose; moist (ALLUVIUM) *(continued)*						
35				SS 9	67	5-5-5 (10)			
			SILTY SAND (SM) with clay seams - dark gray and orange; medium dense; moist (ALLUVIUM)						
40				SS 10	61	4-7-8 (15)			
			SAND (SP) with gravel - dark gray and orange; loose; moist (ALLUVIUM)						
45				SS 11	89	3-5-4 (9)			
			FAT CLAY (CH) with sand seams - dark gray; very stiff; moist (ALLUVIUM)						
50				SS 12	67 (17)	7-8-13 (21)			
			SILTY SAND (SM) with clay seams and petrified wood at depth - dark gray; medium dense to dense; moist (ALLUVIUM)						
55				SS 13	94	6-10-12 (22)			
60				SS 14	100	12-14-18 (32)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 3/4/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION -2+00

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 85.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60			SILTY SAND (SM) with clay seams and petrified wood at depth - dark gray; medium dense to dense; moist (ALLUVIUM) *(continued)*						
			FAT CLAY (CH) with sand seams - dark gray and light gray; very stiff; moist (ALLUVIUM)						
65				SS 15	94 (17)	7-10-18 (28)			
			SANDY CLAY (CL) - light gray to light blue gray; hard to very stiff; moist (ALLUVIUM)						
70				SS 16	100 (25)	12-21-26 (47)			
75				SS 17	100 (6)	6-7-13 (20)			
80				SS 18	100 (25)	6-7-10 (17)			
85				SS 19	100 (17)	7-8-9 (17)			

Bottom of borehole at 85.0 feet.

NOTES:

BORING NUMBER B-4

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/4/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION ---
PROPOSED FFE ---
NORTHING / EASTING ---
REFUSAL ---
STATION -1+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0		▥	SILTY SAND (SM) - brown; loose; moist (ALLUVIUM)						
				SS 1	100	8-4-5 (9)			
		▨	FAT CLAY (CH) - light gray and light brown; very stiff; moist (ALLUVIUM)	SS 2	83 (22)	4-10-8 (18)			
5		░	SAND (SP) - light brown; medium dense; moist (ALLUVIUM)						
		▨	FAT CLAY (CH) with sand - light gray and orange; micaceous; firm to stiff; moist (ALLUVIUM)	SS 3	83 (13)	0-5-3 (8)			
10		░	SAND (SP) - light gray and orange; loose; moist (ALLUVIUM)	SS 4	83	2-5-5 (10)			
		░	SAND (SP) with clay seams - orange, brown, and light brown; medium dense to loose; moist (ALLUVIUM)						
15				SS 5	83	5-7-12 (19)			
20				SS 6	0	3-3-5 (8)			
		▨	FAT CLAY (CH) with a sand seam - dark gray; firm; moist (ALLUVIUM)						
25				SS 7	100 (11)	2-3-5 (8)			
		░	SAND (SP) - light gray and orange; loose to medium dense; moist (ALLUVIUM)						
30				SS 8	61	6-5-5 (10)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-4

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/4/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION ---
PROPOSED FFE ---
NORTHING / EASTING ---
REFUSAL ---
STATION -1+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30			SAND (SP) - light gray and orange; loose to medium dense; moist (ALLUVIUM) *(continued)*						
35				SS 9	61	5-6-7 (13)			
			FAT CLAY (CH) with sand seams - dark gray and orange; stiff; moist (ALLUVIUM)						
40				SS 10	100 (15)	3-5-5 (10)			
			SAND (SP) with clay seams - light brown to light gray; medium dense; moist (ALLUVIUM)						
45				SS 11	83	5-5-7 (12)			
			SAND (SP) - gray and dark gray; medium dense; moist (ALLUVIUM)						
50				SS 12	83	6-6-8 (14)			
55				SS 13	78	8-8-10 (18)			
			SAND (SP) with clay seams - gray and dark gray; medium dense to dense; moist (ALLUVIUM)						
60				SS 14	94	10-13-14 (27)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-4

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/4/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION -1+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60			SAND (SP) with clay seams - gray and dark gray; medium dense to dense; moist (ALLUVIUM) *(continued)*						
65				☒ SS 15	100	11-18-24 (42)			
			SANDY CLAY (CL) - light gray; hard to very stiff; moist (ALLUVIUM)						
70				☒ SS 16	100 (22)	9-14-20 (34)			
75				☒ SS 17	94 (21)	7-13-22 (35)			
80				☒ SS 18	100 (25)	9-11-15 (26)			
85				■ ST 1	100				

Bottom of borehole at 85.0 feet.

NOTES:

BORING NUMBER B-5

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 3/3/21	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling	**LOGGED BY** M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary	**LATITUDE / LONGITUDE** ---
GROUND ELEVATION --- **PROPOSED FFE** ---	**NORTHING / EASTING** ---
REFUSAL ---	**STATION** 2+50
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 85.0 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
0			SANDY CLAY (CL) - brown; firm to stiff; moist (ALLUVIUM)						
				SS 1	100 (24)	2-3-3 (6)			
5				SS 2	100 (22)	4-7-8 (15)			
				SS 3	100 (14)	3-5-7 (12)			
10				SS 4	100 (11)	4-5-6 (11)			
			CLAYEY SAND (SC) - red to orange brown; medium dense; moist (ALLUVIUM)						
			FAT CLAY (CH) and CLAYEY SAND (SC) - dark gray, black, light gray, and orange brown; firm and loose; moist (ALLUVIUM)						
15				SS 5	100	2-2-4 (6)			
			SAND (SP) with clay seams - light brown and light gray; loose; moist (ALLUVIUM)						
20				SS 6	72	3-4-4 (8)			
			SAND (SP) - brown, orange brown, and light gray; medium dense to very loose; moist (ALLUVIUM)						
25				SS 7	6	6-7-8 (15)			
30				SS 8	61	5-4-3 (7)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-5

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/3/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 2+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30			SAND (SP) - brown, orange brown, and light gray; medium dense to very loose; moist (ALLUVIUM) *(continued)*						
35				SS 9	78	4-6-7 (13)			
40				SS 10	50	0-0-1 (1)			
45				SS 11	72	5-4-4 (8)			
			FAT CLAY (CH) with silt seams - blue gray and dark gray; stiff; moist (ALLUVIUM)						
50				SS 12	94 (18)	4-5-6 (11)			
55				SS 13	100 (22)	4-6-9 (15)			
			FAT CLAY (CH) with petrified wood at depth - dark gray; hard to very stiff; moist (ALLUVIUM)						
60				SS 14	61 (22)	7-13-21 (34)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-5

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 3/3/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 2+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 85.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60		▨	FAT CLAY (CH) with petrified wood at depth - dark gray; hard to very stiff; moist (ALLUVIUM) *(continued)*						
65		▨		☒ SS 15	100 (25)	5-8-10 (18)			
		░	SAND (SP) with clay seams - gray and dark gray; dense to medium dense; moist (ALLUVIUM)						
70		░		☒ SS 16	94	11-16-20 (36)			
75		░		☒ SS 17	94	10-13-13 (26)			
		▨	SANDY CLAY (CL) - light gray; very stiff; moist (ALLUVIUM)						
80		▨		☒ SS 18	100 (19)	9-12-15 (27)			
85		▨		☒ SS 19	100 (25)	7-12-14 (26)			

Bottom of borehole at 85.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-6

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/2/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 6+60
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
0		▨	SANDY CLAY (CL) - red brown and brown; stiff; moist (ALLUVIUM)	SS 1 SS 2	100 (19) 94 (17)	3-5-7 (12) 4-6-7 (13)			
5		▩	FAT CLAY (CH) - gray and brown; stiff; moist (ALLUVIUM)						
		▨	CLAYEY SAND (SC) - orange brown and gray; medium dense; moist (ALLUVIUM)	SS 3	94	4-5-6 (11)			
10		░	SILTY SAND (SM) - light brown with red; medium dense; moist (ALLUVIUM)	SS 4	67	5-8-10 (18)			
15		░	SAND (SP) with clay seams - orange brown and light brown; loose; moist (ALLUVIUM)	SS 5	89	2-3-5 (8)			
20		▨	SANDY CLAY (CL) - dark gray; micaceous; stiff; moist (ALLUVIUM)	SS 6	100 (14)	3-5-7 (12)			
25		░	SAND (SP) with clay seams - dark gray and light gray; medium dense; moist (ALLUVIUM)	SS 7	83	8-6-7 (13)			
30		▩	FAT CLAY (CH) - dark gray; firm; moist (ALLUVIUM)	SS 8	100 (17)	3-3-4 (7)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-6

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/2/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 6+60
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30			FAT CLAY (CH) - dark gray; firm; moist (ALLUVIUM) *(continued)*						
			SAND (SP) - gray and light gray; medium dense; moist (ALLUVIUM)						
35				SS 9	89	3-5-6 (11)			
40				SS 10	100	3-5-7 (12)			
45				SS 11	94	4-6-10 (16)			
50				SS 12	100	6-6-11 (17)			
			GRAVELLY SAND (SPG) - gray; medium dense; moist (ALLUVIUM)						
55				SS 13	100	8-13-15 (28)			
			CLAYEY SAND (SC) with clay seams - gray; medium dense; moist (ALLUVIUM)						
60				SS 14	100	7-8-13 (21)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-6

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 3/2/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 6+60

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 85.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60			CLAYEY SAND (SC) with clay seams - gray; medium dense; moist (ALLUVIUM) *(continued)*						
			FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)						
			SANDY CLAY (CL) - light blue gray; very stiff; moist (ALLUVIUM)	SS 15	100 (22)	5-8-12 (20)			
65									
				SS 16	100 (25)	8-12-12 (24)			
70									
			SILTY SAND (SM) with gravel - light gray; dense; moist (ALLUVIUM)						
				SS 17	89	10-14-17 (31)			
75									
			SANDY CLAY (CL) - light gray; hard; moist (ALLUVIUM)						
				SS 18	100 (19)	11-15-17 (32)			
80									
				ST 1	100				
85									

Bottom of borehole at 85.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-7

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/1/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 8+30
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0			LEAN CLAY (CL) with mulch - light brown; firm; moist (FILL)						
			CLAYEY SAND (SC) - light brown; loose; moist (ALLUVIUM)						
				SS 1	89	3-4-4 (8)			
5				SS 2	72	2-4-5 (9)			
				SS 3	94	3-4-4 (8)			
			SAND (SP) - light brown and brown; loose; moist (ALLUVIUM)						
10				SS 4	89	3-5-5 (10)			
			GRAVELLY SAND (SPG) - light brown; medium dense; very moist (ALLUVIUM)						
15				SS 5	72	4-5-8 (13)			
20				SS 6	100	6-6-10 (16)			
			SAND (SP) with trace amounts of gravel - orange brown; medium dense; very moist (ALLUVIUM)						
25				SS 7	100	5-7-8 (15)			
			SAND (SP) - orange brown and brown; medium dense; moist (ALLUVIUM)						
30				SS 8	56	6-6-7 (13)			

NOTES:

(Continued Next Page)

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-7

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/1/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 8+30
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30		░	SAND (SP) - orange brown and brown; medium dense; moist (ALLUVIUM) *(continued)*						
		▨	FAT CLAY (CH) with sand and gravel seams - dark gray; stiff; moist (ALLUVIUM)	SS 9	100 (18)	3-7-8 (15)			
35		░	SAND (SP) - gray; medium dense; moist (ALLUVIUM)						
40		▨	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)	SS 10	94 (17)	2-4-5 (9)			
45		░	SILTY SAND (SM) - gray; dense; moist (ALLUVIUM)	SS 11	100	8-15-18 (33)			
50		░	SAND (SP) with petrified wood at surface - gray to light gray; very dense; moist (ALLUVIUM)	SS 12	83	17-24-41 (65)			
55		░		SS 13	56	15-22-42 (64)			
60		░	SAND (SP) with gravel - dark gray; dense; moist (ALLUVIUM)	SS 14	50	11-18-21 (39)			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-7

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 3/1/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 8+30
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 85.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60		⁘	SAND (SP) with gravel - dark gray; dense; moist (ALLUVIUM) *(continued)*						
65		⁘		☒ SS 15	100	14-17-20 (37)			
		▨	SANDY CLAY (CL) with sand seams - gray and light gray; very stiff; moist (ALLUVIUM)						
70		▨		☒ SS 16	61 (11)	5-10-13 (23)			
		⁘	SAND (SP) - light gray; medium dense; moist (ALLUVIUM)						
75		⁘		☒ SS 17	89 (17)	9-11-11 (22)			
		▨	FAT CLAY (CH) with sand - light gray; very stiff; moist (ALLUVIUM)						
		▨	SANDY CLAY (CL) - light gray and blue gray; hard to very stiff; moist (ALLUVIUM)						
80		▨		☒ SS 18	94 (25)	12-18-25 (43)			
85		▨		☒ SS 19	100 (25)	6-8-9 (17)			

Bottom of borehole at 85.0 feet.

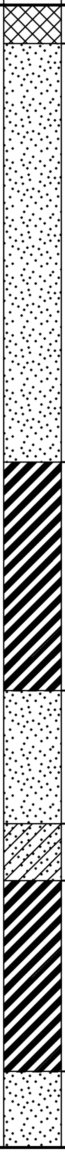
NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-8

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/16/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 41+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
0			CLAYEY SAND (SC) with topsoil and mulch - brown; moist (FILL)						
			SAND (SP) - brown, light brown, and red brown; moist (ALLUVIUM)						
5									
10									
			FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
15									
			SAND (SP) - brown and gray; moist (ALLUVIUM)						
20									
			CLAYEY SAND (SC) - dark gray; moist (ALLUVIUM)						
			FAT CLAY (CH) - dark gray; moist (ALLUVIUM)						
25									
			SAND (SP) - orange, tan, and light gray; moist (ALLUVIUM)						
30									

NOTES:

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-8

PAGE 2 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 4/16/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR M&W Drilling

LOGGED BY J. Haley **ON-SITE REP.** J. Haley

DRILLING METHOD Sonic Drilling

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 41+75

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30			SAND (SP) - orange, tan, and light gray; moist (ALLUVIUM) *(continued)*						
35									
40									
45			SAND (SP) - gray and dark gray; moist (ALLUVIUM)						
			SAND (SP) - light brown; moist (ALLUVIUM)						
50									
			SAND (SP) - gray; moist (ALLUVIUM)						
			FAT CLAY (CH) with sand - dark gray; moist (ALLUVIUM)						
55									
			CLAYEY SAND (SC) - gray and dark gray; moist (ALLUVIUM)						
60									

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-8

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 4/16/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR M&W Drilling

LOGGED BY J. Haley **ON-SITE REP.** J. Haley

DRILLING METHOD Sonic Drilling

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 41+75

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
60									
			CLAYEY SAND (SC) - gray and dark gray; moist (ALLUVIUM) *(continued)*						
			SANDY CLAY (CH) - dark gray; moist (ALLUVIUM)						
			SAND (SP) - gray; moist (ALLUVIUM)						
65									
70									
75			SANDY CLAY (CH) - gray; moist (ALLUVIUM)						
			SAND (SP) - gray; moist (ALLUVIUM)						
			LEAN CLAY (CL) - light gray; moist (ALLUVIUM)						
80			CLAYEY SAND (SC) - light gray; moist (ALLUVIUM)						
85			LEAN CLAY (CL) - light gray; moist (ALLUVIUM)						
90									

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-9

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/16/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 43+25
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0		▩	CLAYEY SAND (SC) - light brown; moist (FILL)						
		▨	FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
5									
		⁘	SAND (SP) - gray; moist (ALLUVIUM)						
10									
		▨	FAT CLAY (CH) with sand seams - dark gray; moist (ALLUVIUM)						
15									
		▨	FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
		⁘	SAND (SP) - gray; moist (ALLUVIUM)						
20									
		▨	FAT CLAY (CH) with sand and lignite seams - dark gray and gray; moist (ALLUVIUM)						
25									
		⁘	SAND (SP) - gray; moist (ALLUVIUM)						
30									

NOTES:

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BORING NUMBER B-9

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/16/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 43+25
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30		▒	SAND (SP) - gray; moist (ALLUVIUM) *(continued)*						
35		▒	SAND (SP) - tan and orange; moist (ALLUVIUM)						
		▨	CLAYEY SAND (SC) - gray; moist (ALLUVIUM)						
40 45		▒	SAND (SP) - gray; moist (ALLUVIUM)						
		▒	SAND (SP) with lignite seams - dark gray; moist (ALLUVIUM)						
50		▒	SAND (SP) with clay seams - gray; moist (ALLUVIUM)						
55		▒	SAND (SP) - gray; moist (ALLUVIUM)						
60		▩	SANDY CLAY (CH) - gray; moist to very moist (ALLUVIUM)						

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-9

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 4/16/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR M&W Drilling

LOGGED BY J. Haley **ON-SITE REP.** J. Haley

DRILLING METHOD Sonic Drilling

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 43+25

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60		░	SAND (SP) - gray; moist (ALLUVIUM)						
65		░							
		░	SAND (SP) with clay seams - gray; moist (ALLUVIUM)						
70		▨	FAT CLAY (CH) - dark gray; moist (ALLUVIUM)						
		░	SAND (SP) - dark gray; moist (ALLUVIUM)						
		▨	SANDY CLAY (CH) - dark gray; moist (ALLUVIUM)						
75		▨	LEAN CLAY (CL) with sand - light gray; moist (ALLUVIUM)						
		░	SAND (SP) - gray; moist (ALLUVIUM)						
80		░							
		▨	LEAN CLAY (CL) with sand - light gray; moist (ALLUVIUM)						
85		▨							
		▨	SANDY CLAY (CL) - light gray; moist (ALLUVIUM)						
90									

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-10

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/14/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 53+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
0		▦	SANDY CLAY (CH) - brown; moist (FILL)						
		▦	TOPSOIL / MULCH (FILL)						
		░	SAND (SP) - brown; moist (ALLUVIUM)						
5		░							
10		▨	FAT CLAY (CH) with sand - brown and gray; moist (ALLUVIUM)						
		░	SAND (SP) - orange, red brown, and light brown; moist (ALLUVIUM)						
15		░							
20		░	SAND (SP) - gray and dark gray; moist (ALLUVIUM)						
25		▨	FAT CLAY (CH) - dark gray; moist (ALLUVIUM)						
		░	SAND (SP) - gray and dark gray; moist (ALLUVIUM)						
30									

NOTES:

(Continued Next Page)

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/14/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 53+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30		▨	FAT CLAY (CH) with sand - dark gray; moist (ALLUVIUM)						
		░	SAND (SP) - orange and light brown; moist (ALLUVIUM)						
35		░	SAND (SP) - dark gray; moist (ALLUVIUM)						
40		░							
		▨	FAT CLAY (CH) with sand - dark gray; moist (ALLUVIUM)						
		░	SAND (SP) - dark gray; moist (ALLUVIUM)						
45		▨	FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
50		▨							
55		▨							
60		▨							

NOTES:

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BORING NUMBER B-10

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 4/14/21	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling	**LOGGED BY** J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling	**LATITUDE / LONGITUDE** ---
GROUND ELEVATION --- **PROPOSED FFE** ---	**NORTHING / EASTING** ---
REFUSAL ---	**STATION** 53+75
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 90.0 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60		░	SAND (SP) with clay seams - dark gray; moist (ALLUVIUM)						
65		░							
		▨	SANDY CLAY (CH) - gray; moist to very moist (ALLUVIUM)						
		░	SAND (SP) - gray and light gray; moist (ALLUVIUM)						
70		░							
		▨	SANDY CLAY (CL) - gray and light gray; moist (ALLUVIUM)						
75		░	SAND (SP) - light gray; moist (ALLUVIUM)						
80		░							
		▨	LEAN CLAY (CL) - light gray; moist (ALLUVIUM)						
85		▨	LEAN CLAY (CL) with sand seams - gray; moist (ALLUVIUM)						
90		▨							

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-11

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/14/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 55+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 80.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0									
			SANDY CLAY (CH) - brown and gray; moist (FILL)						
			TOPSOIL / MULCH (FILL)						
5			SAND (SP) - orange and light brown; moist (ALLUVIUM)						
10									
15			SAND (SP) - tan and white; moist (ALLUVIUM)						
			SAND (SP) with clay seams - maroon and brown; moist (ALLUVIUM)						
20									
			SAND (SP) - orange and light brown; moist (ALLUVIUM)						
25			SAND (SP) - dark gray; moist (ALLUVIUM)						
			FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
30									

NOTES:

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-11

PAGE 2 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/14/21
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling
LOGGED BY J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 55+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 80.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30		▨	FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM) *(continued)*						
		▨	SANDY CLAY (CH) - dark gray; moist (ALLUVIUM)						
		▨	FAT CLAY (CH) - dark gray and gray; moist (ALLUVIUM)						
35		▨							
40		▨							
45		▨							
		░	SAND (SP) - dark gray and gray; moist (ALLUVIUM)						
50		░	SAND (SP) with trace gravel - dark gray; moist (ALLUVIUM)						
		░	SAND (SP) - gray and dark gray; moist (ALLUVIUM)						
55		░							
60									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-11

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 4/14/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR M&W Drilling

LOGGED BY J. Haley **ON-SITE REP.** J. Haley

DRILLING METHOD Sonic Drilling

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 55+75

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 80.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
60		░	SAND (SP) - gray and dark gray; moist (ALLUVIUM) *(continued)*						
65		▨	SANDY CLAY (CL) - gray; moist to very moist (ALLUVIUM)						
		▨	LEAN CLAY (CL) with sand seams - light gray; moist (ALLUVIUM)						
70		▨							
75		▨							
80		▨							

Bottom of borehole at 80.0 feet.

NOTES:

BORING NUMBER B-12

PAGE 1 OF 3

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 4/13/21

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR M&W Drilling

LOGGED BY J. Haley **ON-SITE REP.** J. Haley

DRILLING METHOD Sonic Drilling

LATITUDE / LONGITUDE ---

GROUND ELEVATION --- **PROPOSED FFE** ---

NORTHING / EASTING ---

REFUSAL ---

STATION 59+75

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

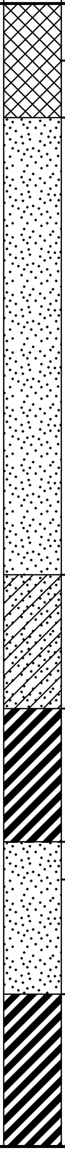
AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 70.0 ft

AFTER 24 HOURS ---



DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0			SANDY CLAY (CH) - brown; moist (FILL)						
			WOOD AND MULCH (FILL)						
5 10			SAND (SP) - light brown; moist (ALLUVIUM)						
15			CLAYEY SAND (SC) with clay seams - maroon and orange; moist (ALLUVIUM)						
20			FAT CLAY (CH) with silt seams - dark gray; moist (ALLUVIUM)						
			SAND (SP) - orange and light brown; moist (ALLUVIUM)						
25			SAND (SP) - gray and dark gray; moist (ALLUVIUM)						
30			FAT CLAY (CH) with sand seams - dark gray and gray; moist to very moist (ALLUVIUM)						

NOTES:

(Continued Next Page)

BORING NUMBER B-12

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 4/13/21	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR M&W Drilling	**LOGGED BY** J. Haley **ON-SITE REP.** J. Haley
DRILLING METHOD Sonic Drilling	**LATITUDE / LONGITUDE** ---
GROUND ELEVATION --- **PROPOSED FFE** ---	**NORTHING / EASTING** ---
REFUSAL ---	**STATION** 59+75
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 70.0 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30		▨	FAT CLAY (CH) with sand seams - dark gray and gray; moist to very moist (ALLUVIUM) *(continued)*						
35		▨							
		░	SAND (SP) - gray; moist (ALLUVIUM)						
40		▨	FAT CLAY (CH) - dark gray; moist (ALLUVIUM)						
		▨	SANDY CLAY (CH) - dark gray; moist (ALLUVIUM)						
45		▨							
		▒	CLAYEY SAND (SC) - dark gray; moist (ALLUVIUM)						
50		▒							
		▧	LEAN CLAY (CL) - light gray; moist (ALLUVIUM)						
55		▧							
		▧	LEAN CLAY (CL) with sand - light gray; moist (ALLUVIUM)						
60									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER B-12

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 4/13/21
PROJECT LOCATION Fayetteville, NC
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DRILLING METHOD Sonic Drilling
LATITUDE / LONGITUDE ---
GROUND ELEVATION --- **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL ---
STATION 59+75
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 70.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60			CLAYEY SAND (SC) - light gray; moist (ALLUVIUM)						
65									
			LEAN CLAY (CL) - light gray; moist (ALLUVIUM)						
70									

Bottom of borehole at 70.0 feet.

NOTES:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

December 7, 2020

The Chemours Company FC, LLC
1007 Market Street
Wilmington, DE 19899

ATTENTION: Mr. Sebastian Bahr, Project Director CRG
Sebastian.Bahr@chemours.com

Subject: **REPORT OF GEOTECHNICAL EXPLORATION**
Chemours Barrier Wall
Fayetteville, NC
GEOServices Project No. 41-20500

Dear Mr. Bahr:

We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed in general accordance with GEOS Proposal No. 41-20500, dated June 30, 2020. The following report presents our findings and recommendations for the proposed roadway construction and barrier wall in Fayetteville, North Carolina.

GEOServices sincerely appreciates the opportunity to serve as your geotechnical consultant. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,
GEOServices, LLC

Derek Kilday

SEAL
032829
DENNIS ALLEN HUCKABA
3-19-21

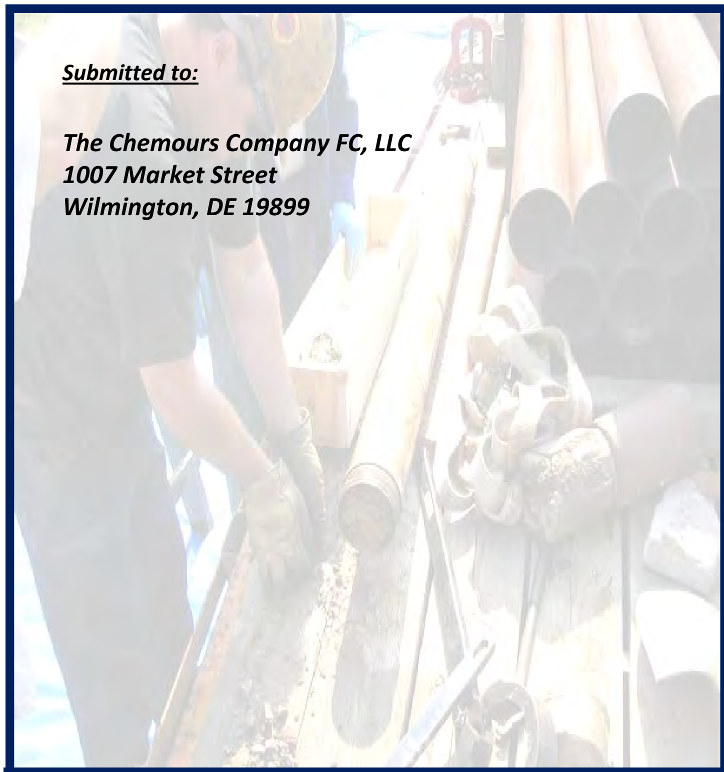
Derek K. Kilday, P.E.
Vice President

Dennis A. Huckaba, P.E.
Principal
NC 032829

REPORT OF GEOTECHNICAL EXPLORATION

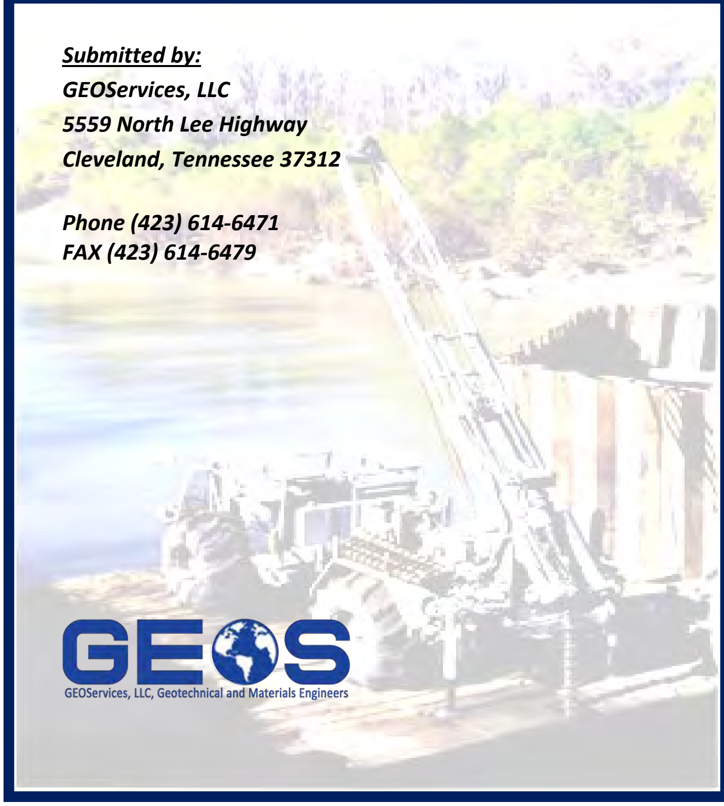
CHEMOURS PROPOSED BARRIER WALL

Fayetteville, North Carolina



Submitted to:

The Chemours Company FC, LLC
1007 Market Street
Wilmington, DE 19899



Submitted by:
GEOServices, LLC
5559 North Lee Highway
Cleveland, Tennessee 37312

Phone (423) 614-6471
FAX (423) 614-6479

GEOServices, LLC, Geotechnical and Materials Engineers

GEOSERVICES, LLC
PROJECT NO. 41-20500

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APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this geotechnical exploration was to characterize the subsurface conditions for the design and construction of the proposed roadway and barrier wall at the existing Chemours facility in Fayetteville, North Carolina. This report summarizes the collected subsurface exploration information and provides recommendations for general site preparation, excavation and fill requirements, slope stability analyses, retaining wall design parameters, and the benefits and drawbacks of several acceptable technologies for installation of the barrier wall.

1.2 BACKGROUND INFORMATION

The site for the proposed project is located at the existing Chemours Fayetteville Works facility located at 22828 NC Highway 87 in Fayetteville, North Carolina. GEOServices understands that as part of the Consent Order with the State of North Carolina (by and through North Carolina Department of Environmental Quality (NCDEQ)) Chemours has agreed to implement measures to reduce the amount of polyfluoroalkyl substances (PFAS) which are discharged to the nearby Cape Fear River.

At the Chemours Fayetteville Works facility there are four on-site surface Seeps (A through D) that have been identified to discharge into the nearby Cape Fear River. Per- and polyfluoroalkyl substances (PFAS) from the site reach the Cape Fear River from these seeps as referenced in Geosyntec 2020A. At the time this report was prepared, design (Seeps A, B, and D) and construction (Seep C) are on-going for interim seep remediation systems, pursuant to Consent Order Addendum paragraph 2(a). These interim measures consisting of in-situ flow-through cells which are designed to reduce the PFAS loadings from the seeps to the river.

Per the Consent Order, Chemours must complete the installation and begin operation of a ground water treatment system which will include controlling groundwater migrating toward both the four identified on-site seeps and the Cape Fear River by March 15, 2023. This barrier wall groundwater control system is anticipated to significantly reduce groundwater seepage to the point where measurable flows may no longer be present at Seeps C and D. It is expected that the surficial aquifer and perched water will still feed Seeps A and B. As such, these waters will be captured and treated in accordance with Consent Order Addendum paragraph 2(c)(i).

This geotechnical exploration and report were designed to gather the necessary soil information for design of the barrier wall and produce recommendations for the infrastructure necessary to complete the installation of the barrier wall.

1.3 SITE DESCRIPTION

The Chemours Fayetteville Works site is located at 22828 NC Highway 87 along the intersection of Bladen and Cumberland County in North Carolina. The property is located within a 2,177 acre parcel. Figures 1 and 2 in Appendix A show the extents of the facility. The site is bordered by wooded areas and farmland to the north and south, by the Cape Fear River to the east, and by NC Highway 87 to the west. A barrier wall is planned to be constructed to reduce groundwater/seep loading of the adjacent Cape Fear River. The preliminary barrier wall alignment extends north from Old Outfall OO2 for a route length of approximately 9,000 feet. The proposed barrier wall alignment is preliminarily designed to follow the contour at elevation 72 feet MSL and will extend to the necessary depths to terminate within the underlying Cape Fear Confining Unit. While four alignments were conceptually performed, the majority of the four alignments share a common alignment with some small divergences around active seeps. The common alignment was utilized for the geotechnical exploration.

The site for the proposed barrier wall alignment was primarily heavily wooded but clearing of the roadway alignment (approximately 100 feet in width) was performed as part of the Pre-design Investigation Plan (PDI). Based on the existing topography, maximum cuts of approximately 20 feet and maximum fills of approximately 13 feet will be required to accommodate the proposed grades. Heights of cut and fill will vary slightly based on the alignment/barrier wall equipment that is chosen.

1.4 SCOPE OF STUDY

Geotechnical exploration for the barrier wall alignment involved a site reconnaissance, field drilling, laboratory testing, and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, and conclusions and recommendations. Following the text of this report, Appendix A presents figures and test boring records. Appendix B presents integrated electronic seismic piezocone penetration test (CPT) results. Appendix C presents pore pressure dissipation testing data. Appendix D presents laboratory testing results. Appendix E presents the representative photographs from the drilling and laboratory testing. Appendix F presents the sample slope stability calculations.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, subsurface water, or air, on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

2.1 FIELD EXPLORATION

The subsurface conditions along the proposed barrier wall alignment were explored with a series of integrated electronic seismic piezocone penetration test (CPT) soundings and traditional mud rotary borings. The borings and CPT soundings were alternated and spaced at increments of 250 feet along the proposed alignment to generate the best coverage. This resulted in a total of nineteen (19) CPT soundings and nineteen (19) traditional mud rotary borings. The boring/sounding locations and depths were selected by GEOServices personnel in conjunction with the proposed barrier wall alignment alternatives. Approximate boring locations are shown on the Boring Location Plans, Figure 3-5 of Appendix A. The boring locations were located and staked in the field by GEOServices utilizing a handheld GPS unit. Integrated electronic seismic piezocone penetration tests (CPT) were performed September 17 through September 20 and mud rotary borings were performed September 28 through October 6 and October 12 through October 15. The depths reference the ground surface elevations at the site that existed at the time of the exploration.

2.1.1 SPT Borings

A total of nineteen borings were advanced using open hole methods with NWJ rods. The drill crew worked in general accordance with ASTM D 6151 (HSA Drilling) and ASTM D783 (Direct Rotary with Water-Based Drilling Fluid). The soil cuttings and drilling fluid were collected and placed in drums and the borings were backfilled with grout before leaving the site. Detailed test boring records are presented in Appendix A.

Standard penetration test (SPT) blow counts were measured using the split-spoon standard penetration test procedure (ASTM D 1586). In split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth and provide an indication of the relative density of granular materials and strength of cohesive materials. Soil collected by the sampler during the SPT are used for material property tests. Less disturbed samples for conductivity and strength testing were collected using thin walled tube sampling test procedure (ASTM D 1587).

2.1.2 Cone Penetration Testing (CPT)

A total of nineteen locations were explored using an integrated electronic seismic piezocone penetration test (CPT). The piezocone dimensions and the operating procedure were in accordance with ASTM D 5778. Since the CPT is a direct push technology it allows data to be obtained continuously (approximately every 2 inches). A computer connected to the cone records tip resistance, sleeve friction, and dynamic pore pressure via instruments in the cone. Additionally, when the cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, water is injected into a saturated porous stone to generate excess pore pressures, without advancing the cone the pressure is then allowed to dissipate and pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file. Pore pressure dissipation testing was performed in each of the nineteen CPT sounding locations. The pore pressure dissipation results are presented in Appendix C.

2.2 LABORATORY TEST PROGRAM

Soil samples collected during drilling were transported to the GEOServices laboratory for visual classification and laboratory testing. Laboratory tests were performed on representative split-spoon samples, Shelby tube (thin walled tube) samples and bulk samples obtained during the field exploration phase of this project. The following laboratory testing was performed on select samples to determine various properties of the soil:

- Atterberg Limits (ASTM D 4318): Seventeen Atterberg limits tests were performed for this project. These tests help us to confirm visual classifications according to the Unified Soil Classification System (USCS). The plastic limit and liquid limit represent the moisture content at which a cohesive soil changes from a semi-solid to a plastic state and from a plastic state to liquid state, respectively.

- Natural Moisture Content (ASTM D 2216): Moisture content determinations were performed on 371 samples for this project. The natural moisture content is defined as the ratio of the weight of water present in the soil to the dry weight of soil.
- Particle Size Analysis (ASTM D 6913): Fourteen particle size analyses were performed for this project. The particle size analysis is used to determine the soil classification and determine drainage properties of the material. The results will later be used in the laboratory soil classification (ASTM D 2487).
- Wash 200 (ASTM D 1140): Sixteen wash 200 tests were performed for this project. This test measures the total amount of clay and silt sized particles in a sample and is used to assist in the soil classification (ASTM D 2487).
- Standard Proctor Moisture-Density Tests (ASTM D 698): Two Standard Proctor tests were performed on collected soil samples. This test provides information concerning the relationship between moisture content, compaction effort, and density.
- Consolidated Undrained (CU) Triaxial Testing (ASTM D 4767): Two triaxial tests were performed on an undisturbed Shelby Tube sample. The triaxial testing provides the strength characteristics of the sampled soil.
- Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (ASTM D 5084): Seventeen hydraulic conductivity tests were performed on undisturbed Shelby Tube samples. These tests provide permeability measurements necessary for estimating the flow of water through the subsurface and necessary in designing the depth of the barrier wall.

The test results are presented on individual laboratory data sheets and a Soil Data Summary, both enclosed in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site lies in the Coastal Plain Physiographic Province. The Province extends from the Atlantic Ocean inland to an erosional contact boundary with the Piedmont Province. This boundary lies about 40 miles northwest of the project site.

Published geologic information indicates the site is underlain by the Black Creek Formation consisting primarily of lignitic clays which are gray to black and contain thin beds of fine grained micaceous sand and thick lenses of cross-bedded sand. Glauconotic fossiliferous clayey sand lenses are often present in the upper part of the formation. Locally the site is influenced by the adjacent Cape Fear River.

3.2 SUBSURFACE CONDITIONS

The subsurface conditions along the proposed barrier wall alignment were explored with a series of integrated electronic seismic piezocone penetration tests (CPT) and traditional mud rotary borings. The borings and cone soundings were alternated and spaced at increments of 250 feet along the proposed alignment to generate the best coverage. This resulted in a total of nineteen (19) cone soundings and nineteen (19) traditional mud rotary borings. Individual logs for the mud rotary (SPT borings) are presented in Appendix A of this report and are indexed by station number along the roadway alignment. Individual logs for the piezocone penetration test (CPT) soundings are provided in Appendix B.

Generally, the borings/soundings encountered alluvial deposits for the full penetration/boring depth. The borings were extended to penetration refusals ranging from 24.5 to 89.2 feet below existing grade, or to predetermined refusal depths of 90 feet below existing grade.

3.2.1 Surficial Materials

Due to the previous clearing and grading that was performed as part of the Pre-Design Investigation (PDI), very little surficial soils were encountered in the boring samples. Topsoil measuring approximately six inches in thickness was encountered in borings 5+00, 20+00, and 62+50. Beneath these surficial layers in these borings and from the ground surface in the remaining borings, alluvial soils were encountered to cone penetration refusal or predetermined termination depths ranging from 24.5 to 89.2 feet.

3.2.2 Alluvial Deposits

As mentioned previously, alluvial deposits at the site were encountered beneath the topsoil in three locations and from the ground surface in the remaining locations. Based on the previously provided *Numerical Modeling Report* dated December 2019 and prepared by Geosyntec, we understand the alluvial soils in the vicinity of the barrier wall have been previously categorized as the Black Creek Confining Unit, Black Creek Aquifer, Floodplain Deposits, and the Cape Fear Confining Unit. The scope of this portion of the PDI was to determine the geotechnical properties for the design of the proposed roadway and barrier wall, the descriptions provided on the boring logs are limited to the engineering classifications necessary for that task.

The alluvial deposits at the site can generally be broken down into two classifications: fine and coarse grained. The fine-grained soils generally consisted of a combination of dark gray and black clays (CL and CH). In some areas the clay had isolated sand deposits and the quantity of silt varied. Additionally, petrified wood chunks were identified in some samples. The N-values in the fine-grained soils ranged from 4 blows per foot to 50 blows per 0 inches of penetration, indicating a consistency of soft to very hard. The soft to firm clay layers were generally isolated to the upper soils and the clays of the Cape Fear Confining Unit were generally hard or better in consistency.

The coarse-grained alluvial soils encountered consisted of silty sands, clayey sands, poorly grades sands, gravelly sands (SM, SC, SP, SPG). These materials were light gray, light brown and even orangish brown in color. The N-values in the coarse-grained alluvium ranged from 3 blows per foot to 50 blows per 0 inches of penetration, indicating a relative density of very loose to very dense. The coarse-grained materials were primarily loose to medium dense with some isolated dense and very dense layers.

3.2.3 Subsurface Water

Subsurface water was estimated in eighteen of the nineteen (all except 2+50) penetration tests using the pore pressure dissipation data. Due to the mud rotary techniques utilized to perform the SPT borings, water levels could not be reliably obtained. Water level depths ranging from 20.0 to 28.0 feet, at the time of drilling are estimated from the CPT sounding records. Subsurface water levels may fluctuate due to seasonal changes in precipitation amounts. Additionally, discontinuous zones of perched water may exist within the overburden and/or at the contact with bedrock. The groundwater information presented in this report is the information that was collected at the time of exploration activities. A summary of the subsurface water depths encountered in the borings is shown below:

Table 1 – Subsurface Water Summary

Sounding Station Number	Suburface Water Depth (feet)	Elevation at Penetration Location (feet)	Suburface Water Elevation (feet)
7+50	10	71.4	61.4
12+50	12	70.1	58.1
17+50	25	70.7	45.7
22+50	26	70.3	44.3
27+50	16	72.0	56
32+00	37	80.9	43.9
35+00	26	79.1	53.1
40+00	20	72.8	52.8
45+00	23	71.4	48.4
50+00	26	73.0	47
55+00	35	78.6	43.6
60+00	21	75.7	54.7
65+00	23	79.3	56.3
70+00	30	77.9	47.9
75+00	51	81.4	30.4
80+00	45	78.8	33.8
85+00	45	77.1	32.1
90+00	41	75.1	34.1

Note: Depths reference the existing ground elevations at the time of the exploration.
**Water level based on pore pressure dissipation data.*

3.2.4 Refusal Conditions

Auger refusal materials were not encountered in any of the nineteen mud rotary borings, however, cone refusal was observed in seventeen of the nineteen penetration locations during field exploration. Refusal is a designation applied to any material that cannot be penetrated by the equipment. The refusal may indicated dense sand or gravel layers or obstruction such as petrified wood which were observed in some of the auger borings.

Table 2 – Penetration Refusal Summary

Sounding Station Number	Refusal Depth (feet)	Elevation at Penetration Location (feet)	Refusal Elevation (feet)
2+50	24.5	83.8	59.3
12+50	68.6	70.1	1.5
22+50	76.5	70.3	-6.2
27+50	71.4	72.0	0.6
32+00	71.1	80.9	9.8
35+00	89.7	79.1	-10.6
40+00	82.9	72.8	-10.1
45+00	59.8	71.4	11.6
45+00A	56.7	71.4	14.7
50+00	71.9	73.0	1.1
55+00	61.0	78.6	17.6
60+00	71.3	75.7	4.4
65+00	78.5	79.3	0.8
70+00	70.5	77.9	7.4
75+00	61.3	81.4	20.1
75+00A	57.9	81.4	23.5
80+00	66.9	78.8	11.9
85+00	80.2	77.1	-3.1
90+00	69.0	75.1	6.1

Note: Depths reference the existing ground elevations at the time of the exploration.

3.2.5 General

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring and cone penetration logs included in Appendix A should be reviewed for specific information at individual sampling locations. The depth and thickness of the subsurface strata indicated on the boring cross-sections were generalized from and interpolated between test locations. The transition between materials will be more or less gradual than indicated and may be abrupt. Information on actual subsurface conditions exists only at the specific boring locations and is relevant to the time the exploration was performed. Variations may occur and should be expected between boring locations. The stratification lines were used for analytical purposes and, unless specifically stated otherwise, should not be used as the basis for design or construction cost estimates.

3.3 LABORATORY TESTING RESULTS

Laboratory tests were performed on representative split-spoon samples, Shelby tube samples and bulk samples obtained during the field exploration phase of this project. Moisture content determinations, Atterberg limits tests, particle size analyses and Wash 200 tests were performed to assist in classification of the sampled soils. The resulting soil descriptions are provided on the boring logs in Appendix A.

In addition to the index property testing, consolidated undrained (CU) triaxial testing was performed on two selected Shelby tube samples to evaluate the general strength conditions of the underlying soils. The Shelby tube samples were obtained at stations of 62+50 and 87+50 at depths of 35 to 37 feet and 55 to 57 feet, respectively. Effective cohesion values ranged from 0.63 to 2.51 psi and effective friction angles ranged from 22.8 to 26.4 degrees.

Seventeen hydraulic conductivity tests were also performed on Shelby tube (“undisturbed”) samples obtained during the field exploration. The hydraulic conductivities obtained within the clays were generally on the order of 10^{-8} cm/s or 10^{-9}cm/s, while those obtained in the sands where on the order of 10^{-4} cm/s. The full laboratory testing results are provided in Appendix D.

4.0 ENGINEERING ANALYSIS AND DESIGN RECOMMENDATIONS

4.1 SLOPE STABILITY ANALYSIS

The construction of the barrier wall will require the installation of an access pathway/roadway to facilitate the equipment and materials necessary for the construction. As part of this exploration, GEOS was charged with performing stability analyses for the worst access road cross-sections (based on the conceptual design sections). The sections below outline the material parameter selection, geometry selection, analysis methodology, analysis results and provide recommendations for the proposed construction. Detailed slope stability calculations are provided in Appendix F and should be reviewed as it relates to each cross-section independently.

4.1.1 Analysis Procedure

The stability analyses included three distinct cross-sections identified as Stations 55+00, 75+00, and 77+00 on GEOServices Temporary Access Road conceptual drawing dated July 27, 2020. These sections were selected as they represented the maximum cut, fill, and existing slopes that would be required as part of the barrier wall construction. Slope analysis utilized Slide2 (Rocscience version 9.010) limit equilibrium slope modeling software and the Spencer complete equilibrium method to evaluate global stability along potential circular failure surfaces. The groundwater table was based on the elevations from the pore pressure dissipations performed as part of the penetration testing. Additionally, an assumed roadway surcharge of 500 psf was included to account for the equipment loading during barrier wall construction. Once the equipment type and barrier wall installation methodology are selected the surcharge value and extents should be verified.

4.1.2 Material Parameter Selection

Seven different materials are considered in the analysis profile: these materials consisted of the following: 1) upper sand, 2) upper lean clay, 3) upper fat clay, 4) lower fat clay, 5) new fill soils, and 6) roadway material. The unit weights and strength parameters utilized during the analysis were based primarily on the laboratory testing performed as part of this exploration. These parameters were then adjusted to account for changes in soil consistency identified by SPT N-values as well as the available CPT data. In some instances, final adjustments were made to consider published soil strength parameter standards such as NAVFAC. The material parameters utilized for the stability analysis of the proposed roadway are summarized in the table below.

Table 3 – Slope Stability Modeling Parameters

Layer Name	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)
Upper Sand	115	0	28
Upper Lean Clay	120	100	24
Upper Fat Clay	125	100	26
Lower Fat Clay	110	100	26
New Fill Soils	115	0	30
Roadway Material	145	0	45

4.1.3 Slope Geometry

The slope geometry at the three identified critical cross-sections was obtained from the Temporary Access Road Conceptual Drawing prepared by GEOServices and dated July 27, 2020. The three critical sections are located at Stations 55+00, 75+00, and 76+00.

The first section that was analyzed was the fill slope on the lower side and the cut slope on the upper side at Station 55+00. The lower slope was constructed at an inclination of 2H:1V with a maximum height of 4 feet. Additionally, the slope continues downward at an inclination ranging from 3.6H:1V to 4.4H:1V. The upper slope is constructed at an inclination of 2H:1V with a maximum height of 9 feet. Additionally, the slope continues upward at an inclination ranging from 2H:1V to 2.8H:1V. The roadway section is located between the upper and lower slopes with a width of 14 feet. A roadway surcharge of 500 pounds per square foot (psf) was applied along the centerline for a width of 10 feet.

The second section that was analyzed was the natural slope on the lower side and the cut slope on the upper side at Station 75+00. The lower slope is currently at the natural inclination ranging from 1.5H:1V to 1.9H:1V for a maximum height of 14 feet. The upper slope is constructed at an inclination of 2H:1V with a maximum height of 19 feet. Additionally, the slope continues upward at an inclination ranging from 6H:1V to 8H:1V. The roadway section is located between the upper and lower slopes with a width of 14 feet. A roadway surcharge of 500 psf was applied along the centerline for a width of 10 feet.

The third section that was analyzed was the fill slope on the lower side and the cut slope on the upper side at Station 76+00. The lower slope is constructed at an inclination of 2H:1V with a maximum height of 12 feet. Additionally, the slope continues downward at an inclination ranging from 6H:1V to 20H:1V. The upper slope is constructed at an inclination of 2H:1V with a maximum height of 12 feet. Additionally, the slope continues upward at an inclination ranging from 10H:1V to 13H:1V. The roadway section is located between the upper and lower slopes with a width of 14 feet. A roadway surcharge of 500 psf was applied along the centerline for a width of 10 feet.

4.1.4 Stability Analysis Results

The results of the global stability analysis results are presented in the table shown below. Sample slope stability plots and outputs are provided in Appendix F of this report. The stability plots show the center of rotation and failure path for the critical (lowest) failure surface located and the corresponding factor of safety. The calculated factors of safety are tabulated below.

Table 4 – Slope Stability Modeling Results

Station	Case	Calculated F.O.S.	Target F.O.S.
55+00	Lower Slope Global (Proposed)	1.14	1.5
	Upper Slope Global (Proposed)	1.06	1.5
75+00	Lower Slope Global (Proposed)	1.04	1.5
	Upper Slope Global (Proposed)	1.2	1.5
76+00	Lower Slope Global (Proposed)	1.16	1.5
	Upper Slope Global (Proposed)	1.06	1.5

4.1.5 Stability Analysis Conclusions

The proposed slope sections constructed at inclinations of 2H:1V do not exhibit adequate factors of safety, even for temporary slopes. This was expected based on the failures observed during limited traffic loading and the short duration of exposure for the temporary access road (during the subsurface exploration) for drilling. Once it was determined with the modeling that the existing slope inclinations were not adequate, the analyzed slopes were flattened in the model and the slopes were reanalyzed until an adequate factor of safety was observed. Maximum inclinations of 3H:1V the embankment and slopes exhibit adequate factors of safety against global failure at the sections analyzed (Table 5 and Appendix F).

Table 5 – Slope Stability Modeling Results

Station	Case	Calculated F.O.S.	Required F.O.S.
55+00	Lower Slope Global (3H:1V)	1.73	1.5
	Upper Slope Global (3H:1V)	1.60	1.5
75+00	Lower Slope Global (3H:1V)	1.64	1.5
	Upper Slope Global (3H:1V)	1.66	1.5
76+00	Lower Slope Global (3H:1V)	1.65	1.5
	Upper Slope Global (3H:1V)	1.60	1.5

To complete the barrier wall investigation, a clearing width of approximately 100 feet was centered on the barrier wall roadway alignment. While these clearing limits were adequate for the conceptual plan that was provided (slope inclinations of 2H:1V), results of the stability analysis indicate that the maximum slope inclination of the roadway slopes should be 3H:1V. It should be noted that existing slope inclinations are steeper than 3H:1V and will likely require regrading for permanent slopes. The flattening of the slope inclinations will require construction of some small retaining walls to optimize the earthwork volumes. The designer of the barrier wall access road will have to balance wall cost with additional earthwork to determine the most cost-effective alternative.

While the 3H:1V slopes exhibit acceptable factors of safety against global failure in modeling scenarios, it is our experience that improper control of surface drainage or inadequate slope maintenance can lead to problems with surficial stability (particularly in sandy soils). The final grading plan for the roadway should include diversion berms at the crests of slopes to divert surface runoff from the slope face. The toe of the slope should also be graded to provide positive drainage and prevent ponding of water. In addition, erosion control fabric is recommended on the slope face to aid in the establishment of permanent vegetative cover. Regular maintenance of the slope should include repairing bare spots and areas of erosion in a timely manner.

4.2 SETTLEMENT

Construction of the access road will result in fill depths on the order of 10 to 15 feet at several sections of the alignment, based on current topography measurements. Data from the field exploration and laboratory testing were used to estimate the consolidation settlement within the overburden soils which would result from the weight of the fill. For the deepest fill sections (up to 15 feet), the maximum post-construction settlement is estimated to be approximately 1.5 inches. Due to the sandy nature of many of the underlying soils and the anticipated fill composition, this settlement will likely occur in a period of less than 120 days after fill placement. Given that the barrier wall installation will occur prior to paving of the access road, a significant portion of the consolidation settlement is expected to be completed well before the final paving and utilities are placed.

4.3 RETAINING WALL RECOMMENDATIONS

4.3.1 Foundation Recommendations

Foundations for any potential retaining structures are anticipated to bear in stiff or better newly placed fill soil or existing alluvial soils. The recommended allowable bearing pressure for design of the foundations is 3,000 pounds per square foot (psf). If a mechanically stabilized earth (MSE) walls are utilized, the foundation bearing area considered should encompass the area from the front of the facing unit to the end of the geogrid reinforcement.

Shallow foundation bearing capacity and deep foundation resistances should be used without increase for seismic case. However, design should consider the typical reduction of design factor of safety for seismic loading (which typically equates to the historical one-third increase in resistance for transient loading).

Foundation subgrade observations should be performed by a GEOServices geotechnical engineer, or a qualified representative, so that the recommendations provided in this report are consistent with the site conditions encountered. This is of elevated importance due to the small variations that can be encountered in small lateral distances within the floodplain deposits and surficial soils. A dynamic cone penetrometer (DCP) is commonly utilized to provide information that is compared to the data obtained in the geotechnical report. Where unacceptable materials are encountered, the material should be excavated to stiff, suitable soils or remediated at the geotechnical engineer’s direction. Typical remedial measures consist of undercutting, overexcavation, or combinations thereof.

4.3.2 Lateral Earth Pressures

At this time, no retaining walls are planned; however, with the grading changes required to accommodate the 3H:1V slopes, retaining walls may be a cost/time effective alternative to additional clearing and grading. Therefore, equivalent fluid pressures are provided below for multiple backfill conditions for cantilever-type walls. Three cases are considered: 1) active earth pressure for granular backfill (clean sand or gravel); 2) at-rest earth pressure for granular backfill; and, 3) at-rest earth pressure for fine-grained (silty or clayey sands) backfill.

Condition 1 - The active earth pressure for granular backfill (free draining) will result in an equivalent fluid pressure of 28.4 pounds per cubic foot (pcf). If the granular backfill is to develop active earth pressure conditions, walls must be flexible and/or free to rotate or translate at the top approximately one inch laterally for every 20 feet of wall height.

Condition 2 - The at-rest earth pressure for granular backfill (free draining) will result in an equivalent fluid pressure of 45.2 pcf. For retaining walls that will not rotate or translate, such as building walls or other walls rigidly connected to structures, at-rest conditions will develop.

Condition 3 - Walls backfilled with fine-grained material (silty or clayey sands) should be designed using the at-rest earth pressure whether restrained at the top, or not. Fine-grained soils typically creep over time which produces additional lateral stresses to the wall. The equivalent fluid pressure for this case is 57.5 pcf.

In all cases, forces from any expected surcharge loading including sloping backfill should be added to the equivalent fluid pressures. The walls should be properly drained to remove water or hydrostatic pressure should be added to the design pressure. Also, all backfill for the walls should be placed in accordance with the structural fill recommendations described hereinafter.

Table 6 – Static Earth Pressure Summary

Earth Pressure Condition	Backfill Type	Unit Weight (pcf)	Earth Pressure Coefficient*	Equivalent Fluid Pressure
Active (Ka)	Granular	105	0.27	28.4
	On-Site Silty and Clayey Sands	115	0.33	38.0
At-Rest (Ko)	Granular	105	0.43	45.2
	On-Site Silty and Clayey Sands	115	0.5	57.5
Passive (Kp)	Granular	105	3.69	--
	On-Site Silty and Clayey Sands	115	3.0	--

Note: In each instance the earth pressure coefficients provided are unfactored.
**Earth pressure coefficients are based on a flat backslope condition.*

For rigid, cast-in-place concrete walls, a friction factor of 0.45 between foundation concrete and the bearing soils may be used when evaluating friction. If a stone leveling course is utilized beneath the foundation, a friction factor of 0.55 between foundation concrete and the dense graded aggregate base may be used when evaluating friction.

Also, an ultimate passive earth pressure resistance of well-compacted soil fill can be utilized to resist sliding (in conjunction with friction). However, to limit deformation when relying on passive strength, we recommend using a minimum safety factor of 3.0 applied to the ultimate passive resistance value. Additionally, this is based on the upper 2 feet of soil being neglected during the calculation of passive resistance.

4.4 SEISMIC SITE CONDITIONS

In accordance with the International Building Code (2018) we have provided the following table of seismic design information for the site. After evaluating the subsurface conditions at each boring individually, it was determined that the barrier wall and roadway would be located within seismic site class D. A table follows, showing the calculated spectral response accelerations for both a short and 1-second period. These values are provided for informational purposes only.

Applicability of seismic design requirements and considerations should be determined by the designer of each geotechnical structure along the barrier wall alignment.

Table 7 – Seismic Conditions Summary

S_S g	S_1 g	S_{DS} g	S_{D1} g	PGA g	PGA_M g
0.171	0.076	0.183	0.122	0.086	0.138

4.5 PAVEMENT DESIGN RECOMMENDATIONS

4.5.1 Temporary Roadway Construction (for Barrier Wall Installation)

The barrier wall roadway will be constructed to create access for the equipment necessary to install the barrier wall. After grading, the barrier wall will be installed prior to final paving. At this time multiple technologies are being considered for the barrier wall each with its own requirements and limitations. While the exact requirements for equipment support will be unknown until the barrier wall technology is selected, the degradation of the temporary access road during this exploration process indicates that some temporary stabilization of the roadway will be required regardless of the selected technology. This is especially true due to the increased traffic that will be present during construction coupled with the construction schedule duration likely requiring work during and/or after rain events.

Traditionally, temporary access roads are stabilized by utilizing geo-grid or larger stone sections. In the case of the barrier wall installation, the temporary roadway will have to be penetrated by the equipment. As such, the temporary roadway design will have to be stable enough to support the proposed traffic and equipment yet still penetrable by the equipment. Once the construction methodology is selected, GEOS can provide multiple temporary pavement sections for contractor pricing.

4.5.2 Flexible Pavement Design

Based on conversations with Chemours personnel, it is understood that the roadway will be lightly loaded after barrier wall construction. AASHTO flexible pavement design methods have been utilized for pavement recommendations. Pavement recommendations are based on the assumptions that the subgrade has been properly prepared per recommendations in this report. A design CBR of 8, a design life of 20 years and a terminal serviceability of 1.5 were utilized for the design. Flexible pavement design loading considers traffic of 50,000 ESALs.

Table 8 – Flexible Pavement Section Summary

Recommended Thickness (Inches)	
Asphalt Type	**S9.5B**
Bituminous Asphalt Surface Mix	2.5
Bituminous Asphalt Base Mix	--
Compacted Crushed Aggregate Base	6.0

Pavement base stone equivalent to an ABC Gradation in accordance with NCDOT Specifications Section 1005 is recommended for all flexible pavements. The bituminous asphalt pavement should be Grading “78M” as per section 1005 for the surface mix. Compaction requirements for the crushed aggregate base and the bituminous asphalt pavement should generally follow North Carolina Department of Transportation specifications.

The recommended pavement thickness presented in this report section are considered typical and minimum for the assumed parameters in the general site area. Budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, the owner, and the project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life.

4.5.3 General

Pavement recommendations are based upon the assumption that the subgrade has been prepared as described in previous report sections and that any off-site soil borrow to be used to backfill to the final subgrade meets the requirements for structural soil fill.

All paved areas should be constructed with positive drainage to direct water off-site and to minimize surface water seeping into the pavement subgrade. The subgrade should have a minimum slope of 1 percent. In down-grade areas, the basestone should extend through the slope to allow any water entering the basestone a path to exit. Water-tight seals should also be provided at formed construction and expansion joints for any rigid pavements.

4.6 SITE PREPARATION RECOMMENDATIONS

4.6.1 Subgrade

Site stripping within the proposed construction areas should include the removal of topsoil, vegetation, unsuitable fill, and deleterious materials (if encountered). The stripping operations should extend a minimum of 5 feet beyond the limits of proposed fill areas. The vegetation should be removed from the site and not utilized as fill material. However, the topsoil can be utilized in non-structural/ non-slope areas (i.e. green spaces). Placement in these areas should be observed by a geotechnical engineer upon grading to confirm the recommendations in this report are followed.

After the completion of stripping operations and excavation to reach the planned subgrade elevation, the subgrade should be initially densified with a vibratory smooth drum compactor and then proofrolled with a fully-loaded, tandem-axle dump truck or other pneumatic-tired construction equipment of similar weight. The geotechnical engineer or a qualified representative should observe proofrolling. Areas judged to perform unsatisfactorily (e.g., pumping and/or rutting) by the engineer should be undercut and replaced with structural soil fill or remediated at the geotechnical engineer's recommendation. Areas to receive structural soil fill should also be proofrolled prior to the placement of new fill. Proofrolling operations shall be extended a distance of 10 feet beyond the edge of the building and 5 feet beyond the edge of pavement areas.

The existing sandy soils may rebound elastically or "fluff-up" within the upper 12 to 24 inches after the removal of several feet of confining overburden soils. In cuts where this condition may exist, the elastic rebound problem may be handled by compacting the exposed surface in cut with proper compaction equipment.

4.6.2 Structural Soil Fill

Material considered suitable for use as structural fill should be clean soil free of organics and other deleterious material, containing no rock fragments greater than 6 inches in dimension. Preferably, structural soil fill material should be classified as SP, SP-SM, SM or SC and have less than 35% passing the #200 sieve. All material to be used as structural fill should be tested by the geotechnical engineer to confirm that it meets the project requirements before being placed.

Structural fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Each lift should be compacted to at least 98 percent of the soil's maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus (-) 3 percent to plus (+) 3 percent of the optimum moisture content. Each lift should be tested by geotechnical personnel to confirm that the contractors' method is capable of achieving the project requirements before placing subsequent lifts. Areas which have become soft or frozen should be removed before additional structural fill is placed.

Fill slopes should be compacted in horizontal benches, to the above specifications, beyond the actual horizontal limits of the slope. The excess fill should then be cut from the face of the fill slope using a dozer or other earthwork equipment. The pushing of soil over the slope and compacting the soil to the slope edge does not provide adequate compaction for the face of the slope and is unacceptable.

4.6.3 Compacted Crushed Stone Fill

Properly compacted dense graded aggregate may be used as fill below the building or pavement subgrade areas, particularly in areas where soft soil conditions are encountered and undercut near subgrade level. Dense graded aggregate may be used provided that the aggregate is compacted to a minimum of 98 percent of the standard Proctor. The crushed stone fill should be placed in loose, horizontal lifts not exceeding 10 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus 2 percent to plus 2 percent of the optimum moisture content. Each lift should be tested by the geotechnical representative to confirm that it meets the project requirements before placing any subsequent lifts.

4.7 BARRIER WALL DESIGN ALTERNATIVES

4.7.1 General

As part of the Consent Order, a barrier is to be constructed at the subject site. The purpose of the barrier wall system is to reduce the loading of the untreated groundwater from entering the Cape Fear River watershed along a specified alignment on the property.

Barrier walls are designed to provide a zone of low hydraulic conductivity material of sufficient thickness to discourage the migration of groundwater along the naturally occurring path. Two general methodologies are used to construct barrier walls: (1) material improvement; and, (2) material replacement. Improvement methods add a slurry or cement additive and mix with in-situ soils to decrease the hydraulic conductivity. Conversely, in replacement methods, the in-situ soils are removed from a section and replaced with a backfill material designed to meet project performance requirements. Both methods are designed based on the project performance requirements and need to be evaluated with trials and robust field QA/QC programs.

Several technologies exist within the two general barrier wall methodologies; many of which are proprietary, in design and tooling, to the specialty contractors that install the walls. Based on conversations with specialty contractors, GEOS considered four methods of barrier wall construction: Deep Soil Mixing, Cutter Soil Mixing, Trench Cutting and Remixing, and Clamshell Replacement. Other methods such as vibrating beam and jet grouting were proposed by contractors contacted during the exploration phase, but were excluded from consideration based on the depth of treatment anticipated (vibrating beam) and in-situ soil conditions (jet grouting) anticipated for the subject site. Each of the considered methods is summarized below.

4.7.2 Material Improvement Methods: Deep Soil Mixing

Deep Soil Mixing (DSM) is a general term for the improving in-situ soils through mechanical mixing of in-situ soils with binders (cement or other pozzolanic materials) to improve the target engineering properties of the system. Several variations of DSM exist using both wet and dry binder materials depending on site conditions.

The typical setup for DSM is side-by-side paddle mixer heads that rotate about vertical axes like typical auger tooling attached to top drive equipment. As the auger-mixers rotate, dry or slurried binder is injected through the stem of the augers and mixed with the in-situ soil as the tooling is inserted and removed, while rotating, creating overlapping cylinders of soil-binder mix on each pass. The resulting overlapping cylinders form a mixed panel of improved soil/binder slurry. The size of the overlapping columns (width of wall) is customizable with diameters of 2ft to 4ft being typical. The process is monitored in real-time using digital rig-monitoring software and grab samples of the resulting slurry mix. Core samples of the finished wall are preferred for confirmation of hydraulic conductivity, strength, and durability parameters. The table below outlines both the advantages and disadvantages associate with this system.

Table 9 – Deep Soil Mixing

Advantages	utilization of in-situ soils for improved performance
	variable sizes that can optimize the design based on the seepage modeling
	relatively small volume of spoils compared to other methods
Disadvantages	verticality and overlap quality rely on electronic rig monitoring and are difficult to field verify
	sampling and observation very important to achieve continuous wall required for barrier function

4.7.3 Material Improvement Methods: Cutter Soil Mixing

Cutter Soil Mixing (CSM) is similar in theory to DSM but instead of using circular paddle mixers rotating about vertical axes, the CSM head (sometimes called a hydromill) has cutter wheels rotating about horizontal axes. The CSM head injects binder while thoroughly mixing soils and binder using wheels and cutter teeth to shear the soil/binder mix. Each pass of the cutter head creates a panel and panels are overlapped to create a continuous wall. The process is monitored using digital rig-monitoring software and grab samples of the resulting slurry mix. Coring of the panel joints and selected panels is preferred for confirmation of design properties. The table below outlines both the advantages and disadvantages associate with this system.

Table 10 – Cutter Soil Mixing

Advantages	utilization of in-situ soils for improved performance
	thorough mixing and consistent panel dimensions
	increased depth of treatment available compared to DSM
Disadvantages	panel width limited by cutter head size
	sampling and observation very important to achieve continuous wall required for barrier function

4.7.4 Material Improvement Methods: Trench Cutting and Remixing

Trench cutting and remixing uses a full depth vertical cutting head resembling a large chain saw mounted on a crawler machine to cut and mix the soil vertically with cementitious material. This method is similar to other mixing methods in that it utilizes in-situ soils and improves their engineering properties with the addition of cementitious material. Contrary to other mixing methods, trench cutting continually mixes along the full depth of the barrier wall using injection ports along the cutter head, and moves in continuous sections along the alignment, eliminating the panel overlaps present in other methods. The table below outlines both the advantages and disadvantages associate with this system.

Table 11 – Trench Cutting and Remixing

Advantages	uniform mixing along continuous path minimizes joints and possible discontinuities which are possible in other methods
	inclinometer readings along the machine post provide real-time feedback of wall verticality along full-height
	trench is stable without the use of slurry
Disadvantages	constant panel sections are completed in long stretches and may require an increase in labor presence

4.7.5 Material Replacement Methods: Clamshell Replacement

A straightforward method for full material replacement is the Clamshell method of lowering a clamshell bucket attached to large spool crane machines. When the bucket is pulled up, the jaws of the bucket close and excavate material which is then raised out of the hole and deposited into trucks. This method requires a guidewall to be constructed along the alignment to assist in maintaining verticality of the bucket. During excavation, slurry is used to stabilize the panels as the clamshell is inserted and removed during the excavation process, and the slurry needs to be controlled, desanded, and disposed of at the end of the job. Panels are excavated along the alignment forming a continuous excavation that is filled with concrete, grout, or other low-permeability material to form the barrier wall.

Table 12 – Trench Cutting and Remixing

Advantages	complete replacement of in-situ materials with lower permeability material
	variable sizes that can optimize the design based on seepage modeling
	can be extended to greater depths because head is not fixed mast
	QA/QC monitored with sonar and can be performed in slurry before replacing with cementitious material
Disadvantages	verticality difficult to maintain and verify
	requires slurry to stabilize the trench (slurry has to be controlled and disposed of after construction)
	slurry requires desanding or other on-site support equipment for storage, treatment, and disposal
	guidewall must be constructed before clamshell placement begins
	volume of spoils much higher than mixing and would require traffic of trucks for haul off
	excavation and pouring of wall separate options and separate equipment

4.7.6 Estimated Barrier Wall Depth

We understand that as part of the Consent Order, a barrier is to be constructed at the subject site. The purpose of the barrier is to reduce the loading of the untreated groundwater from entering the Cape Fear River watershed along a specified alignment on the property. The barrier wall will be extended from the proposed alignment and extended (keyed) into the upper Cape Fear confining unit. Ultimately, the depth of embedment and barrier wall thickness will be selected based on the results of the seepage modeling during the design process. However, as various technologies are evaluated based on their viability for this project, we believe the anticipated depth to the confining layer as well as the fluctuation within this layer will be beneficial to the technology selection process. As such, the table below provides the approximate elevation and depth of the upper Cape Fear confining unit. Mud rotary (SPT) borings collected along the alignement were predominately utilized to delineate the confining unit..

Table 13 – Depth to Confining Layer

Station Number	Approximate Depth to Confining Layer (feet)	Elevation at top of Confining Layer (feet)
0+00	70	4.5
5+00	77	-3.0
10+00	72	-0.5
15+00	57	13.5
20+00	67	6.0
25+00	67	4.0
30+00	67	9.0
33+50	79	4.0
37+50	68	12.5
42+50	77	-5.5
47+50	62	10.0
52+50	62	15.5
57+50	67	11.5
62+50	51	25.0
67+50	77	-5.5
72+50	77	2.0
77+50	62	16.5
82+50	77	5.5
87+50	72	6.0

4.7.7 Pre-Construction

The geotechnical information in this report should be provided to potential contractors to be used for conceptual discussions on the most appropriate construction approach for the soil and groundwater conditions at this site. GEOS should be involved in all contractor conversations regarding the form, function, and construction of the barrier wall. At the time this report was prepared, we understand Chemours has limited the contractors to Dewind Dewatering and Keller North America.

Selection of the construction methodology is of paramount importance to facilitate the on-going design of the project. The construction method will dictate the required width of construction access, dictate the thickness of the barrier wall, dictate the amount the depth can be fluctuated, and provide the range potential permeabilities that can be reasonable achieved during the construction method.

Once the construction method is selected, GEOS will provide separate recommendations for site preparation for support equipment areas (mixing plants, slurry storage, etc) and support equipment traffic. With the length of the wall, it is likely that multiple support areas will need to be constructed to facilitate construction, regardless of the method selected.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 EXCAVATIONS

At the time this report was prepared, the barrier wall roadway design has not yet been finalized. As mentioned previously, isolated retaining walls may be utilized to facilitate grade change in some portions of the alignment. Depending on the wall type selected, temporary excavations will likely be required for placement. Depending on the wall construction process, temporary excavations or shoring may be required. Once the excavation requirements are provided, GEOServices can assist the design team in the design of the temporary excavation or if necessary, the shoring/bracing.

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service and under no circumstances should GEOServices be assumed to be responsible for construction site safety.

5.2 MOISTURE SENSITIVE SOILS

The soils encountered at this site will be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Construction traffic patterns should be varied to prevent the degradation of previously stable subgrade. In addition, plastic soils which become wet, may be slow to dry and thus significantly impact the progress of grading and compaction activities. If site grading is performed during the wet weather season, methods such as discing and allowing the material to dry will likely be required to meet the required compaction recommendations. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather. Climate data for Fayetteville, NC obtained from Weatherbase indicate in the following table the average monthly precipitation.

Table 14 – Average Precipitation Summary

Month	Monthly Precipitation Average (Inches)	Month	Monthly Precipitation Average (Inches)
January	3.5	July	5.8
February	3.6	August	5.7
March	3.8	September	4.3
April	3.3	October	2.7
May	3.6	November	2.8
June	4.7	December	3.2

5.3 DRAINAGE AND SURFACE WATER CONCERNS

To reduce the potential for undercut, water should not be allowed to collect on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, subsurface water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water into prepared subgrades. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

6.0 LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of geotechnical practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the borings will not become evident until construction. We recommend that GEOServices be retained to observe the project construction in the field. GEOServices cannot accept responsibility for conditions which deviate from those described in this report if not retained to perform construction observation and testing. If variations appear evident, recommendations from this report should be re-evaluated. In the event that any changes in the nature, design, or location of the project are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may have to be re-evaluated.

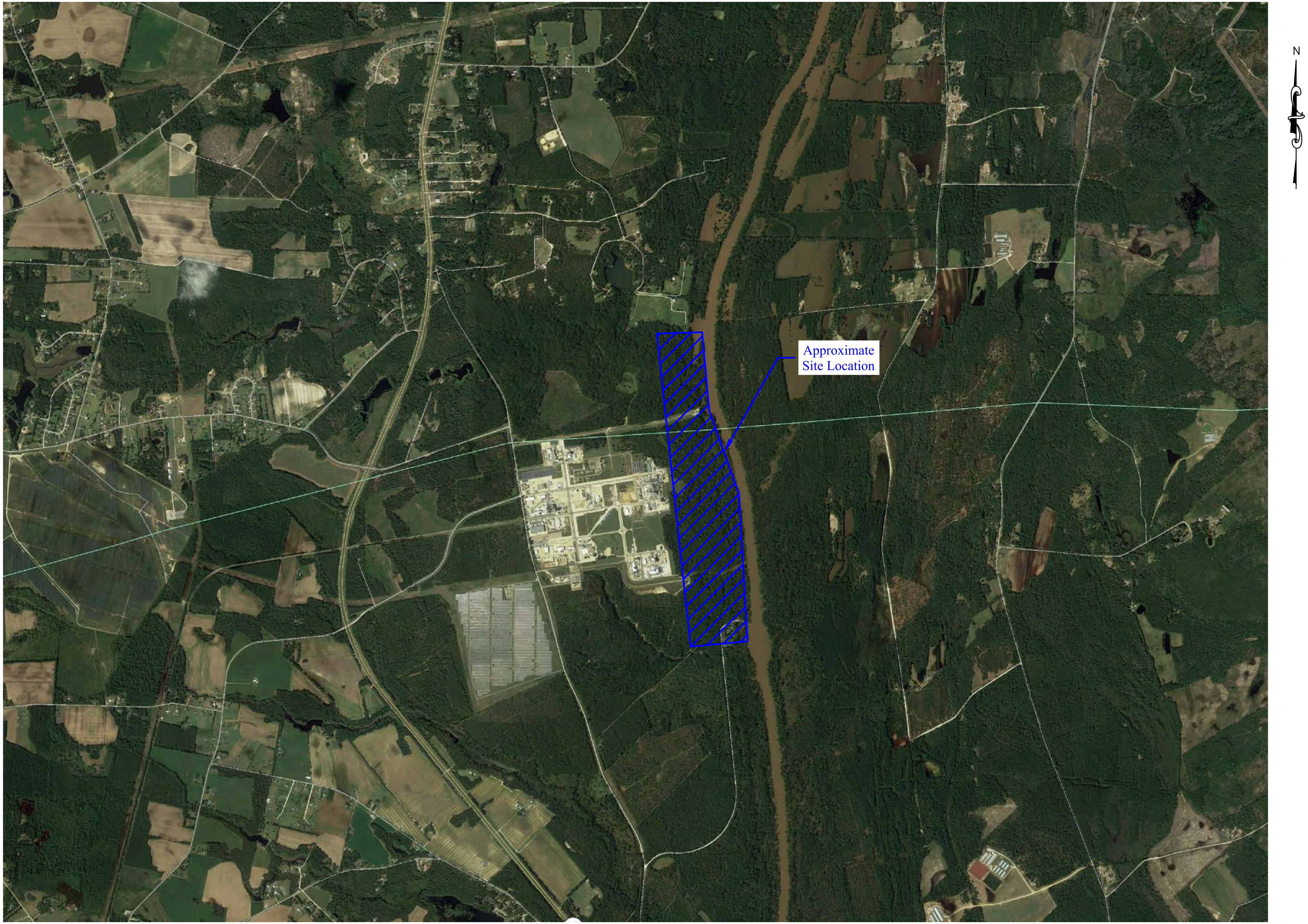
GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX A

Figures and Test Boring Records

GEOServices, LLC, Geotechnical and Materials Engineers

Figures



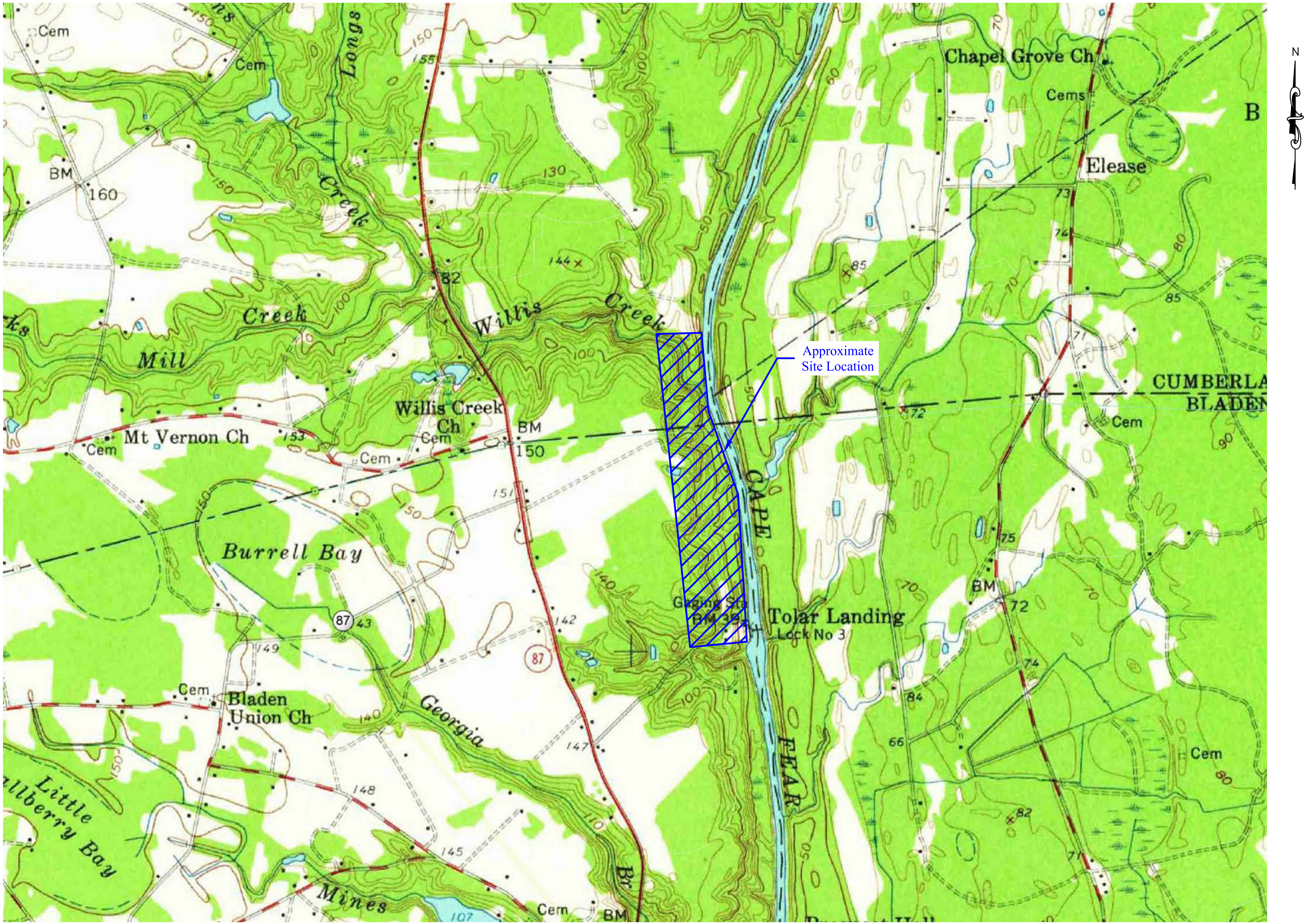
NOTES:
1.) BASE MAP PROVIDED BY GOOGLE EARTH PRO (9/18/18).

SITE VICINITY MAP
Chemours Barrier Wall
Fayetteville, North Carolina

DRAWN BY:	JTH
APPROVED BY:	DKK
SCALE:	NTS
JOB NO.:	41-20500
DATE:	12/4/2020

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
5559 North Lee Highway
Cleveland, Tennessee 37312
Phone: (423) 614-6471
Fax: (423) 614-6479

FIGURE 1



NOTES:

1.) BASE MAP PROVIDED BY USGS TOPOGRAPHIC MAP (1959) - SAINT PAULS QUADRANGLE (NC).

USGS TOPOGRAPHIC MAP

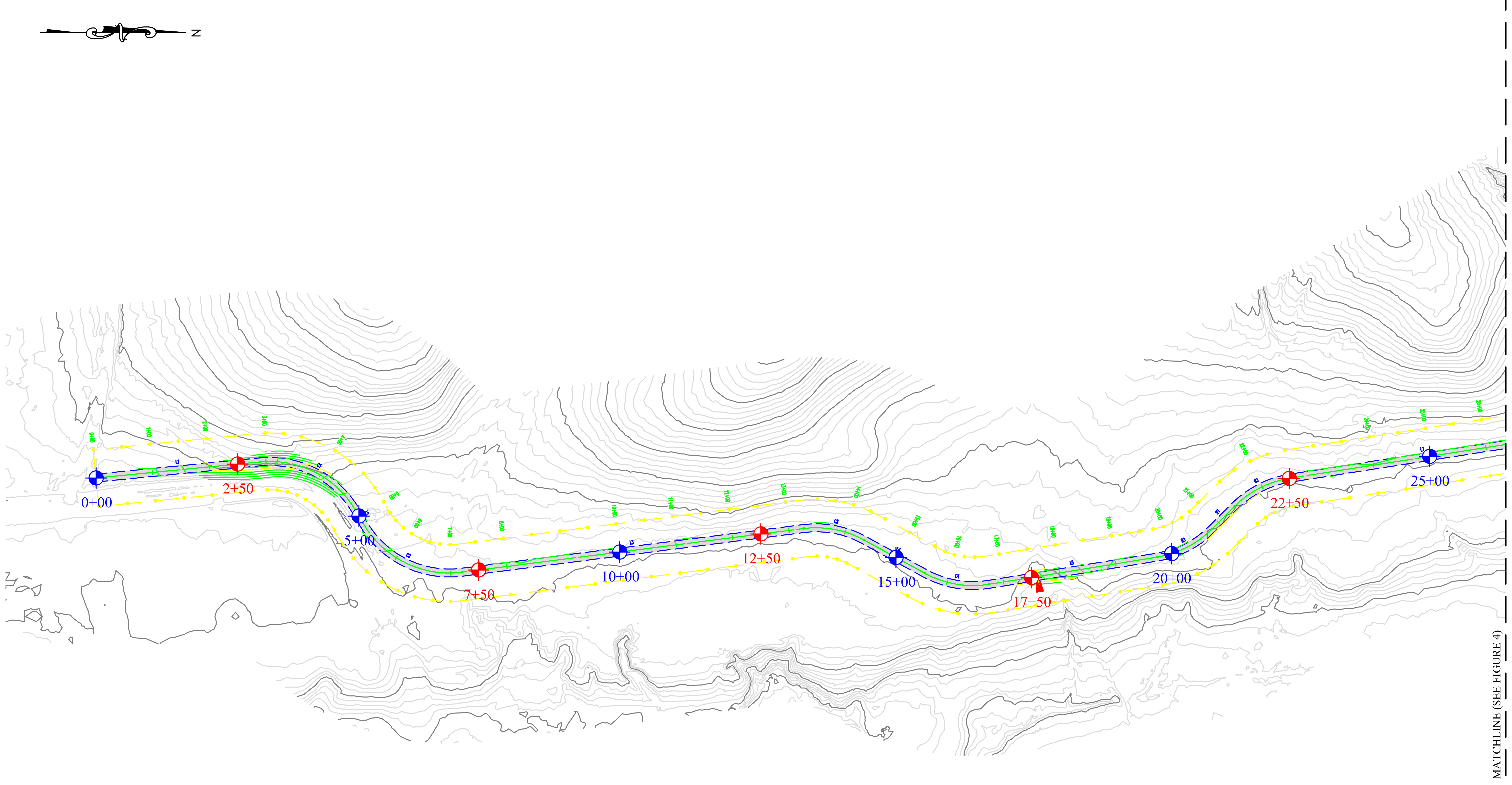
Chemours Barrier Wall

Fayetteville, North Carolina

DRAWN BY:	JTH
APPROVED BY:	DKK
SCALE:	NTS
JOB NO.:	41-20500
DATE:	12/4/2020

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
5559 North Lee Highway
Cleveland, Tennessee 37312
Phone: (423) 614-6471
Fax: (423) 614-6479

FIGURE 2



NOTES:

1.) BORING LOCATIONS ARE SHOWN IN GENERAL ARRANGMENT ONLY.
2.) DO NOT USE BORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY ROBERT G. CAMPBELL & ASS.

🔵	LOCATION OF SOIL TEST BORING (SPT)
🔴	LOCATION OF SOIL TEST BORING (CPT)

BORING LOCATION PLAN
Chemours Barrier Wall
Fayetteville, North Carolina

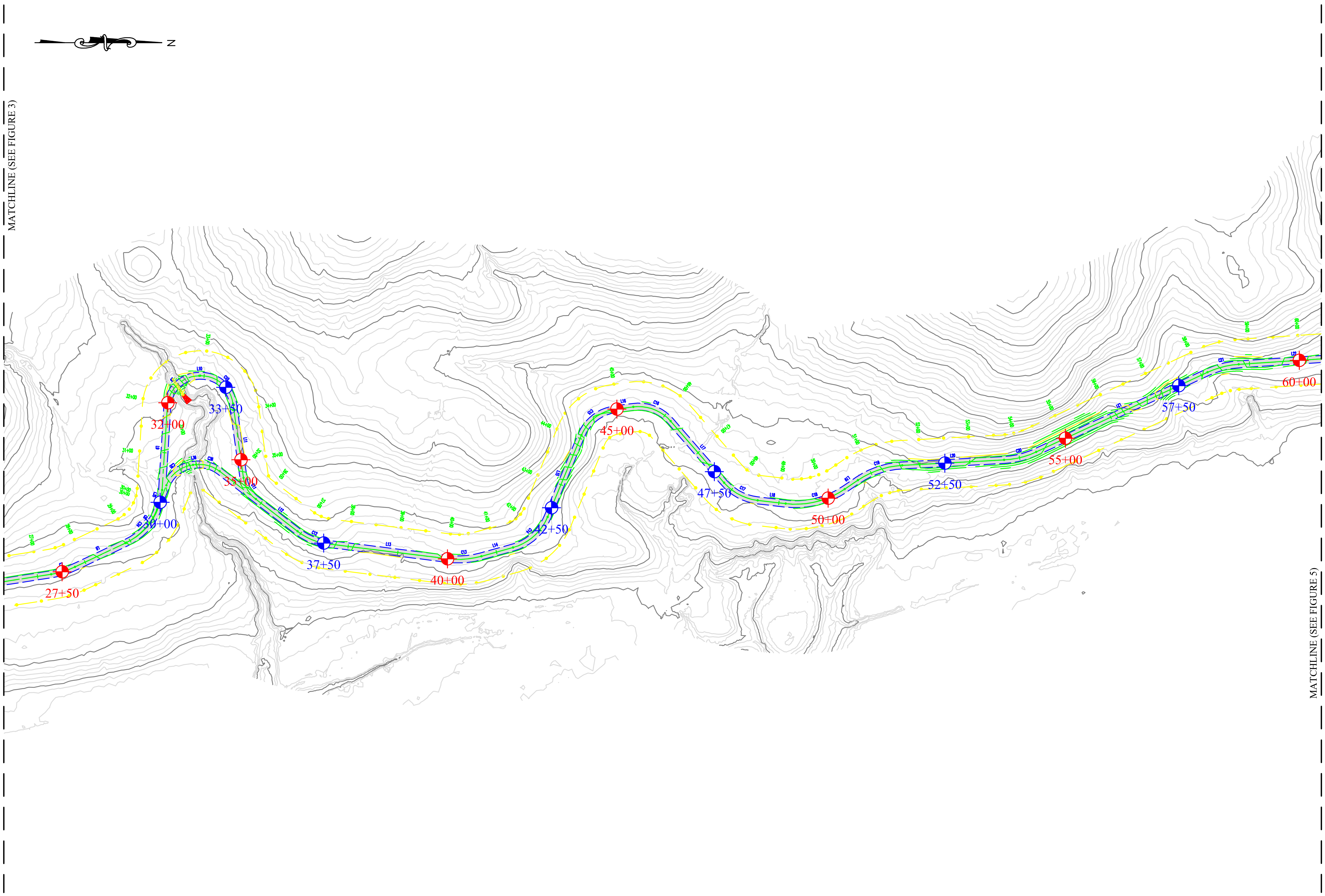
DRAWN BY:	JTH
APPROVED BY:	DKK
SCALE:	NTS
JOB NO.:	41-20500
DATE:	12/4/2020

GEOServices, LLC-Geotechnical and Materials Engineers

5559 North Lee Highway
Cleveland, Tennessee 37312

Phone: (423) 614-6471
Fax: (423) 614-6479

FIGURE 3



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🔵 LOCATION OF SOIL TEST BORING (SPT)
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BORING LOCATION PLAN
Chemours Barrier Wall
Fayetteville, North Carolina

DRAWN BY:	JTH
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5559 North Lee Highway
Cleveland, Tennessee 37312
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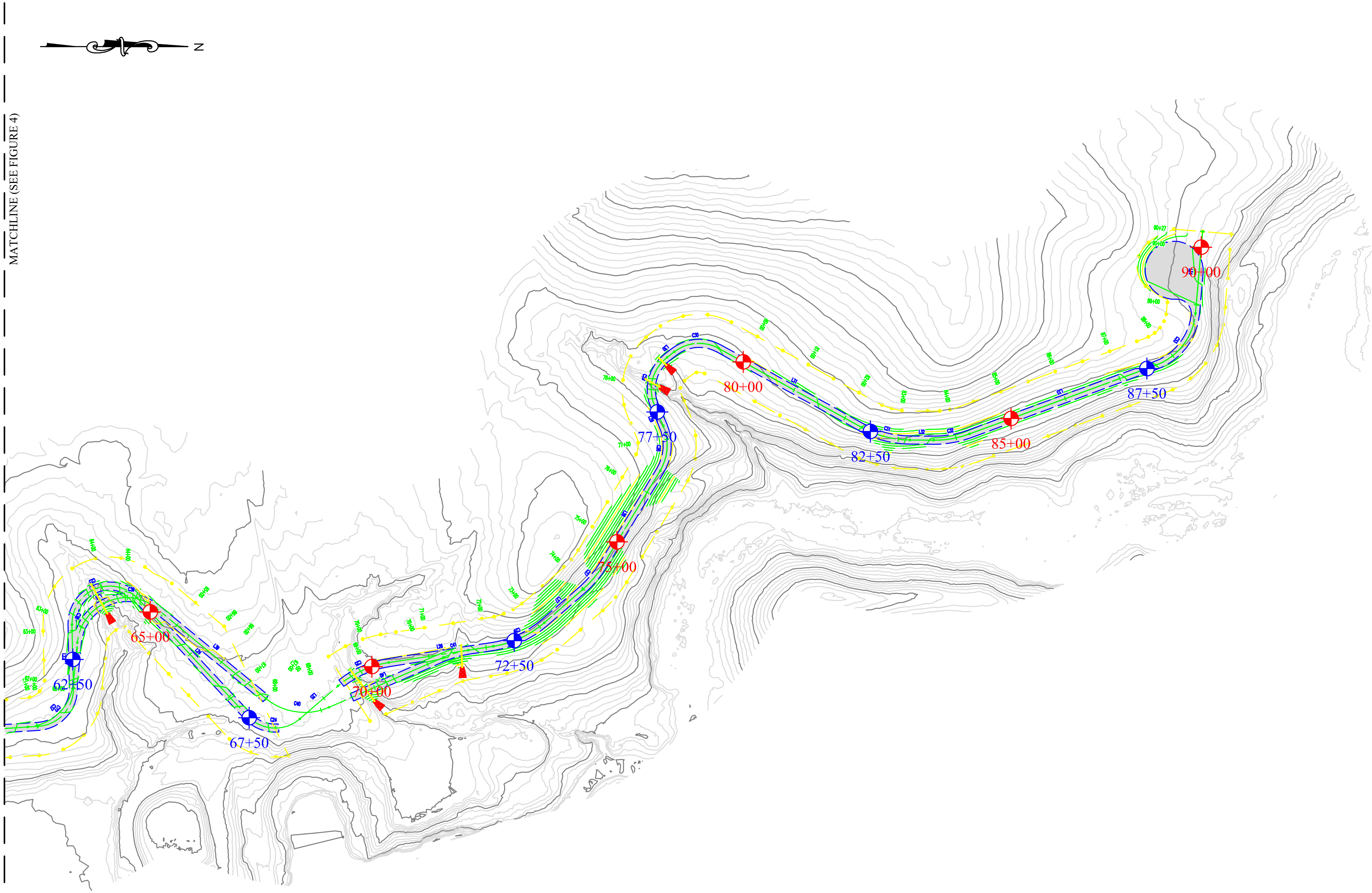
FIGURE 4



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🔵 LOCATION OF SOIL TEST BORING (SPT)
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BORING LOCATION PLAN
Chemours Barrier Wall
Fayetteville, North Carolina

DRAWN BY:	JTH
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FIGURE 5

GEOServices, LLC, Geotechnical and Materials Engineers

Test Boring Records (SPT)

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

BOULDERS: GREATER THAN 300 mm
COBBLES: 75 mm to 300 mm
GRAVEL: 4.74 mm to 75 mm
COARSE SAND: 2 mm to 4.74 mm
MEDIUM SAND: 0.425 mm to 2 mm
FINE SAND: 0.075 mm to 0.425 mm
SILTS & CLAYS: LESS THAN 0.075 mm

COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0 - 500
3 - 4	SOFT	500 - 1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATON. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140 LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

ST: UNDISTURBED SAMPLE
SS: SPLIT SPOON SAMPLE
CORE: ROCK CORE SAMPLE
AU: AUGER OR BAG SAMPLE

SOIL PROPERTY SYMBOLS

N: STANDARD PENETRATION, BPF
M: MOISTURE CONTENT %
LL: LIQUID LIMIT %
PI: PLASTICITY INDEX %
Qp: POCKET PENETROMETER VALUE, TSF
Qu: UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW: DRY UNIT WEIGHT, PCF

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
0 TO 25	VERY POOR

ROCK HARDNESS

VERY SOFT: ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.

SOFT: ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND CRUMBLES WITH FIRM HAND PRESSURE.

MODERATELY HARD: SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.

HARD: ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.

VERY HARD: ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.

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SUBSURFACE DIAGRAM

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

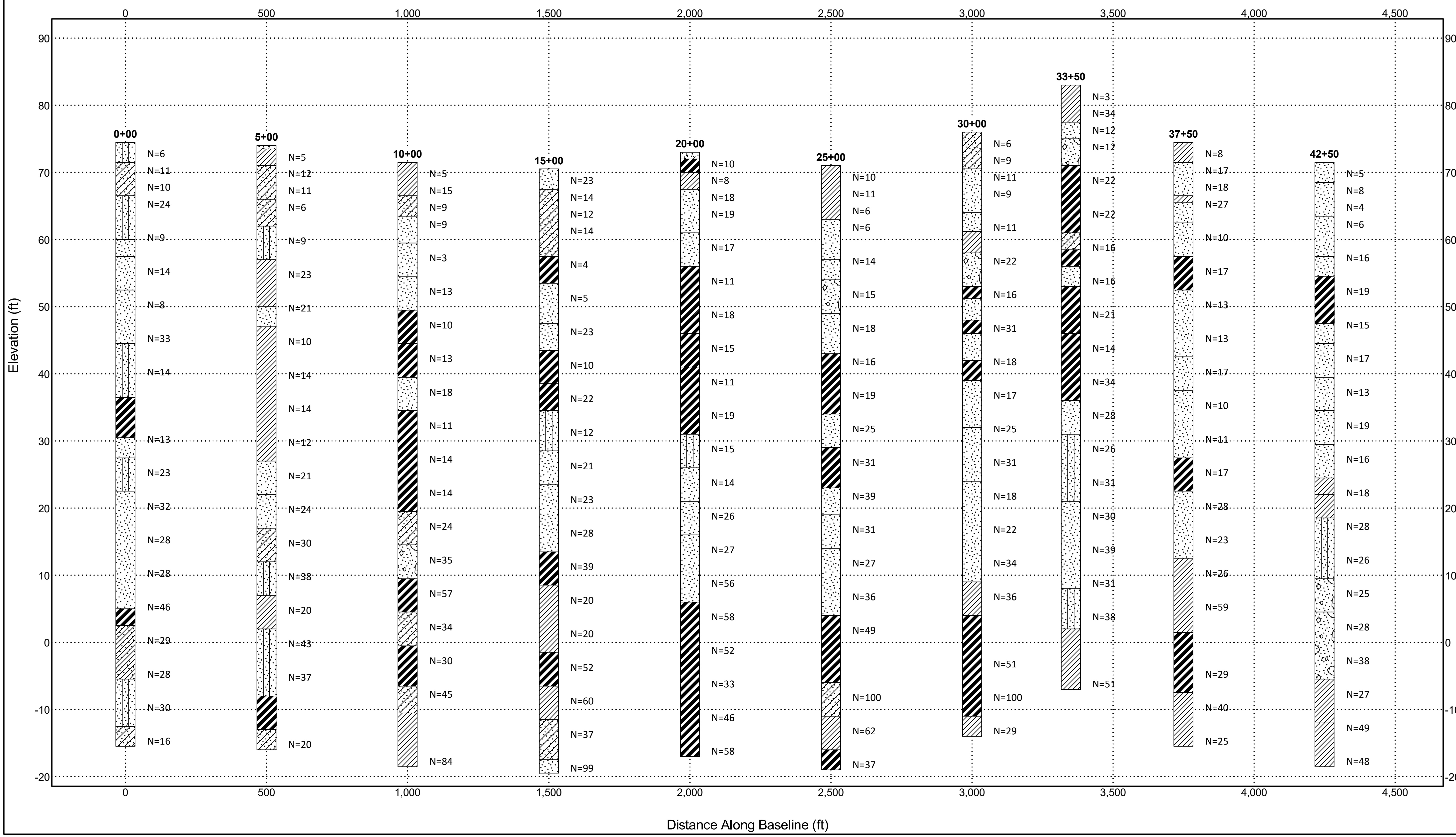
CLIENT The Chemours Company

PROJECT NUMBER 41-20500

PROJECT NAME Chemours Barrier Wall

PROJECT LOCATION Fayetteville, NC

▨ USCS Silty Sand	▨ USCS Clayey Sand	▨ USCS Poorly-graded Sand
▨ USCS High Plasticity Clay	▨ USCS Low Plasticity Sandy Clay	▨ Topsoil
▨ USCS Low Plasticity Clay	▨ USCS Poorly-graded Gravelly Sand	



SUBSURFACE DIAGRAM

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

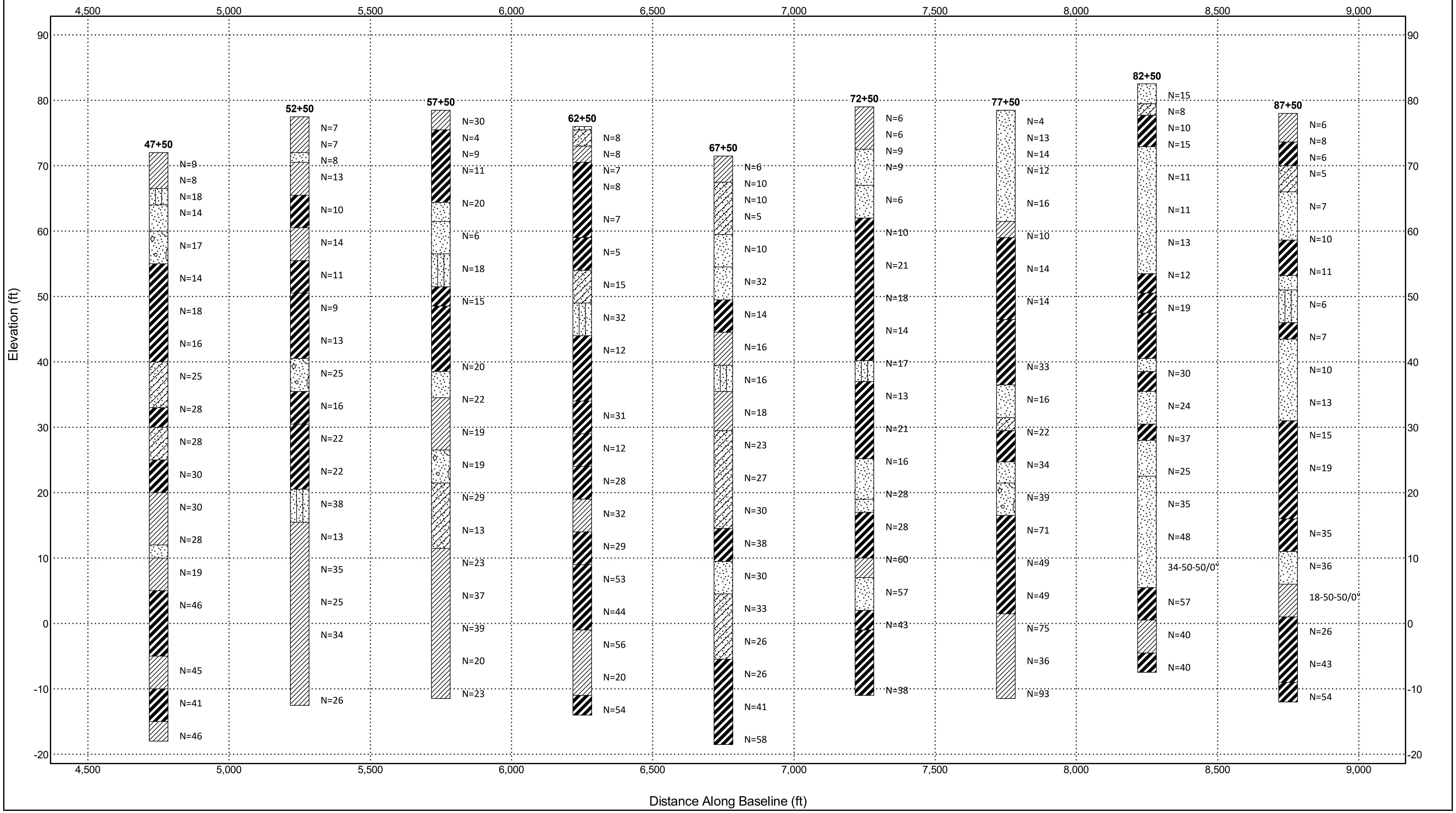
CLIENT The Chemours Company

PROJECT NUMBER 41-20500

PROJECT NAME Chemours Barrier Wall

PROJECT LOCATION Fayetteville, NC

- ▨ USCS Low Plasticity Clay
- ▨ USCS Poorly-graded Gravelly Sand
- ▨ Topsoil
- ▨ USCS Silty Sand
- ▨ USCS High Plasticity Clay
- ▨ USCS Poorly-graded Sand
- ▨ USCS Clayey Sand



GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 0+00

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/28/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83399° / -78.82601°
GROUND ELEVATION 74.5 ft
PROPOSED FFE ---
NORTHING / EASTING N394556 ft / E2052210 ft
REFUSAL ---
STATION 0+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
0	74.5		SILTY SAND (SM) - light brown; moist; loose; (ALLUVIUM)							
				SS 1	60	3-3-3 (6)	17			
			CLAYEY SAND (SC) - light brown, orange brown, and gray; moist; medium dense to loose; (ALLUVIUM)							
5	69.5			SS 2	93	3-4-7 (11)	23			4.25
				SS 3	100	3-4-6 (10)	15			3.0
			SILTY SAND (SM) - light brown and orange brown; moist; medium dense; (ALLUVIUM)							
10	64.5			SS 4	87	10-13-11 (24)	13			
				ST 1	40					
15	59.5			SS 5	93	4-5-4 (9)	18			
			SAND (SP) - white and light brown; moist; loose; (ALLUVIUM)							
			SAND (SP) - light brown and orange brown; moist; medium dense; (ALLUVIUM)							
20	54.5			SS 6	100	5-8-6 (14)	17			
			SAND (SP) - light brown, gray, and orange brown; very moist; loose to dense; (ALLUVIUM)							
25	49.5			SS 7	100	2-3-5 (8)	20			
30	44.5			SS 8	100	6-13-20 (33)	14			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 0+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/28/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83399° / -78.82601°
GROUND ELEVATION 74.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N394556 ft / E2052210 ft
REFUSAL ---
STATION 0+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
30	44.5		SILTY SAND (SM) - light brown; moist; medium dense (ALLUVIUM)							
				SS 9	73	9-6-8 (14)	37			
35	39.5									
			FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)	ST 2	100		20	81	56	
40	34.5									
			SAND (SP) - orange brown and light brown; medium dense; moist (ALLUVIUM)	SS 10	73	5-6-7 (13)	49			4.0
45	29.5									
			SILTY SAND (SM) - light gray and orange brown; medium dense; moist (ALLUVIUM)							
				SS 11	93	8-10-13 (23)	22			
50	24.5									
			SAND (SP) with gravel - dark gray; dense to medium dense; moist (ALLUVIUM)							
				SS 12	67	10-15-17 (32)	20			
55	19.5									
				SS 13	67	11-16-12 (28)	27			
60	14.5									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 0+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 9/28/20	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling	**LOGGED BY** M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary	**LATITUDE / LONGITUDE** 34.83399° / -78.82601°
GROUND ELEVATION 74.5 ft **PROPOSED FFE** ---	**NORTHING / EASTING** N394556 ft / E2052210 ft
REFUSAL ---	**STATION** 0+00
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	14.5	SAND (SP) with gravel - dark gray; dense to medium dense; moist (ALLUVIUM) *(continued)*							
65	9.5		SS 14	93	11-12-16 (28)	28			
70	4.5		SS 15	87	13-21-25 (46)	28			4.5
		FAT CLAY (CH) with petrified wood - dark brown; hard; moist (ALLUVIUM)							
		SANDY CLAY (CH) - dark gray to light gray; very stiff; moist (ALLUVIUM)							
75	-0.5		SS 16	87	8-14-15 (29)	3			4.0
80	-5.5		SS 17	93	3-5-23 (28)	20			
		SILTY SAND (SM) - light gray; medium dense; moist (ALLUVIUM)							
85	-10.5		SS 18	87	12-16-14 (30)	15			
		CLAYEY SAND (SC) - gray; medium dense; very moist (ALLUVIUM)							
90	-15.5		SS 19	100	7-8-8 (16)	20			3.5

Bottom of borehole at 90.0 feet.

NOTES:

BORING NUMBER 5+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/29/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83525° / -78.82578°
GROUND ELEVATION 74 ft **PROPOSED FFE** ---
NORTHING / EASTING N395018 ft / E2052277 ft
REFUSAL ---
STATION 5+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -16.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	74.0									
			Topsoil							
			SANDY CLAY (CL) - brown; firm; moist (ALLUVIUM)	SS 1	73	2-2-3 (5)	21			3.0
			CLAYEY SAND (SC) - light brown; medium dense; moist (ALLUVIUM)	SS 2	87	5-6-6 (12)	18			
5	69.0									
				SS 3	100	3-5-6 (11)	26			
			CLAYEY SAND (SC) - gray to orange brown; loose; moist (ALLUVIUM)	SS 4	87	3-3-3 (6)	24			
10	64.0									
			SILTY SAND (SM) with some clay - orange brown to brown; loose; moist (ALLUVIUM)	SS 5	80	2-4-5 (9)	28			
15	59.0									
			LEAN CLAY (CL) - dark gray; very stiff; moist (ALLUVIUM)	SS 6	100	6-11-12 (23)	50			4.5
20	54.0									
			SAND (SP) - orange brown; medium dense; moist (ALLUVIUM)	SS 7	87	6-11-10 (21)	47			
25	49.0									
			LEAN CLAY (CL) - dark gray; stiff; moist (ALLUVIUM)	SS 8	100	4-4-6 (10)	43			4.5
30	44.0									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 5+00

PAGE 2 OF 3

PROJECT NAME Chemours Barrier Wall

DATE 9/29/20

DRILLING CONTRACTOR Independence Drilling

DRILLING METHOD Mud Rotary

GROUND ELEVATION 74 ft **PROPOSED FFE** ---

REFUSAL ---

TOP OF ROCK ---

BEGAN CORING ---

FOOTAGE CORED (LF) ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -16.0 ft

GEOServices PROJECT# 41-20500

PROJECT LOCATION Fayetteville, NC

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

LATITUDE / LONGITUDE 34.83525° / -78.82578°

NORTHING / EASTING N395018 ft / E2052277 ft

STATION 5+00

GROUND WATER LEVELS:

AT END OF DRILLING ---

AFTER 1 HOUR ---

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
30	44.0		LEAN CLAY (CL) - dark gray; stiff; moist (ALLUVIUM) *(continued)*							
35	39.0			SS 9	93	3-6-8 (14)	46			4.5
40	34.0			SS 10	100	4-6-8 (14)	47			4.0
45	29.0			SS 11	100	3-5-7 (12)	45			3.5
			SAND (SP) - dark gray; medium dense; very moist (ALLUVIUM)							
50	24.0			SS 12	67	6-9-12 (21)	38			
			SAND (SP) with gravel - gray; medium dense; very moist (ALLUVIUM)							
55	19.0			SS 13	87	9-10-14 (24)	27			
			CLAYEY SAND (SC) - gray; medium dense; very moist (ALLUVIUM)							
60	14.0			SS 14	93	7-12-18 (30)	35			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 5+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/29/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83525° / -78.82578°
GROUND ELEVATION 74 ft **PROPOSED FFE** ---
NORTHING / EASTING N395018 ft / E2052277 ft
REFUSAL ---
STATION 5+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -16.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	14.0	▨	CLAYEY SAND (SC) - gray; medium dense; very moist (ALLUVIUM) *(continued)*							
		░	SILTY SAND (SM) with some clay - gray; dense; moist (ALLUVIUM)							
65	9.0			SS 15	87	12-17-21 (38)	29			
		▨	SANDY CLAY (CL) - gray and light gray; very stiff; moist (ALLUVIUM)							
70	4.0			SS 16	100	9-10-10 (20)	20			4.5
		░	SILTY SAND (SM) with clay - light gray; dense; moist (ALLUVIUM)							
75	-1.0			SS 17	87	11-18-25 (43)	25			4.5
80	-6.0			SS 18	100	1-13-24 (37)	15			4.5
				ST 1	90					
		▨	SANDY CLAY (CH) - gray; moist (ALLUVIUM)	ST 2	95					
85	-11.0									
		▨	CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM)							
90	-16.0			SS 19	100	8-9-11 (20)	22			

Bottom of borehole at 90.0 feet.

NOTES:

BORING NUMBER 10+00

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 9/30/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.83651° / -78.82557°

GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N395476 ft / E2052340 ft

REFUSAL ---

STATION 10+00

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	71.5		SANDY CLAY (CL) - gray brown; firm to stiff; moist (ALLUVIUM)							
				SS 1	100	2-2-3 (5)	17			3.5
5	66.5			SS 2	100	3-6-9 (15)	24			4.0
			CLAYEY SAND (SC) - gray brown; loose; moist (ALLUVIUM)	SS 3	93	4-5-4 (9)	20			
			SAND (SP) - light brown and brown; loose; moist (ALLUVIUM)							
10	61.5			SS 4	87	3-4-5 (9)	21			
			SAND (SP) - orange brown and light brown; very loose; moist (ALLUVIUM)							
15	56.5			SS 5	60	3-2-1 (3)	36			
			SAND (SP) with some gravel - dark gray; medium dense; very moist (ALLUVIUM)							
20	51.5			SS 6	73	5-6-7 (13)	32			
			FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
25	46.5			SS 7	100	3-4-6 (10)	46			3.0
			FAT CLAY (CH) - dark brown; stiff; moist (ALLUVIUM)							
30	41.5			SS 8	93	4-5-8 (13)	38			3.75

NOTES:

(Continued Next Page)

BORING NUMBER 10+00

PAGE 2 OF 3

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 9/30/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.83651° / -78.82557°

GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N395476 ft / E2052340 ft

REFUSAL ---

STATION 10+00

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	41.5		FAT CLAY (CH) - dark brown; stiff; moist (ALLUVIUM) *(continued)*							
			SAND (SP) - gray and dark gray; medium dense; moist (ALLUVIUM)							
35	36.5			SS 9	60	7-8-10 (18)	20			
			FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
40	31.5			SS 10	100	4-5-6 (11)	42			3.5
45	26.5			SS 11	100	5-6-8 (14)	43			3.0
50	21.5			SS 12	100	4-6-8 (14)	45			3.5
			CLAYEY SAND (SC) - dark gray to gray; medium dense; moist (ALLUVIUM)							
55	16.5			SS 13	100	9-10-14 (24)	42			
			GRAVELLY SAND (SPG) with some clay - dark gray to gray; dense; very moist (ALLUVIUM)							
60	11.5			SS 14	100	14-14-21 (35)	18			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 10+00

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 9/30/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.83651° / -78.82557°

GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N395476 ft / E2052340 ft

REFUSAL ---

STATION 10+00

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	11.5		GRAVELLY SAND (SPG) with some clay - dark gray to gray; dense; very moist (ALLUVIUM) *(continued)*							
			FAT CLAY (CH) with some sand - light gray; hard; moist (ALLUVIUM)							
65	6.5			SS 15	100	14-23-34 (57)	15			4.5
			CLAYEY SAND (SC) - light gray; dense; very moist (ALLUVIUM)							
70	1.5			SS 16	87	9-14-20 (34)	19			1.5
			FAT CLAY (CH) - gray; very stiff; moist (ALLUVIUM)							
75	-3.5			SS 17	100	9-13-17 (30)	20			4.5
			CLAYEY SAND (SC) - light gray; dense; very moist (ALLUVIUM)							
80	-8.5			SS 18	80	16-20-25 (45)	21			1.0
				ST 1	100					
			SANDY CLAY (CH) - dark gray to light gray; hard; very moist (ALLUVIUM)	ST 2	15					
85	-13.5									
90	-18.5			SS 19	100	27-40-44 (84)	17			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 15+00

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/30/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83785° / -78.82554°
GROUND ELEVATION 70.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N395962 ft / E2052350 ft
REFUSAL ---
STATION 15+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -19.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0	70.5		SAND (SP) - light brown and orange brown; medium dense; moist (ALLUVIUM)	☒ SS 1	100	11-14-9 (23)	8		
			CLAYEY SAND (SC) - light brown and orange brown; medium dense; moist (ALLUVIUM)	☒ SS 2	87	5-6-8 (14)	17		
5	65.5			☒ SS 3	87	4-5-7 (12)	23		
				☒ SS 4	93	8-7-7 (14)	21		
10	60.5								
			FAT CLAY (CH) - brown and orange brown; soft; moist (ALLUVIUM)	☒ SS 5	73	2-2-2 (4)	26		
15	55.5								
			SAND (SP) - light brown and orange brown; loose; moist (ALLUVIUM)	☒ SS 6	40	4-3-2 (5)	17		
20	50.5			■ ST 1	55				
			SAND (SP) - light brown, red brown, and gray; medium dense; moist (ALLUVIUM)	☒ SS 7	87	9-10-13 (23)	24		
25	45.5								
			FAT CLAY (CH) with sand - dark gray; stiff; moist (ALLUVIUM)	☒ SS 8	100	4-4-6 (10)	47		
30	40.5								

NOTES:

(Continued Next Page)

BORING NUMBER 15+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/30/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83785° / -78.82554°
GROUND ELEVATION 70.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N395962 ft / E2052350 ft
REFUSAL ---
STATION 15+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -19.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
30	40.5		FAT CLAY (CH) with sand - dark gray; stiff; moist (ALLUVIUM) *(continued)*						
			FAT CLAY (CH) with sand and petrified wood - dark gray, light brown, and brown; very stiff; moist (ALLUVIUM)						
35	35.5			☒ SS 9	87	8-10-12 (22)	43		
				■ ST 2	100			56	36
			SILTY SAND (SM) - light brown and orange brown; medium dense; very moist (ALLUVIUM)						
40	30.5			☒ SS 10	80	5-6-6 (12)	28		
			SAND (SP) - light gray and dark gray; medium dense; moist (ALLUVIUM)						
45	25.5			☒ SS 11	100	5-10-11 (21)	37		
			SAND (SP) - light gray; medium dense; moist (ALLUVIUM)						
50	20.5			☒ SS 12	93	7-9-14 (23)	37		
55	15.5			☒ SS 13	80	4-11-17 (28)	41		
			FAT CLAY (CH) - gray and dark gray; hard; moist (ALLUVIUM)						
60	10.5			☒ SS 14	100	5-14-25 (39)	13		

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 15+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 9/30/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83785° / -78.82554°
GROUND ELEVATION 70.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N395962 ft / E2052350 ft
REFUSAL ---
STATION 15+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -19.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
60	10.5		FAT CLAY (CH) - gray and dark gray; hard; moist (ALLUVIUM) *(continued)*						
			SANDY CLAY (CL) - gray; very stiff; moist (ALLUVIUM)						
65	5.5			SS 15	93	6-8-12 (20)	17		
70	0.5			SS 16	93	7-8-12 (20)	18		
			FAT CLAY (CH) - gray; hard; moist (ALLUVIUM)						
75	-4.5			SS 17	93	13-23-29 (52)	19		
			SANDY CLAY (CL) - gray; hard; moist (ALLUVIUM)						
80	-9.5			SS 18	100	15-30-30 (60)	19		
			CLAYEY SAND (SC) - gray; dense; very moist (ALLUVIUM)						
85	-14.5			SS 19	93	9-15-22 (37)	24		
			SAND (SP) - light gray; very dense; very moist (ALLUVIUM)						
90	-19.5			SS 20	100	14-49-50 (99)	19		

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 20+00

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/1/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.83918° / -78.82555°

GROUND ELEVATION 73 ft **PROPOSED FFE** ---

NORTHING / EASTING N396447 ft / E2052343 ft

REFUSAL ---

STATION 20+00

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -17.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	73.0	⁘	Topsoil							
		▨	FAT CLAY (CH) with sand - brown and orange brown; micaceous; stiff; moist (ALLUVIUM)	SS 1	100	3-4-6 (10)	18			4.0
5	68.0	▨	SANDY CLAY (CL) - brown; firm; moist (ALLUVIUM)	SS 2	93	3-3-5 (8)	21			3.0
		⁘	SAND (SP) - brown and light brown; medium dense; moist (ALLUVIUM)	SS 3	87	7-9-9 (18)	20			
10	63.0	⁘		SS 4	87	6-11-8 (19)	21			
15	58.0	⁘	SAND (SP) - orange brown and brown; medium dense; moist (ALLUVIUM)	SS 5	67	5-8-9 (17)	18			
20	53.0	▨	FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM)	SS 6	93	2-5-6 (11)	44			3.5
25	48.0	▨		SS 7	100	6-8-10 (18)	44			3.75
30	43.0	▨	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)	SS 8	87	3-6-9 (15)	42			4.0

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 20+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/1/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83918° / -78.82555°
GROUND ELEVATION 73 ft **PROPOSED FFE** ---
NORTHING / EASTING N396447 ft / E2052343 ft
REFUSAL ---
STATION 20+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -17.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	43.0		FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM) *(continued)*							
			FAT CLAY (CH) with sand and petrified wood - dark gray; stiff to very stiff; moist (ALLUVIUM)							
35	38.0			SS 9	100	5-5-6 (11)	41			3.5
				ST 1	100			70	44	
40	33.0			SS 10	80	6-8-11 (19)	44			4.0
			SILTY SAND (SM) - yellow brown; medium dense; moist (ALLUVIUM)							
45	28.0			SS 11	67	7-7-8 (15)	19			
				ST 2	100					
			SAND (SP) - light brown to dark brown; medium dense; very moist (ALLUVIUM)							
50	23.0			SS 12	80	4-6-8 (14)	21			
			SAND (SP) with gravel - gray brown; medium dense; very moist (ALLUVIUM)							
55	18.0			SS 13	93	8-10-16 (26)	22			
			SAND (SP) - gray; medium dense to very dense; very moist (ALLUVIUM)							
60	13.0			SS 14	73	6-12-15 (27)	28			

NOTES:

(Continued Next Page)

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 20+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/1/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.83918° / -78.82555°
GROUND ELEVATION 73 ft **PROPOSED FFE** ---
NORTHING / EASTING N396447 ft / E2052343 ft
REFUSAL ---
STATION 20+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -17.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	13.0	░	SAND (SP) - gray; medium dense to very dense; very moist (ALLUVIUM) *(continued)*							
65	8.0	░		☒ SS 15	93	10-21-35 (56)	20			
		▨	FAT CLAY (CH) - light gray; hard; moist (ALLUVIUM)							
70	3.0	▨		☒ SS 16	100	21-29-29 (58)	34			4.5
		▨		■ ST 3	90					
75	-2.0	▨		☒ SS 17	100	17-21-31 (52)	21			4.5
		▨		■ ST 4	100					
80	-7.0	▨		☒ SS 18	87	7-15-18 (33)	23			4.5
85	-12.0	▨		☒ SS 19	100	14-22-24 (46)	26			4.5
90	-17.0	▨		☒ SS 20	100	14-26-32 (58)	21			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 25+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/2/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84043° / -78.82612°
GROUND ELEVATION 71 ft
PROPOSED FFE ---
NORTHING / EASTING N396900 ft / E2052172 ft
REFUSAL ---
STATION 25+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -19.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
0	71.0		SANDY CLAY (CL) - brown, orange brown, and light brown; stiff to firm; moist (ALLUVIUM)						
				SS 1	100	4-4-6 (10)	14		
				SS 2	87	2-4-7 (11)	19		
5	66.0								
				SS 3	100	2-2-4 (6)	25		
			SAND (SP) - light brown and orange brown; loose; moist (ALLUVIUM)						
				SS 4	80	4-3-3 (6)	26		
10	61.0								
			SAND (SP) - gray; medium dense; moist (ALLUVIUM)	SS 5	87	4-6-8 (14)	35		
15	56.0								
			GRAVELLY SAND (SPG) - dark gray; medium dense; moist (ALLUVIUM)						
				SS 6	93	5-6-9 (15)	23		
20	51.0								
			SAND (SP) - light gray; medium dense; moist (ALLUVIUM)						
				SS 7	80	7-8-10 (18)	23		
25	46.0								
			FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)						
				SS 8	100	7-6-10 (16)	45		
30	41.0								

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 25+00

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/2/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84043° / -78.82612°
GROUND ELEVATION 71 ft
PROPOSED FFE ---
NORTHING / EASTING N396900 ft / E2052172 ft
REFUSAL ---
STATION 25+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -19.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS	
								LIQUID LIMIT	PLASTICITY INDEX
30	41.0		FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM) *(continued)*						
35	36.0			SS 9	93	5-8-11 (19)	40		
			SAND (SP) - light brown, orange brown, and gray; medium dense; moist (ALLUVIUM)						
40	31.0			SS 10	80	7-11-14 (25)	28		
			FAT CLAY (CH) with sand - gray and dark gray; hard; moist (ALLUVIUM)						
45	26.0			SS 11	100	7-13-18 (31)	35		
			SAND (SP) with petrified wood - gray; dense; moist (ALLUVIUM)						
50	21.0			SS 12	93	15-20-19 (39)	38		
			SAND (SP) with gravel - gray; dense; moist (ALLUVIUM)						
55	16.0			SS 13	93	11-15-16 (31)	78		
			SAND (SP) - gray; dense; moist (ALLUVIUM)						
60	11.0			SS 14	80	11-13-14 (27)	23		

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 25+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall

DATE 10/2/20

DRILLING CONTRACTOR Independence Drilling

DRILLING METHOD Mud Rotary

GROUND ELEVATION 71 ft **PROPOSED FFE** ---

REFUSAL ---

TOP OF ROCK ---

BEGAN CORING ---

FOOTAGE CORED (LF) ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -19.0 ft

GEOServices PROJECT# 41-20500

PROJECT LOCATION Fayetteville, NC

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

LATITUDE / LONGITUDE 34.84043° / -78.82612°

NORTHING / EASTING N396900 ft / E2052172 ft

STATION 25+00

GROUND WATER LEVELS:

AT END OF DRILLING ---

AFTER 1 HOUR ---

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX
60	11.0								
			SAND (SP) - gray; dense; moist (ALLUVIUM) *(continued)*						
65	6.0			☒ SS 15	87	13-17-19 (36)	22		
			FAT CLAY (CH) - light gray; hard; moist (ALLUVIUM)						
70	1.0			☒ SS 16	93	12-22-27 (49)	21		
				■ ST 1	65				
				■ ST 2	100			52	35
75	-4.0								
			CLAYEY SAND (SC) - gray; very dense; moist (ALLUVIUM)						
80	-9.0			☒ SS 17	27	50-50-50 (100)	30		
			SANDY CLAY (CL) - gray; hard; moist (ALLUVIUM)						
85	-14.0			☒ SS 18	100	19-29-33 (62)	19		
			FAT CLAY (CH) - gray brown; hard; moist (ALLUVIUM)						
90	-19.0			☒ SS 19	93	12-16-21 (37)	19		

Bottom of borehole at 90.0 feet.

NOTES:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 30+00

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/2/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84164° / -78.82672°
GROUND ELEVATION 76 ft **PROPOSED FFE** ---
NORTHING / EASTING N397343 ft / E2051993 ft
REFUSAL ---
STATION 30+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	76.0		CLAYEY SAND (SC) - light brown and orange brown; loose; moist (ALLUVIUM)							
				SS 1	100	4-3-3 (6)	22			2.75
5	71.0			SS 2	67	3-4-5 (9)	19			
			SAND (SP) - light brown, brown, and orange brown; medium dense to loose; moist (ALLUVIUM)	SS 3	73	4-5-6 (11)	17			
10	66.0			SS 4	73	3-4-5 (9)	36			
			SAND (SP) with petrified wood - orange brown and brown; medium dense; very moist (ALLUVIUM)							
15	61.0			SS 5	87	4-4-7 (11)	21			2.5
			LEAN CLAY (CL) - gray; firm; moist (ALLUVIUM)							
			GRAVELLY SAND (SPG) - gray and dark gray; medium dense; very moist (ALLUVIUM)							
20	56.0			SS 6	60	7-7-15 (22)	68			
			FAT CLAY (CH) - dark gray; firm; moist (ALLUVIUM)							
25	51.0			SS 7	73	1-4-12 (16)	41			4.0
			SAND (SP) - gray and dark gray; medium dense; moist (ALLUVIUM)							
			FAT CLAY (CH) - dark gray; hard; moist (ALLUVIUM)							
30	46.0			SS 8	87	6-12-19 (31)	43			4.5

NOTES:

(Continued Next Page)

BORING NUMBER 30+00

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/2/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84164° / -78.82672°
GROUND ELEVATION 76 ft **PROPOSED FFE** ---
NORTHING / EASTING N397343 ft / E2051993 ft
REFUSAL ---
STATION 30+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	46.0		SAND (SP) - gray and dark gray; medium dense; very moist (ALLUVIUM)							
			FAT CLAY (CH) with sand - dark gray; very stiff; very moist (ALLUVIUM)	SS 9	93	8-7-11 (18)	42			4.25
35	41.0									
			SAND (SP) - dark gray to orange brown; medium dense; very moist (ALLUVIUM)							
40	36.0			SS 10	73	4-7-10 (17)	27			
			SAND (SP) - light gray; medium dense to dense; moist (ALLUVIUM)							
45	31.0			SS 11	87	9-12-13 (25)	34			
50	26.0			SS 12	73	11-13-18 (31)	30			
			SAND (SP) - gray; medium dense; very moist to moist (ALLUVIUM)							
55	21.0			SS 13	53	6-9-9 (18)	21			
60	16.0			SS 14	53	8-11-11 (22)	22			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 30+00

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/2/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84164° / -78.82672°
GROUND ELEVATION 76 ft **PROPOSED FFE** ---
NORTHING / EASTING N397343 ft / E2051993 ft
REFUSAL ---
STATION 30+00
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	16.0		SAND (SP) - gray; medium dense; very moist to moist (ALLUVIUM) *(continued)*							
65	11.0			SS 15	73	12-17-17 (34)	23			
			LEAN CLAY (CL) with sand and petrified wood - dark gray; hard; moist (ALLUVIUM)							
70	6.0			SS 16	93	13-12-24 (36)	33			3.0
				ST 1	95			43	26	
			FAT CLAY (CH) - light gray and gray; hard; moist to very moist (ALLUVIUM)	ST 2	100					
75	1.0									
80	-4.0			SS 17	100	10-21-30 (51)	22			4.5
85	-9.0			SS 18	60	10-50-50 (100)	22			4.5
			SANDY CLAY (CL) - light gray and blue gray; very stiff; moist (ALLUVIUM)							
90	-14.0			SS 19	87	9-14-15 (29)	23			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 33+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/3/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.84201° / -78.82748°

GROUND ELEVATION 83 ft **PROPOSED FFE** ---

NORTHING / EASTING N397475 ft / E2051763 ft

REFUSAL ---

STATION 33+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

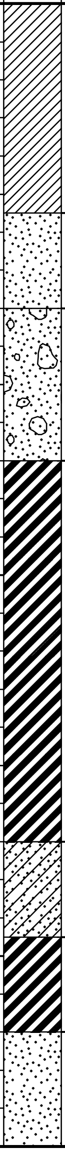
AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -7.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	83.0		SANDY CLAY (CL) - light brown, orange brown, and red brown; soft to hard; moist (ALLUVIUM)							
				SS 1	93	2-2-1 (3)	19			1.5
5	78.0			SS 2	93	2-8-26 (34)	46			1.25
			SAND (SP) - yellow brown and brown; medium dense; moist (ALLUVIUM)	SS 3	87	7-6-6 (12)	19			
10	73.0		GRAVELLY SAND (SPG) with clay seam - light brown to gray; medium dense; moist (ALLUVIUM)	SS 4	87	3-3-9 (12)	45			2.5
			FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)							
15	68.0			SS 5	100	5-9-13 (22)	48			4.5
20	63.0			SS 6	87	6-8-14 (22)	41			4.5
			CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM)							
25	58.0		FAT CLAY (CL) - gray; stiff; moist (ALLUVIUM)	SS 7	80	5-8-8 (16)	34			3.5
			SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
30	53.0			SS 8	100	7-8-8 (16)	48			3.5

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 33+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/3/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84201° / -78.82748°
GROUND ELEVATION 83 ft **PROPOSED FFE** ---
NORTHING / EASTING N397475 ft / E2051763 ft
REFUSAL ---
STATION 33+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -7.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	53.0		FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)							
35	48.0			SS 9	100	4-9-12 (21)	43			4.5
			FAT CLAY (CH) with sand - dark gray; stiff to hard; moist (ALLUVIUM)							
40	43.0			SS 10	100	4-6-8 (14)	42			3.5
45	38.0			SS 11	93	8-15-19 (34)	42			4.5
			SAND (SP) with gravel - light gray and gray; medium dense; moist (ALLUVIUM)							
50	33.0			SS 12	93	12-13-15 (28)	19			
			SILTY SAND (SM) - light gray and gray; medium dense to dense; moist (ALLUVIUM)							
55	28.0			SS 13	73	10-11-15 (26)	37			
60	23.0			SS 14	87	10-13-18 (31)	37			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 33+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/3/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84201° / -78.82748°
GROUND ELEVATION 83 ft **PROPOSED FFE** ---
NORTHING / EASTING N397475 ft / E2051763 ft
REFUSAL ---
STATION 33+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -7.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	23.0		SILTY SAND (SM) - light gray and gray; medium dense to dense; moist (ALLUVIUM) *(continued)*							
			SAND (SP) - light gray and gray; medium dense to dense; moist (ALLUVIUM)							
				SS 15	87	11-14-16 (30)	25			
65	18.0									
				SS 16	87	12-17-22 (39)	23			
70	13.0									
				SS 17	93	12-12-19 (31)	24			
75	8.0		SILTY SAND (SM) - light gray; dense; moist (ALLUVIUM)							
				SS 18	100	16-21-17 (38)	26			4.0
80	3.0			ST 1	85			49	21	
			LEAN CLAY (CH) with sand - light gray to gray; hard; moist (ALLUVIUM)	ST 2	100					
85	-2.0									
				SS 19	100	10-24-27 (51)	22			4.0
90	-7.0									

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 37+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/4/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84254° / -78.82644°
GROUND ELEVATION 74.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N397671 ft / E2052075 ft
REFUSAL ---
STATION 37+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
0	74.5	▨	SANDY CLAY (CL) - orange brown and brown; firm; moist (ALLUVIUM)	SS 1	100	3-4-4 (8)	16			3.25
5	69.5	░	SAND (SP) - light brown and red brown; medium dense; moist (ALLUVIUM)	SS 2	80	4-7-10 (17)	10			
		░		SS 3	40	4-7-11 (18)	19			
		▨	SANDY CLAY (CL) - gray; stiff; moist (ALLUVIUM)							
10	64.5	░	SAND (SP) - brown and red brown; medium dense; moist (ALLUVIUM)	SS 4	73	10-18-9 (27)	21			3.5
		░	SAND (SP) with gravel - light brown; loose; moist (ALLUVIUM)							
15	59.5	░		SS 5	73	5-5-5 (10)	20			
		▩	FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)							
20	54.5	▩		SS 6	87	4-7-10 (17)	36			4.0
		░	SAND (SP) - light brown to light yellow brown; medium dense; moist (ALLUVIUM)							
25	49.5	░		SS 7	80	4-6-7 (13)	27			
30	44.5	░		SS 8	87	6-6-7 (13)	23			

NOTES:

(Continued Next Page)

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/4/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.84254° / -78.82644°

GROUND ELEVATION 74.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N397671 ft / E2052075 ft

REFUSAL ---

STATION 37+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	POCKET PEN. (tsf)
30	44.5									
			SAND (SP) - light brown to light yellow brown; medium dense; moist (ALLUVIUM) *(continued)*							
			SAND (SP) - light gray; medium dense; moist (ALLUVIUM)							
35	39.5			SS 9	67	7-8-9 (17)	23			
			SAND (SP) - light gray with yellow brown; loose; moist (ALLUVIUM)							
40	34.5			SS 10	67	6-5-5 (10)	21			
			SAND (SP) - orange brown and light gray; medium dense; moist (ALLUVIUM)							
45	29.5			SS 11	73	6-5-6 (11)	20			
			FAT CLAY (CH) with petrified wood and sand - dary gray and gray; very stiff; moist (ALLUVIUM)							
50	24.5			SS 12	60	5-7-10 (17)	30			3.0
			SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
55	19.5			SS 13	67	10-13-15 (28)	16			
60	14.5			SS 14	80	11-12-11 (23)	22			

NOTES:

(Continued Next Page)

BORING NUMBER 37+50

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 10/4/20	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling	**LOGGED BY** M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary	**LATITUDE / LONGITUDE** 34.84254° / -78.82644°
GROUND ELEVATION 74.5 ft **PROPOSED FFE** ---	**NORTHING / EASTING** N397671 ft / E2052075 ft
REFUSAL ---	**STATION** 37+50
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -15.5 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	14.5	⁘	SAND (SP) - gray; medium dense; moist (ALLUVIUM) *(continued)*							
		▨	SANDY CLAY (CL) - light gray; very stiff to hard; moist (ALLUVIUM)							
65	9.5	▨		SS 15	100	9-11-15 (26)	18			4.0
70	4.5	▨		SS 16	93	14-25-34 (59)	16			4.5
		▨		ST 1	0					
		▧	FAT CLAY (CH) - light gray; very stiff; moist (ALLUVIUM)							
75	-0.5	▧		ST 2	100					
		▧		ST 3	100					
80	-5.5	▧		SS 17	87	10-12-17 (29)	23			4.5
		▨	SANDY CLAY (CL) - light gray to light blue gray; hard to very stiff; moist (ALLUVIUM)							
85	-10.5	▨		SS 18	93	14-18-22 (40)	24			2.5
90	-15.5	▨		SS 19	87	9-10-15 (25)	27			2.0

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 42+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/5/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.8438° / -78.82668°

GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N398127 ft / E2052004 ft

REFUSAL ---

STATION 42+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	71.5	SAND (SP) - brown to light brown; very loose; moist (ALLUVIUM)							
			SS 1	93	2-2-3 (5)	7			
		SAND (SP) with gravel - orange brown to red brown; loose to very loose; moist (ALLUVIUM)							
5	66.5		SS 2	80	3-4-4 (8)	14			
			SS 3	53	2-2-2 (4)	26			
		SAND (SP) - yellow, light gray, and pink brown; loose; moist (ALLUVIUM)							
10	61.5		SS 4	80	2-2-4 (6)	27			
15	56.5	SAND (SP) - gray with dark gray; medium dense; moist (ALLUVIUM)	SS 5	87	4-7-9 (16)	25			
		FAT CLAY (CH) with trace amounts of gravel and sand - dark gray; very stiff; moist (ALLUVIUM)							
20	51.5		SS 6	87	5-8-11 (19)	36			4.5
25	46.5	SAND (SP) - yellow brown and gray; medium dense; moist (ALLUVIUM)	SS 7	87	5-7-8 (15)	22			
		SAND (SP) - yellow brown to light gray; medium dense; moist (ALLUVIUM)							
30	41.5		SS 8	80	9-7-10 (17)	25			

NOTES:

(Continued Next Page)

BORING NUMBER 42+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/5/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.8438° / -78.82668°
GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N398127 ft / E2052004 ft
REFUSAL ---
STATION 42+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	41.5		SAND (SP) - yellow brown to light gray; medium dense; moist (ALLUVIUM) *(continued)*							
			SAND (SP) - gray to orange brown; medium dense; moist (ALLUVIUM)							
35	36.5			SS 9	93	6-6-7 (13)	26			
			SAND (SP) - orange brown to light gray; medium dense; moist (ALLUVIUM)							
40	31.5			SS 10	80	6-8-11 (19)	24			
			SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
45	26.5			SS 11	80	5-7-9 (16)	23			
			SANDY CLAY (CL) with black sand - dark gray; stiff; moist (ALLUVIUM)	SS 12	100	8-7-11 (18)	41			3.75
50	21.5		LEAN CLAY (CL) - dark gray; very stiff; moist (ALLUVIUM)	ST 1	100			27	10	
			SILTY SAND (SM) - gray and dark gray; medium dense; moist (ALLUVIUM)							
55	16.5			SS 13	87	6-12-16 (28)	40			
60	11.5			SS 14	87	9-10-16 (26)	44			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 42+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/5/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.8438° / -78.82668°
GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N398127 ft / E2052004 ft
REFUSAL ---
STATION 42+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	11.5		SILTY SAND (SM) - gray and dark gray; medium dense; moist (ALLUVIUM) *(continued)*							
			GRAVELLY SAND (SPG) - gray; medium dense; moist (ALLUVIUM)							
				SS 15	67	10-12-13 (25)	19			
65	6.5									
			GRAVELLY SAND (SPG) with clay - gray and dark gray; medium dense to dense; very moist (ALLUVIUM)							
				SS 16	80	9-9-19 (28)	29			
70	1.5									
				SS 17	73	11-18-20 (38)	31			
75	-3.5									
			SANDY CLAY (CL) - light gray; very stiff; moist (ALLUVIUM)							
				SS 18	93	9-11-16 (27)	22			3.5
80	-8.5									
				ST 2	100					
			SANDY CLAY (CL) - light gray and blue gray; hard; moist (ALLUVIUM)	SS 19	93	7-14-35 (49)	22			4.5
85	-13.5									
				SS 20	100	14-15-33 (48)	14			4.5
90	-18.5									

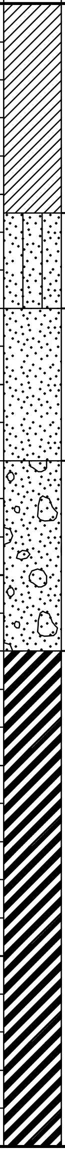
Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 47+50

PROJECT NAME	Chemours Barrier Wall	**GEOServices PROJECT#**	41-20500
DATE	10/6/20	**PROJECT LOCATION**	Fayetteville, NC
DRILLING CONTRACTOR	Independence Drilling	**LOGGED BY**	M. Guillot
		ON-SITE REP.	M. Guillot
DRILLING METHOD	Mud Rotary	**LATITUDE / LONGITUDE**	34.84469° / -78.82692°
GROUND ELEVATION	72 ft	**NORTHING / EASTING**	N398453 ft / E2051932 ft
PROPOSED FFE	---	**STATION**	47+50
REFUSAL	---	**GROUND WATER LEVELS:**	
TOP OF ROCK	---	**AT END OF DRILLING**	---
BEGAN CORING	---	**AFTER 1 HOUR**	---
FOOTAGE CORED (LF)	---	**AFTER 24 HOURS**	---
BOTTOM OF HOLE	Depth 90.0 ft / Elev -18.0 ft		



DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	72.0		SANDY CLAY (CL) - brown; stiff to firm; moist (ALLUVIUM)							
				SS 1	100	3-4-5 (9)	21			4.0
5	67.0			SS 2	87	2-4-4 (8)	26			4.0
			SILTY SAND (SM) - orange brown; medium dense; moist (ALLUVIUM)	SS 3	80	4-8-10 (18)	13			
			SAND (SP) - orange brown; medium dense; moist (ALLUVIUM)							
10	62.0			SS 4	67	4-7-7 (14)	18			
			GRAVELLY SAND (SPG) - gray and dark gray; medium dense; moist (ALLUVIUM)							
15	57.0			SS 5	80	5-8-9 (17)	28			
			FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM)							
20	52.0			SS 6	100	4-5-9 (14)	40			4.25
25	47.0			SS 7	100	4-7-11 (18)	39			3.75
30	42.0			SS 8	100	5-7-9 (16)	34			4.0

NOTES:

(Continued Next Page)

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 47+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/6/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84469° / -78.82692°
GROUND ELEVATION 72 ft **PROPOSED FFE** ---
NORTHING / EASTING N398453 ft / E2051932 ft
REFUSAL ---
STATION 47+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	POCKET PEN. (tsf)
30	42.0	▨	FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM) *(continued)*							
		▨	CLAYEY SAND (SC) - gray; medium dense; moist (ALLUVIUM)							
				SS 9	93	9-12-13 (25)	25			
35	37.0									
		▨	FAT CLAY (CH) - gray; very stiff; moist (ALLUVIUM)	SS 10	100	12-14-14 (28)	36			4.5
40	32.0									
		▨	CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM)							
				SS 11	100	11-12-16 (28)	39			
45	27.0									
		▨	FAT CLAY (CH) - gray; very stiff; moist (ALLUVIUM)							
				SS 12	93	6-17-13 (30)	38			4.5
50	22.0									
		▨	SANDY CLAY (CL) with petrified wood at depth - gray; very stiff; moist (ALLUVIUM)							
				SS 13	100	8-12-18 (30)	33			3.0
55	17.0									
				SS 14	87	8-12-16 (28)	28			3.0
60	12.0									

NOTES:

(Continued Next Page)

BORING NUMBER 47+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/6/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84469° / -78.82692°
GROUND ELEVATION 72 ft **PROPOSED FFE** ---
NORTHING / EASTING N398453 ft / E2051932 ft
REFUSAL ---
STATION 47+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	12.0		SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
			SANDY CLAY (CL) - light gray; very stiff; moist (ALLUVIUM)							
				SS 15	100	8-9-10 (19)	18			4.5
65	7.0									
			FAT CLAY (CH) - gray; hard; moist (ALLUVIUM)							
				SS 16	100	13-20-26 (46)	27			4.5
70	2.0									
				ST 1	60					
				ST 2	100					
75	-3.0									
			SANDY CLAY (CL) - light gray; hard; moist (ALLUVIUM)							
				SS 17	93	16-23-22 (45)	24			4.5
80	-8.0									
			FAT CLAY (CH) - gray; hard; moist (ALLUVIUM)							
				SS 18	100	11-18-23 (41)	17			4.5
85	-13.0									
			SANDY CLAY (CL) - light blue gray; hard; moist (ALLUVIUM)							
				SS 19	100	11-20-26 (46)	18			4.5
90	-18.0									

Bottom of borehole at 90.0 feet.

NOTES:

BORING NUMBER 52+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/6/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84596° / -78.82697°
GROUND ELEVATION 77.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N398914 ft / E2051915 ft
REFUSAL ---
STATION 52+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -12.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
0	77.5	▨	LEAN CLAY (CL) - orange brown to gray; firm; moist (ALLUVIUM)							
				SS 1	87	2-3-4 (7)	24			2.5
5	72.5			SS 2	93	3-3-4 (7)	21			2.5
		⁘	SAND (SP) - orange brown and red brown; loose; moist (ALLUVIUM)	SS 3	67	3-4-4 (8)	41			3.0
		▨	LEAN CLAY (CL) - orange brown to gray; firm; moist (ALLUVIUM)							
10	67.5			SS 4	100	3-5-8 (13)	47			2.0
		▩	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
15	62.5			SS 5	100	2-5-5 (10)	40			2.5
		▨	SANDY CLAY (CL) - dark gray; stiff; moist (ALLUVIUM)							
20	57.5			SS 6	80	4-6-8 (14)	39			3.5
		▩	FAT CLAY (CH) with gravel - dark gray; stiff; moist (ALLUVIUM)							
25	52.5			SS 7	67	5-6-5 (11)	53			2.5
		▩	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
30	47.5			SS 8	100	5-4-5 (9)	43			3.5

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(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 52+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/6/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84596° / -78.82697°
GROUND ELEVATION 77.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N398914 ft / E2051915 ft
REFUSAL ---
STATION 52+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -12.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	47.5		FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM) *(continued)*							
35	42.5			SS 9	100	4-6-7 (13)	50			3.5
			GRAVELLY SAND (SPG) with clay - light brown to gray; medium dense; moist (ALLUVIUM)							
40	37.5			SS 10	73	8-10-15 (25)	28			
			FAT CLAY (CH) with gravelly sand - dark fray; very stiff; moist (ALLUVIUM)							
45	32.5			SS 11	100	4-7-9 (16)	30			3.0
			FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)							
50	27.5			SS 12	100	6-9-13 (22)	46			4.5
55	22.5			SS 13	100	6-10-12 (22)	42			4.5
			SILTY SAND (SM) - dark gray; dense; moist (ALLUVIUM)							
60	17.5			SS 14	87	13-14-24 (38)	21			

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 52+50
PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/6/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84596° / -78.82697°
GROUND ELEVATION 77.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N398914 ft / E2051915 ft
REFUSAL ---
STATION 52+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -12.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	17.5	░	SILTY SAND (SM) - dark gray; dense; moist (ALLUVIUM) *(continued)*							
		▨	SANDY CLAY (CL) - light gray to light blue gray; stiff to hard; moist (ALLUVIUM)							
65	12.5			☒ SS 15	100	6-6-7 (13)	20			4.25
70	7.5			☒ SS 16	100	9-15-20 (35)	20			3.0
75	2.5			☒ SS 17	93	8-10-15 (25)	20			4.0
80	-2.5			☒ SS 18	100	9-14-20 (34)	20			4.5
				■ ST 1	80					
				■ ST 2	45					
85	-7.5									
90	-12.5			☒ SS 19	100	7-12-14 (26)	26			3.0

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 57+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/12/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84725° / -78.82748°
GROUND ELEVATION 78.5 ft
PROPOSED FFE ---
NORTHING / EASTING N399383 ft / E2051760 ft
REFUSAL ---
STATION 57+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	78.5									
			SANDY CLAY (CL) with sandstone at depth - gray; very stiff; moist (ALLUVIUM)	SS 1	47	2-4-26 (30)	18			2.0
			FAT CLAY (CH) with sand - dark gray; soft to stiff; moist (ALLUVIUM)	SS 2	0	7-2-2 (4)				
5	73.5									
				SS 3	100	2-4-5 (9)	48			2.5
				SS 4	100	3-5-6 (11)	47			3.0
10	68.5									
				SS 5	80	7-9-11 (20)	13			
			SAND (SP) - orange brown and light brown; medium dense; moist (ALLUVIUM)							
15	63.5									
			SAND (SP) with rock fragments - orange brown and light brown; loose; moist (ALLUVIUM)							
				SS 6	60	3-3-3 (6)	17			
20	58.5									
			SILTY SAND (SM) - gray; medium dense; very moist (ALLUVIUM)							
				SS 7	73	6-7-11 (18)	19			
25	53.5									
			FAT CLAY (CH) - dark gray; micaceous; stiff; moist (ALLUVIUM)							
				SS 8	100	4-6-9 (15)	42			3.0
30	48.5									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 57+50

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 10/12/20	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling	**LOGGED BY** M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary	**LATITUDE / LONGITUDE** 34.84725° / -78.82748°
GROUND ELEVATION 78.5 ft **PROPOSED FFE** ---	**NORTHING / EASTING** N399383 ft / E2051760 ft
REFUSAL ---	**STATION** 57+50
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	48.5									
			FAT CLAY (CH) with rock fragments at top - dark gray; very stiff; moist (ALLUVIUM)	ST 1	100					
				ST 2	100			41	19	
35	43.5									
40	38.5			SS 9	100	6-9-11 (20)	48			4.25
			SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
45	33.5		LEAN CLAY (CL) with sand - dark gray; very stiff; moist (ALLUVIUM)	SS 10	100	8-10-12 (22)	36			3.0
50	28.5			SS 11	87	8-6-13 (19)	58			2.5
			GRAVELLY SAND (SPG) with clay - gray; medium dense; moist (ALLUVIUM)							
55	23.5			SS 12	100	8-6-13 (19)	33			2.0
			CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM)							
60	18.5			SS 13	100	5-11-18 (29)	24			

NOTES:

(Continued Next Page)

BORING NUMBER 57+50

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GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/12/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84725° / -78.82748°
GROUND ELEVATION 78.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N399383 ft / E2051760 ft
REFUSAL ---
STATION 57+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	18.5		CLAYEY SAND (SC) - light gray; medium dense; moist (ALLUVIUM) *(continued)*							
65	13.5			SS 14	100	6-6-7 (13)	15			3.0
			SANDY CLAY (CL) - light gray to light blue gray; hard to very stiff; moist (ALLUVIUM)							
70	8.5			SS 15	100	6-10-13 (23)	19			4.0
75	3.5			SS 16	100	10-18-19 (37)	22			4.25
80	-1.5			SS 17	100	8-16-23 (39)	21			4.5
85	-6.5			SS 18	100	8-9-11 (20)	25			4.5
90	-11.5			SS 19	100	7-9-14 (23)	25			4.5

Bottom of borehole at 90.0 feet.

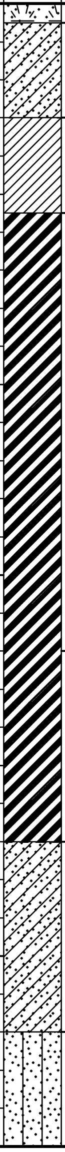
NOTES:

BORING NUMBER 62+50

PAGE 1 OF 3

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/12/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84836° / -78.82806°
GROUND ELEVATION 76 ft **PROPOSED FFE** ---
NORTHING / EASTING N399785 ft / E2051587 ft
REFUSAL ---
STATION 62+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft
AFTER 24 HOURS ---



DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	76.0	TOPSOIL (6 inches)							
		CLAYEY SAND (SC) - orange brown and light brown; loose; moist (ALLUVIUM)	SS 1	87	3-3-5 (8)	13			3.0
		SANDY CLAY (CL) - orange brown, gray, and light brown; firm; moist (ALLUVIUM)	SS 2	87	3-4-4 (8)	19			3.0
5	71.0	FAT CLAY (CH) with sand - light gray to gray; firm; moist (ALLUVIUM)	SS 3	100	2-3-4 (7)	40			2.25
10	66.0		SS 4	100	2-3-5 (8)	44			2.5
15	61.0		SS 5	100	2-3-4 (7)	43			2.5
		FAT CLAY (CH) - dark gray; firm; moist (ALLUVIUM)							
20	56.0		SS 6	100	0-2-3 (5)	49			2.0
		CLAYEY SAND (SC) - gray; medium dense; moist (ALLUVIUM)							
25	51.0		SS 7	93	5-6-9 (15)	38			
		SILTY SAND (SM) - gray; dense; moist (ALLUVIUM)							
30	46.0		SS 8	87	9-15-17 (32)	38			

NOTES:

(Continued Next Page)

BORING NUMBER 62+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/12/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot
ON-SITE REP. M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84836° / -78.82806°
GROUND ELEVATION 76 ft
PROPOSED FFE ---
NORTHING / EASTING N399785 ft / E2051587 ft
REFUSAL ---
STATION 62+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
30	46.0		SILTY SAND (SM) - gray; dense; moist (ALLUVIUM) *(continued)*							
			FAT CLAY (CH) - dark gray and gray; stiff; moist (ALLUVIUM)							
				SS 9	100	3-5-7 (12)	42			2.5
35	41.0									
				ST 1	100					
				ST 2	100					
40	36.0									
			FAT CLAY (CH) with sand - dark gray; hard; moist (ALLUVIUM)							
				SS 10	87	7-13-18 (31)	42			3.25
45	31.0									
			FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
				SS 11	100	4-5-7 (12)	37			3.5
50	26.0									
			FAT CLAY (CH) with gravelly sand - dark gray; very stiff; moist (ALLUVIUM)							
				SS 12	100	6-14-14 (28)	46			4.0
55	21.0									
			SANDY CLAY (CL) - gray; hard; moist (ALLUVIUM)							
				SS 13	100	7-13-19 (32)	24			4.5
60	16.0									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 62+50

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall	**GEOServices PROJECT#** 41-20500
DATE 10/12/20	**PROJECT LOCATION** Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling	**LOGGED BY** M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary	**LATITUDE / LONGITUDE** 34.84836° / -78.82806°
GROUND ELEVATION 76 ft **PROPOSED FFE** ---	**NORTHING / EASTING** N399785 ft / E2051587 ft
REFUSAL ---	**STATION** 62+50
TOP OF ROCK ---	**GROUND WATER LEVELS:**
BEGAN CORING ---	**AT END OF DRILLING** ---
FOOTAGE CORED (LF) ---	**AFTER 1 HOUR** ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -14.0 ft	**AFTER 24 HOURS** ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	16.0	▨	SANDY CLAY (CL) - gray; hard; moist (ALLUVIUM) *(continued)*							
		▩	FAT CLAY (CH) with sand - gray; very stiff; moist (ALLUVIUM)							
65	11.0	▩		☒ SS 14	100	9-14-15 (29)	20			4.5
		▩	FAT CLAY (CH) - light blue gray; hard; moist (ALLUVIUM)							
70	6.0	▩		☒ SS 15	100	15-24-29 (53)	23			4.5
75	1.0	▩		☒ SS 16	100	12-22-22 (44)	20			4.5
		▨	SANDY CLAY (CL) - light blue gray to blue gray; hard to very stiff; moist (ALLUVIUM)							
80	-4.0	▨		☒ SS 17	100	12-27-29 (56)	24			4.5
85	-9.0	▨		☒ SS 18	100	6-9-11 (20)	25			3.0
		▩	FAT CLAY (CL) - gray to gray brown; hard; moist (ALLUVIUM)							
90	-14.0	▩		☒ SS 19	100	12-26-28 (54)	23			4.5

Bottom of borehole at 90.0 feet.

NOTES:

BORING NUMBER 67+50

PAGE 1 OF 3

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/13/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.84919° / -78.82772°

GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N400089 ft / E2051688 ft

REFUSAL ---

STATION 67+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	71.5		SANDY CLAY (CL) - orange brown; firm; moist (ALLUVIUM)							
				SS 1	87	3-3-3 (6)	13			2.5
			CLAYEY SAND (SC) - orange brown; loose to very loose; moist to very moist (ALLUVIUM)	SS 2	73	5-5-5 (10)	16			
5	66.5									
				SS 3	87	5-6-4 (10)	18			
				SS 4	87	2-2-3 (5)	29			
10	61.5									
			SAND (SP) - orange brown to light gray; loose; moist (ALLUVIUM)							
				SS 5	47	5-5-5 (10)	18			
15	56.5									
			SAND (SP) with petrified wood - light brown to gray; dense; moist (ALLUVIUM)							
				SS 6	100	8-14-18 (32)	24			
20	51.5									
			FAT CLAY (CH) with sand - dark gray; stiff; moist (ALLUVIUM)							
				SS 7	87	3-6-8 (14)	40			3.5
25	46.5									
			SANDY CLAY (CL) - dark gray; very stiff; moist (ALLUVIUM)							
				SS 8	100	4-6-10 (16)	47			3.25
30	41.5									

NOTES:

(Continued Next Page)

BORING NUMBER 67+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/13/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84919° / -78.82772°
GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N400089 ft / E2051688 ft
REFUSAL ---
STATION 67+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
30	41.5									
			SANDY CLAY (CL) - dark gray; very stiff; moist (ALLUVIUM) *(continued)*							
			SILTY SAND (SM) - brown, light brown, and orange brown; medium dense; moist to very moist (ALLUVIUM)							
				SS 9	47	5-5-11 (16)	22			
35	36.5			ST 1	45					
			SANDY CLAY (CL) - dark gray; very stiff; moist (ALLUVIUM)							
40	31.5			SS 10	47	7-8-10 (18)	24			
			CLAYEY SAND (SC) - gray and dark gray; medium dense; moist (ALLUVIUM)							
45	26.5			SS 11	73	6-9-14 (23)	8			
50	21.5			SS 12	100	8-13-14 (27)	28			
55	16.5			SS 13	100	8-14-16 (30)	35			
				ST 2	10					
			FAT CLAY (CH) with petrified wood - dark gray; hard; moist (ALLUVIUM)							
60	11.5			SS 14	100	8-15-23 (38)	36			4.5

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 67+50

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/13/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.84919° / -78.82772°
GROUND ELEVATION 71.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N400089 ft / E2051688 ft
REFUSAL ---
STATION 67+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -18.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	11.5		FAT CLAY (CH) with petrified wood - dark gray; hard; moist (ALLUVIUM) *(continued)*							
			SAND (SP) - light gray; medium dense; moist (ALLUVIUM)							
65	6.5			SS 15	93	10-15-15 (30)	25			
			CLAYEY SAND (SC) - light gray; dense to medium dense; moist (ALLUVIUM)							
70	1.5			SS 16	93	13-16-17 (33)	22			
75	-3.5			SS 17	100	10-12-14 (26)	21			
			FAT CLAY (CH) - light gray to gray; very stiff to hard; moist (ALLUVIUM)							
80	-8.5			SS 18	100	8-11-15 (26)	23			4.5
85	-13.5			SS 19	100	9-16-25 (41)	23			4.5
90	-18.5			SS 20	100	14-26-32 (58)	19			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 72+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/14/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.85045° / -78.82816°

GROUND ELEVATION 79 ft **PROPOSED FFE** ---

NORTHING / EASTING N400546 ft / E2051555 ft

REFUSAL ---

STATION 72+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -11.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	79.0	SANDY CLAY (CL) - orange brown; firm; moist (ALLUVIUM)							
			SS 1	100	3-3-3 (6)	13			4.25
5	74.0		SS 2	87	2-3-3 (6)	29			3.0
		SAND (SP) - light brown to orange brown; loose; moist (ALLUVIUM)	SS 3	87	2-4-5 (9)	26			
10	69.0		SS 4	73	3-4-5 (9)	17			
		SAND (SP) with gravel - orange brown to brown; loose; moist (ALLUVIUM)							
15	64.0		SS 5	33	5-4-2 (6)	22			
		FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM)							
20	59.0		SS 6	100	1-4-6 (10)	54			3.25
25	54.0		SS 7	100	5-9-12 (21)	46			4.5
30	49.0		SS 8	100	5-8-10 (18)	45			4.5

NOTES:

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 72+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/14/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85045° / -78.82816°
GROUND ELEVATION 79 ft **PROPOSED FFE** ---
NORTHING / EASTING N400546 ft / E2051555 ft
REFUSAL ---
STATION 72+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
30	49.0		FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM) *(continued)*							
35	44.0			SS 9	100	4-6-8 (14)	42			4.0
			SILTY SAND (SM) - gray; medium dense; moist (ALLUVIUM)							
40	39.0			SS 10	100	5-8-9 (17)	46			
			FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM)							
45	34.0			SS 11	100	4-6-7 (13)	52			4.0
50	29.0			SS 12	100	8-9-12 (21)	51			4.5
			SAND (SP) - orange brown, light brown, and gray; medium dense; moist (ALLUVIUM)							
55	24.0			SS 13	93	6-6-10 (16)	55			
60	19.0			SS 14	93	10-11-17 (28)	41			3.0

NOTES:

(Continued Next Page)

BORING NUMBER 72+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/14/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85045° / -78.82816°
GROUND ELEVATION 79 ft **PROPOSED FFE** ---
NORTHING / EASTING N400546 ft / E2051555 ft
REFUSAL ---
STATION 72+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	19.0	SAND (SP) - gray; medium dense; moist (ALLUVIUM)							
		FAT CLAY (CH) - light gray; very stiff; moist (ALLUVIUM)							
65	14.0		SS 15	100	7-12-16 (28)	25			4.5
		SANDY CLAY (CL) - light gray; very moist; hard (ALLUVIUM)	SS 16	100	19-29-31 (60)	21			4.0
70	9.0								
		SAND (SP) - light gray; very dense; moist (ALLUVIUM)							
75	4.0		SS 17	73	16-22-35 (57)	22			
		SANDY CLAY (CH) - light gray; hard; moist (ALLUVIUM)							
80	-1.0		SS 18	100	10-16-27 (43)	19			3.0
		FAT CLAY (CH) - light gray; hard; moist (ALLUVIUM)	ST 1	100			61	38	
			ST 2	100					
85	-6.0								
90	-11.0		SS 19	100	9-13-25 (38)	22			3.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 77+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/14/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.85113° / -78.82947°

GROUND ELEVATION 78.5 ft **PROPOSED FFE** ---

NORTHING / EASTING N400793 ft / E2051160 ft

REFUSAL ---

STATION 77+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	78.5		SAND (SP) - orange brown and gray; very loose to medium dense; moist (ALLUVIUM)							
				SS 1	100	2-2-2 (4)	10			
				SS 2	73	3-6-7 (13)	45			
5	73.5									
				SS 3	73	5-6-8 (14)	16			
				SS 4	53	4-5-7 (12)	16			
10	68.5									
				SS 5	80	4-6-10 (16)	20			
15	63.5									
			SANDY CLAY (CL) - dark gray; stiff; moist (ALLUVIUM)							
				SS 6	93	5-5-5 (10)	27			1.5
20	58.5		FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
				SS 7	100	5-6-8 (14)	23			2.5
25	53.5									
				SS 8	100	4-6-8 (14)	38			4.0
30	48.5									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 77+50

PROJECT NAME Chemours Barrier Wall

DATE 10/14/20

DRILLING CONTRACTOR Independence Drilling

DRILLING METHOD Mud Rotary

GROUND ELEVATION 78.5 ft **PROPOSED FFE** ---

REFUSAL ---

TOP OF ROCK ---

BEGAN CORING ---

FOOTAGE CORED (LF) ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft

GEOServices PROJECT# 41-20500

PROJECT LOCATION Fayetteville, NC

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

LATITUDE / LONGITUDE 34.85113° / -78.82947°

NORTHING / EASTING N400793 ft / E2051160 ft

STATION 77+50

GROUND WATER LEVELS:

AT END OF DRILLING ---

AFTER 1 HOUR ---

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	48.5		FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM) *(continued)*	ST 1	100					
			SANDY CLAY (CH) - dark gray and gray; hard; moist (ALLUVIUM)	ST 2	100					
35	43.5									
40	38.5			SS 9	93	8-11-22 (33)	42			3.0
			SAND (SP) - gray, orange brown, and light brown; medium dense; moist (ALLUVIUM)							
45	33.5			SS 10	67	6-7-9 (16)	24			
			CLAYEY SAND (SC) - dark gray; medium dense; moist (ALLUVIUM)							
50	28.5		FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)	SS 11	100	6-9-13 (22)	37			4.5
55	23.5		SAND (SP) - orange brown and brown; dense; moist (ALLUVIUM)	SS 12	67	2-10-24 (34)	42			
			GRAVELLY SAND (SPG) with sandy clay - dark gray; dense; moist (ALLUVIUM)							
60	18.5			SS 13	93	10-16-23 (39)	29			

NOTES:

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 77+50

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/14/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85113° / -78.82947°
GROUND ELEVATION 78.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N400793 ft / E2051160 ft
REFUSAL ---
STATION 77+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -11.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	18.5		GRAVELLY SAND (SPG) with sandy clay - dark gray; dense; moist (ALLUVIUM) *(continued)*							
			FAT CLAY (CH) - light gray and gray; hard; moist (ALLUVIUM)							
65	13.5			SS 14	100	17-28-43 (71)	25			4.5
70	8.5			SS 15	100	15-21-28 (49)	25			4.5
75	3.5			SS 16	100	17-23-26 (49)	20			4.5
			SANDY CLAY (CL) - light gray; hard; moist (ALLUVIUM)							
80	-1.5			SS 17	100	14-32-43 (75)	17			4.5
85	-6.5			SS 18	100	14-14-22 (36)	22			4.5
90	-11.5			SS 19	100	27-45-48 (93)	17			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 82+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/15/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85214° / -78.82936°
GROUND ELEVATION 82.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N401161 ft / E2051194 ft
REFUSAL ---
STATION 82+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -7.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	82.5		SAND (SP) - brown and dark brown; medium dense; moist (ALLUVIUM)	SS 1	80	6-7-8 (15)	7			
			CLAYEY SAND (SC) - orange brown; loose; moist (ALLUVIUM)	SS 2	80	3-4-4 (8)	19			2.5
5	77.5		FAT CLAY (CH) - light gray, orange brown, and brown; firm to stiff; moist (ALLUVIUM)	SS 3	100	4-4-6 (10)	41			3.5
				SS 4	100	3-5-10 (15)	40			3.0
10	72.5		SAND (SP) - light brown, light gray, and orange brown; medium dense; moist (ALLUVIUM)							
15	67.5			SS 5	80	3-5-6 (11)	18			
20	62.5			SS 6	100	1-5-6 (11)	23			
25	57.5			SS 7	67	5-6-7 (13)	22			
30	52.5		FAT CLAY (CH) with sand - dark gray; stiff; moist (ALLUVIUM)	SS 8	80	5-4-8 (12)	38			3.0

NOTES:

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GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 82+50

PAGE 2 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/15/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85214° / -78.82936°
GROUND ELEVATION 82.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N401161 ft / E2051194 ft
REFUSAL ---
STATION 82+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -7.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	52.5	▨	FAT CLAY (CH) with sand - dark gray; stiff; moist (ALLUVIUM) *(continued)*							
		▨	FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)	SS 9	100	5-8-11 (19)	41			4.5
35	47.5	▨	FAT CLAY (CH) with petrified wood - dark gray; very stiff; moist (ALLUVIUM)	ST 1	100					
				ST 2	100					
40	42.5									
		⁙	SAND (SP) - light gray; medium dense; moist (ALLUVIUM)							
		▨	FAT CLAY (CH) with sand - dark gray, light gray, and orange brown; very stiff; moist (ALLUVIUM)	SS 10	80	10-13-17 (30)	33			4.5
45	37.5									
		⁙	SAND (SP) - gray and light gray; medium dense; moist (ALLUVIUM)	SS 11	67	9-9-15 (24)	14			
50	32.5									
		▨	FAT CLAY (CH) - dark gray; very stiff; moist (ALLUVIUM)	SS 12	100	10-15-22 (37)	44			4.5
55	27.5	⁙	SAND (SP) - light brown, light gray, and orange brown; dense to medium dense; moist (ALLUVIUM)							
				SS 13	80	8-11-14 (25)	25			
60	22.5									

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 82+50

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/15/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85214° / -78.82936°
GROUND ELEVATION 82.5 ft **PROPOSED FFE** ---
NORTHING / EASTING N401161 ft / E2051194 ft
REFUSAL ---
STATION 82+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -7.5 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
60	22.5	SAND (SP) - light gray; dense; moist (ALLUVIUM)							
65	17.5		SS 14	80	11-14-21 (35)	24			
70	12.5		SS 15	100	11-22-26 (48)	19			4.5
75	7.5		SS 16	100	34-50-50/0"	23			4.5
		FAT CLAY (CH) - gray; hard; moist (ALLUVIUM)							
80	2.5		SS 17	100	16-26-31 (57)	17			4.5
		SANDY CLAY (CL) - light blue gray; hard; moist (ALLUVIUM)							
85	-2.5		SS 18	93	14-18-22 (40)	20			4.5
		FAT CLAY (CH) - light blue gray to gray; hard; moist (ALLUVIUM)							
90	-7.5		SS 19	100	12-18-22 (40)	22			4.5

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 87+50

PAGE 1 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/15/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.85345° / -78.82972°

GROUND ELEVATION 78 ft **PROPOSED FFE** ---

NORTHING / EASTING N401637 ft / E2051086 ft

REFUSAL ---

STATION 87+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -12.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
0	78.0	SANDY CLAY (CL) - orange brown and brown; firm; moist (ALLUVIUM)							
			SS 1	93	3-2-4 (6)	23			2.0
			SS 2	80	2-4-4 (8)	22			3.5
5	73.0	FAT CLAY (CH) - orange brown and gray; firm; moist (ALLUVIUM)							
			SS 3	100	2-2-4 (6)	50			3.25
		CLAYEY SAND (SC) - orange brown, red, and gray; loose (ALLUVIUM)							
			SS 4	93	3-2-3 (5)	46			2.5
10	68.0								
		SAND (SP) - orange brown to gray; loose to medium dense; moist (ALLUVIUM)							
			SS 5	47	3-4-3 (7)	19			
15	63.0								
			SS 6	80	3-5-5 (10)	33			
20	58.0	FAT CLAY (CH) - dark gray; stiff; moist (ALLUVIUM)							
			SS 7	93	6-5-6 (11)	45			3.5
25	53.0	SAND (SP) - orange brown and light gray; medium dense; moist (ALLUVIUM)							
		SILTY SAND (SM) - orange brown, light gray, and dark gray; loose; moist (ALLUVIUM)							
			SS 8	73	1-2-4 (6)	26			
30	48.0								

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 87+50

PAGE 2 OF 3

PROJECT NAME Chemours Barrier Wall
GEOServices PROJECT# 41-20500
DATE 10/15/20
PROJECT LOCATION Fayetteville, NC
DRILLING CONTRACTOR Independence Drilling
LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot
DRILLING METHOD Mud Rotary
LATITUDE / LONGITUDE 34.85345° / -78.82972°
GROUND ELEVATION 78 ft **PROPOSED FFE** ---
NORTHING / EASTING N401637 ft / E2051086 ft
REFUSAL ---
STATION 87+50
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING ---
FOOTAGE CORED (LF) ---
AFTER 1 HOUR ---
BOTTOM OF HOLE Depth 90.0 ft / Elev -12.0 ft
AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	POCKET PEN. (tsf)
30	48.0	SILTY SAND (SM) - orange brown, light gray, and dark gray; loose; moist (ALLUVIUM) *(continued)*							
		FAT CLAY (CH) - dark gray; firm; very moist (ALLUVIUM)							
			SS 9	80	2-3-4 (7)	49			1.5
35	43.0	SAND (SP) - gray and orange brown; loose; moist (ALLUVIUM)							
40	38.0		SS 10	93	1-5-5 (10)	28			
45	33.0		SS 11	53	3-6-7 (13)	20			
		FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM)							
50	28.0		SS 12	100	6-7-8 (15)	39			4.0
55	23.0		SS 13	100	7-9-10 (19)	38			4.5
			ST 1	100					
			ST 2	100					
60	18.0								

NOTES:

(Continued Next Page)

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER 87+50

PAGE 3 OF 3

PROJECT NAME Chemours Barrier Wall

GEOServices PROJECT# 41-20500

DATE 10/15/20

PROJECT LOCATION Fayetteville, NC

DRILLING CONTRACTOR Independence Drilling

LOGGED BY M. Guillot **ON-SITE REP.** M. Guillot

DRILLING METHOD Mud Rotary

LATITUDE / LONGITUDE 34.85345° / -78.82972°

GROUND ELEVATION 78 ft **PROPOSED FFE** ---

NORTHING / EASTING N401637 ft / E2051086 ft

REFUSAL ---

STATION 87+50

TOP OF ROCK ---

GROUND WATER LEVELS:

BEGAN CORING ---

AT END OF DRILLING ---

FOOTAGE CORED (LF) ---

AFTER 1 HOUR ---

BOTTOM OF HOLE Depth 90.0 ft / Elev -12.0 ft

AFTER 24 HOURS ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		POCKET PEN. (tsf)
								LIQUID LIMIT	PLASTICITY INDEX	
60	18.0	▨	FAT CLAY (CH) - dark gray; stiff to very stiff; moist (ALLUVIUM) *(continued)*							
		▨	FAT CLAY (CH) with sand - dark gray; hard; moist (ALLUVIUM)							
65	13.0	▨		☒ SS 14	100	4-14-21 (35)	46			4.5
		░	SAND (SP) - gray and dark gray; dense; moist (ALLUVIUM)							
70	8.0	░		☒ SS 15	93	11-16-20 (36)	41			
		▨	SANDY CLAY (CL) - light gray; hard; moist (ALLUVIUM)							
75	3.0	▨		☒ SS 16	100	18-50-50/0"	19			4.5
		▨	FAT CLAY (CH) - light gray; very stiff; moist (ALLUVIUM)							
80	-2.0	▨		☒ SS 17	100	7-12-14 (26)	26			4.5
85	-7.0	▨		☒ SS 18	100	13-18-25 (43)	22			4.5
		▨	FAT CLAY (CH) with sand - light gray; hard; moist (ALLUVIUM)							
90	-12.0	▨		☒ SS 19	100	12-25-29 (54)	19			4.0

Bottom of borehole at 90.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX B

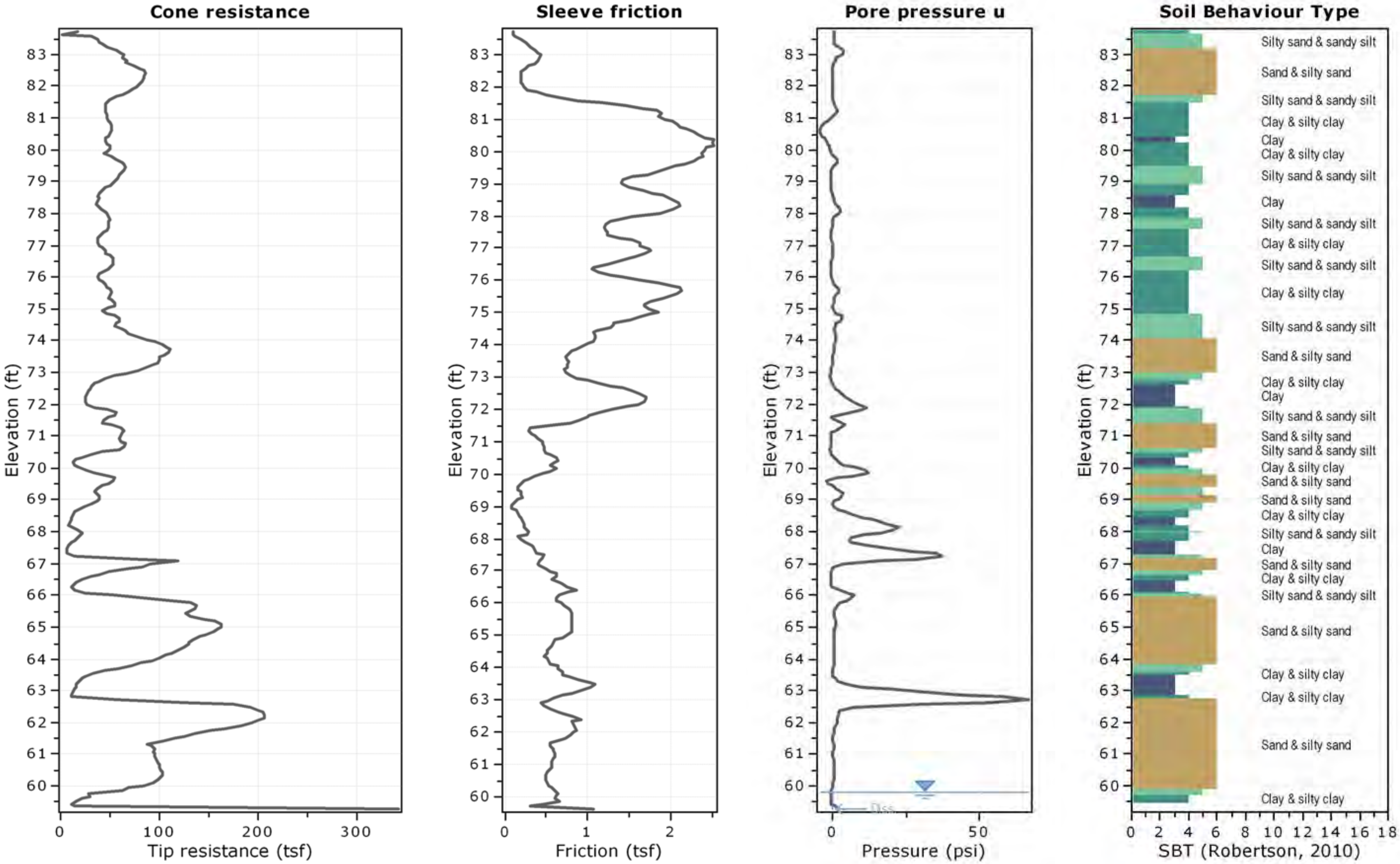
Cone Penetration Results

GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 2+50

Total depth: 24.52 ft
Surface Elevation: 83.80 ft

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

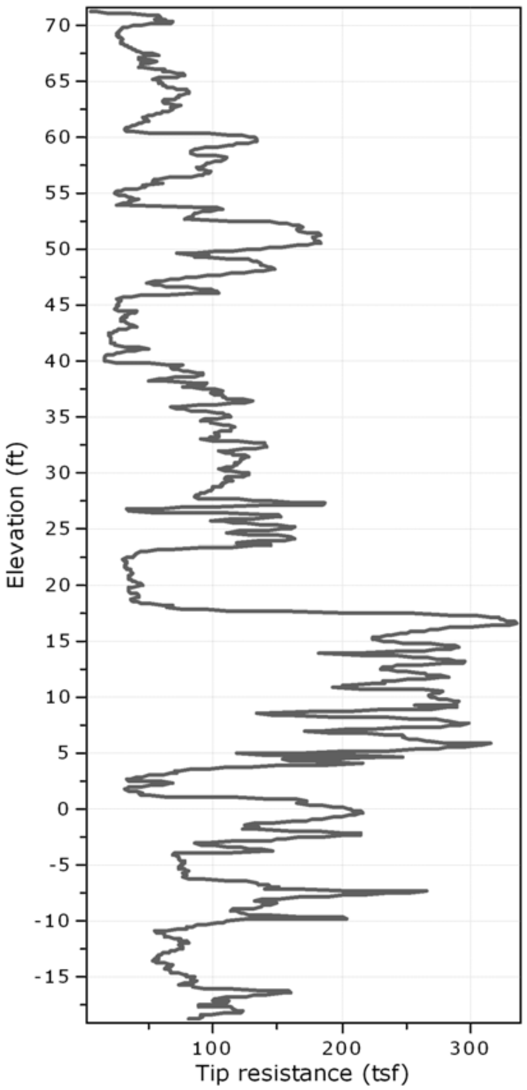


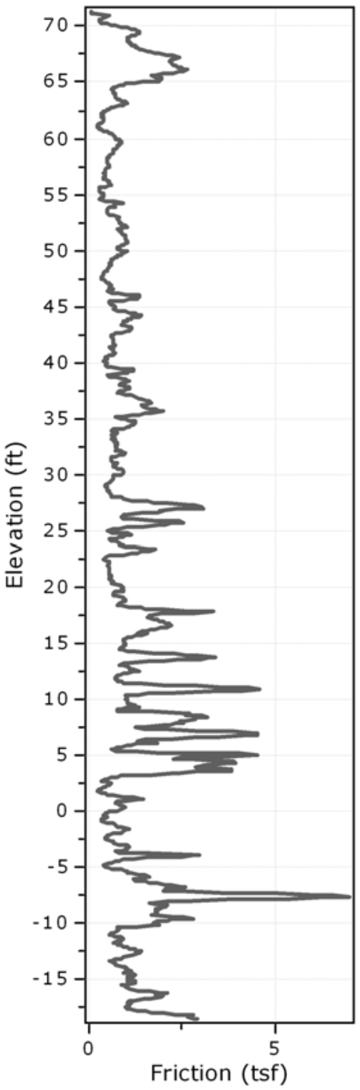
GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

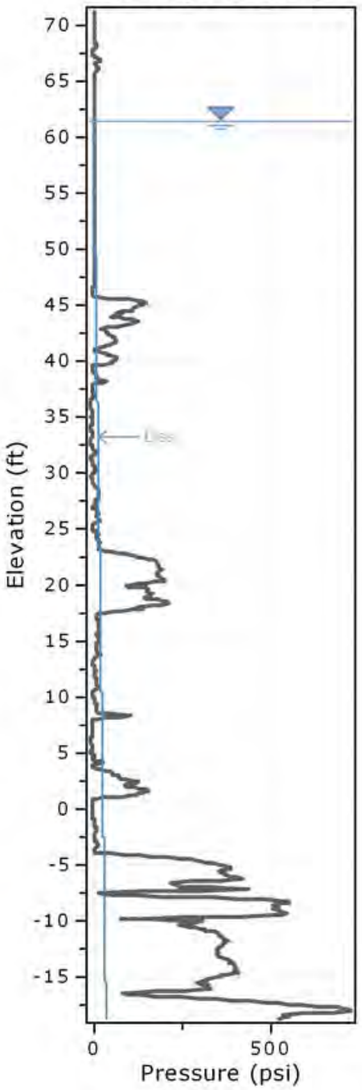
CPT: 7+50

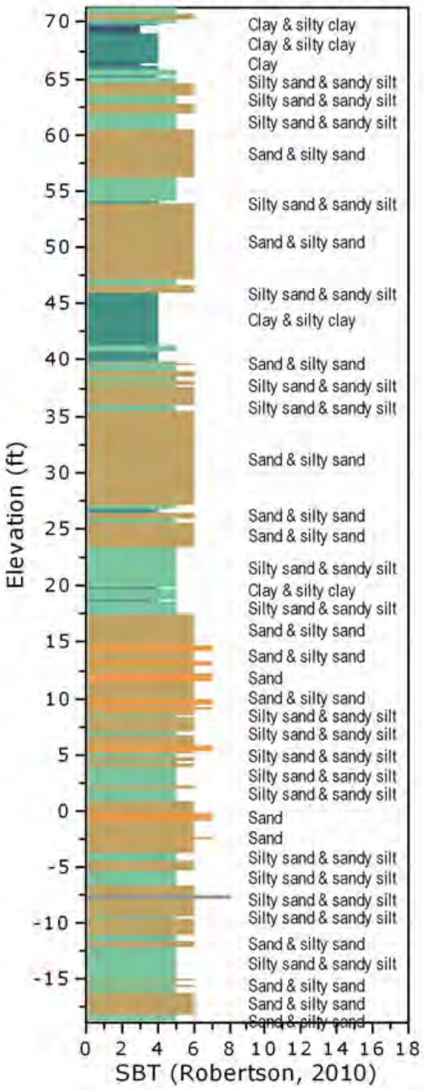
Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 90.22 ft
Surface Elevation: 71.40 ft


Cone resistance


Sleeve friction


Pore pressure u


Soil Behaviour Type

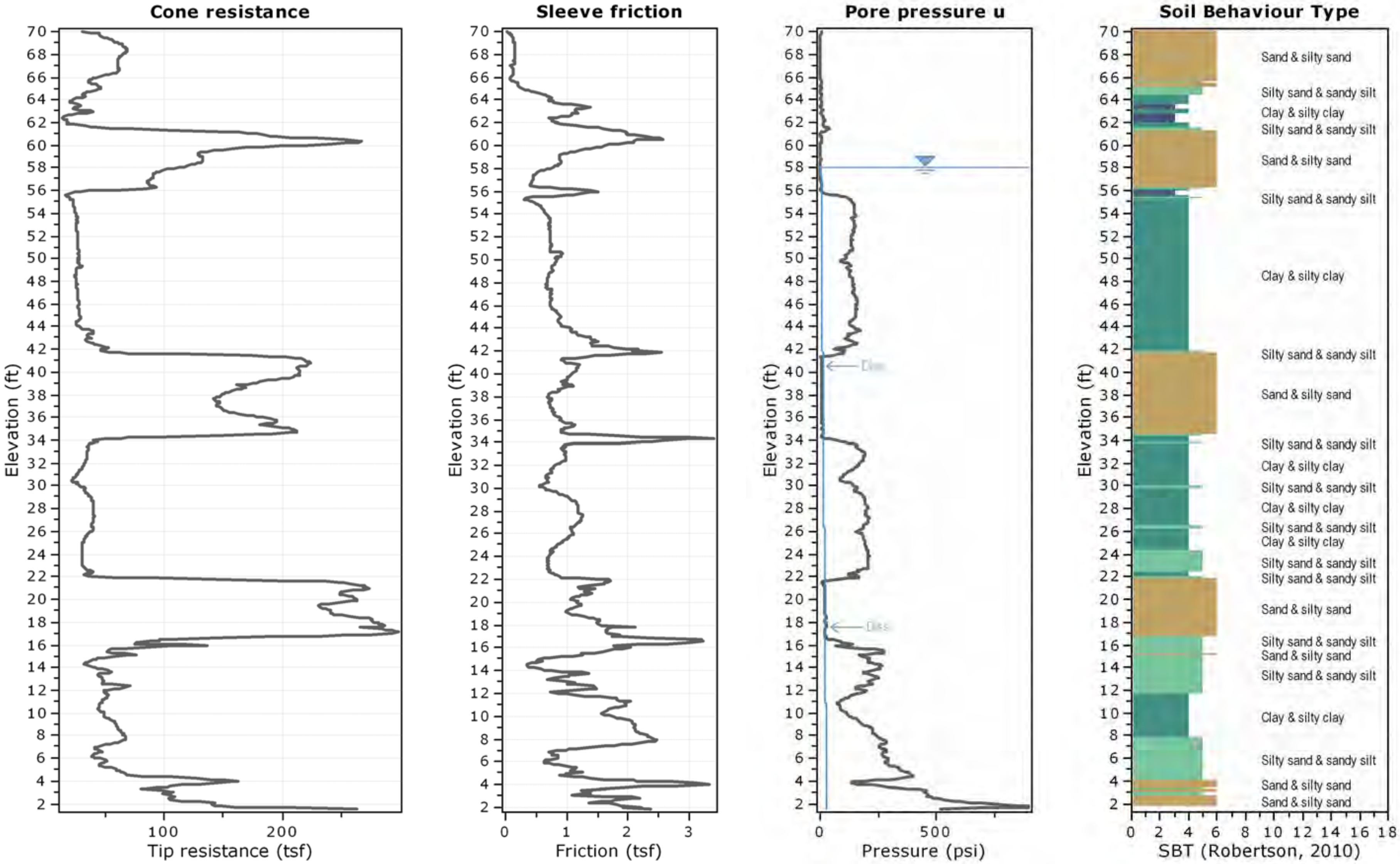
CPT: 12+50

Project: **Barrier Wall**

Location: **Chemours Fayetteville**

Total depth: 68.57 ft

Surface Elevation: 70.10 ft

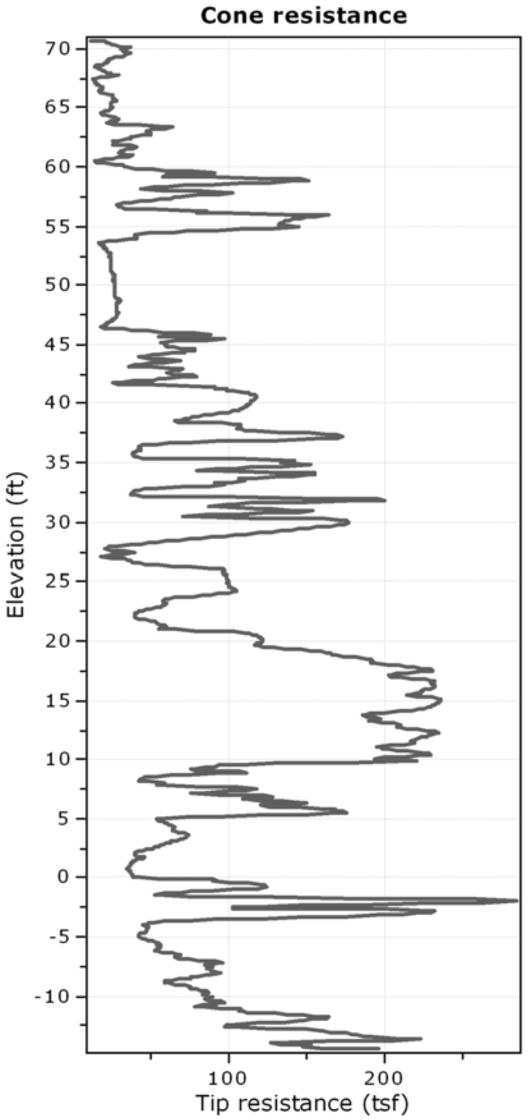


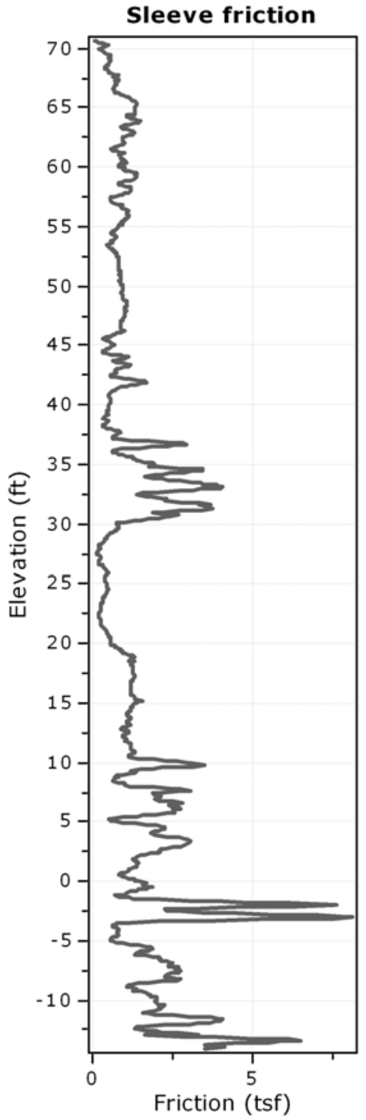
GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

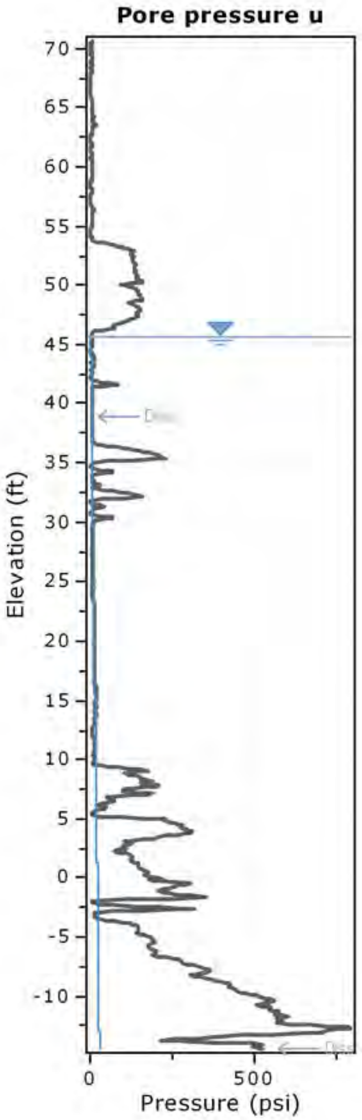
CPT: 17+50

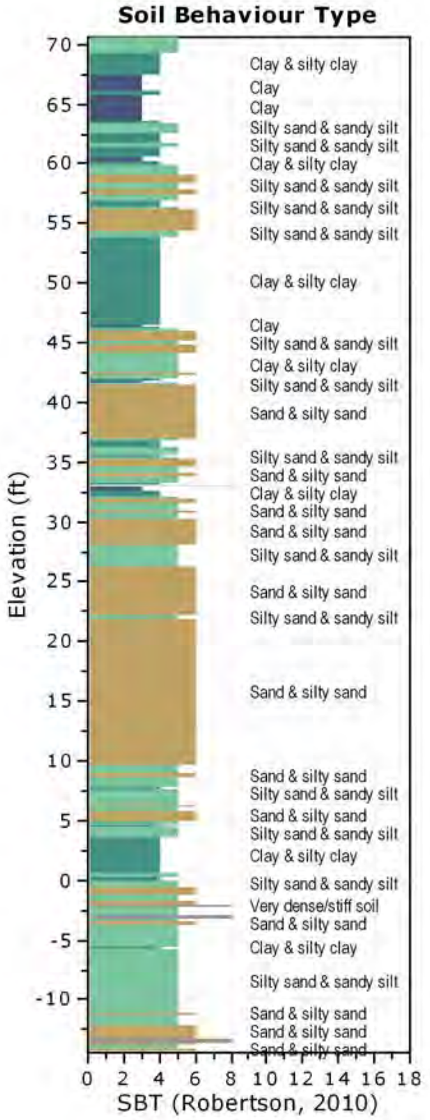
Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 85.14 ft
Surface Elevation: 70.70 ft





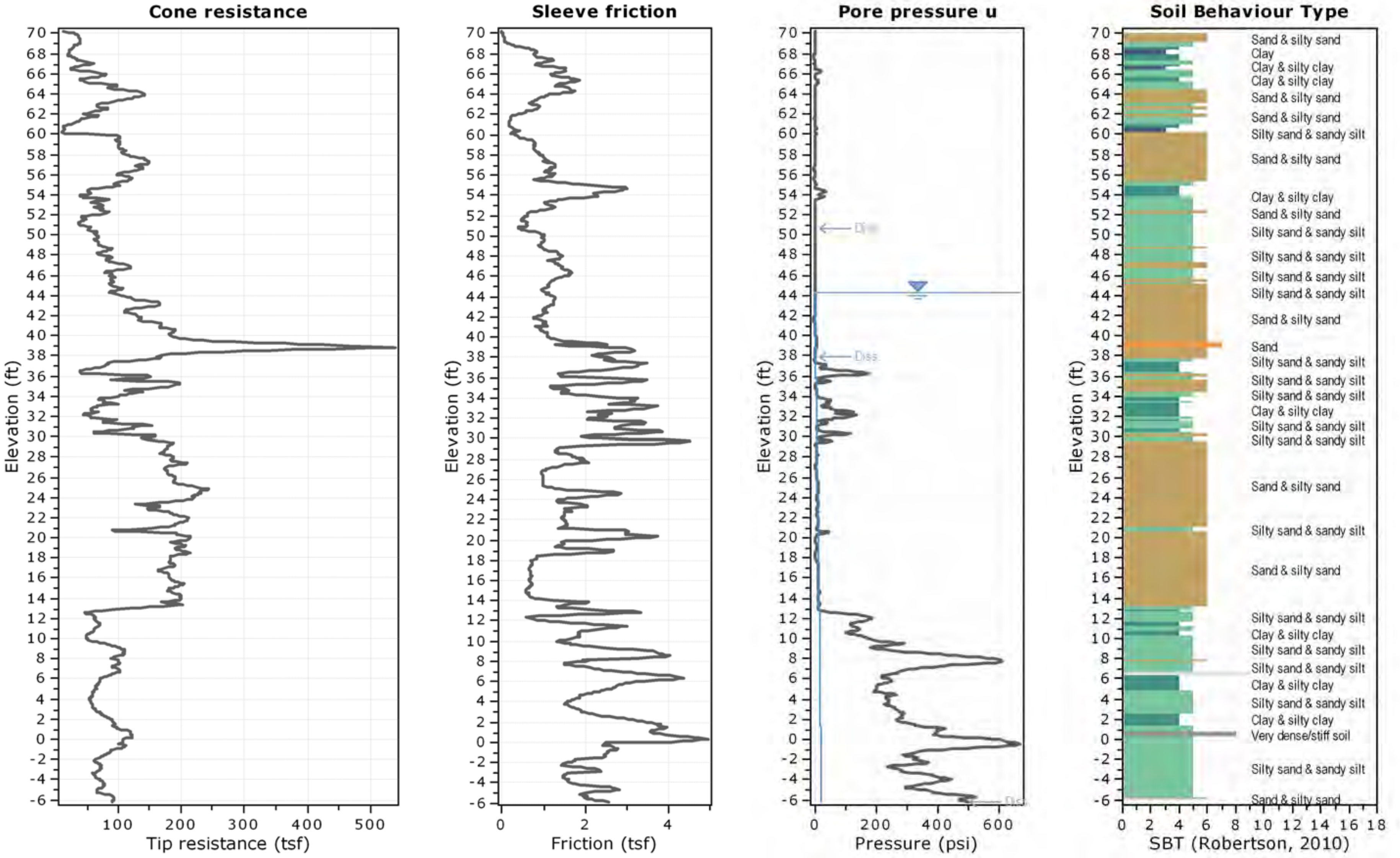




CPT: 22+50

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

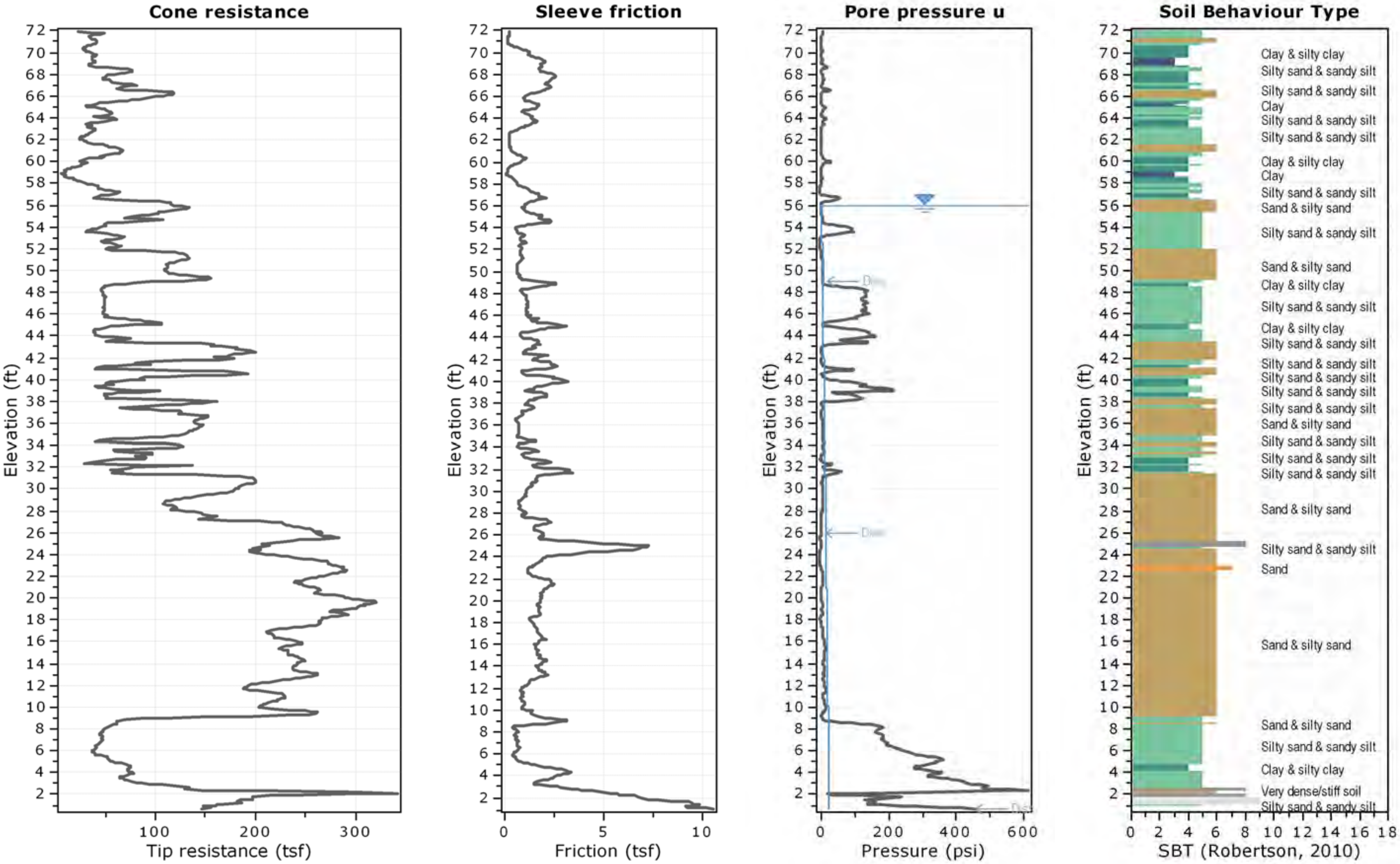
Total depth: 76.53 ft
Surface Elevation: 70.30 ft


Cone resistance **Sleeve friction** **Pore pressure u** **Soil Behaviour Type**

CPT: 27+50

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 71.36 ft
Surface Elevation: 72.00 ft



GEOServices, LLC-Geotechnical and Materials Engineers

GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

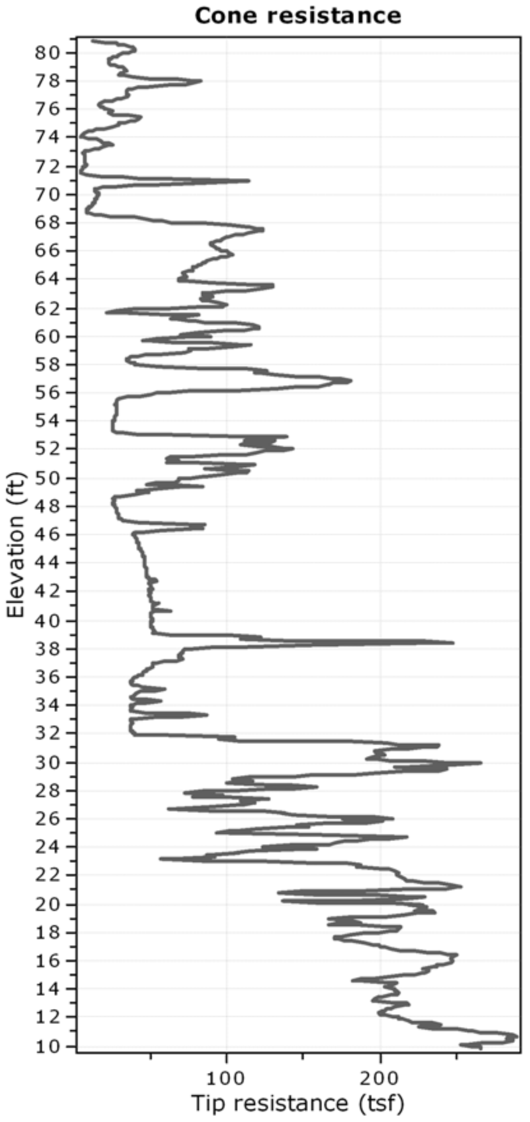
CPT: 32+00

Total depth: 71.11 ft

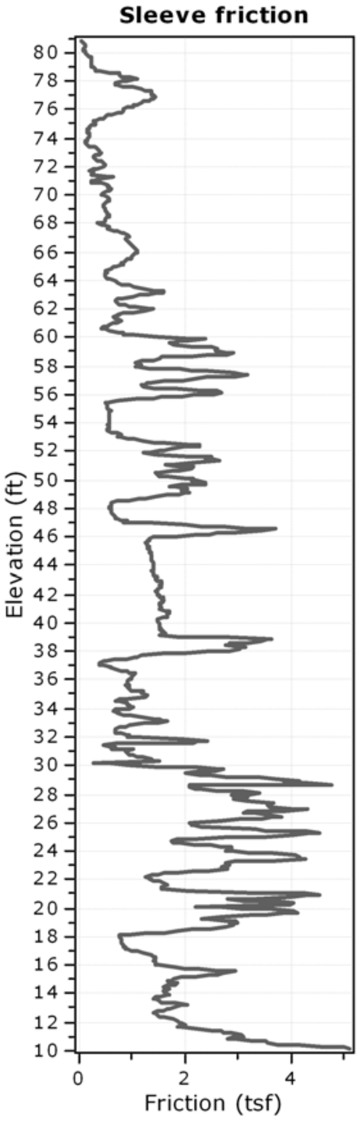
Surface Elevation: 80.90 ft

Project: **Barrier Wall**

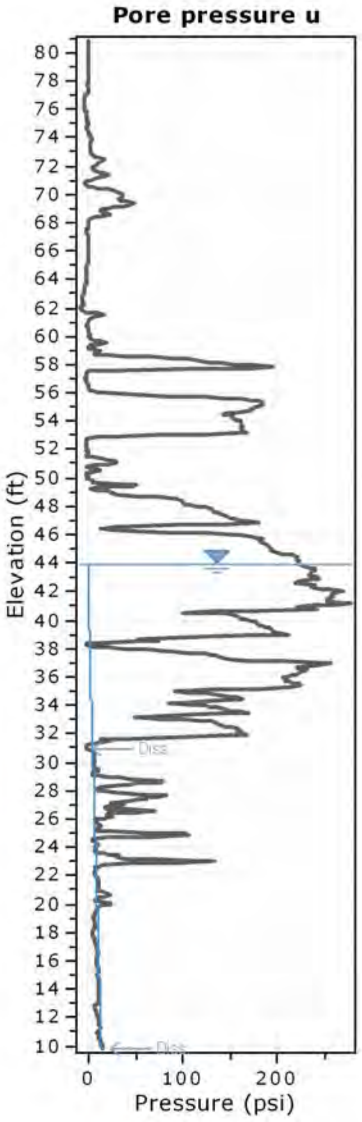
Location: **Chemours Fayetteville**



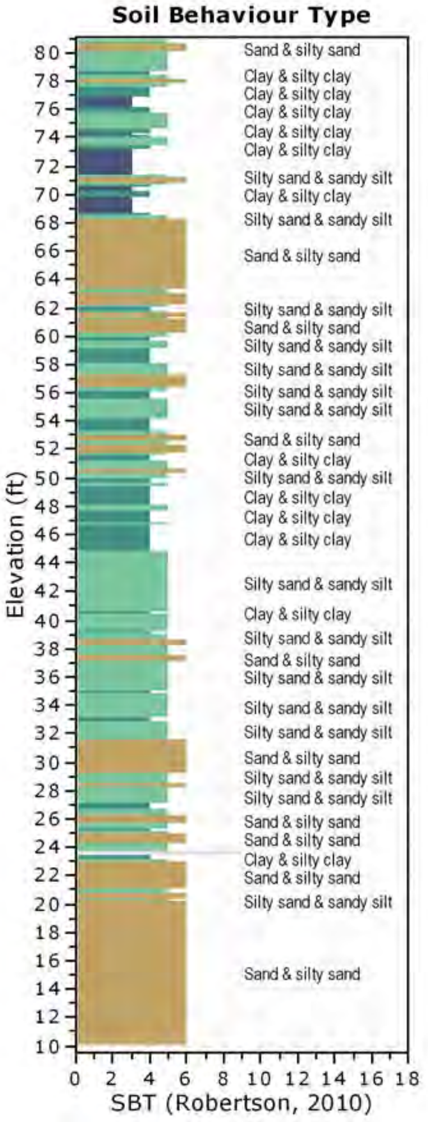
Cone resistance



Sleeve friction



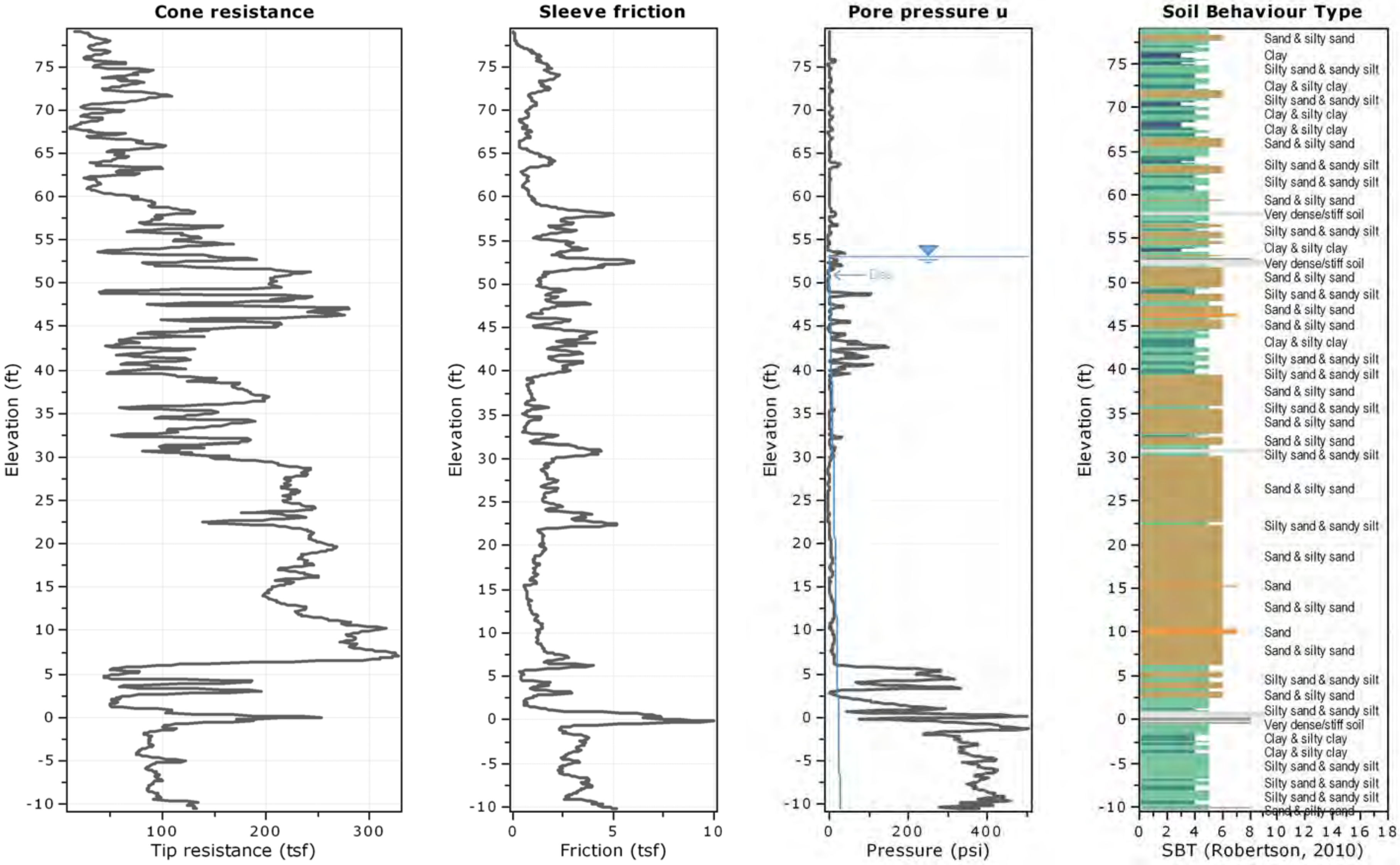
Pore pressure u



Soil Behaviour Type

CPT: 35+00
Total depth: 89.65 ft
Surface Elevation: 79.10 ft

Project: **Barrier Wall**
Location: **Chemours Fayetteville**



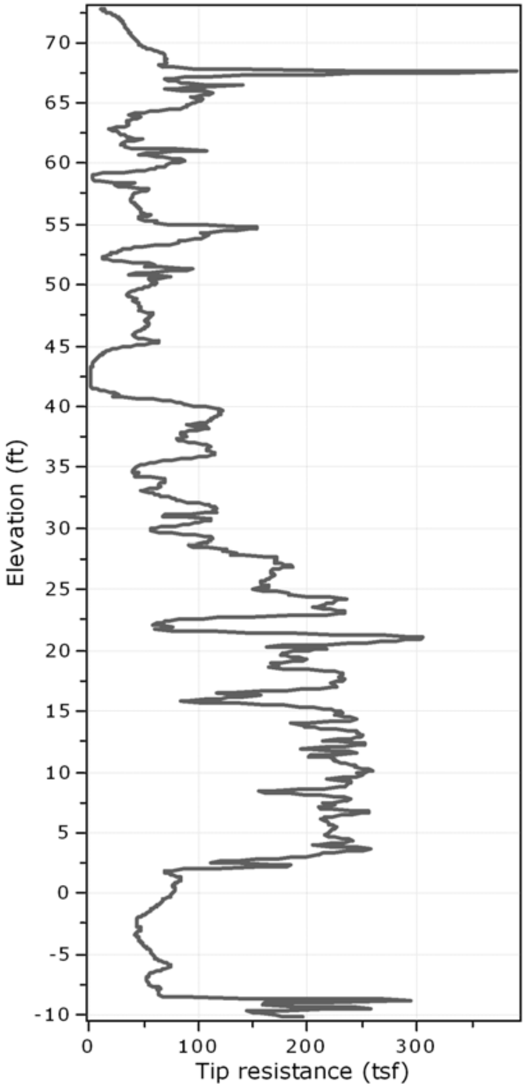
GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 40+00

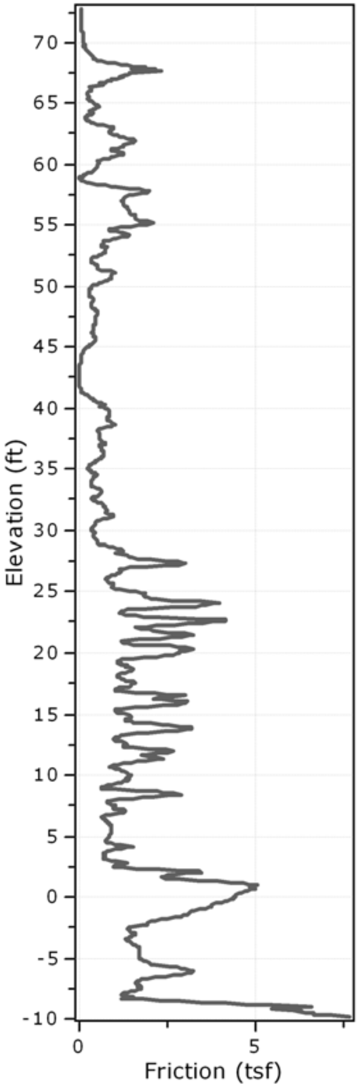
Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 82.92 ft
Surface Elevation: 72.80 ft

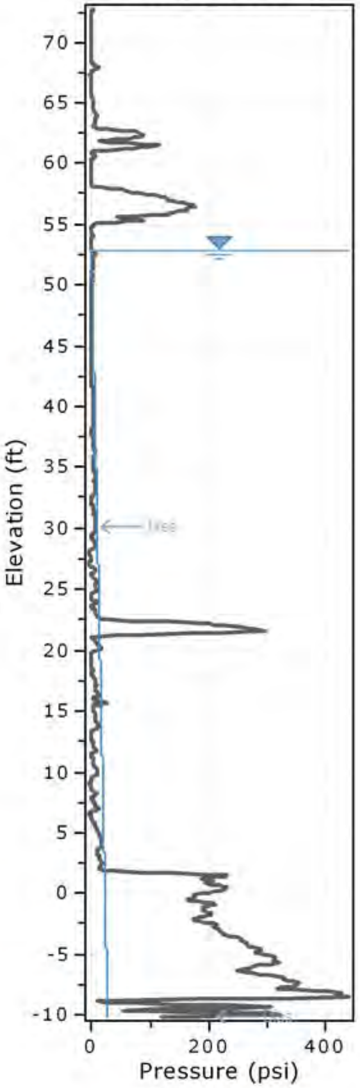
Cone resistance



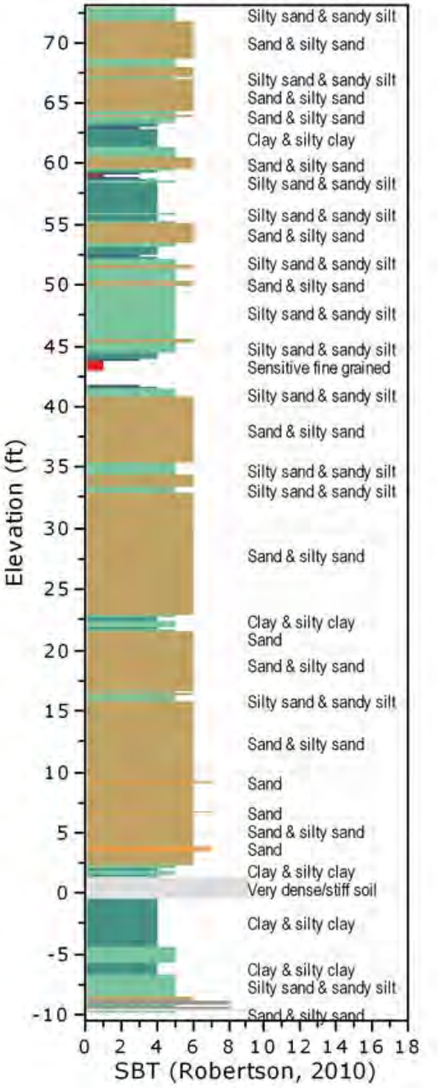
Sleeve friction



Pore pressure u



Soil Behaviour Type



GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

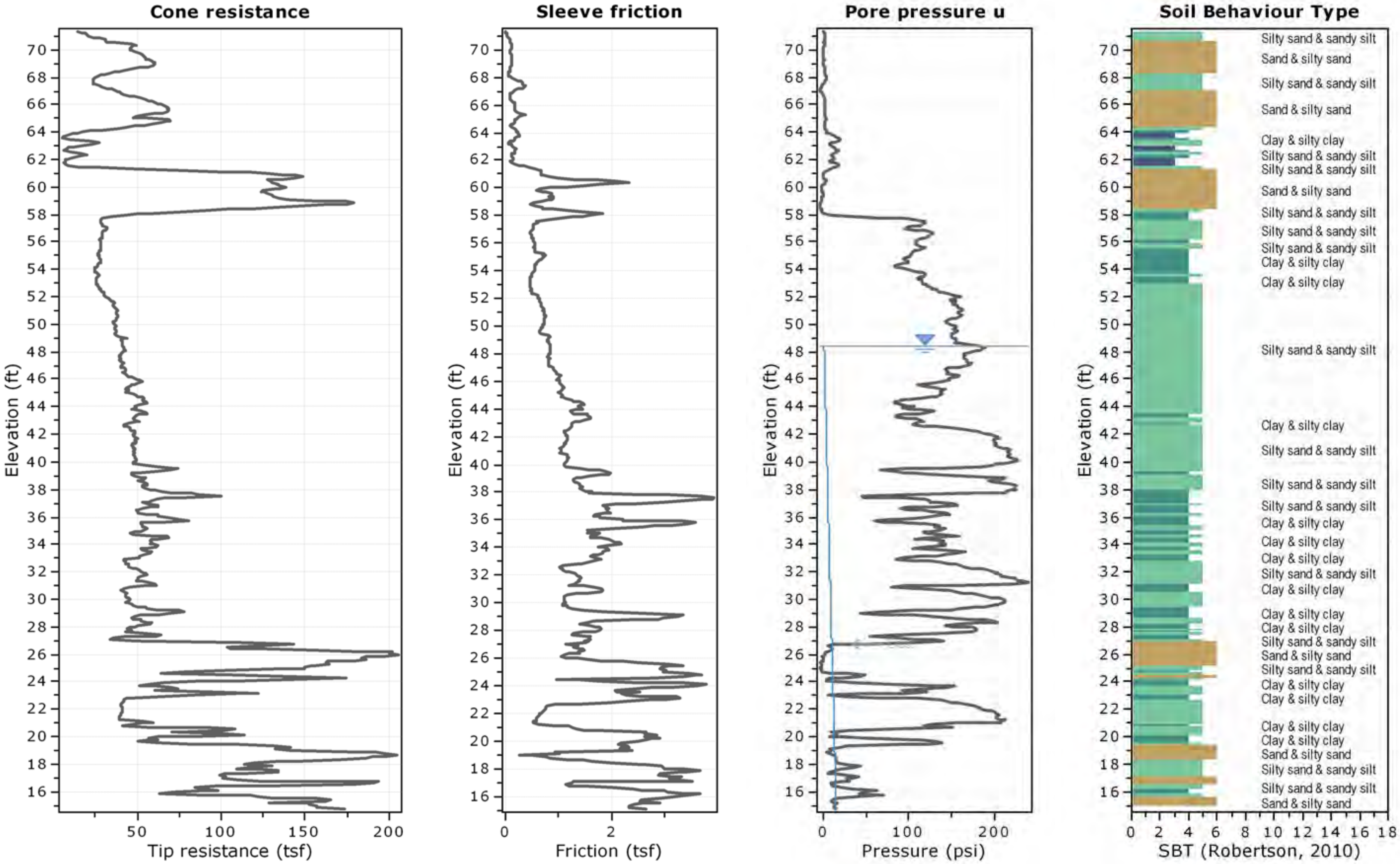
CPT: 45+00A

Total depth: 56.68 ft

Surface Elevation: 71.40 ft

Project: **Barrier Wall**

Location: **Chemours Fayetteville**



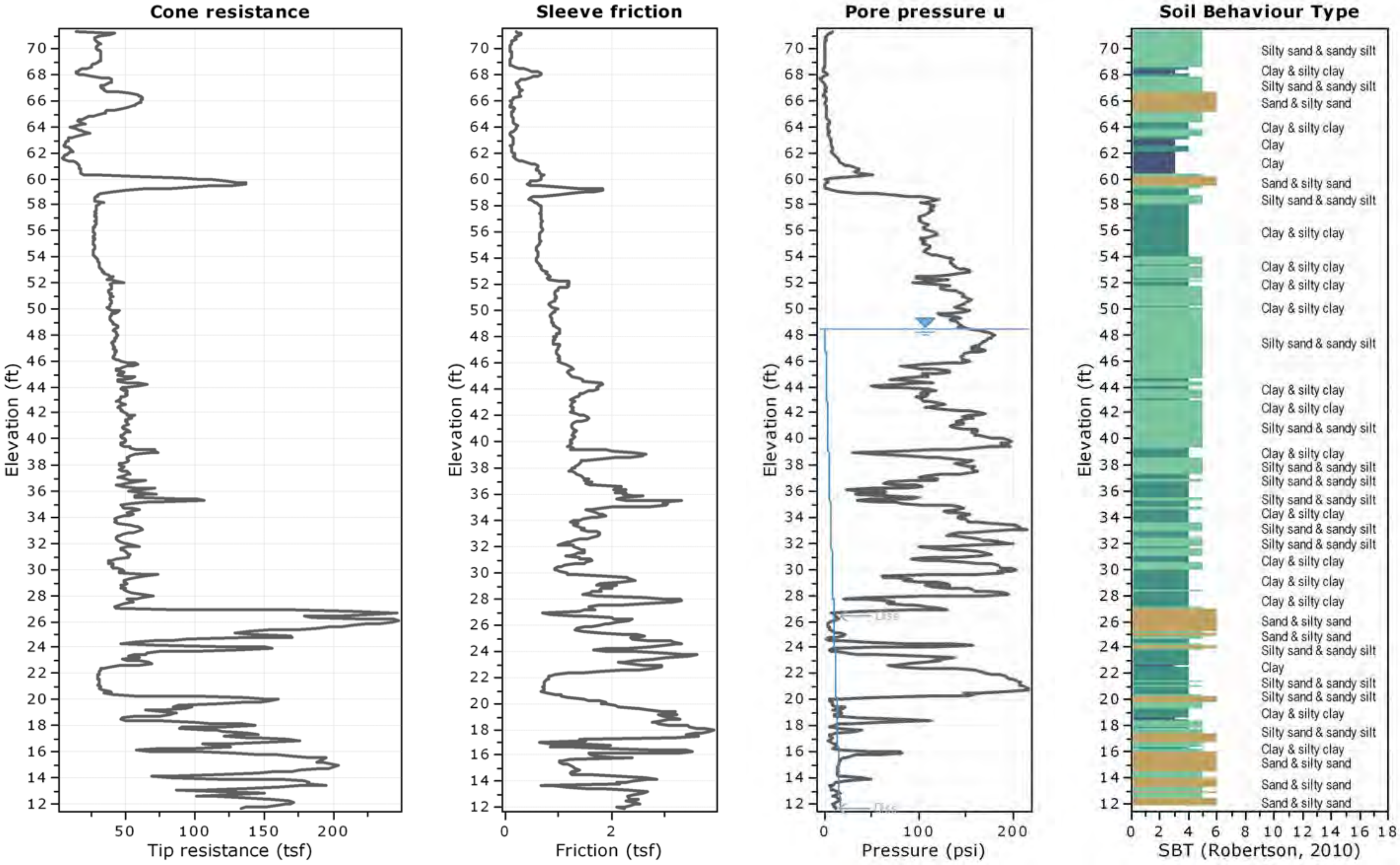
GEOServices, LLC-Geotechnical and Materials Engineers

GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 45+00

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 59.79 ft
Surface Elevation: 71.40 ft


Cone resistance

Sleeve friction

Pore pressure u

Soil Behaviour Type

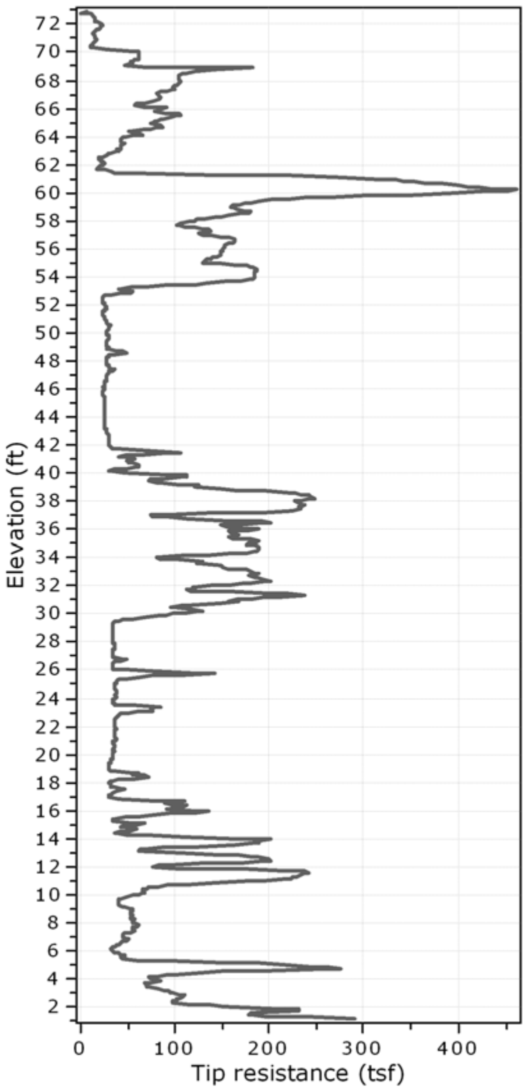
GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 50+00

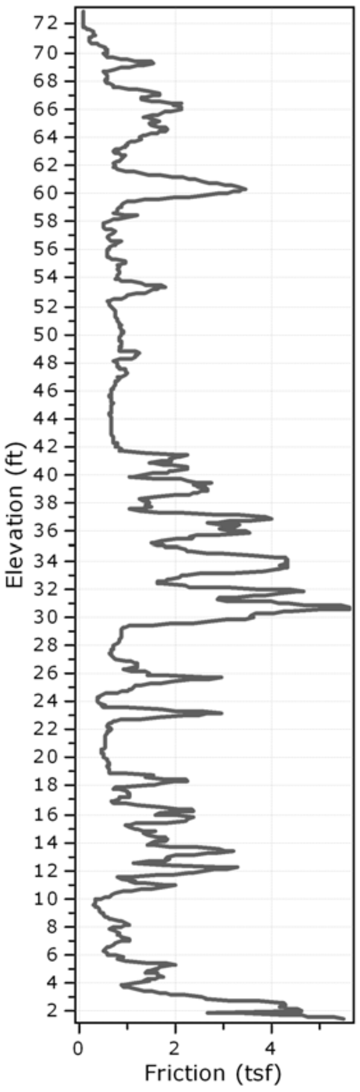
Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 71.85 ft
Surface Elevation: 73.00 ft

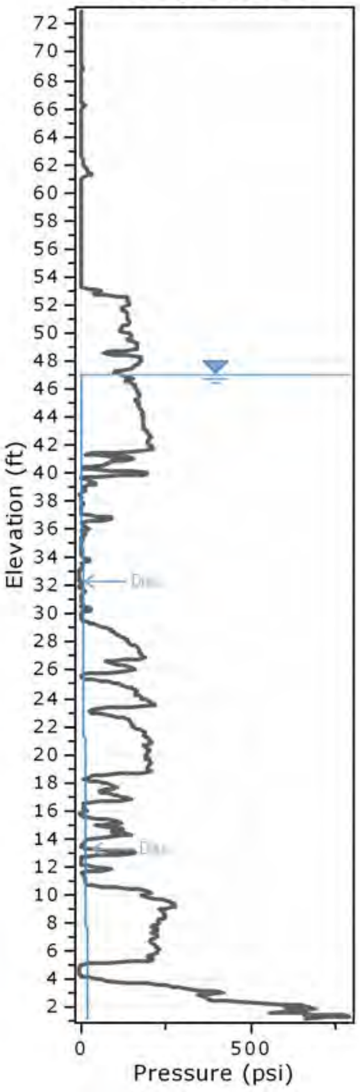
Cone resistance



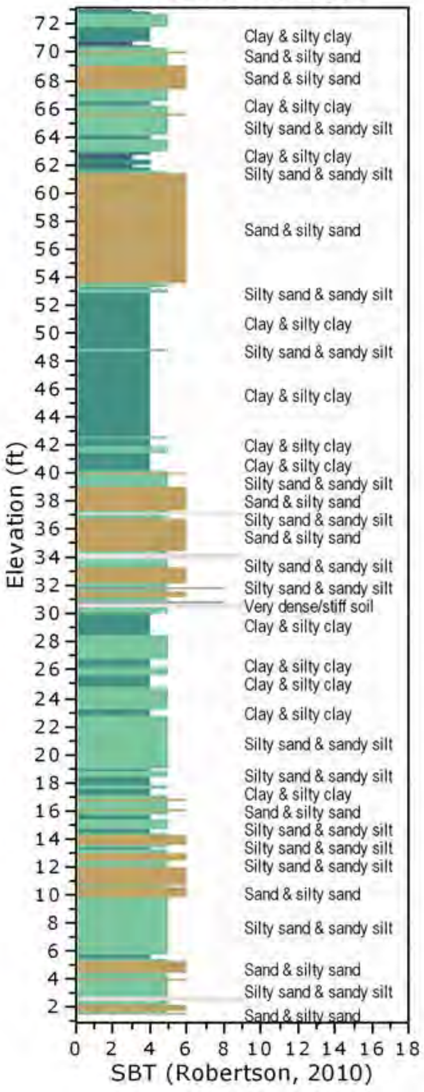
Sleeve friction



Pore pressure u



Soil Behaviour Type

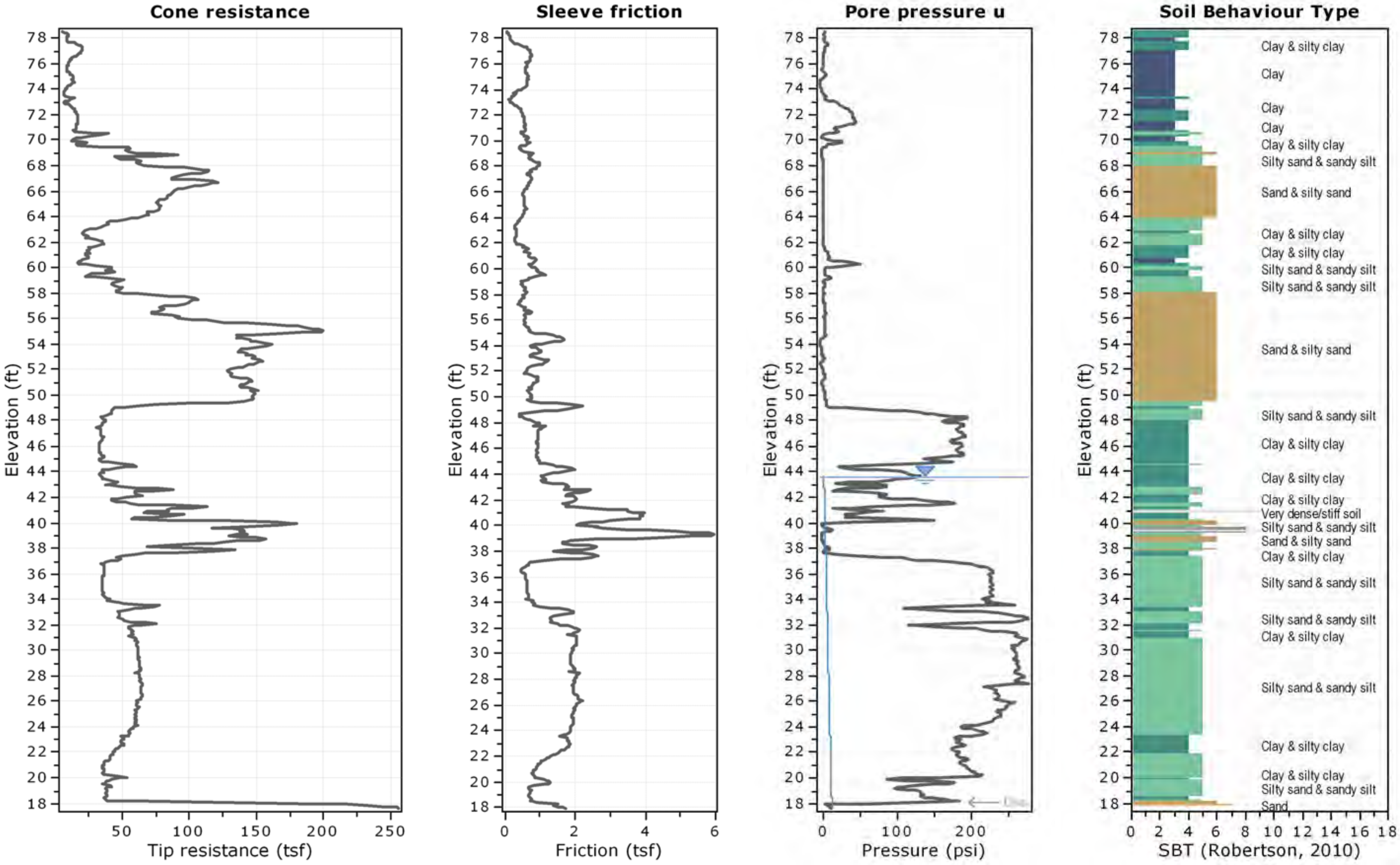


GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 55+00

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 61.02 ft
Surface Elevation: 78.60 ft

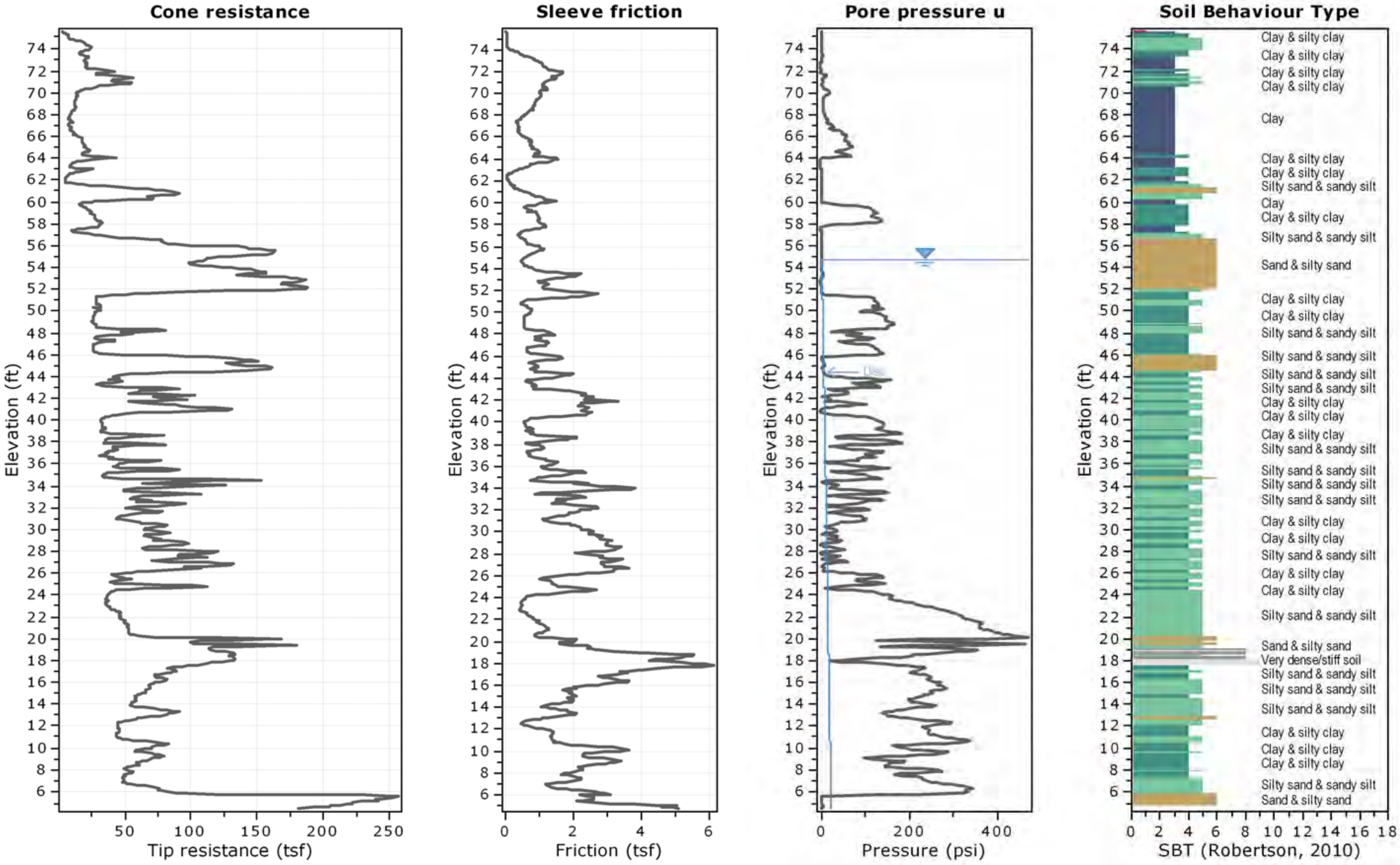


GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 60+00

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

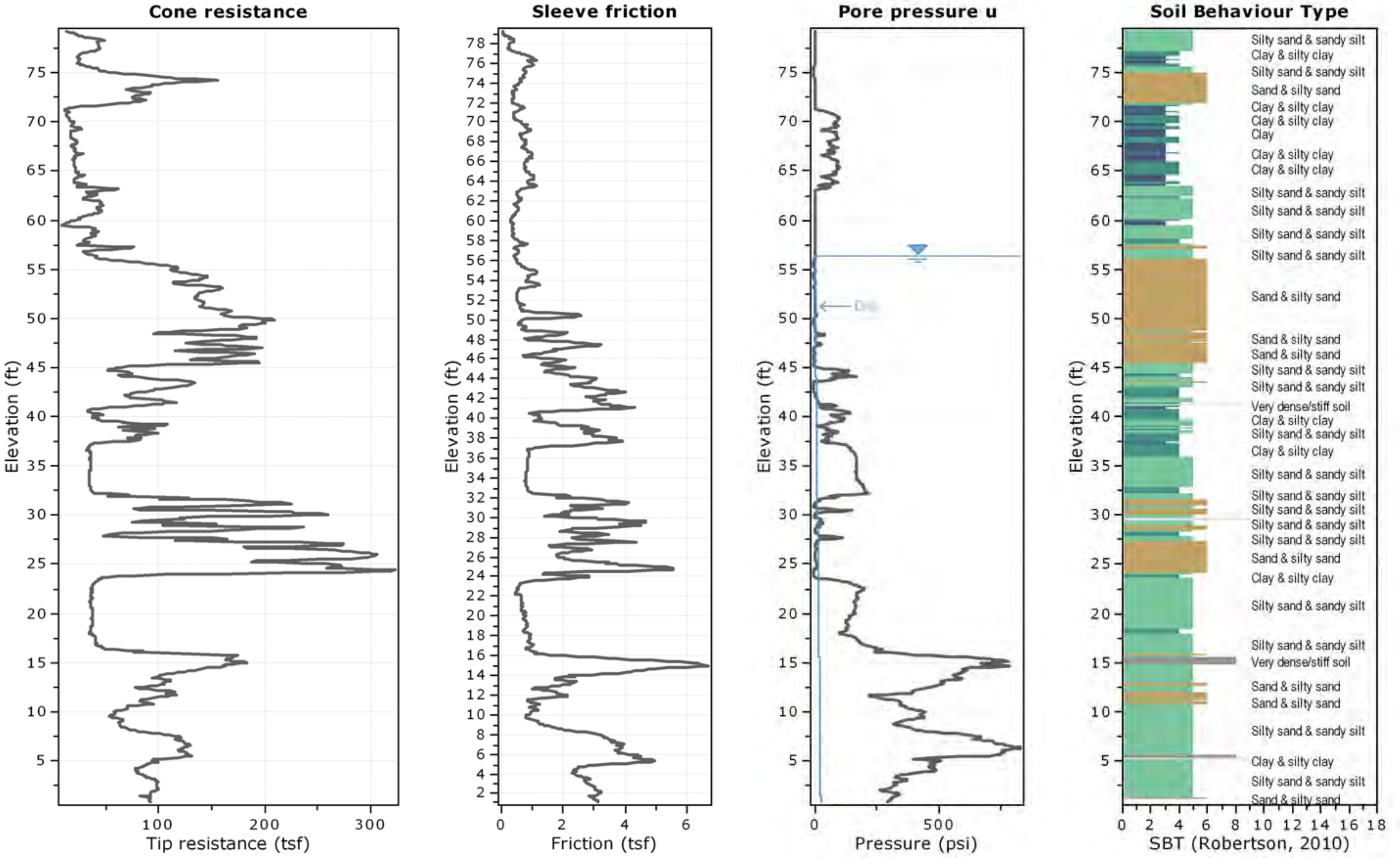
Total depth: 71.28 ft
Surface Elevation: 75.70 ft



CPT: 65+00

Total depth: 78.49 ft
Surface Elevation: 79.30 ft

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

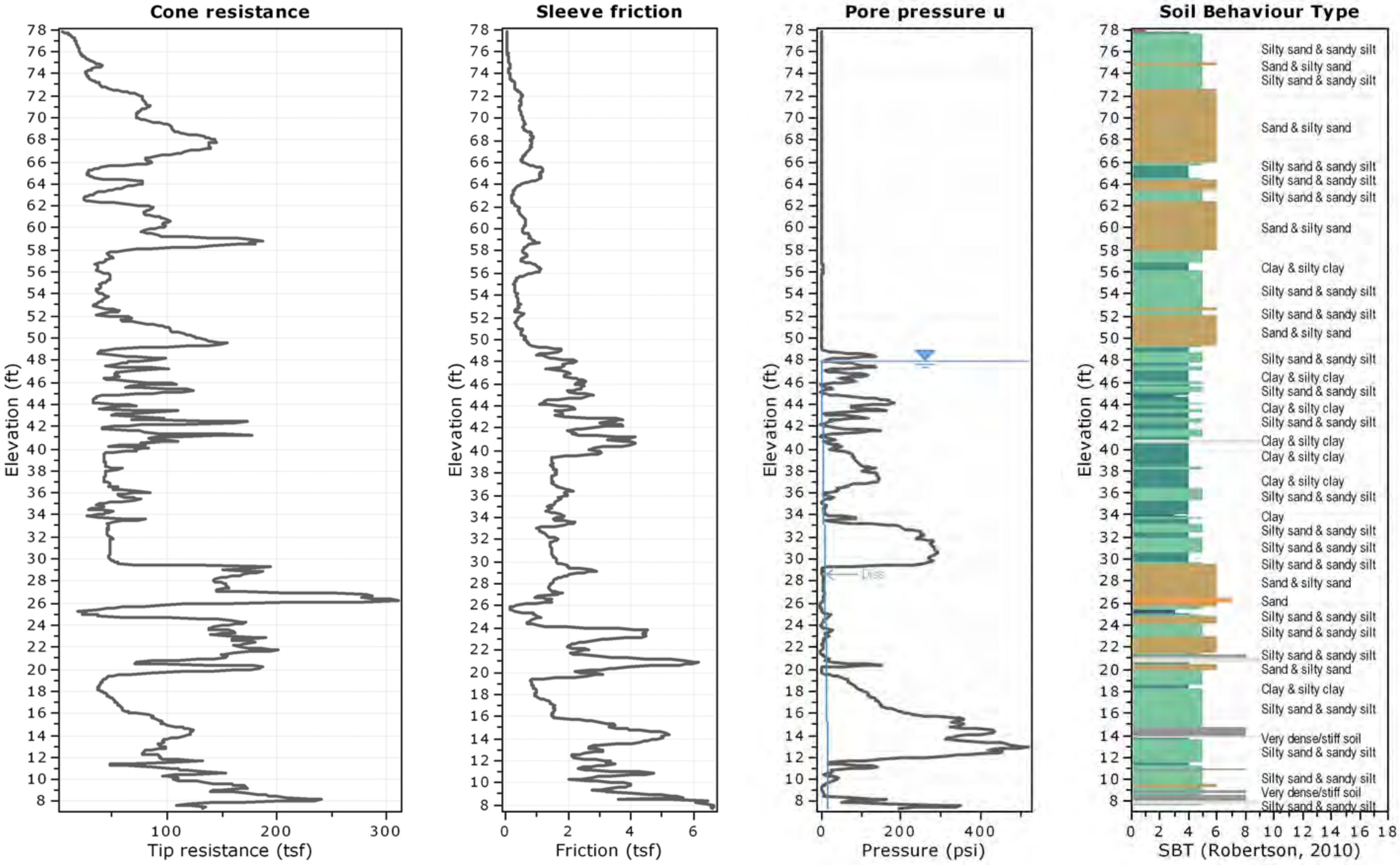


GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 70+00

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 70.54 ft
Surface Elevation: 77.90 ft



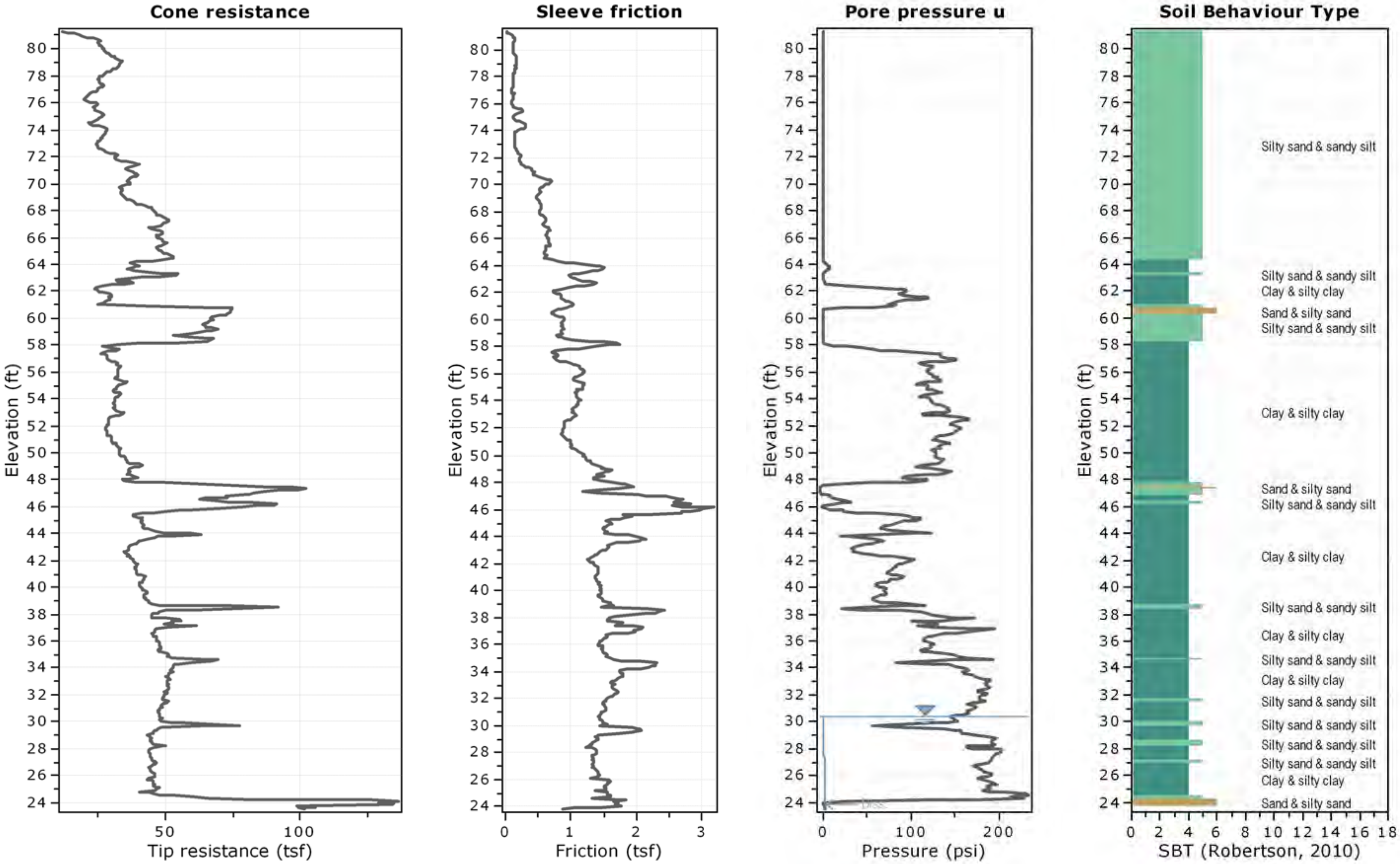
GEOServices, LLC-Geotechnical and Materials Engineers

GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 75+00A

Total depth: 57.91 ft
Surface Elevation: 81.40 ft

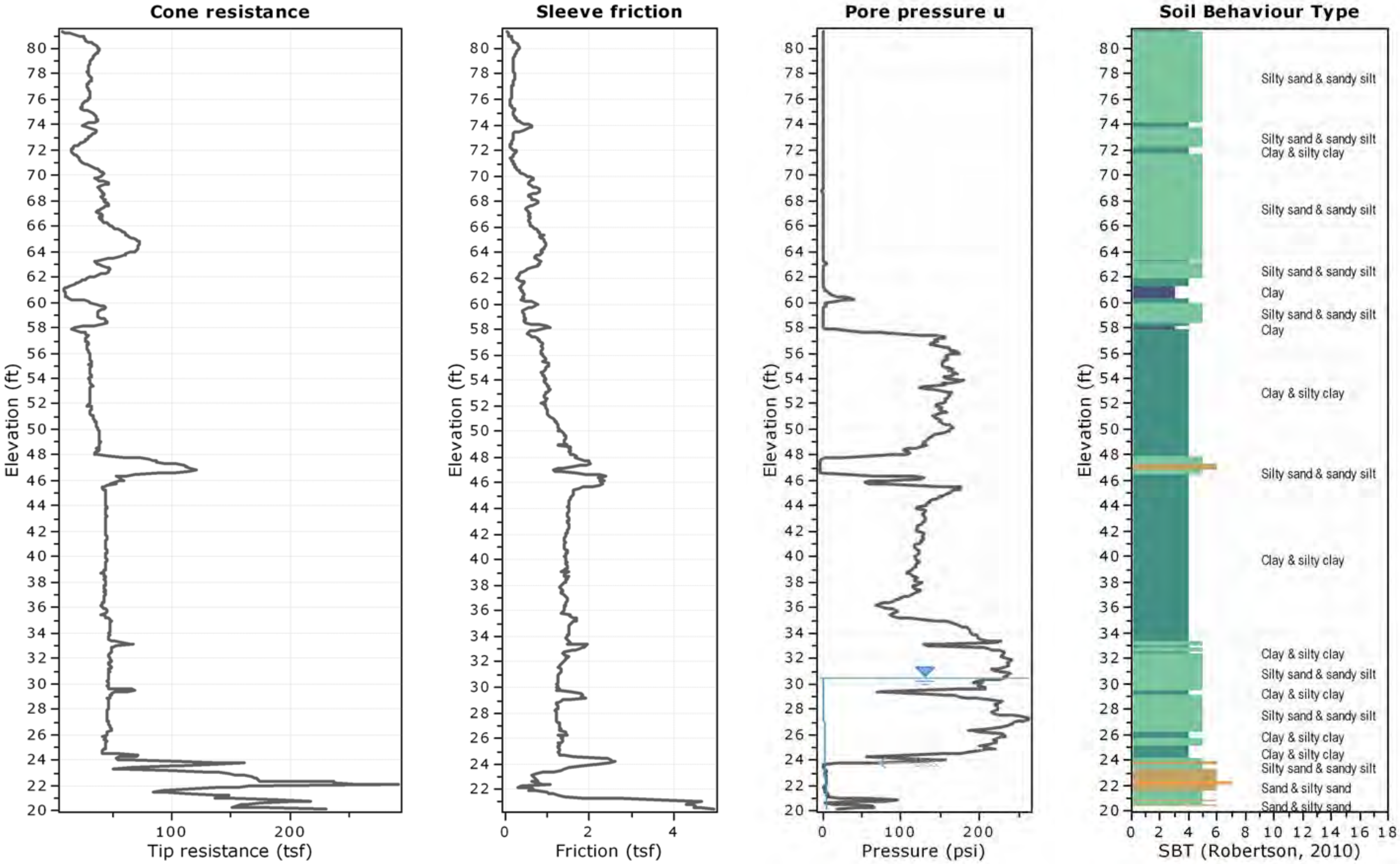
Project: **Barrier Wall**
Location: **Chemours Fayetteville**



GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 75+00
Total depth: 61.27 ft
Surface Elevation: 81.40 ft

Project: **Barrier Wall**
Location: **Chemours Fayetteville**



GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

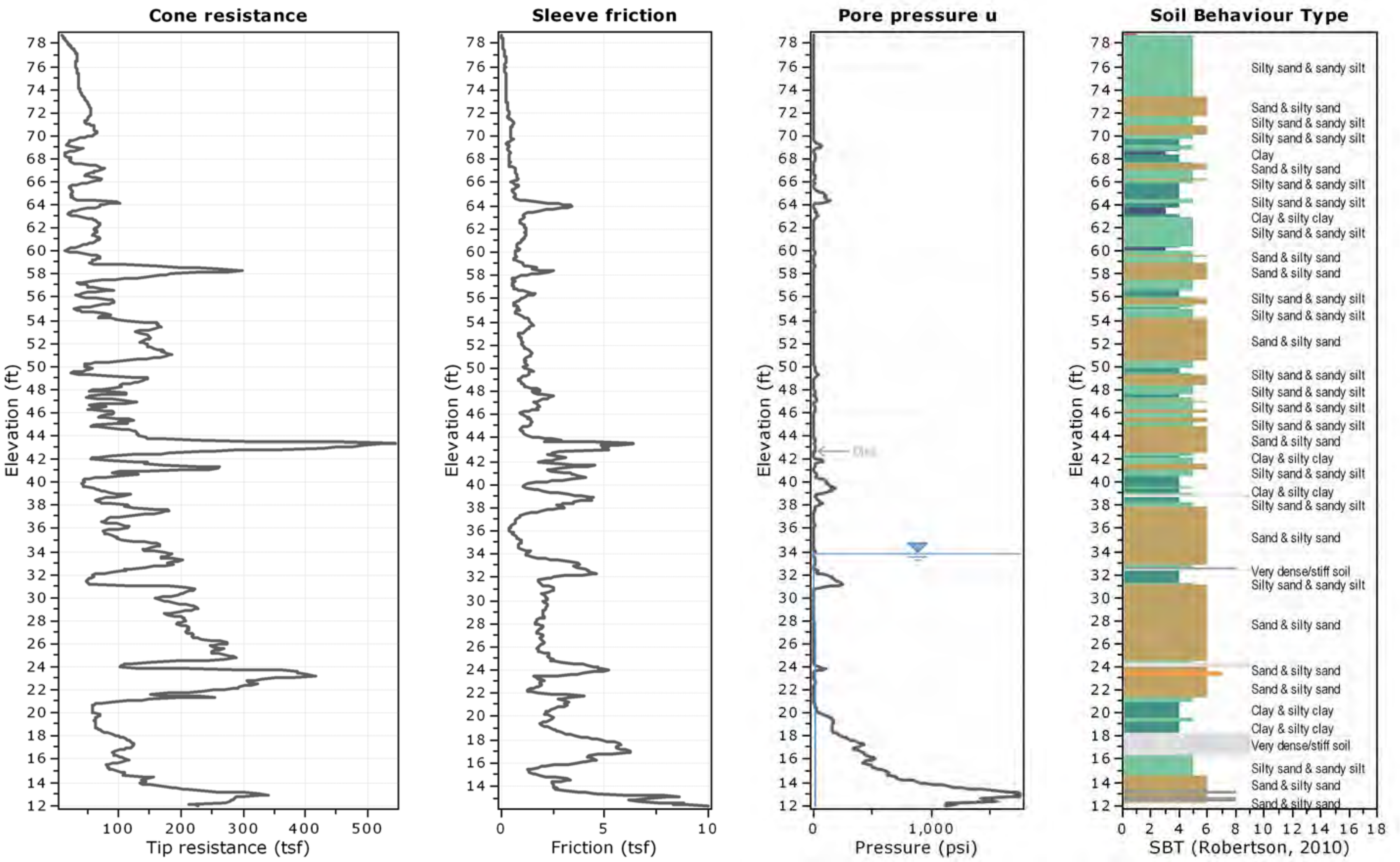
CPT: 80+00

Total depth: 66.85 ft

Surface Elevation: 78.80 ft

Project: **Barrier Wall**

Location: **Chemours Fayetteville**



Cone resistance

Sleeve friction

Pore pressure u

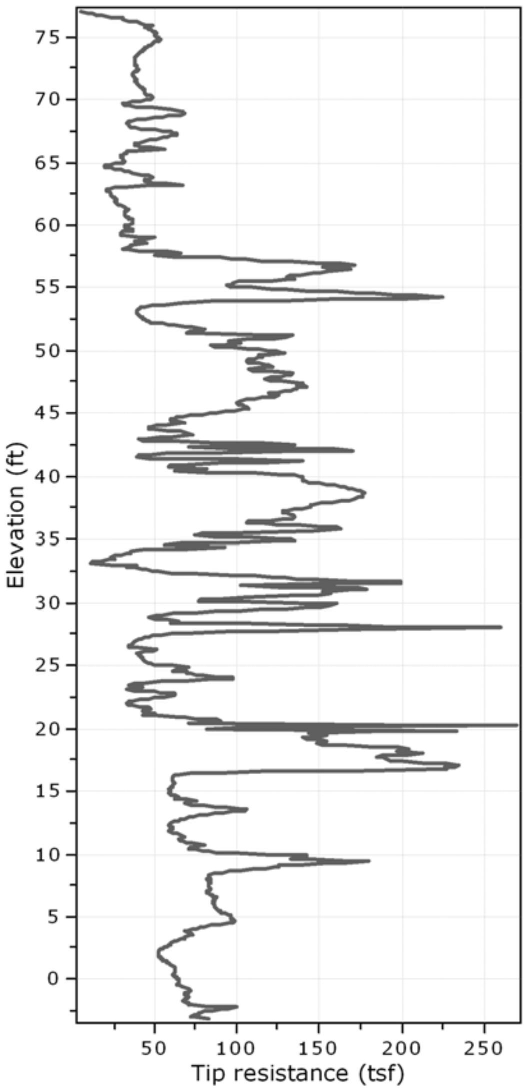
Soil Behaviour Type

CPT: 85+00

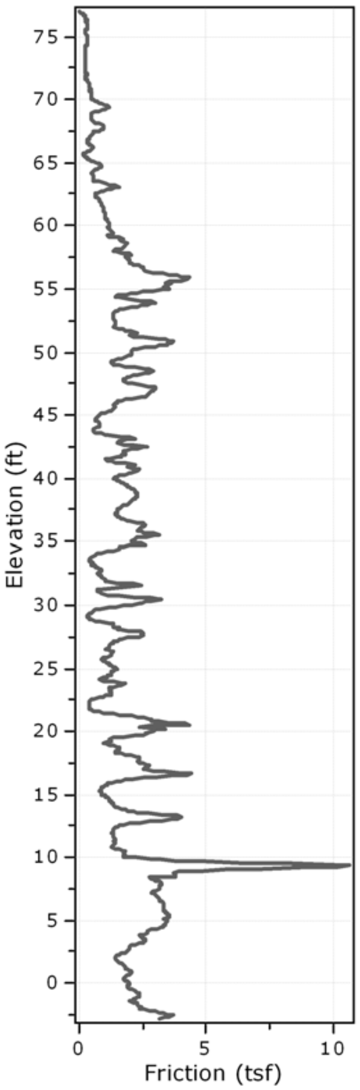
Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 80.22 ft
Surface Elevation: 77.10 ft

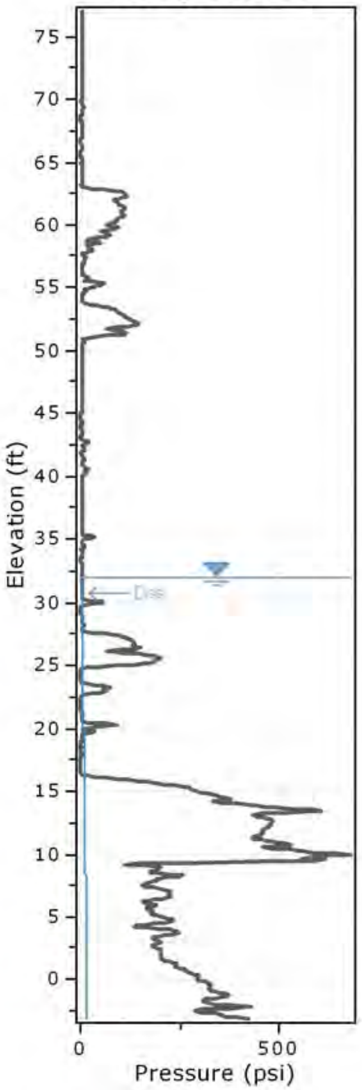
Cone resistance



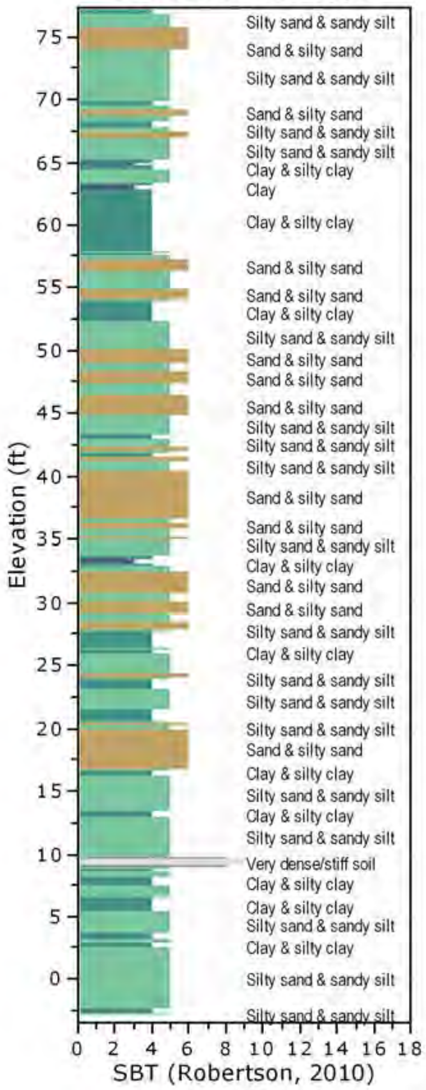
Sleeve friction



Pore pressure u



Soil Behaviour Type

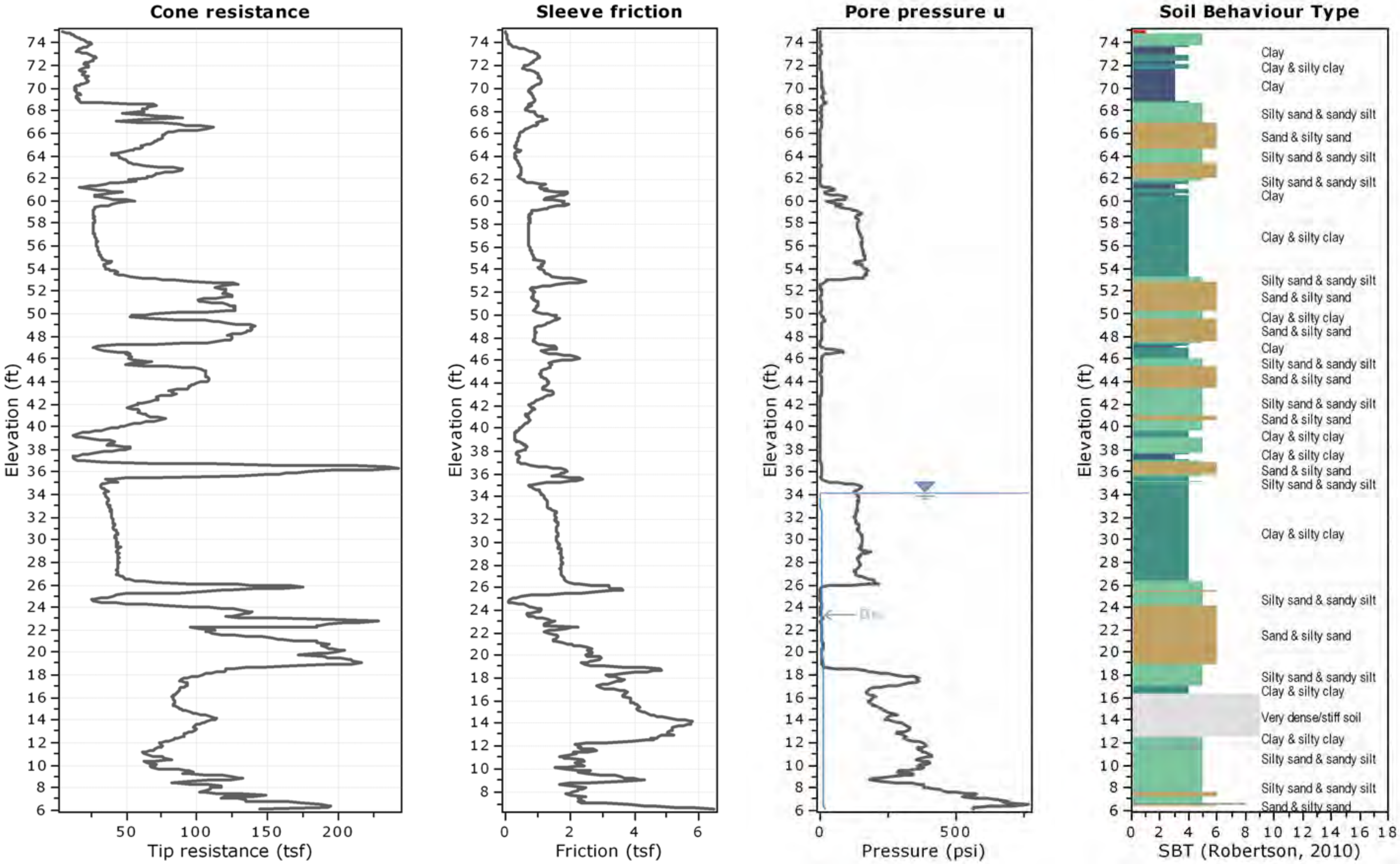


GEOServices, LLC
Cleveland, TN
http://www.geoservicesllc.com

CPT: 90+00

Project: **Barrier Wall**
Location: **Chemours Fayetteville**

Total depth: 68.98 ft
Surface Elevation: 75.10 ft



GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX C

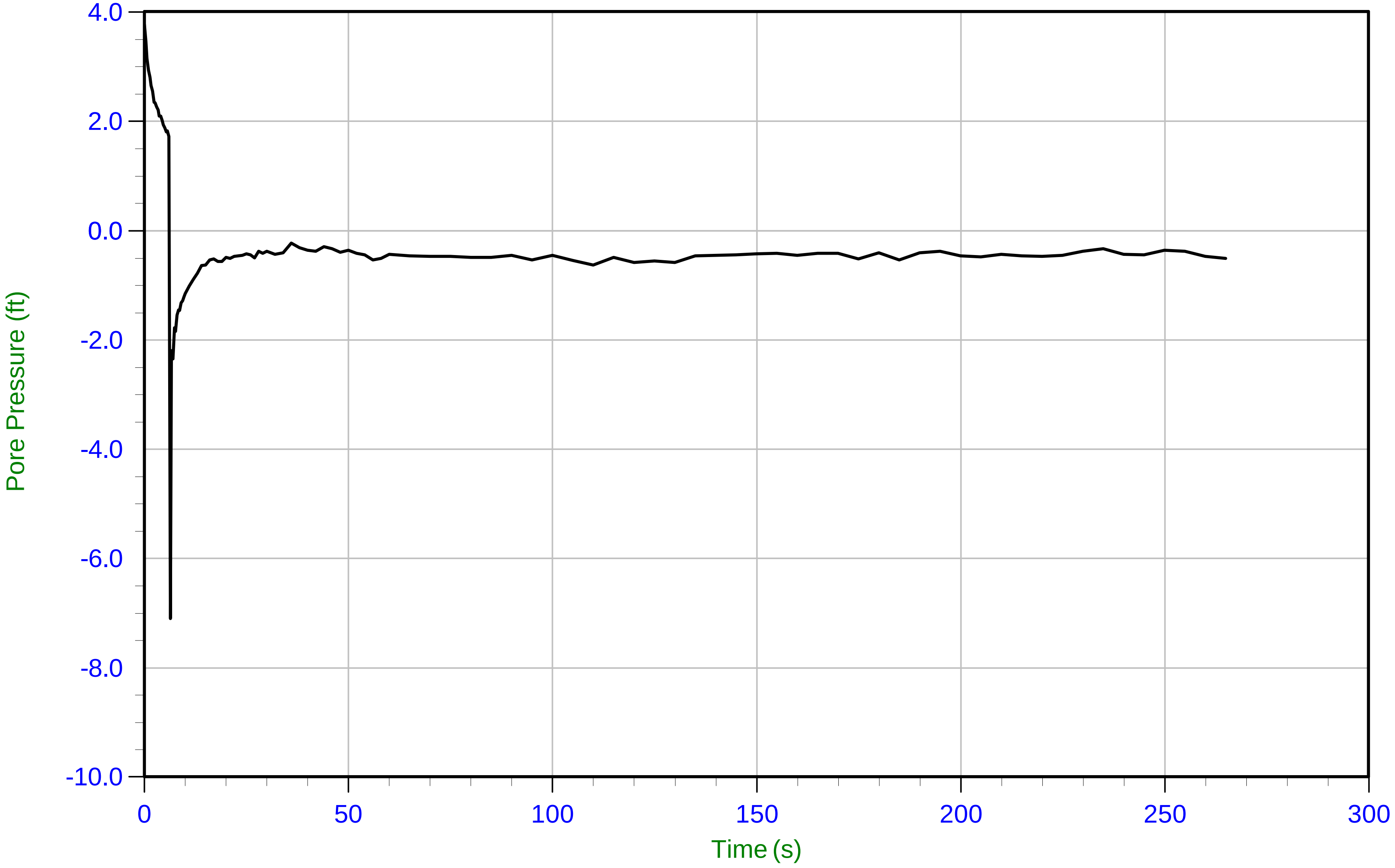
Pore Pressure Dissipation Testing Results

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/14/2020 02:56
Site: Chemours Facility

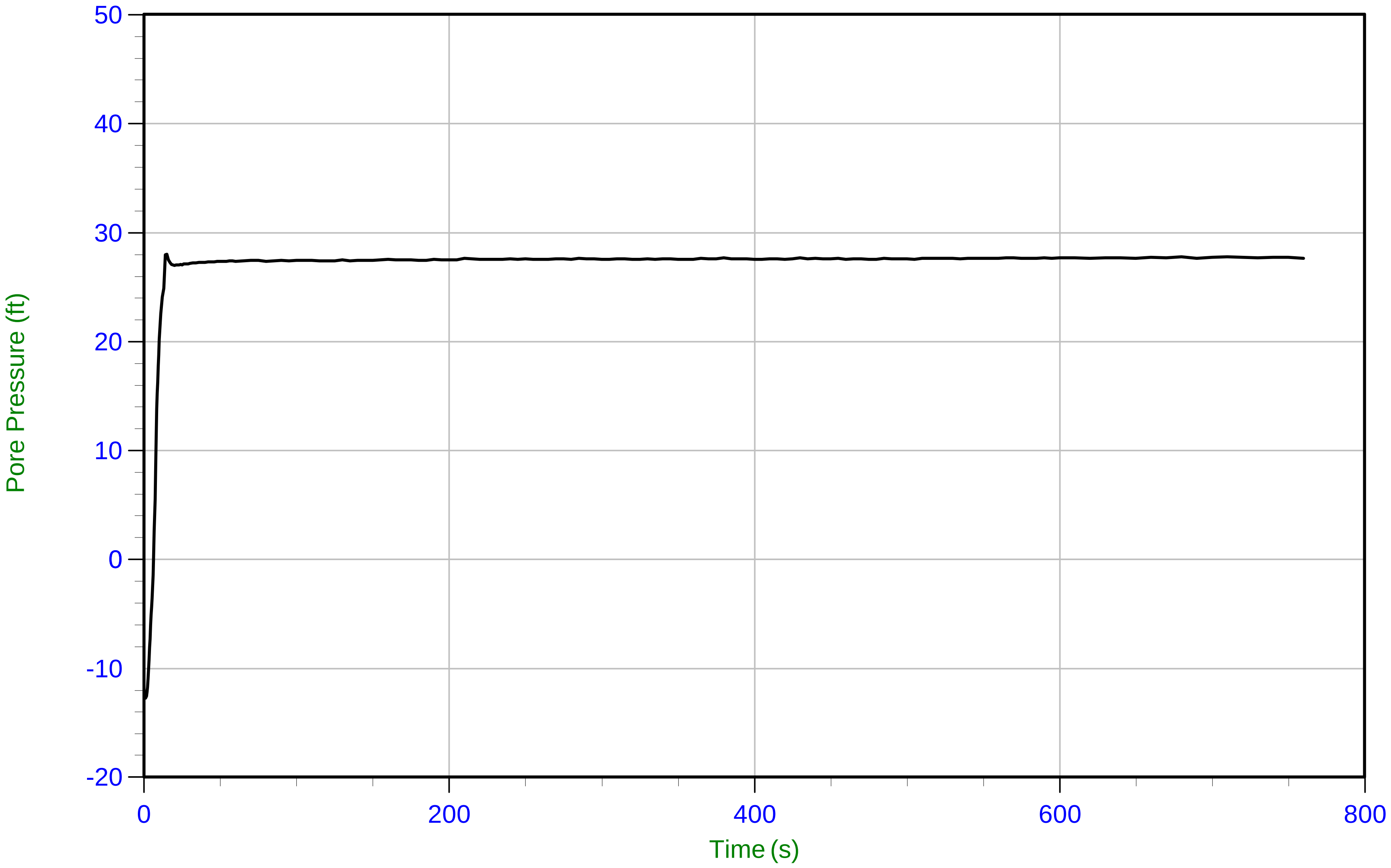
Sounding: 2+50
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-1.ppd2
Depth: 7.475 m / 24.524 ft
Duration: 265.0 s

u Min: -7.1 ft
u Max: 3.8 ft
u Final: -0.5 ft



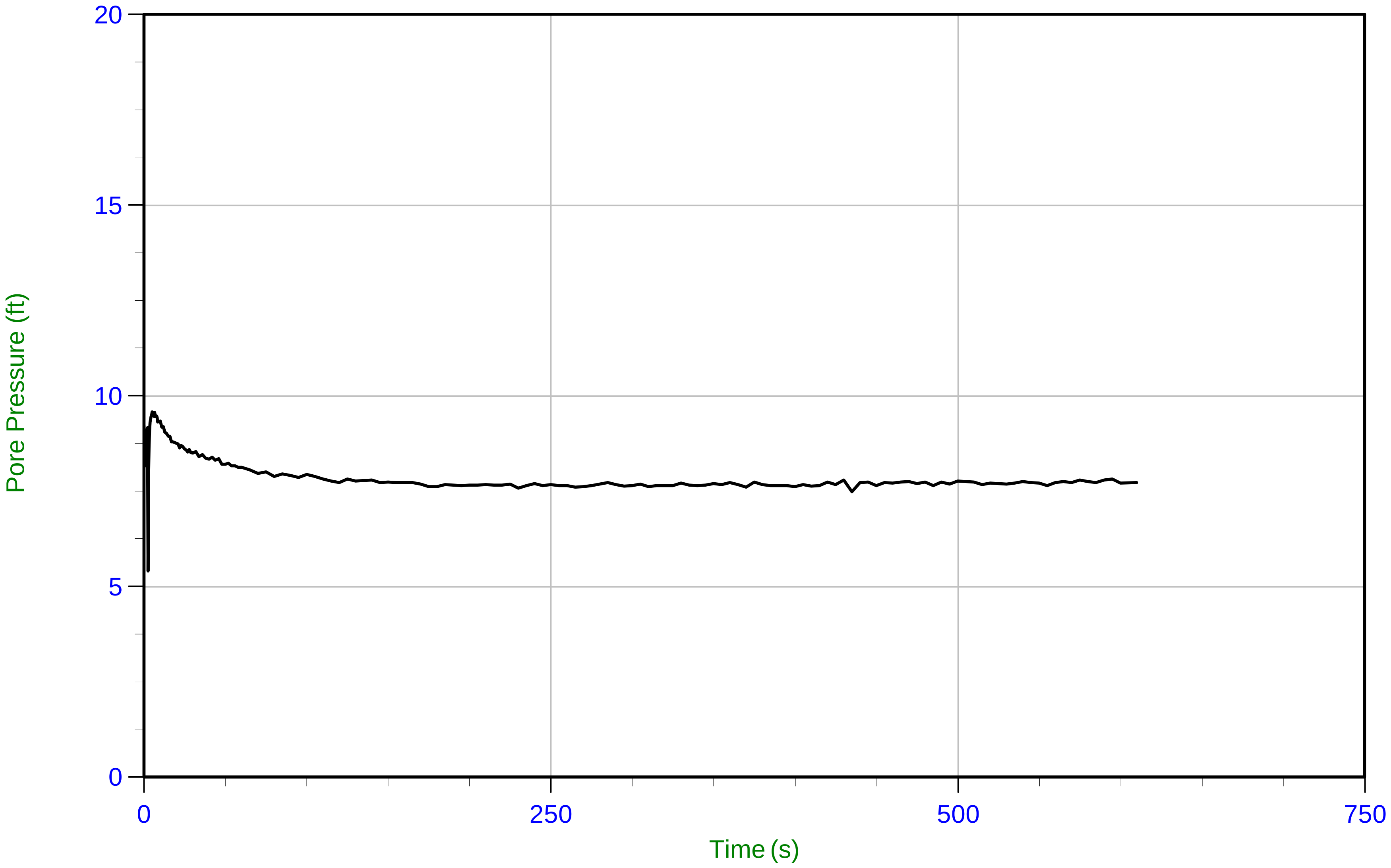
Trace Summary:

Filename: 20-54-21345_CPT_C-2.ppd2
Depth: 11.625 m / 38.139 ft
Duration: 760.0 s

u Min: -12.7 ft
u Max: 28.0 ft
u Final: 27.6 ft

WT: 3.123 m / 10.246 ft
Ueq: 27.9 ft

GeoServices, LLC	Job No: 20-54-21345 Date: 09/15/2020 09:19 Site: Chemours Facility	Sounding: 12+50 Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-3.ppd2
Depth: 9.000 m / 29.527 ft
Duration: 610.0 s

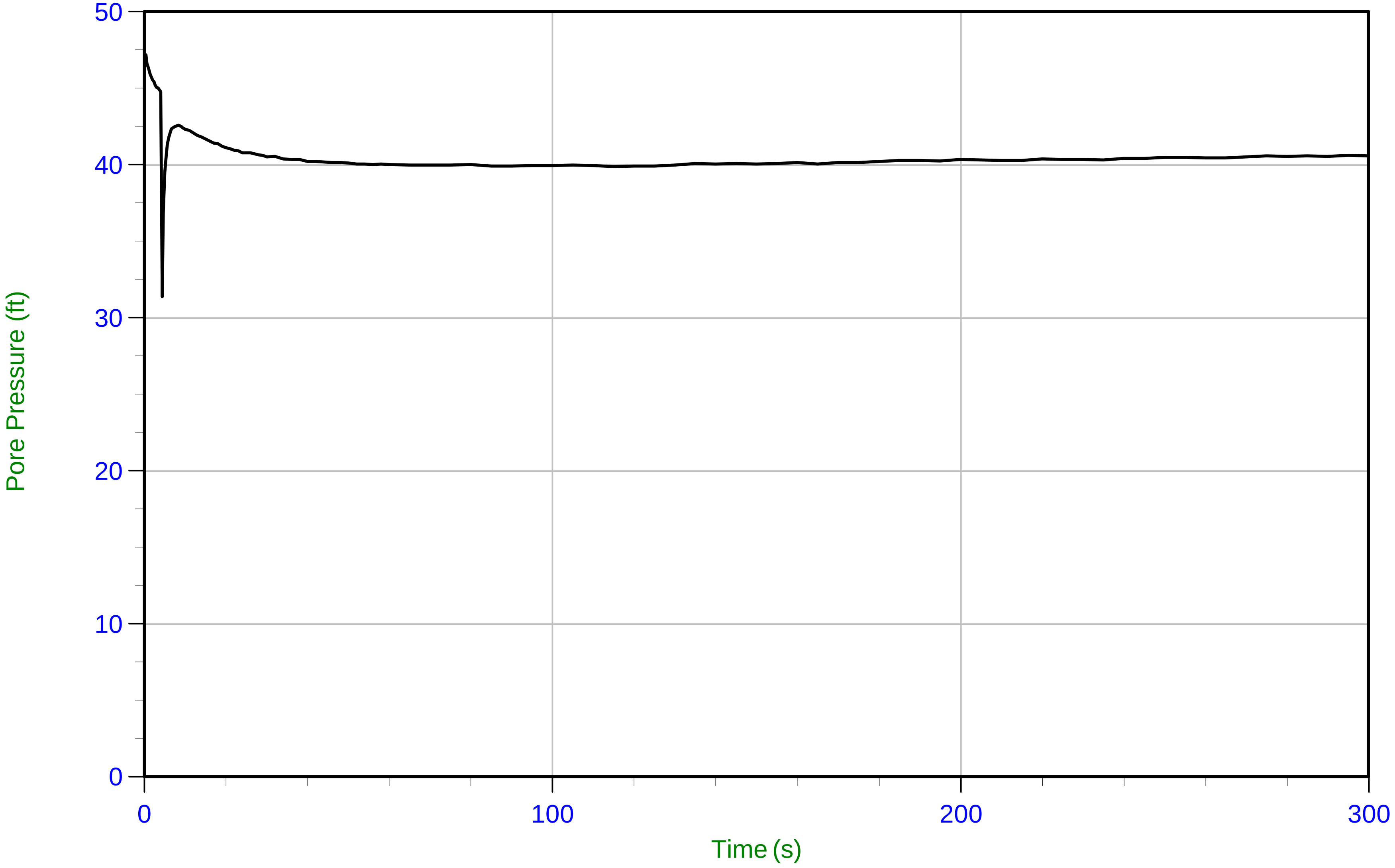
u Min: 5.4 ft
u Max: 9.6 ft
u Final: 7.7 ft

WT: 6.642 m / 21.791 ft
Ueq: 7.7 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/15/2020 09:19
Site: Chemours Facility

Sounding: 12+50
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-3.ppd2
Depth: 16.000 m / 52.493 ft
Duration: 300.0 s

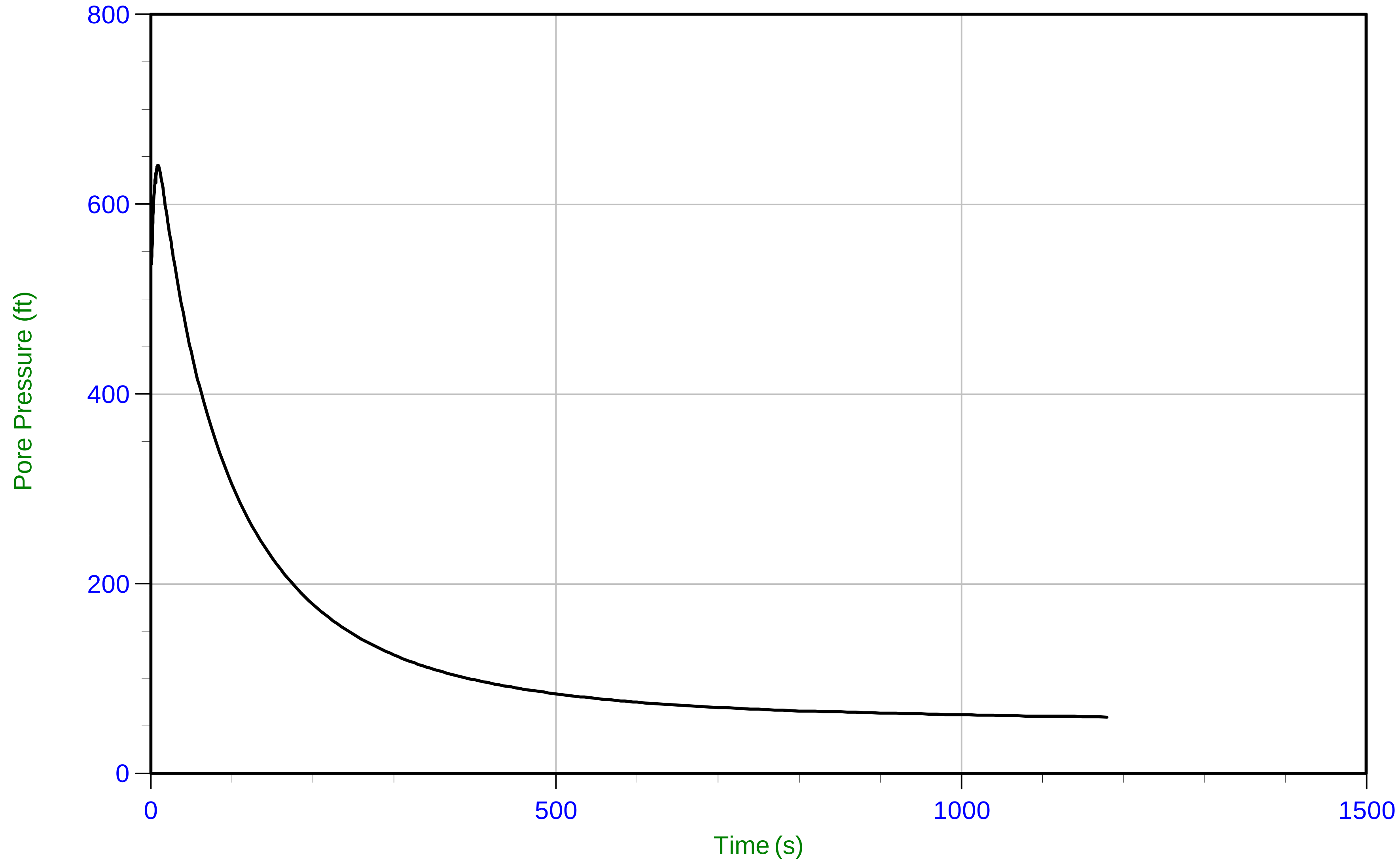
u Min: 31.4 ft
u Max: 47.2 ft
u Final: 40.6 ft

WT: 3.648 m / 11.968 ft
Ueq: 40.5 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/15/2020 09:19
Site: Chemours Facility

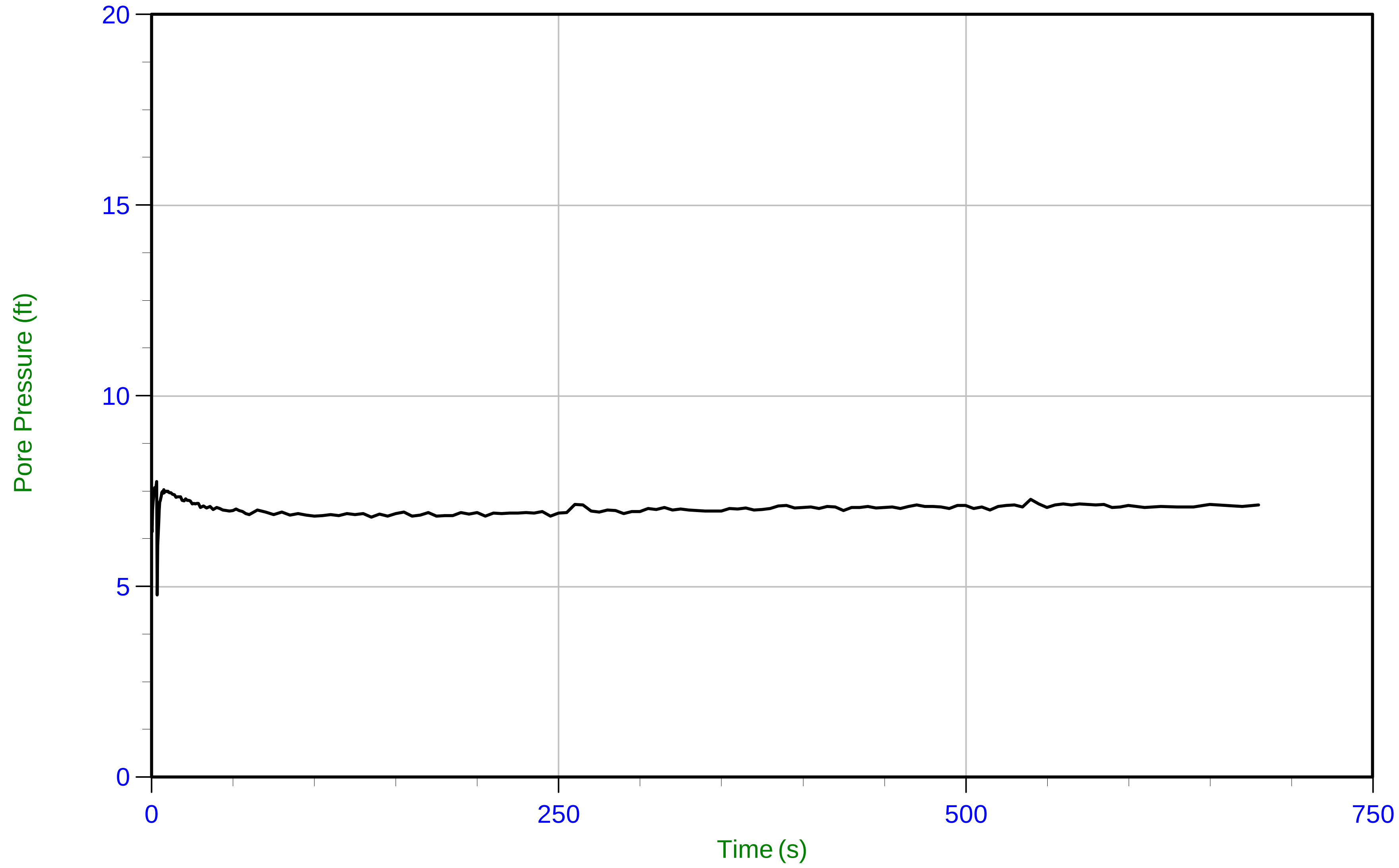
Sounding: 12+50
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-3.ppd2
Depth: 20.900 m / 68.569 ft
Duration: 1180.0 s

u Min: 59.7 ft
u Max: 640.9 ft
u Final: 59.7 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-4.ppd2
Depth: 9.675 m / 31.742 ft
Duration: 680.0 s

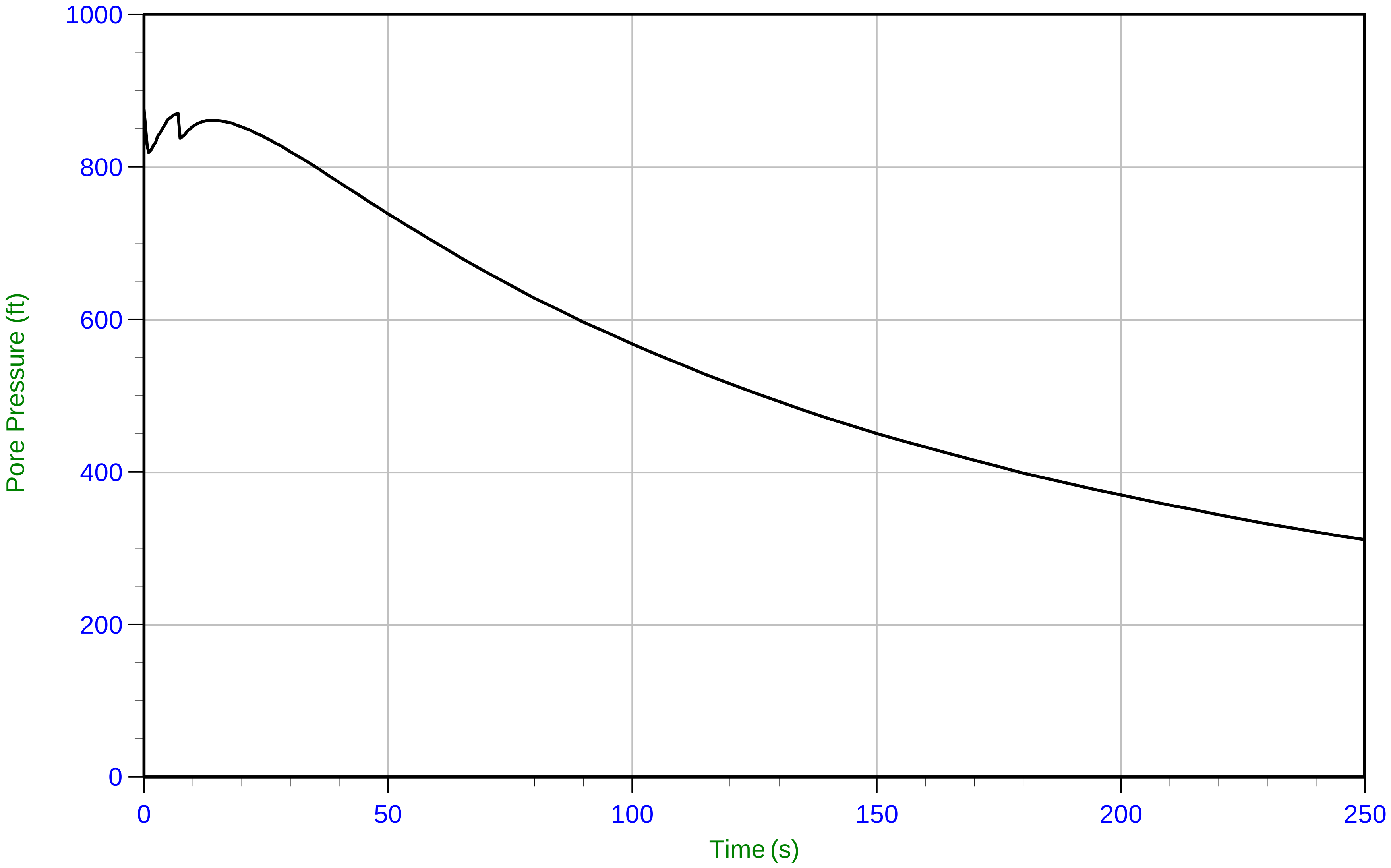
u Min: 4.8 ft
u Max: 7.7 ft
u Final: 7.1 ft

WT: 7.493 m / 24.583 ft
Ueq: 7.2 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/15/2020 11:23
Site: Chemours Facility

Sounding: 17+50
Cone: EC611 Area=15 cm²



Trace Summary:

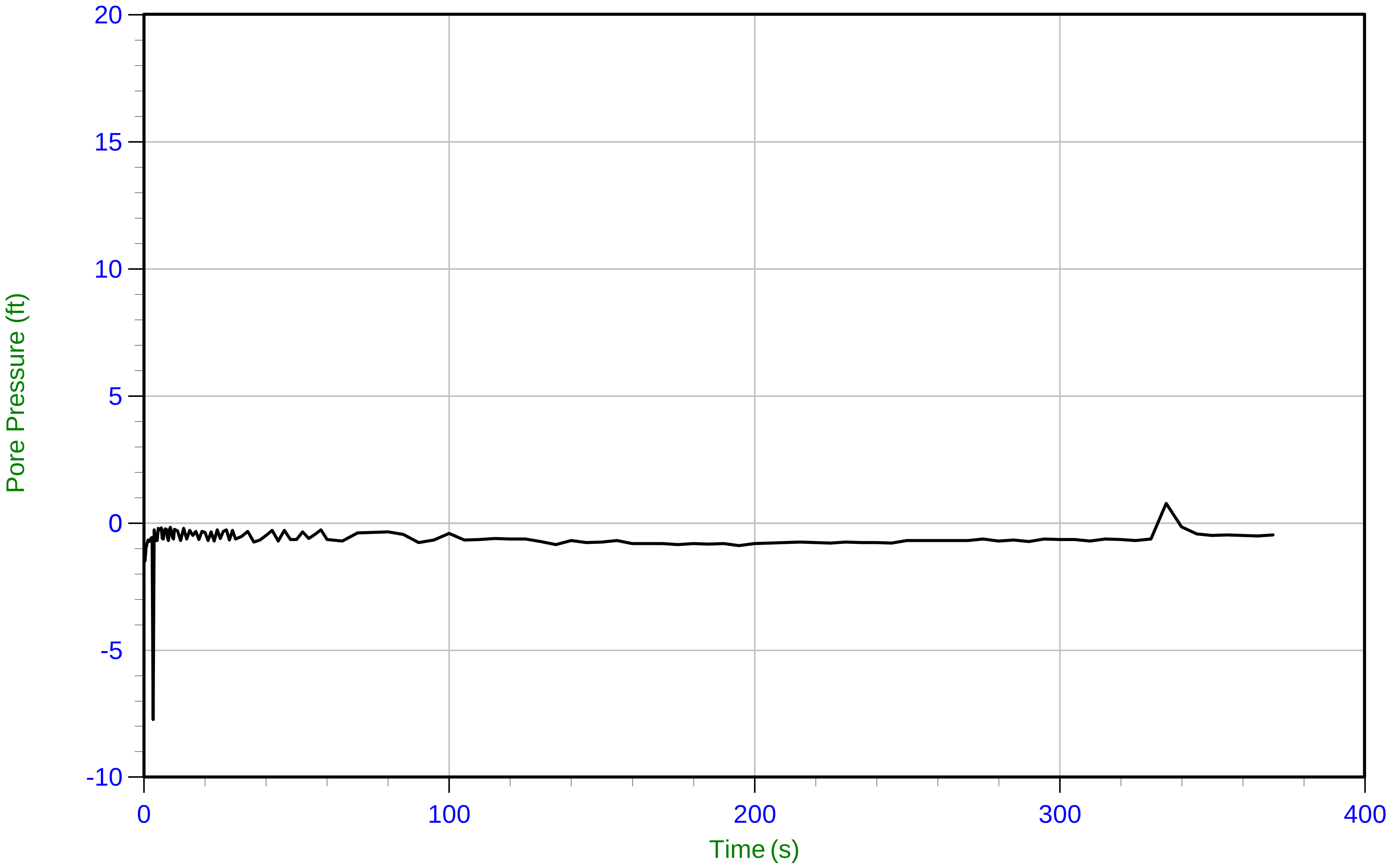
Filename: 20-54-21345_CPT_C-4.ppd2
Depth: 25.950 m / 85.137 ft
Duration: 250.0 s

u Min: 311.6 ft
u Max: 875.8 ft
u Final: 311.6 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/15/2020 01:53
Site: Chemours Facility

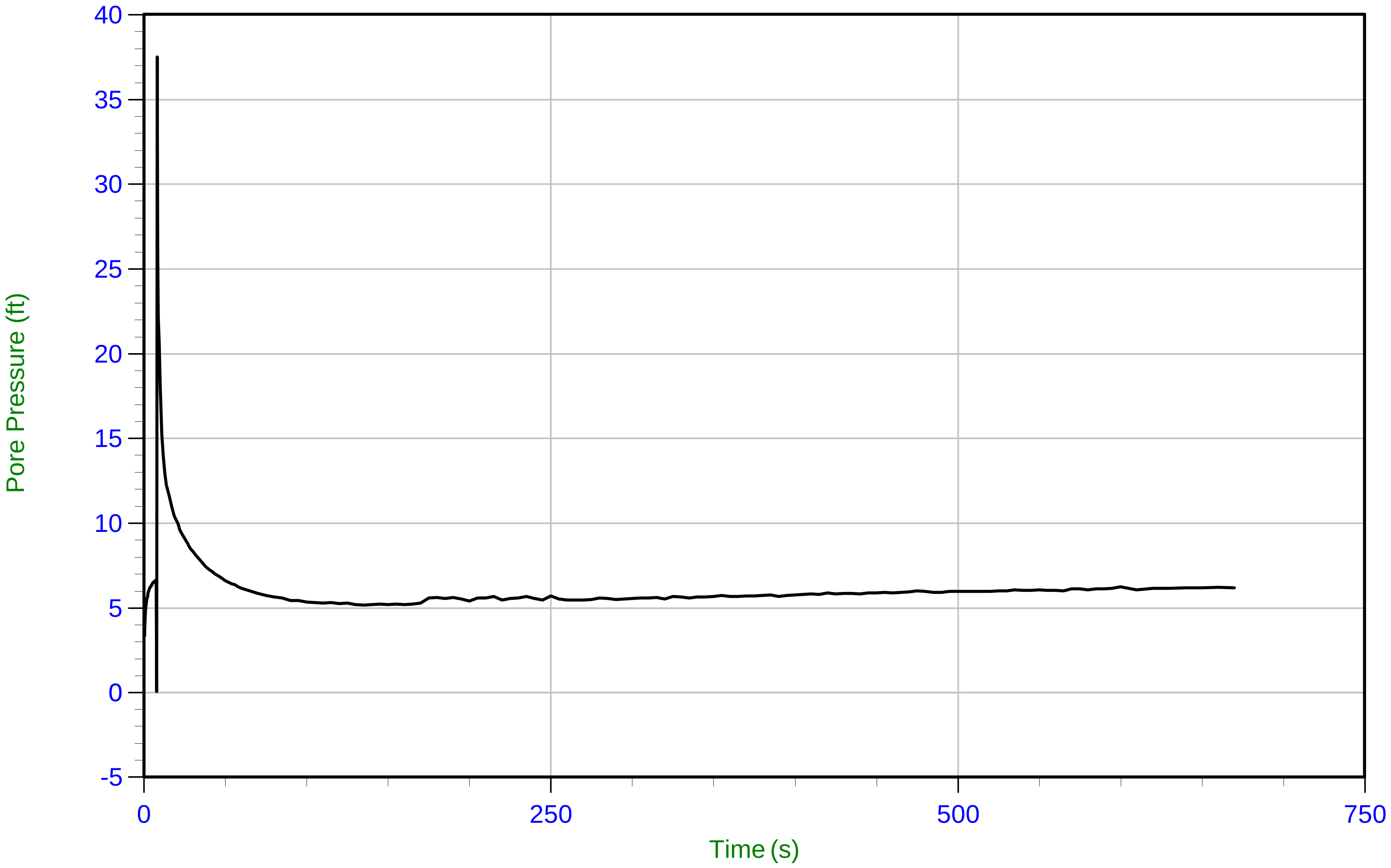
Sounding: 22+50
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-5.ppd2
Depth: 6.000 m / 19.685 ft
Duration: 370.0 s

u Min: -7.7 ft
u Max: 0.8 ft
u Final: -0.5 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-5.ppd2
Depth: 9.850 m / 32.316 ft
Duration: 670.0 s

u Min: 0.0 ft
u Max: 37.5 ft
u Final: 6.2 ft

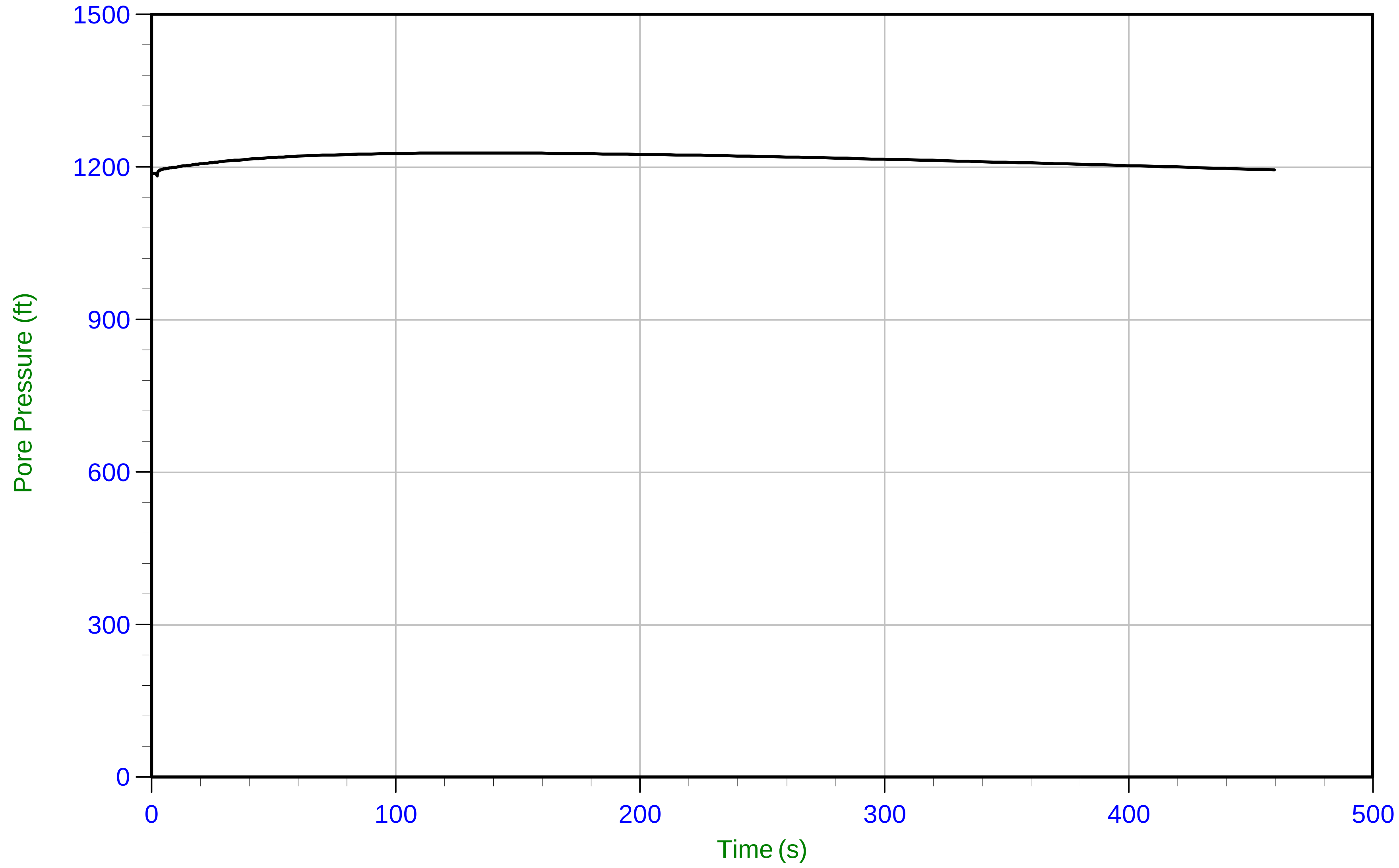
WT: 7.981 m / 26.184 ft
Ueq: 6.1 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/15/2020 01:53
Site: Chemours Facility

Sounding: 22+50
Cone: EC611 Area=15 cm²



Trace Summary:

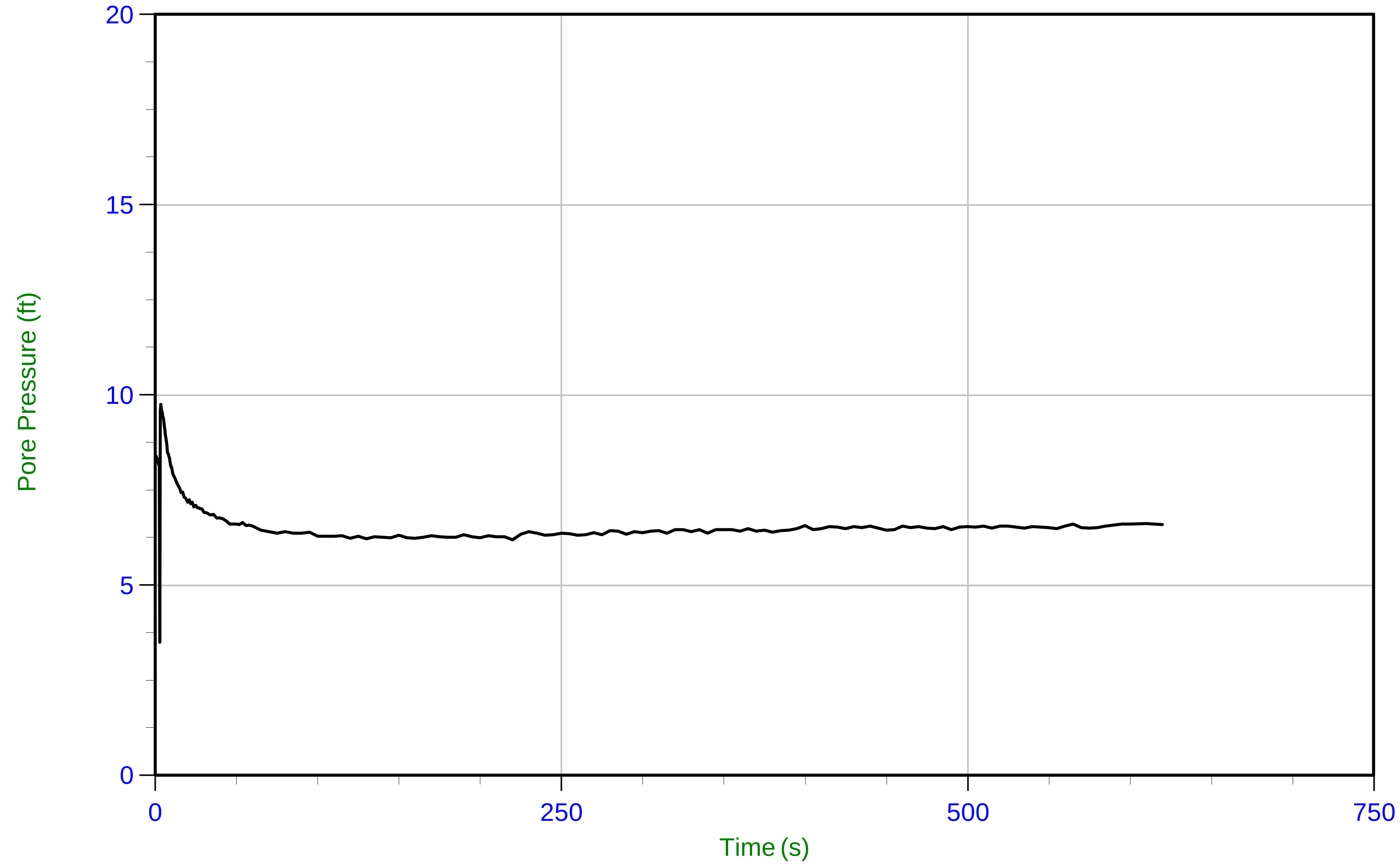
Filename: 20-54-21345_CPT_C-5.ppd2
Depth: 23.325 m / 76.525 ft
Duration: 460.0 s

u Min: 1182.8 ft
u Max: 1227.6 ft
u Final: 1194.5 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 07:47
Site: Chemours Facility

Sounding: 27+50
Cone: EC611 Area=15 cm²

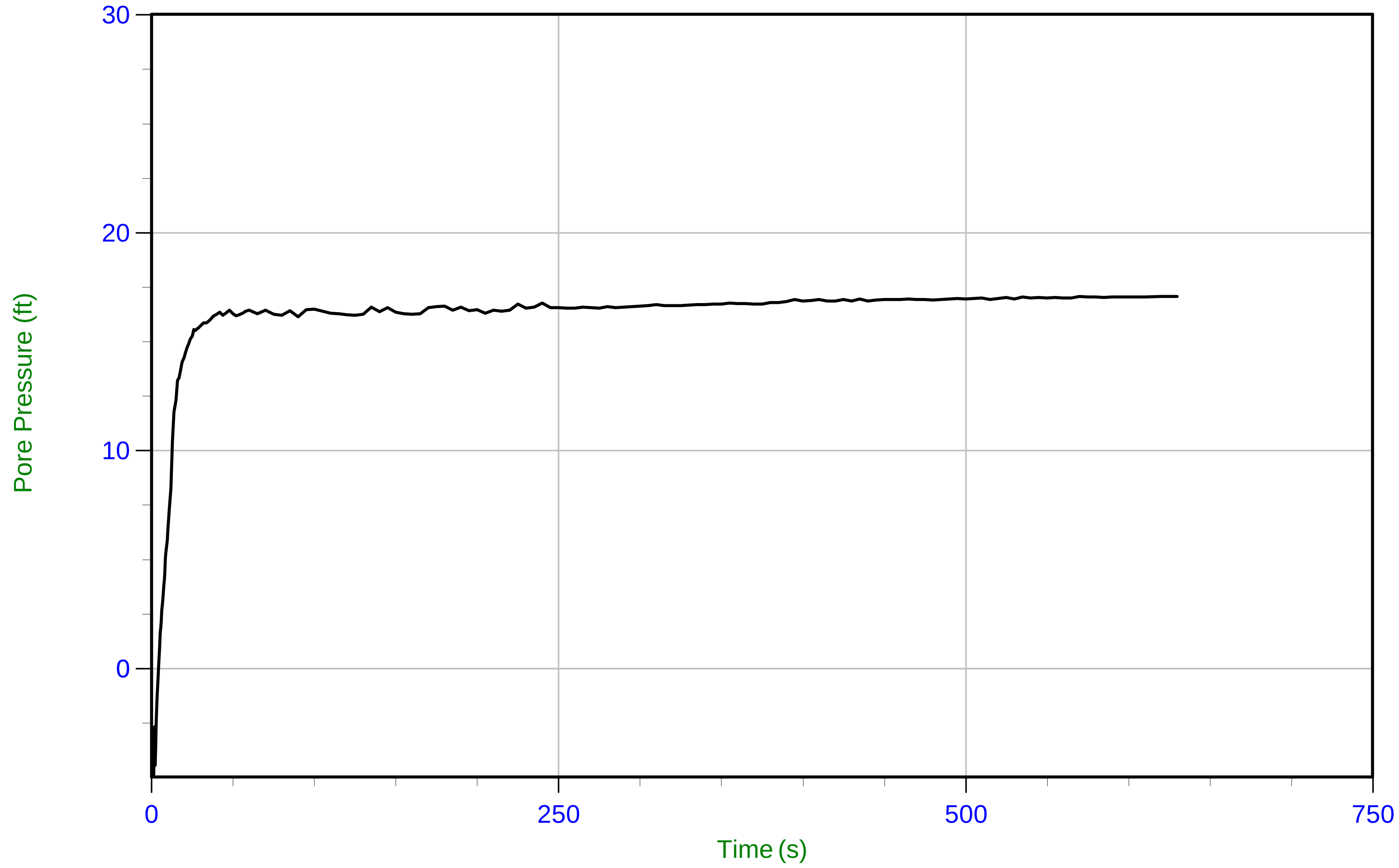


Trace Summary:

Filename: 20-54-21345_CPT_C-6.ppd2
Depth: 7.000 m / 22.966 ft
Duration: 620.1 s

u Min: 3.5 ft
u Max: 9.7 ft
u Final: 6.6 ft

WT: 5.000 m / 16.404 ft
Ueq: 6.6 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-6.ppd2
Depth: 14.025 m / 46.013 ft
Duration: 630.0 s

u Min: -5.8 ft
u Max: 17.1 ft
u Final: 17.1 ft

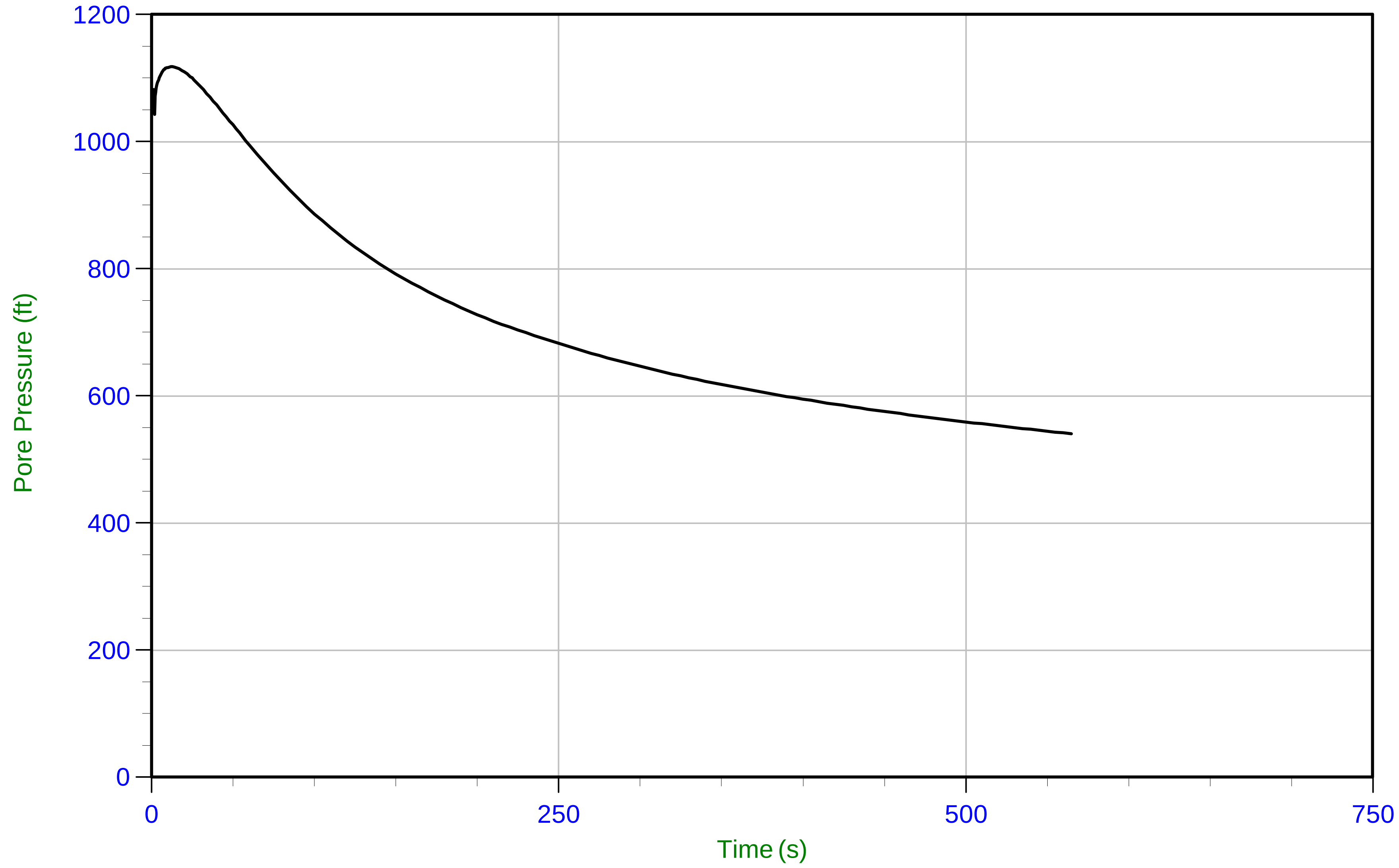
WT: 8.822 m / 28.943 ft
Ueq: 17.1 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 07:47
Site: Chemours Facility

Sounding: 27+50
Cone: EC611 Area=15 cm²



Trace Summary:

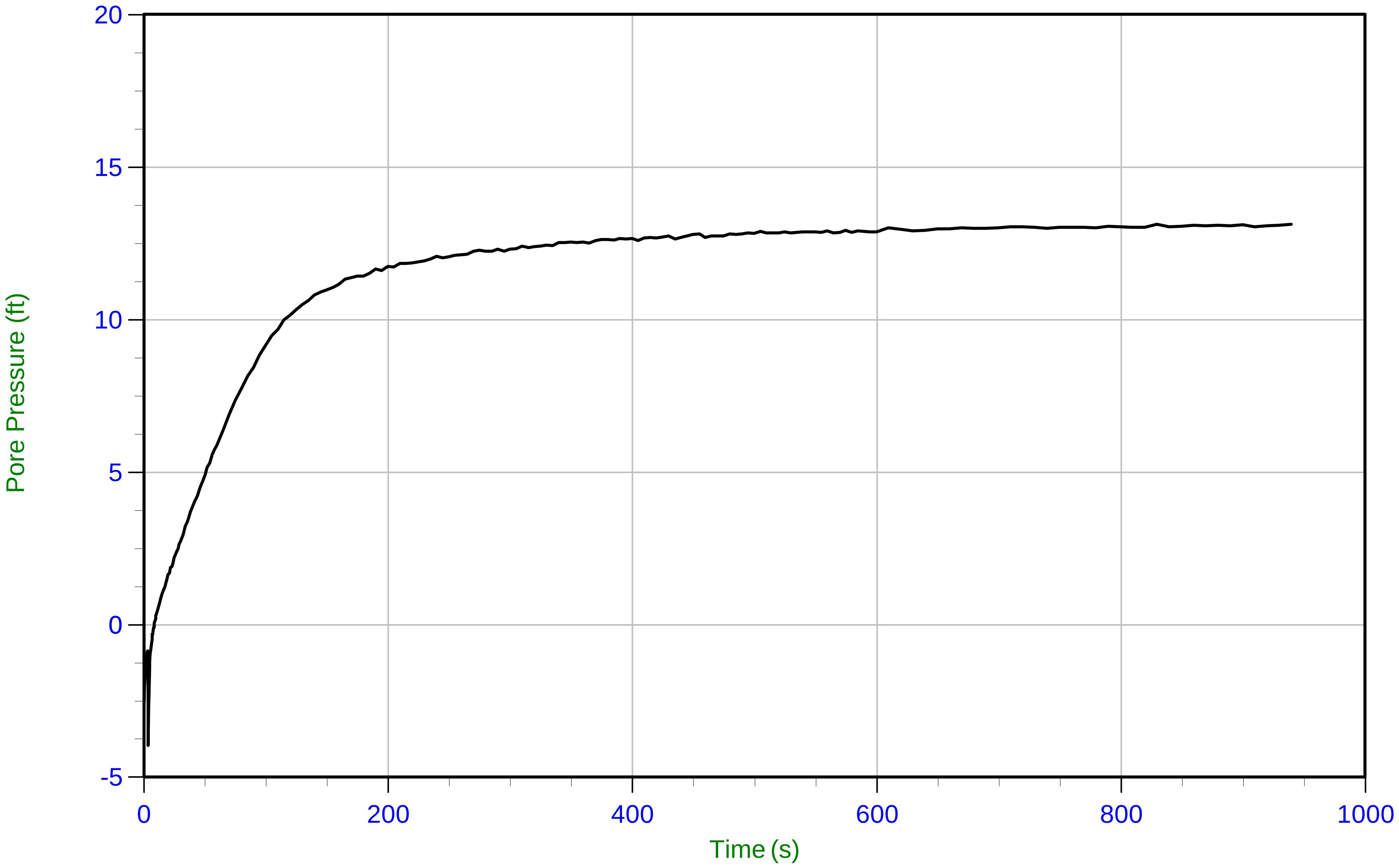
Filename: 20-54-21345_CPT_C-6.ppd2
Depth: 21.750 m / 71.357 ft
Duration: 565.0 s

u Min: 540.3 ft
u Max: 1117.8 ft
u Final: 540.3 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 09:32
Site: Chemours Facility

Sounding: 32+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-7.ppd2
Depth: 15.250 m / 50.032 ft
Duration: 940.0 s

u Min: -4.0 ft
u Max: 13.1 ft
u Final: 13.1 ft

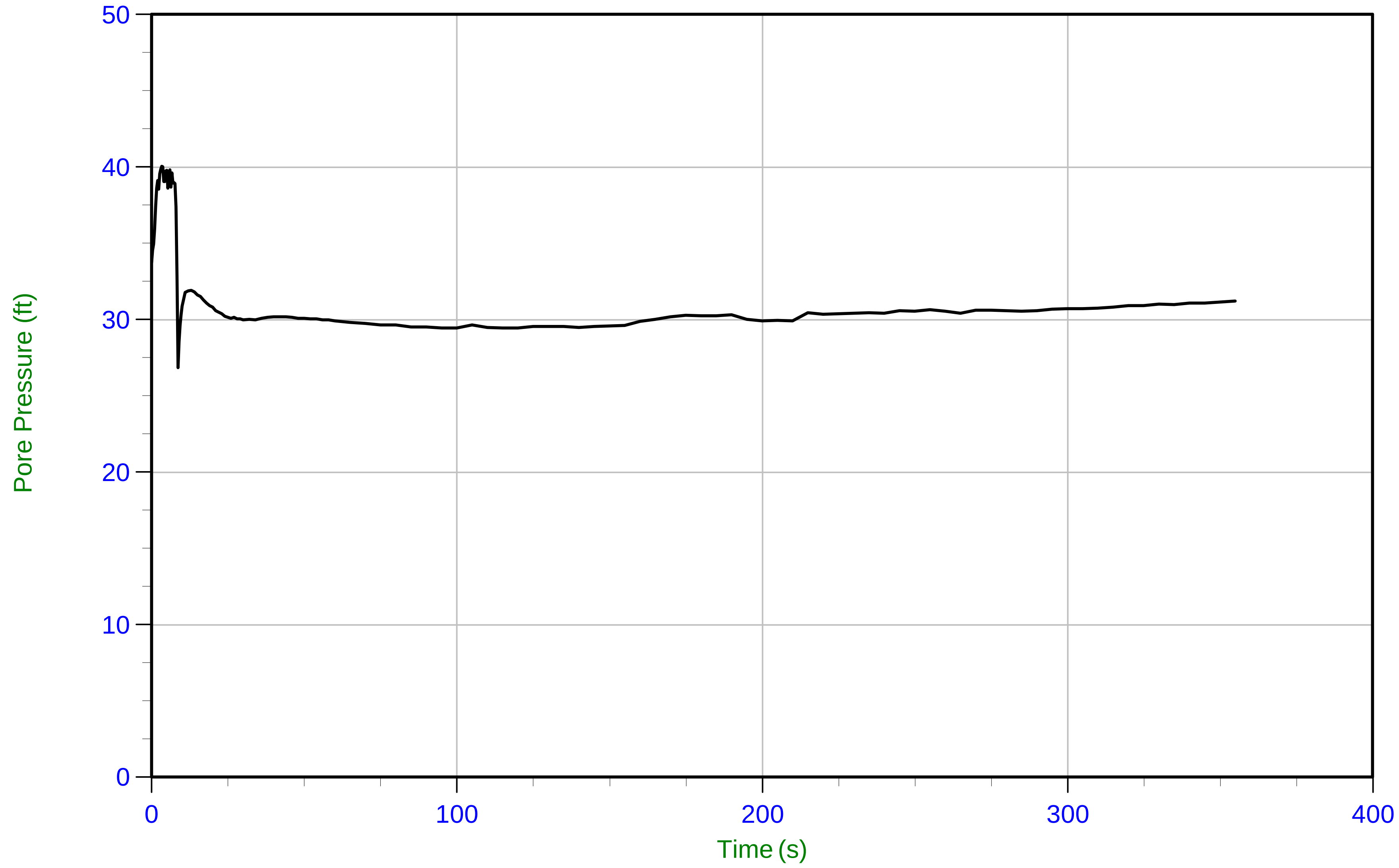
WT: 11.241 m / 36.879 ft
Ueq: 13.2 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 09:32
Site: Chemours Facility

Sounding: 32+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-7.ppd2
Depth: 21.675 m / 71.111 ft
Duration: 355.0 s

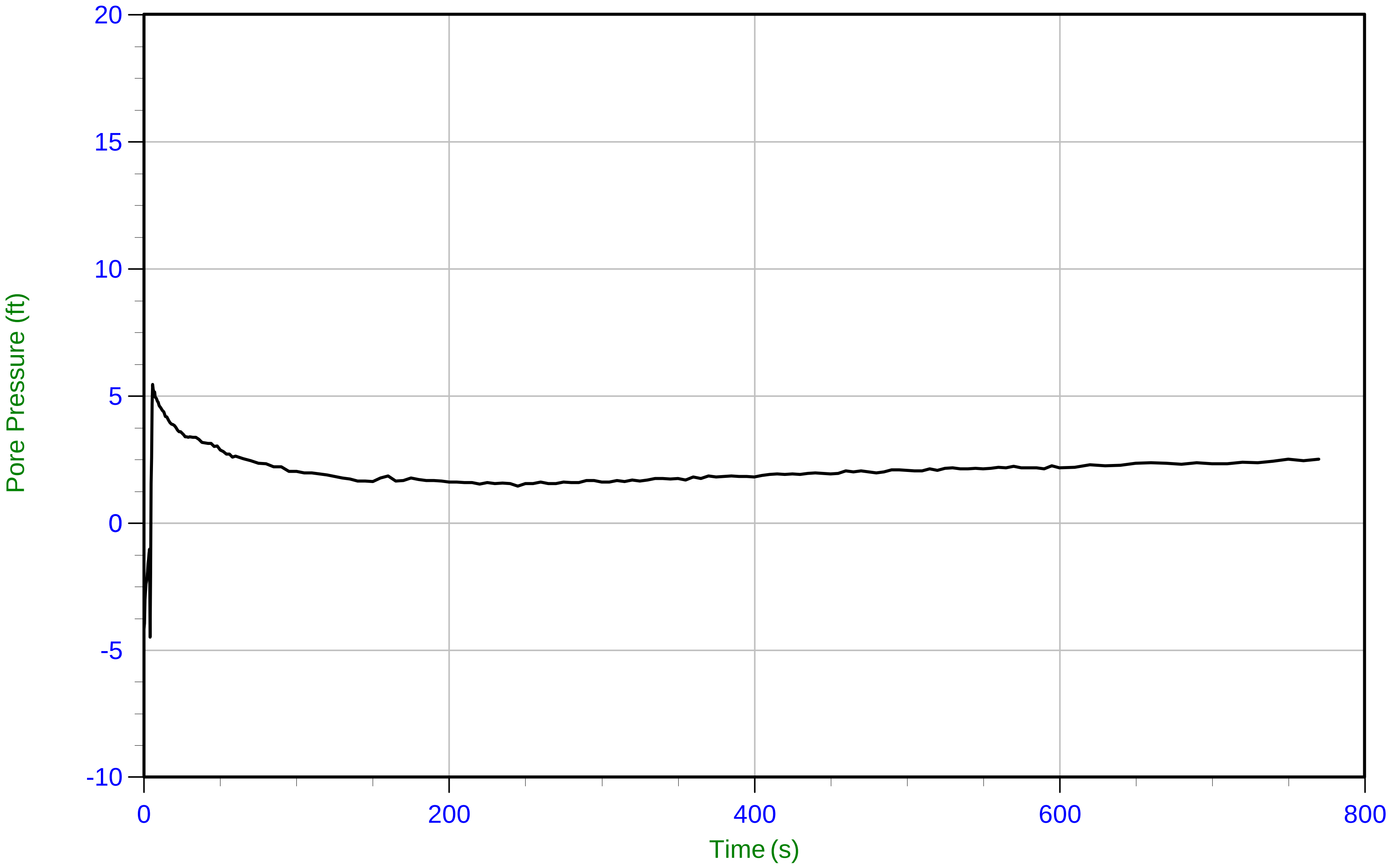
u Min: 26.8 ft
u Max: 40.1 ft
u Final: 31.2 ft

WT: 12.259 m / 40.219 ft
Ueq: 30.9 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 11:58
Site: Chemours Facility

Sounding: 35+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-8.ppd2
Depth: 8.600 m / 28.215 ft
Duration: 770.0 s

u Min: -4.5 ft
u Max: 5.5 ft
u Final: 2.5 ft

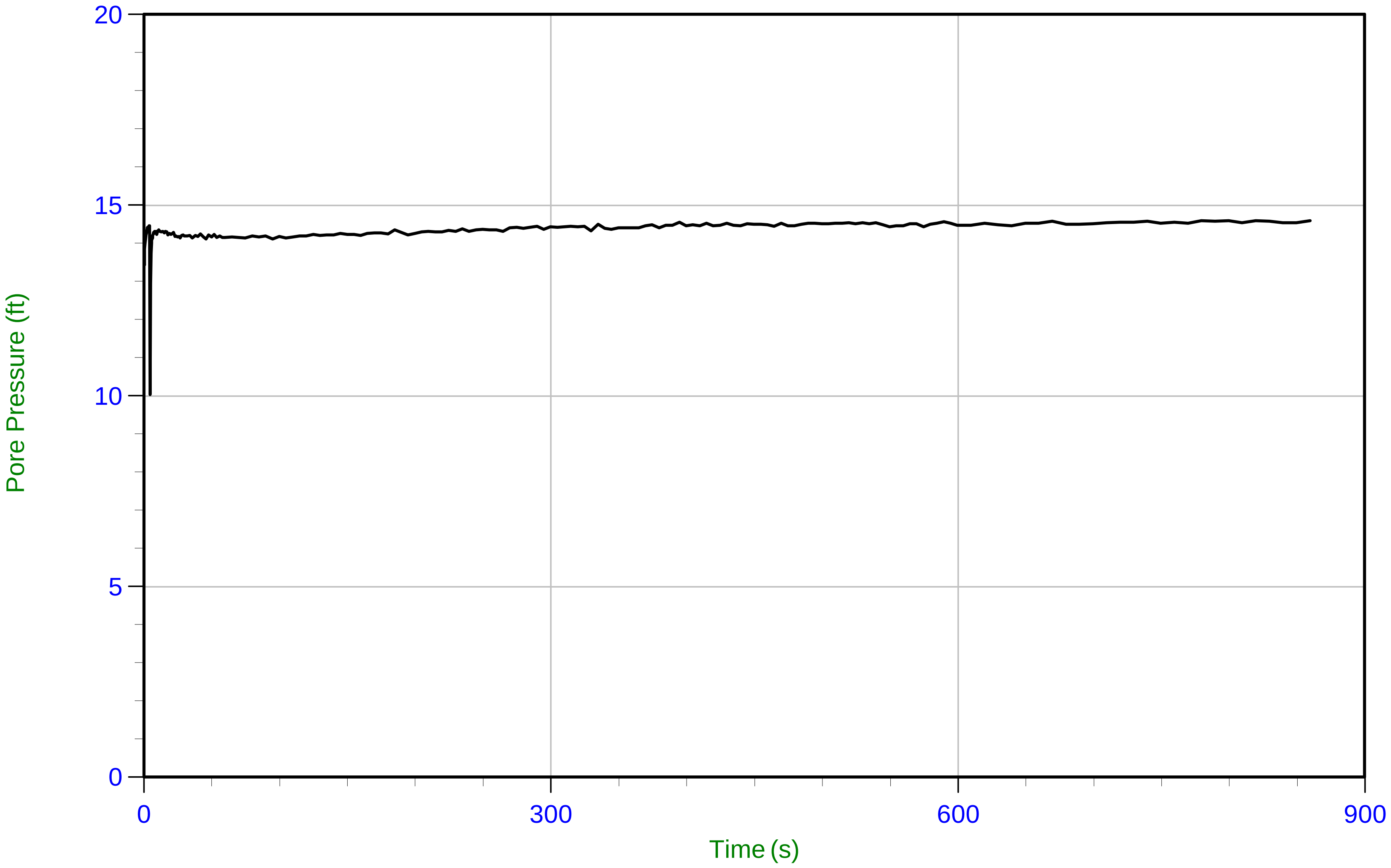
WT: 7.891 m / 25.889 ft
Ueq: 2.3 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/16/2020 02:10
Site: Chemours Facility

Sounding: 40+00
Cone: EC611 Area=15 cm²

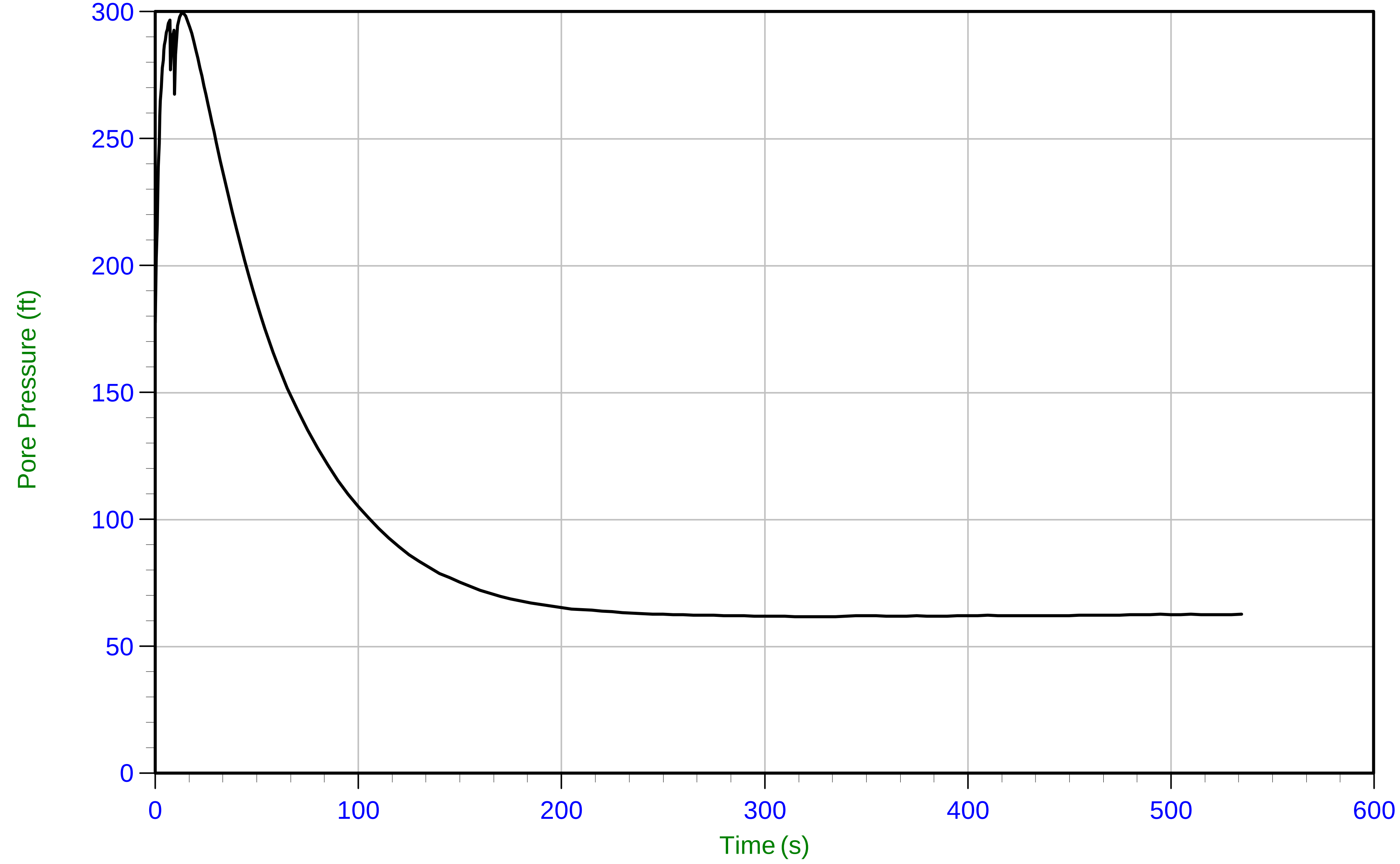


Trace Summary:

Filename: 20-54-21345_CPT_C-9.ppd2
Depth: 13.000 m / 42.650 ft
Duration: 860.0 s

u Min: 10.0 ft
u Max: 14.6 ft
u Final: 14.6 ft

WT: 8.554 m / 28.064 ft
Ueq: 14.6 ft

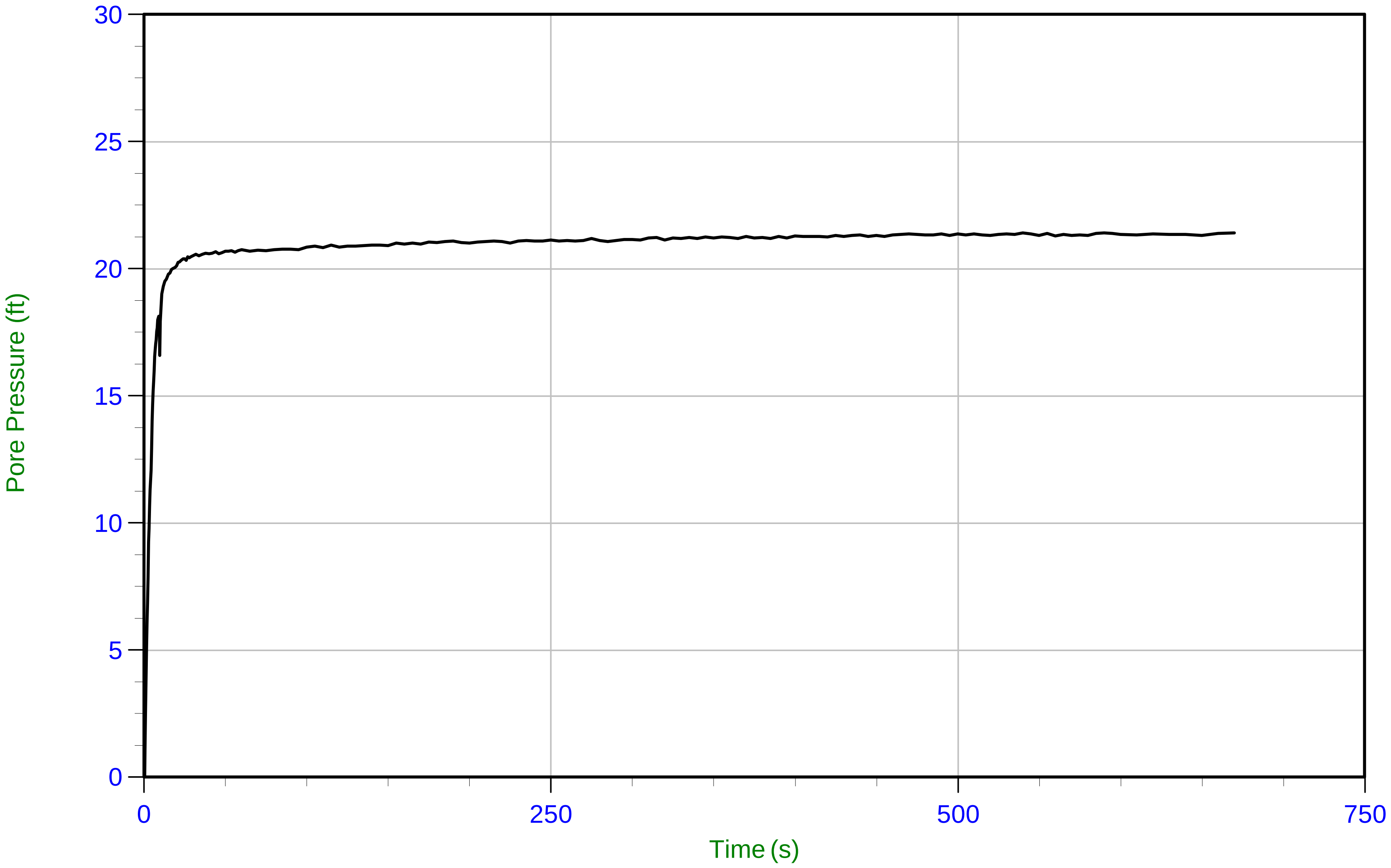


Trace Summary:

Filename: 20-54-21345_CPT_C-9.ppd2
Depth: 25.275 m / 82.922 ft
Duration: 535.0 s

u Min: 61.7 ft
u Max: 299.4 ft
u Final: 62.6 ft

WT: 6.055 m / 19.865 ft
Ueq: 63.1 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-10a.ppd2
Depth: 13.625 m / 44.701 ft
Duration: 670.1 s

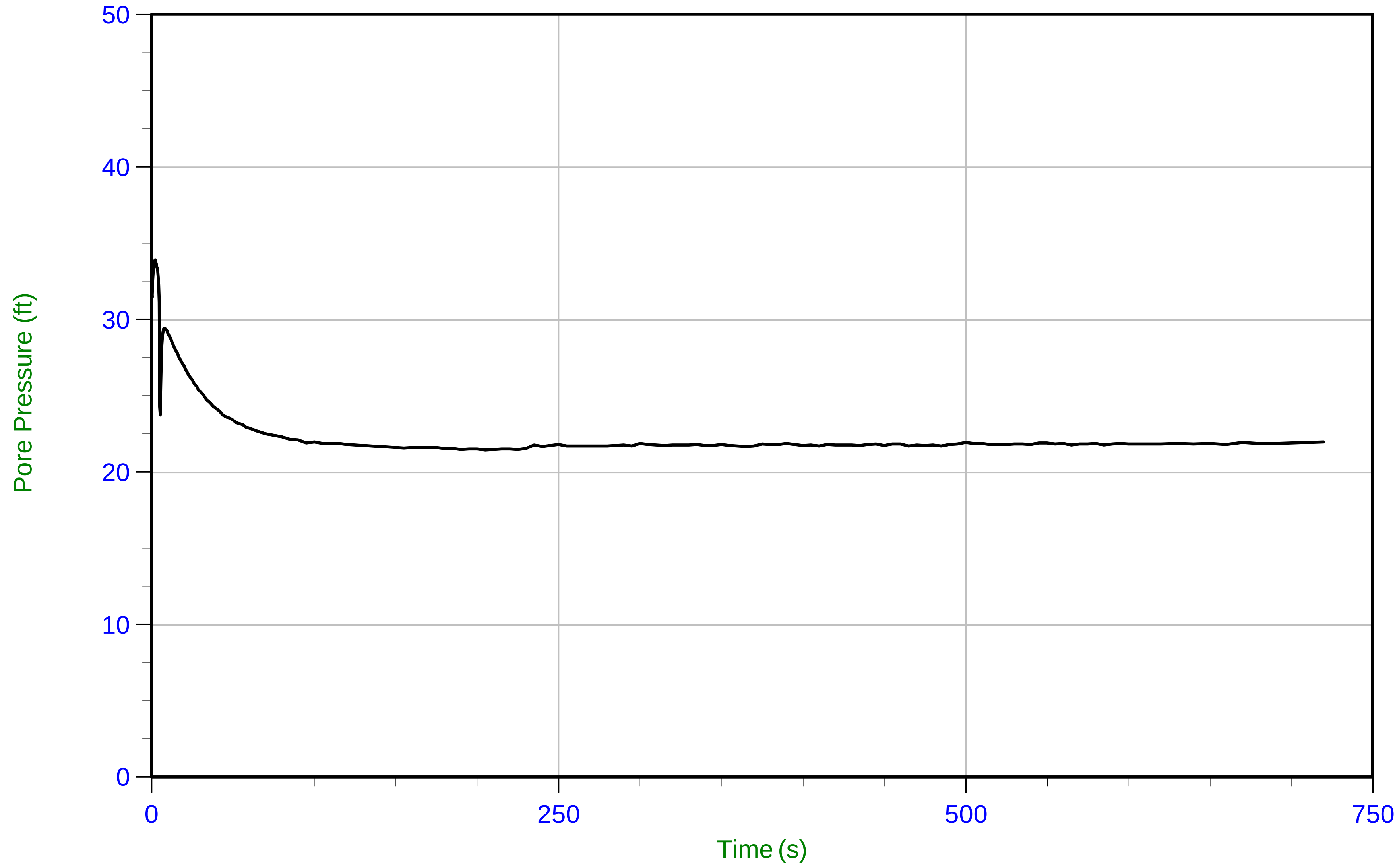
u Min: -1.8 ft
u Max: 21.4 ft
u Final: 21.4 ft

WT: 7.104 m / 23.307 ft
Ueq: 21.4 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/17/2020 08:04
Site: Chemours Facility

Sounding: 45+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-10.ppd2
Depth: 13.725 m / 45.029 ft
Duration: 720.0 s

u Min: 21.4 ft
u Max: 33.9 ft
u Final: 22.0 ft

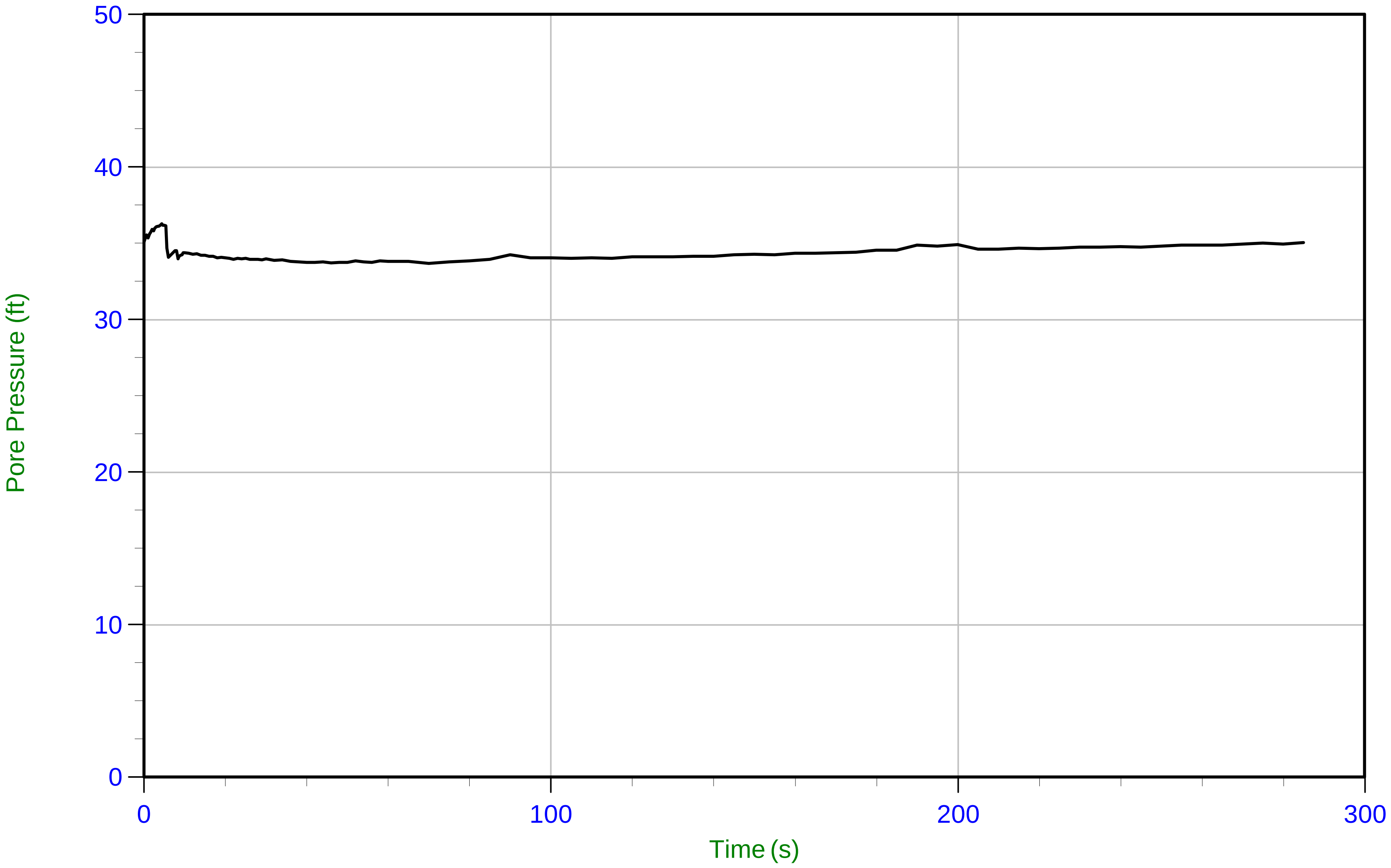
WT: 7.027 m / 23.054 ft
Ueq: 22.0 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/17/2020 08:04
Site: Chemours Facility

Sounding: 45+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-10.ppd2
Depth: 18.225 m / 59.793 ft
Duration: 285.1 s

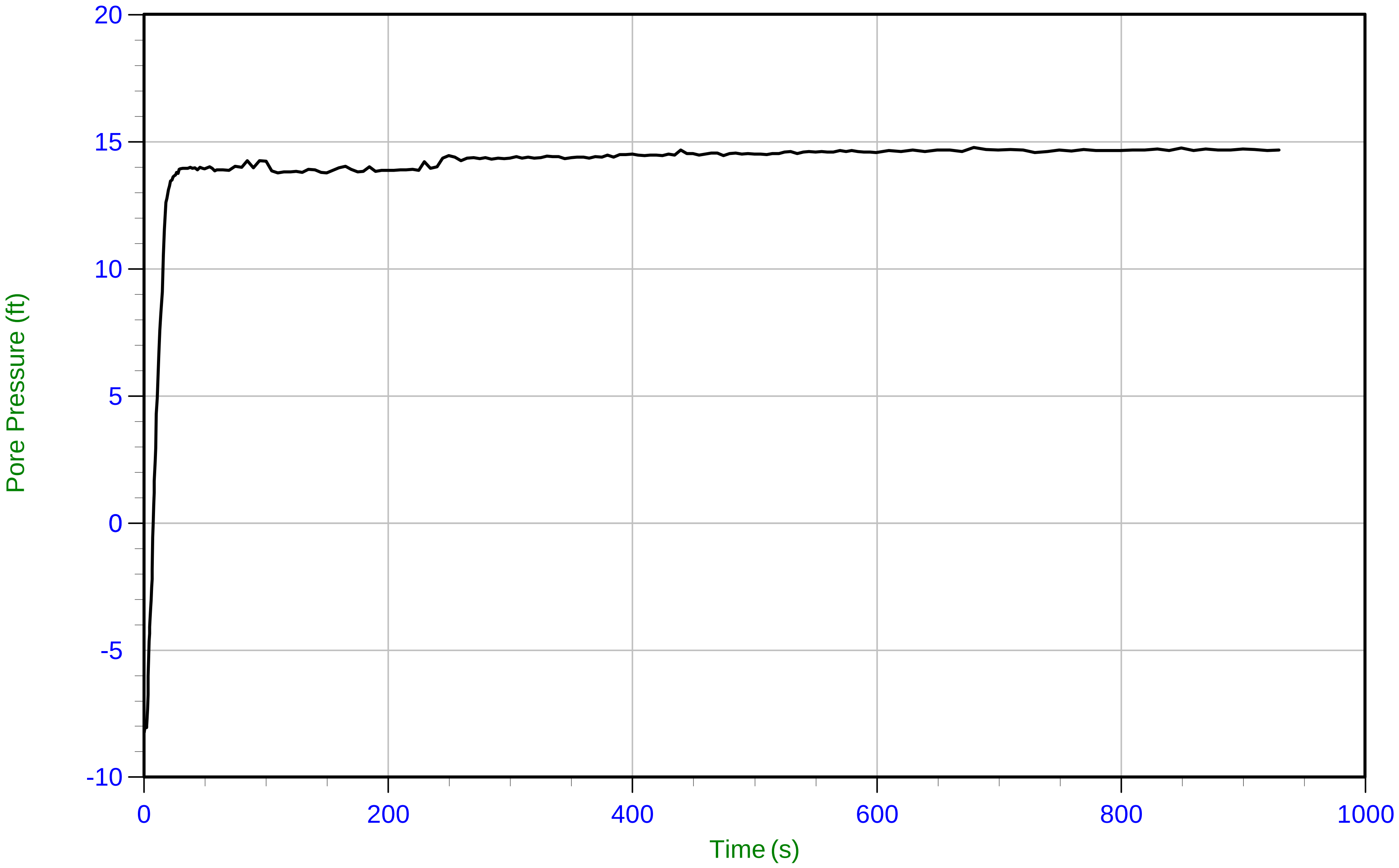
u Min: 33.7 ft
u Max: 36.3 ft
u Final: 35.1 ft

WT: 7.597 m / 24.924 ft
Ueq: 34.9 ft

GeoServices, LLC

Job No: 20-54-21345
Date: 09/18/2020 08:21
Site: Chemours Facility

Sounding: 50+00
Cone: EC611 Area=15 cm²

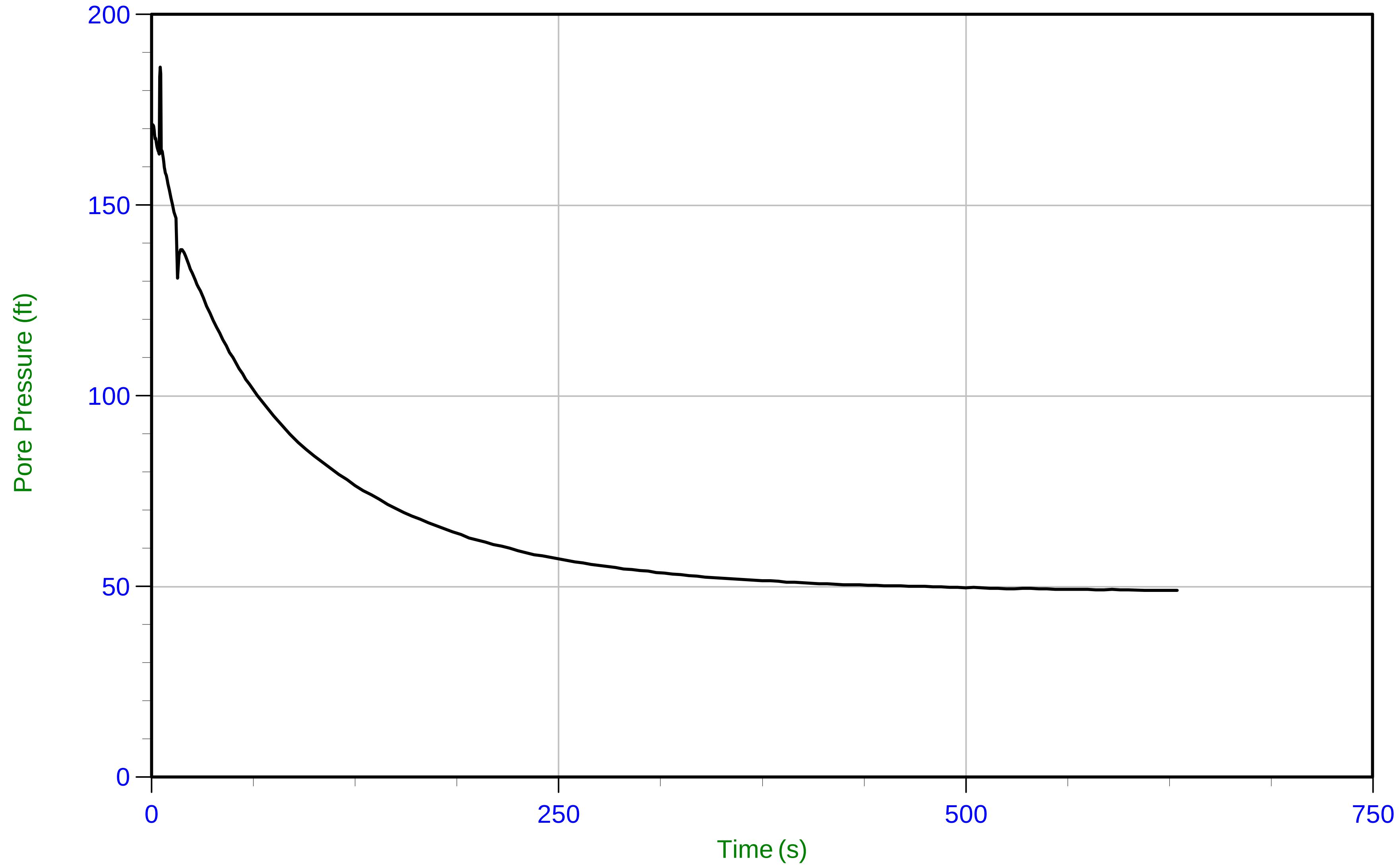


Trace Summary:

Filename: 20-54-21345_CPT_C-11.ppd2
Depth: 12.400 m / 40.682 ft
Duration: 930.0 s

u Min: -8.2 ft
u Max: 14.8 ft
u Final: 14.7 ft

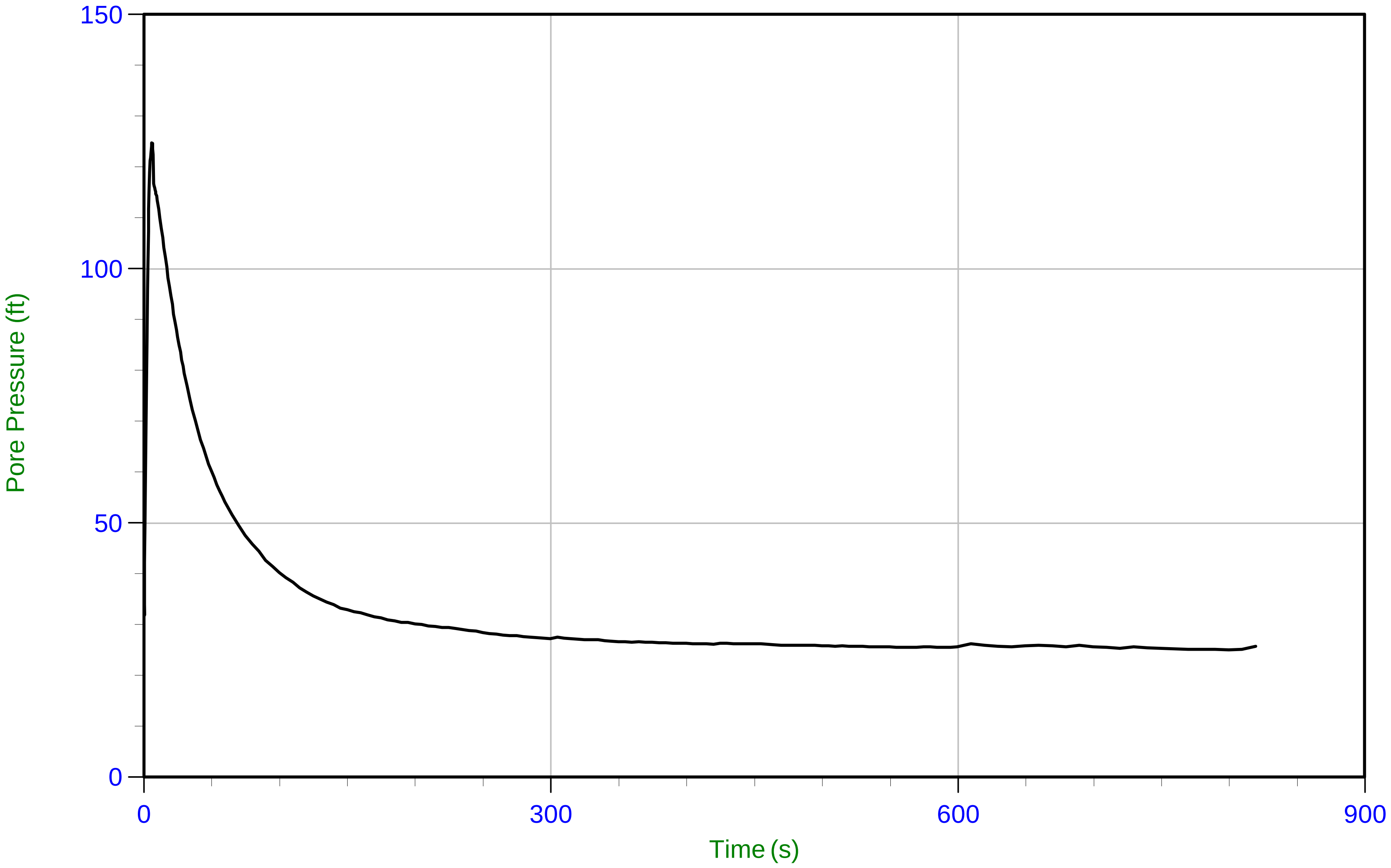
WT: 7.916 m / 25.971 ft
Ueq: 14.7 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-11.ppd2
Depth: 21.900 m / 71.850 ft
Duration: 630.0 s

u Min: 49.0 ft
u Max: 186.2 ft
u Final: 49.0 ft



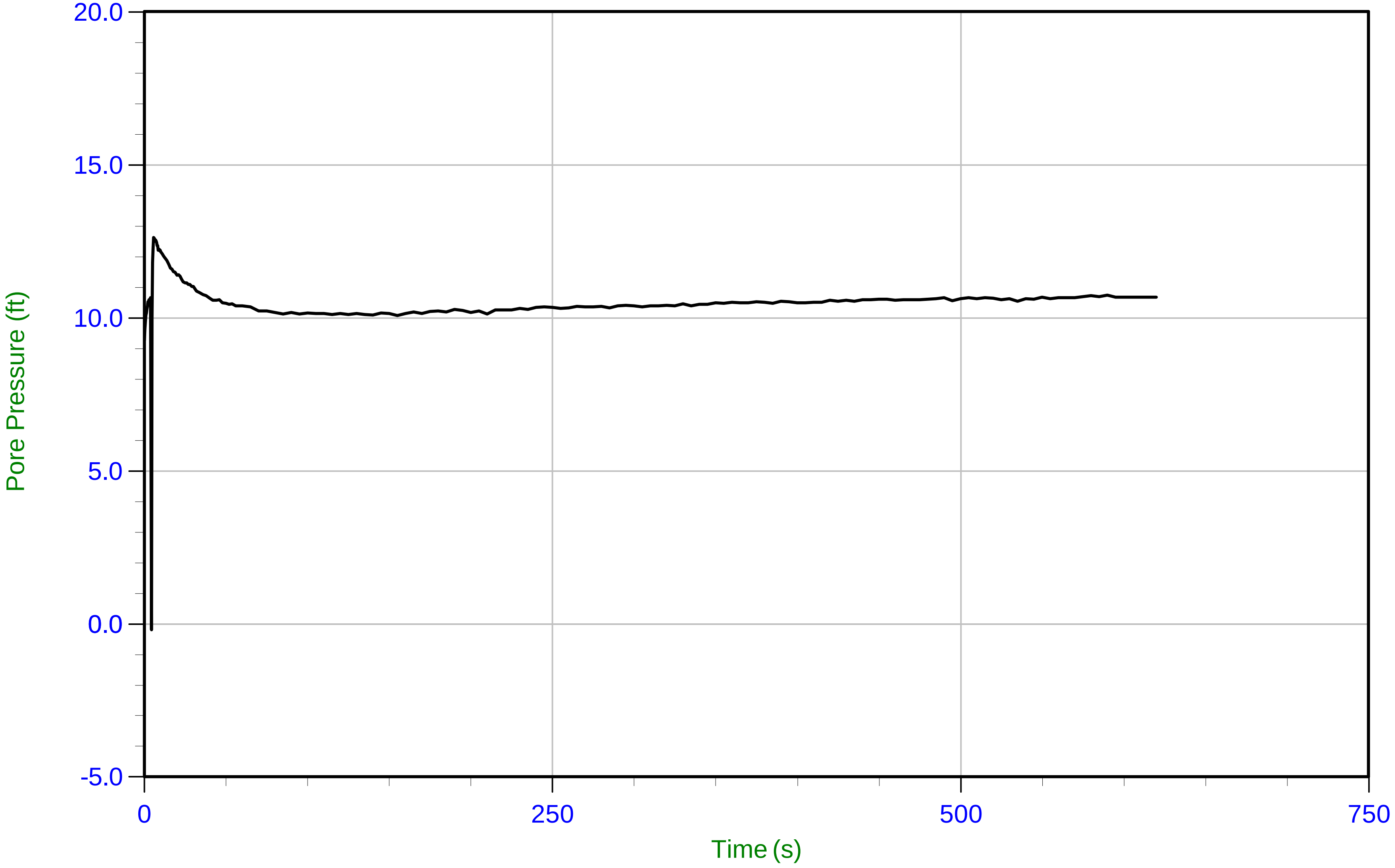
Trace Summary:

Filename: 20-54-21345_CPT_C-12.ppd2	u Min: 25.1 ft	WT: 10.629 m / 34.872 ft
Depth: 18.450 m / 60.531 ft	u Max: 124.7 ft	Ueq: 25.7 ft
Duration: 820.0 s	u Final: 25.7 ft	

GeoServices, LLC

Job No: 20-54-21345
Date: 09/18/2020 11:26
Site: Chemours Facility

Sounding: 60+00
Cone: EC611 Area=15 cm²

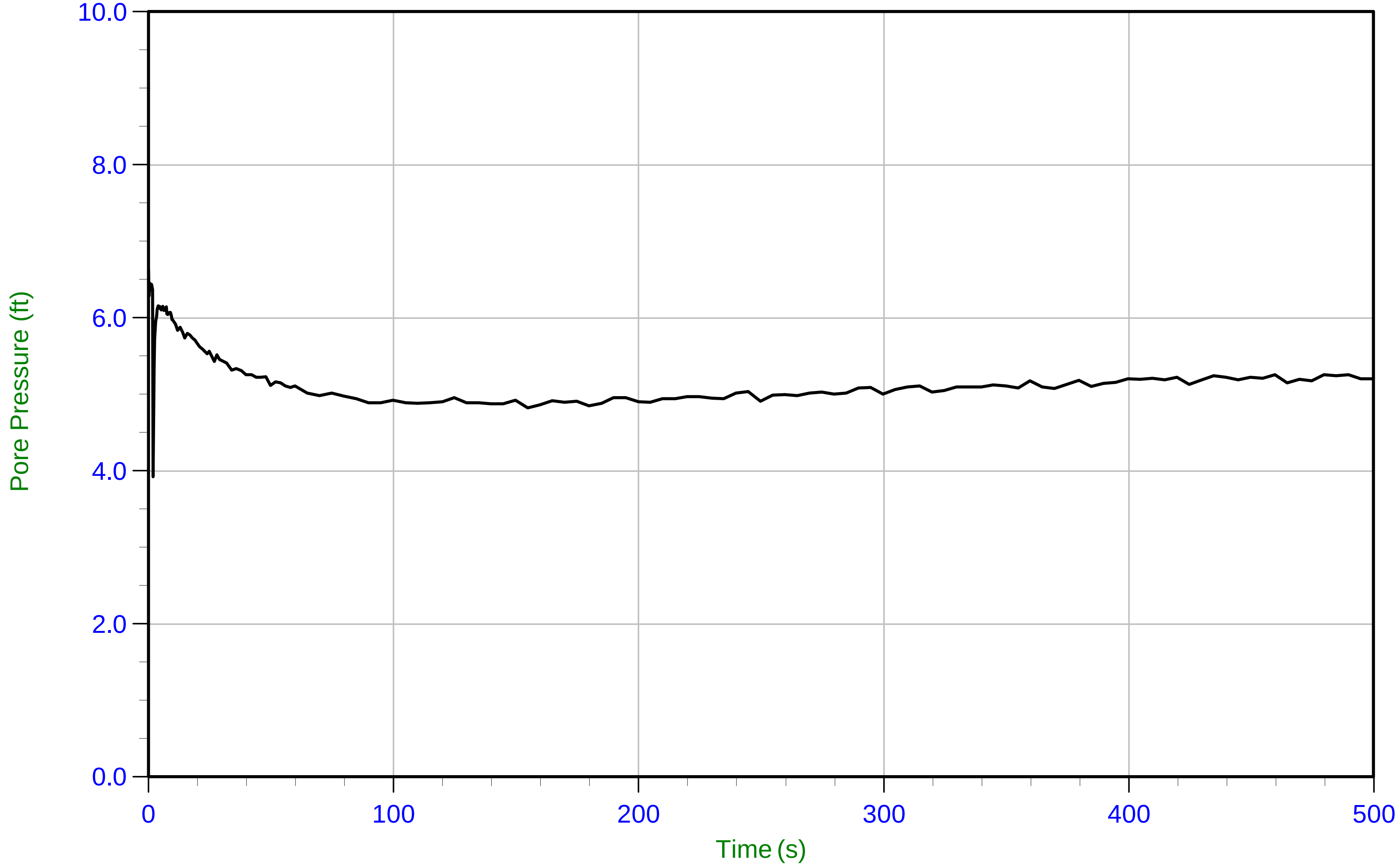


Trace Summary:

Filename: 20-54-21345_CPT_C-13.ppd2
Depth: 9.525 m / 31.250 ft
Duration: 620.0 s

u Min: -0.2 ft
u Max: 12.6 ft
u Final: 10.7 ft

WT: 6.256 m / 20.525 ft
Ueq: 10.7 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-14.ppd2
Depth: 8.550 m / 28.051 ft
Duration: 500.0 s

u Min: 3.9 ft
u Max: 6.6 ft
u Final: 5.2 ft

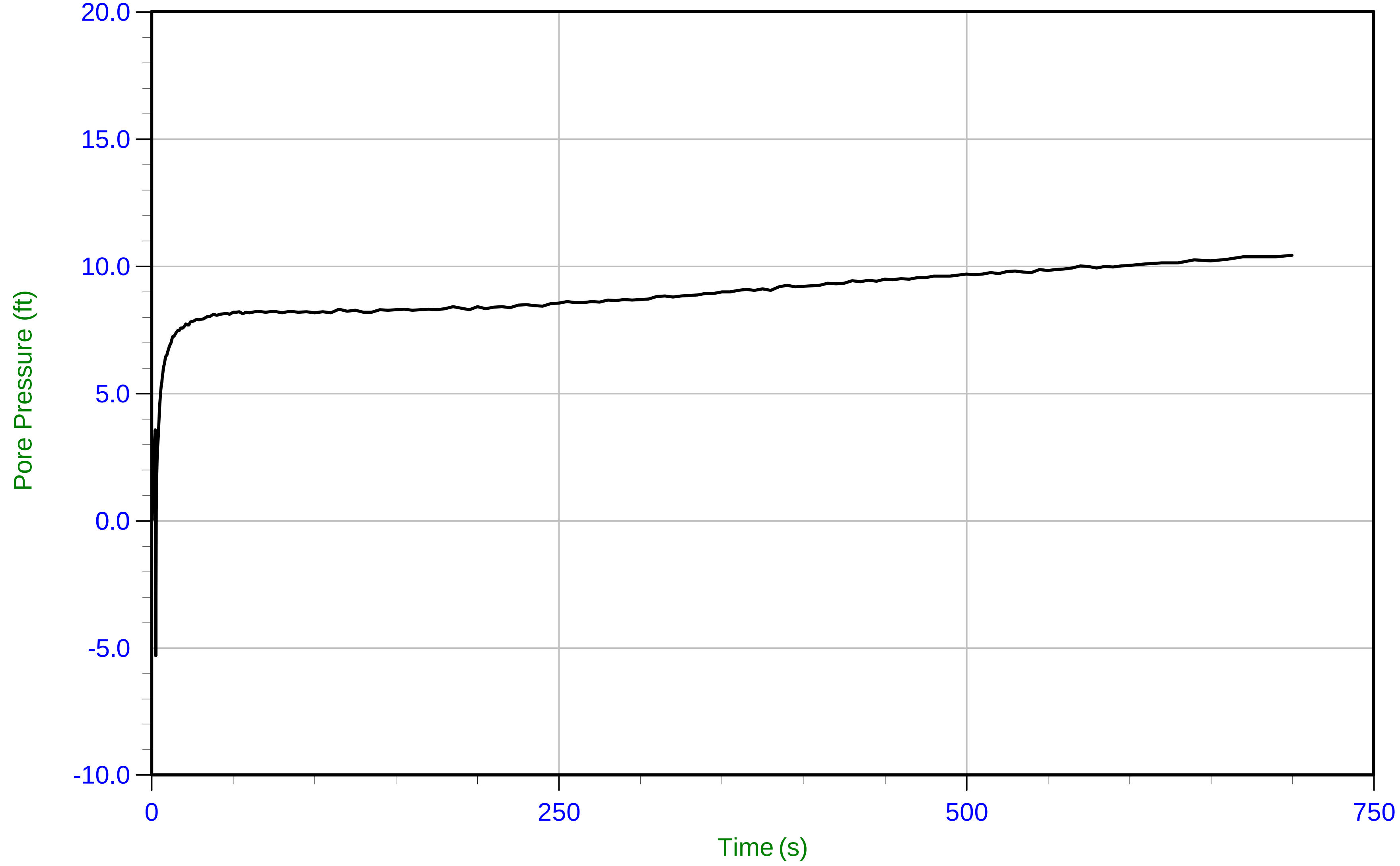
WT: 6.978 m / 22.893 ft
Ueq: 5.2 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/19/2020 08:36
Site: Chemours Facility

Sounding: 70+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-15.ppd2
Depth: 15.025 m / 49.294 ft
Duration: 700.0 s

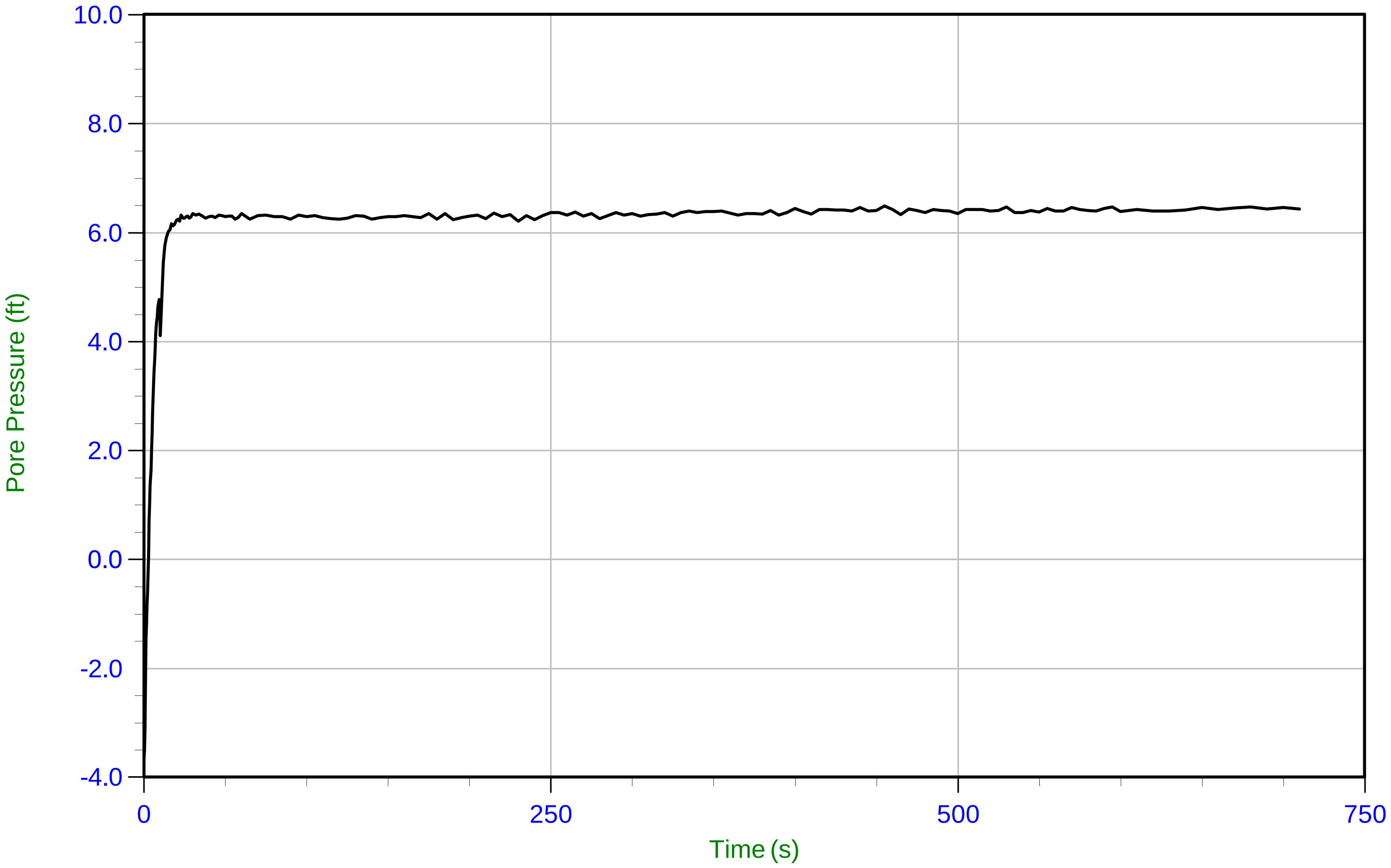
u Min: -5.3 ft
u Max: 10.4 ft
u Final: 10.4 ft

ConeTec

GeoServices, LLC

Job No: 20-54-21345
Date: 09/19/2020 12:16
Site: Chemours Facility

Sounding: 75+00a
Cone: EC611 Area=15 cm²

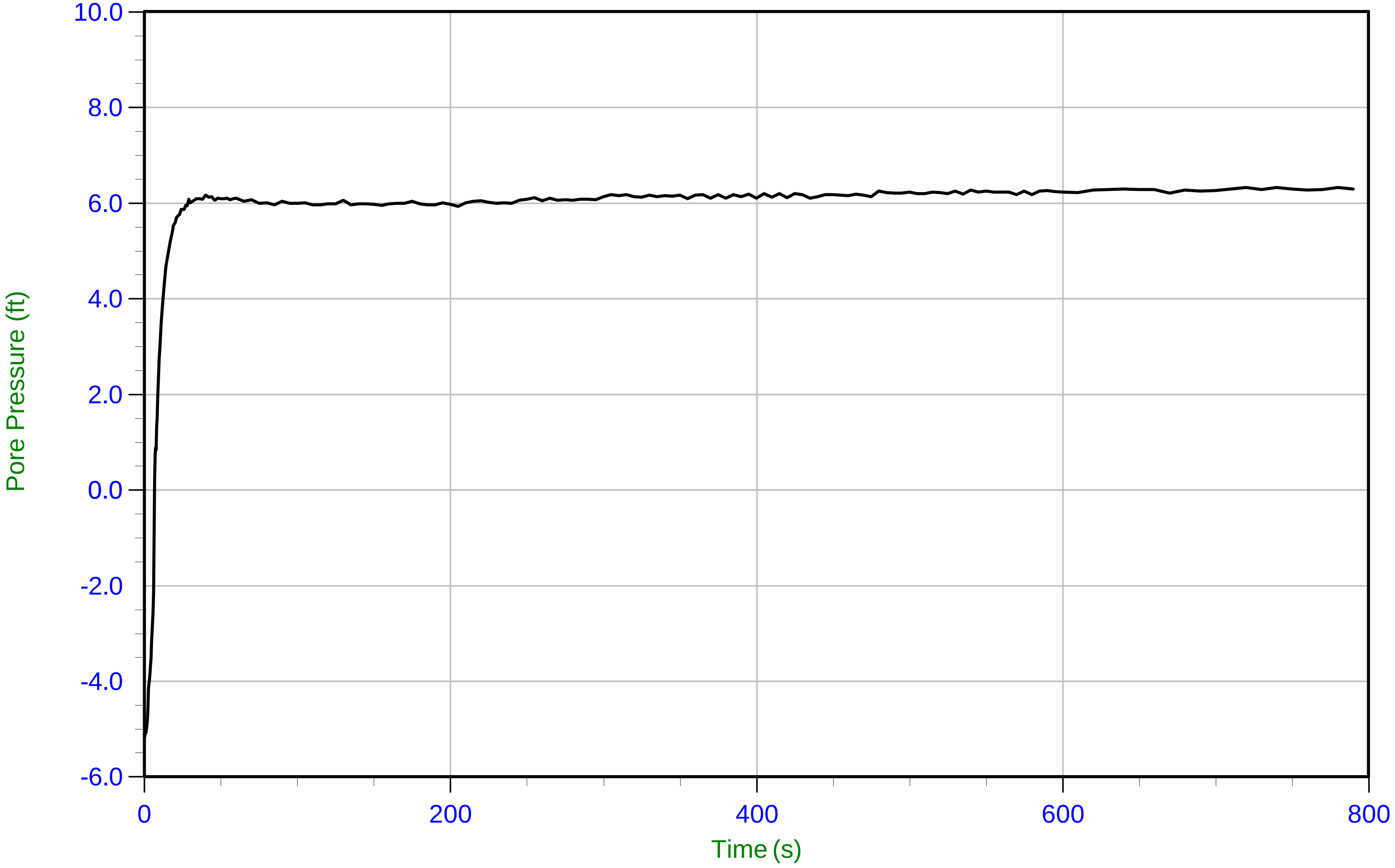


Trace Summary:

Filename: 20-54-21345_CPT_C-16a.ppd2
Depth: 17.550 m / 57.578 ft
Duration: 710.0 s

u Min: -3.6 ft
u Max: 6.5 ft
u Final: 6.4 ft

WT: 15.580 m / 51.115 ft
Ueq: 6.5 ft

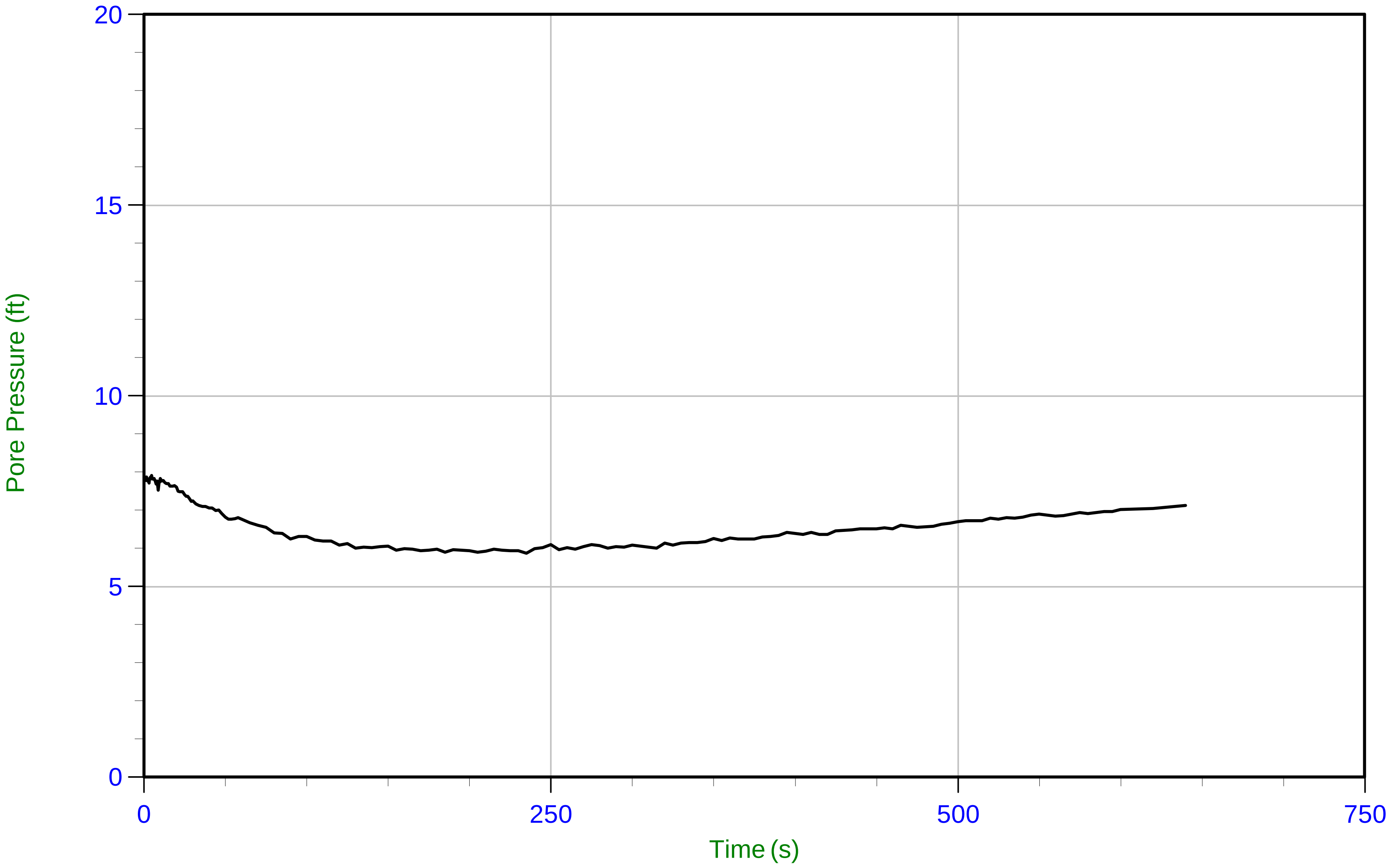


Trace Summary:

Filename: 20-54-21345_CPT_C-16.ppd2
Depth: 17.575 m / 57.660 ft
Duration: 790.0 s

u Min: -5.2 ft
u Max: 6.3 ft
u Final: 6.3 ft

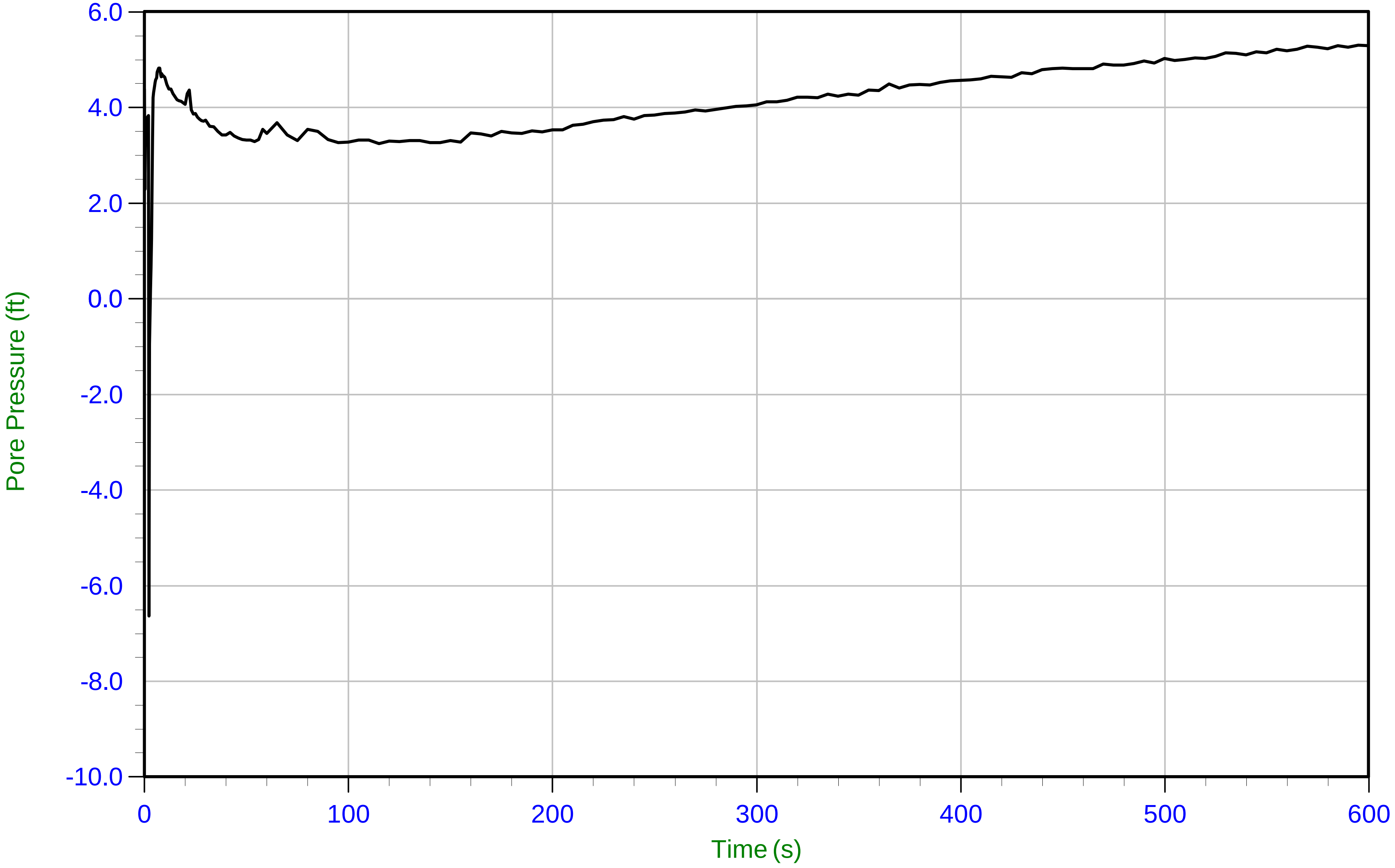
WT: 15.669 m / 51.407 ft
Ueq: 6.3 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-17.ppd2
Depth: 11.025 m / 36.171 ft
Duration: 640.0 s

u Min: 5.9 ft
u Max: 7.9 ft
u Final: 7.1 ft



Trace Summary:

Filename: 20-54-21345_CPT_C-18.ppd2
Depth: 14.150 m / 46.423 ft
Duration: 600.1 s

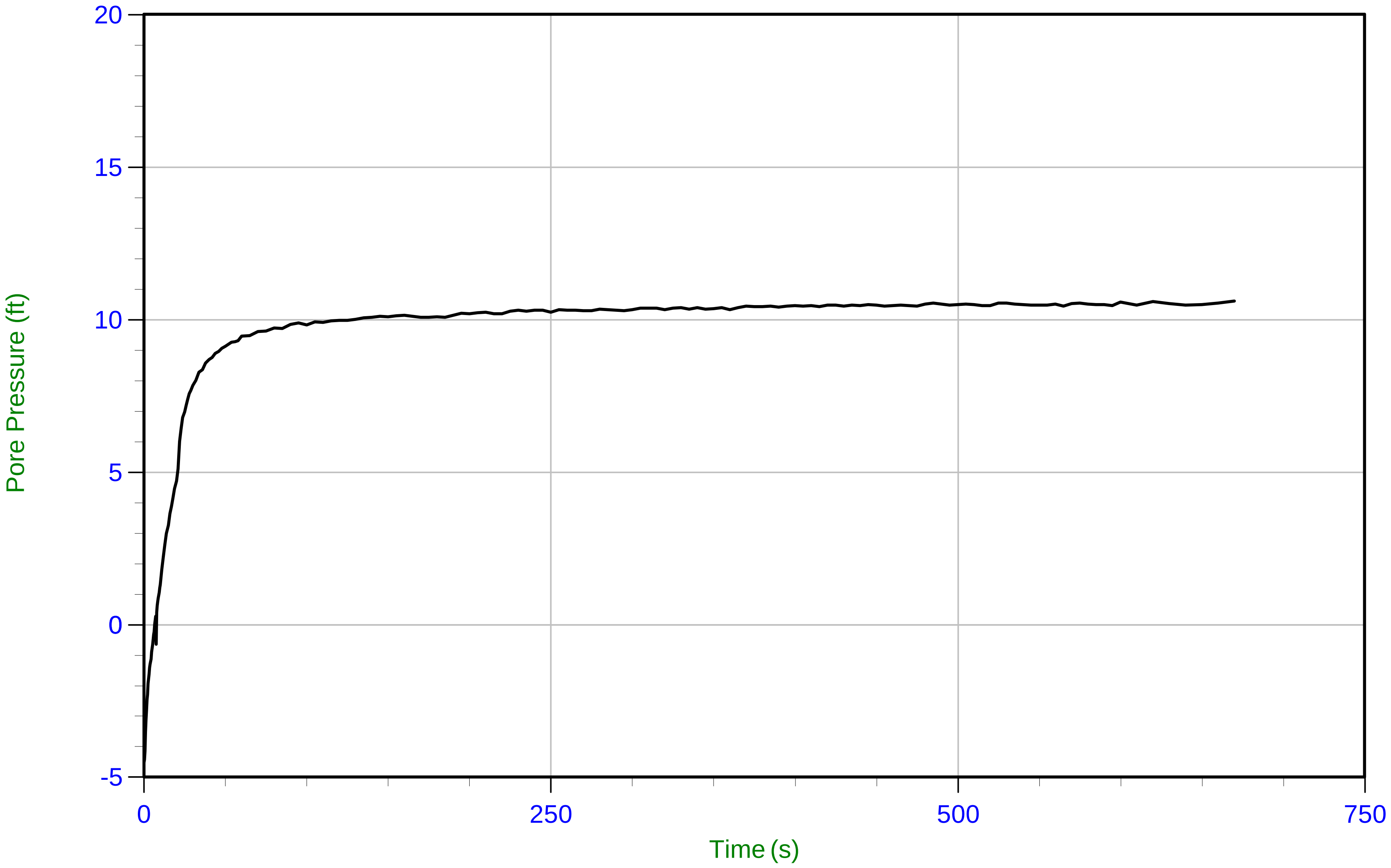
u Min: -6.6 ft
u Max: 5.3 ft
u Final: 5.3 ft

CONETEC

GeoServices, LLC

Job No: 20-54-21345
Date: 09/20/2020 09:17
Site: Chemours Facility

Sounding: 90+00
Cone: EC611 Area=15 cm²



Trace Summary:

Filename: 20-54-21345_CPT_C-19.ppd2
Depth: 15.800 m / 51.837 ft
Duration: 670.0 s

u Min: -4.5 ft
u Max: 10.6 ft
u Final: 10.6 ft

WT: 12.592 m / 41.312 ft
Ueq: 10.5 ft

GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX D

Laboratory Testing Results

GEOServices, LLC, Geotechnical and Materials Engineers

Laboratory Testing Summary

Moisture Content

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
0+00	SS-1	1.0-2.5	17.1%					
	SS-2	3.5-5.0	22.5%					
	SS-3	6.0-7.5	15.2%					
	SS-4	8.5-10.0	12.9%					16.8
	SS-5	13.5-15.0	18.1%					
	SS-6	18.5-20.0	16.7%					
	SS-7	23.5-25.0	19.7%					
	SS-8	28.5-30.0	14.0%					
	SS-9	33.5-35.0	36.8%					
	SS-10	38.5-40.0	20.3%					
	SS-11	43.5-45.0	48.9%					
	SS-12	48.5-50.0	22.4%					
	SS-13	53.5-55.0	19.8%					
	SS-14	58.5-60.0	26.9%					8.1
	SS-15	63.5-65.0	27.5%					
	SS-16	68.5-70.0	28.3%					
	SS-17	73.5-75.0	22.5%					
	SS-18	78.5-80.0	20.4%					
	SS-19	83.5-85.0	15.4%					
	SS-20	88.5-90.0	20.3%					
5+00	SS-1	1.0-2.5	21.0%					
	SS-2	3.5-5.0	18.2%					
	SS-3	6.0-7.5	26.2%					
	SS-4	8.5-10.0	23.5%					
	SS-5	13.5-15.0	27.7%					25.9
	SS-6	18.5-20.0	50.3%					
	SS-7	23.5-25.0	46.9%					
	SS-8	28.5-30.0	43.0%					
	SS-9	33.5-35.0	45.5%					
	SS-10	38.5-40.0	46.6%					
	SS-11	43.5-45.0	45.3%					
	SS-12	48.5-50.0	38.3%					7.5
	SS-13	53.5-55.0	26.7%					
	SS-14	58.5-60.0	35.4%					
	SS-15	63.5-65.0	29.0%					
	SS-16	68.5-70.0	20.2%					
	SS-17	73.5-75.0	25.0%					
	SS-18	78.5-80.0	15.0%					
	ST-2	82.0-84.0	-					33.3
	SS-19	88.5-90.0	22.0%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
10+00	SS-1	1.0-2.5	17.1%					
	SS-2	3.5-5.0	23.8%					
	SS-3	6.0-7.5	19.6%					
	SS-4	8.5-10.0	21.0%					
	SS-5	13.5-15.0	35.9%					
	SS-6	18.5-20.0	32.3%					
	SS-7	23.5-25.0	45.7%					
	SS-8	28.5-30.0	38.3%					
	SS-9	33.5-35.0	19.6%					
	SS-10	38.5-40.0	42.4%					
	SS-11	43.5-45.0	43.0%					
	SS-12	48.5-50.0	45.4%					
	SS-13	53.5-55.0	41.9%					
	SS-14	58.5-60.0	18.3%					
	SS-15	63.5-65.0	15.1%					
	SS-16	68.5-70.0	19.4%					
	SS-17	73.5-75.0	19.5%					
	SS-18	78.5-80.0	20.7%					
	SS-19	88.5-90.0	17.2%					
15+00	SS-1	1.0-2.5	7.8%					
	SS-2	3.5-5.0	16.5%					
	SS-3	6.0-7.5	23.3%					
	SS-4	8.5-10.0	20.7%					
	SS-5	13.5-15.0	25.9%					
	SS-6	18.5-20.0	16.8%					
	SS-7	23.5-25.0	23.6%					
	SS-8	28.5-30.0	47.1%					
	SS-9	33.5-35.0	43.4%					
	ST-2	35.0-37.0	-	56	20	36	CH	75.1
	SS-10	38.5-40.0	28.2%					
	SS-11	43.5-45.0	36.8%					
	SS-12	48.5-50.0	36.7%					
	SS-13	53.5-55.0	40.5%					
	SS-14	58.5-60.0	13.3%					
	SS-15	63.5-65.0	17.0%					
	SS-16	68.5-70.0	17.5%					
	SS-17	73.5-75.0	18.6%					
	SS-18	78.5-80.0	19.0%					
	SS-19	83.5-85.0	24.3%					
	SS-20	88.5-90.0	18.7%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
20+00	SS-1	1.0-2.5	18.0%					
	SS-2	3.5-5.0	20.5%					
	SS-3	6.0-7.5	19.7%					
	SS-4	8.5-10.0	21.4%					
	SS-5	13.5-15.0	18.0%					
	SS-6	18.5-20.0	44.4%					
	SS-7	23.5-25.0	43.6%					
	SS-8	28.5-30.0	42.1%					
	SS-9	33.5-35.0	40.5%					
	SS-10	38.5-40.0	44.3%					
	SS-11	43.5-45.0	19.4%					
	SS-12	48.5-50.0	20.8%					
	SS-13	53.5-55.0	21.9%					
	SS-14	58.5-60.0	28.1%					6.4
	SS-15	63.5-65.0	20.3%					
	SS-16	68.5-70.0	33.8%					
	SS-17	73.5-75.0	20.9%					
	SS-18	78.5-80.0	22.8%					
	SS-19	83.5-85.0	25.9%					
	SS-20	88.5-90.0	21.0%					
25+00	SS-1	1.0-2.5	13.8%					
	SS-2	3.5-5.0	18.6%					
	SS-3	6.0-7.5	25.2%					
	SS-4	8.5-10.0	25.9%					
	SS-5	13.5-15.0	34.6%					8.6
	SS-6	18.5-20.0	22.8%					
	SS-7	23.5-25.0	23.4%					
	SS-8	28.5-30.0	44.6%					
	SS-9	33.5-35.0	40.3%					
	SS-10	38.5-40.0	27.5%					
	SS-11	43.5-45.0	34.8%					
	SS-12	48.5-50.0	37.7%					
	SS-13	53.5-55.0	77.5%					
	SS-14	58.5-60.0	22.5%					
	SS-15	63.5-65.0	21.5%					
	SS-16	68.5-70.0	20.8%					
	ST-2	72.0-74.0	-	52	17	35	CH	80.8
	SS-17	78.5-80.0	29.5%					
	SS-18	83.5-85.0	18.6%					
	SS-19	88.5-90.0	18.7%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
30+00	SS-1	1.0-2.5	22.0%					
	SS-2	3.5-5.0	18.9%					
	SS-3	6.0-7.5	16.5%					
	SS-4	8.5-10.0	36.0%					
	SS-5	13.5-15.0	21.0%					
	SS-6	18.5-20.0	67.7%					
	SS-7	23.5-25.0	41.3%					
	SS-8	28.5-30.0	42.8%					
	SS-9	33.5-35.0	41.5%					
	SS-10	38.5-40.0	26.6%					
	SS-11	43.5-45.0	33.8%					
	SS-12	48.5-50.0	29.8%					
	SS-13	53.5-55.0	20.9%					
	SS-14	58.5-60.0	22.0%					
	SS-15	63.5-65.0	22.5%					
	SS-16	68.5-70.0	33.0%					
	SS-17	78.5-80.0	22.1%					
	SS-18	83.5-85.0	22.4%					
	SS-19	88.5-90.0	23.3%					
33+50	SS-1	1.0-2.5	18.9%					
	SS-2	3.5-5.0	45.8%					
	SS-3	6.0-7.5	19.0%					
	SS-4	8.5-10.0	45.3%					
	SS-5	13.5-15.0	48.2%					
	SS-6	18.5-20.0	40.8%					
	SS-7	23.5-25.0	33.7%					
	SS-8	28.5-30.0	48.3%					
	SS-9	33.5-35.0	43.0%					
	SS-10	38.5-40.0	41.8%					
	SS-11	43.5-45.0	42.0%					
	SS-12	48.5-50.0	18.7%					
	SS-13	53.5-55.0	36.5%					21.0
	SS-14	58.5-60.0	37.3%					
	SS-15	63.5-65.0	24.5%					
	SS-16	68.5-70.0	22.5%					
	SS-17	73.5-75.0	23.7%					
	SS-18	78.5-80.0	25.7%					
	ST-1	80.0-82.0	-					71.3
	SS-19	88.5-90.0	21.9%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
37+50	SS-1	1.0-2.5	16.1%					
	SS-2	3.5-5.0	10.3%					
	SS-3	6.0-7.5	19.1%					
	SS-4	8.5-10.0	20.6%					
	SS-5	13.5-15.0	20.2%					
	SS-6	18.5-20.0	36.1%					
	SS-7	23.5-25.0	27.0%					
	SS-8	28.5-30.0	22.9%					
	SS-9	33.5-35.0	22.8%					11.6
	SS-10	38.5-40.0	20.5%					
	SS-11	43.5-45.0	20.2%					
	SS-12	48.5-50.0	29.9%					
	SS-13	53.5-55.0	15.7%					
	SS-14	58.5-60.0	21.7%					
	SS-15	63.5-65.0	17.9%					
	SS-16	68.5-70.0	15.6%					
	SS-17	78.5-80.0	22.9%					
	SS-18	83.5-85.0	24.3%					
	SS-19	88.5-90.0	26.7%					
42+50	SS-1	1.0-2.5	7.1%					
	SS-2	3.5-5.0	13.8%					
	SS-3	6.0-7.5	26.0%					
	SS-4	8.5-10.0	26.9%					8.2
	SS-5	13.5-15.0	25.2%					
	SS-6	18.5-20.0	36.0%					
	SS-7	23.5-25.0	21.5%					
	SS-8	28.5-30.0	25.1%					
	SS-9	33.5-35.0	25.9%					13.3
	SS-10	38.5-40.0	24.1%					
	SS-11	43.5-45.0	23.3%					
	SS-12	48.5-50.0	41.0%					
	ST-1	50.0-52.0	-	27	17	10	CL	80.6
	SS-13	53.5-55.0	39.6%					
	SS-14	58.5-60.0	44.1%					
	SS-15	63.5-65.0	19.1%					
	SS-16	68.5-70.0	28.9%					
	SS-17	73.5-75.0	31.1%					
	SS-18	78.5-80.0	22.1%					
	SS-19	83.5-85.0	21.5%					
	SS-20	88.5-90.0	14.4%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
47+50	SS-1	1.0-2.5	20.9%					
	SS-2	3.5-5.0	26.4%					
	SS-3	6.0-7.5	13.1%					
	SS-4	8.5-10.0	17.5%					
	SS-5	13.5-15.0	27.6%					
	SS-6	18.5-20.0	39.6%					
	SS-7	23.5-25.0	38.8%					
	SS-8	28.5-30.0	34.0%					
	SS-9	33.5-35.0	24.6%					
	SS-10	38.5-40.0	36.1%					
	SS-11	43.5-45.0	38.7%					
	SS-12	48.5-50.0	37.6%					
	SS-13	53.5-55.0	32.5%					
	SS-14	58.5-60.0	28.0%					
	SS-15	63.5-65.0	17.9%					
	SS-16	68.5-70.0	27.0%					
	SS-17	78.5-80.0	24.2%					
	SS-18	83.5-85.0	17.2%					
	SS-19	88.5-90.0	17.6%					
52+50	SS-1	1.0-2.5	24.3%					
	SS-2	3.5-5.0	20.6%					
	SS-3	6.0-7.5	40.6%					
	SS-4	8.5-10.0	46.8%					
	SS-5	13.5-15.0	40.4%					
	SS-6	18.5-20.0	39.3%					
	SS-7	23.5-25.0	53.3%					
	SS-8	28.5-30.0	42.5%					
	SS-9	33.5-35.0	50.4%					
	SS-10	38.5-40.0	27.7%					
	SS-11	43.5-45.0	29.6%					
	SS-12	48.5-50.0	45.7%					
	SS-13	53.5-55.0	41.5%					
	SS-14	58.5-60.0	21.4%					
	SS-15	63.5-65.0	19.8%					
	SS-16	68.5-70.0	19.8%					
	SS-17	73.5-75.0	20.2%					
	SS-18	78.5-80.0	19.6%					
	SS-19	88.5-90.0	25.8%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
57+50	SS-1	1.0-2.5	17.6%					
	SS-2	3.5-5.0	-					
	SS-3	6.0-7.5	47.8%					
	SS-4	8.5-10.0	47.4%					
	SS-5	13.5-15.0	13.4%					
	SS-6	18.5-20.0	16.7%					
	SS-7	23.5-25.0	18.9%					6.1
	SS-8	28.5-30.0	42.4%					
	SS-9	38.5-40.0	48.2%					
	SS-10	43.5-45.0	36.4%					
	SS-11	48.5-50.0	57.7%					
	SS-12	53.5-55.0	33.0%					
	SS-13	58.5-60.0	24.3%					
	SS-14	63.5-65.0	15.2%					23.2
	SS-15	68.5-70.0	19.2%					
	SS-16	73.5-75.0	21.8%					
	SS-17	78.5-80.0	20.6%					
	SS-18	83.5-85.0	25.1%					
	SS-19	88.5-90.0	25.0%					
62+50	SS-1	1.0-2.5	12.9%					
	SS-2	3.5-5.0	19.2%					
	SS-3	6.0-7.5	39.6%					
	SS-4	8.5-10.0	44.1%					
	SS-5	13.5-15.0	42.9%					
	SS-6	18.5-20.0	48.5%					
	SS-7	23.5-25.0	37.9%					
	SS-8	28.5-30.0	38.2%					
	SS-9	33.5-35.0	41.6%					
	SS-10	43.5-45.0	41.9%					
	SS-11	48.5-50.0	36.5%					
	SS-12	53.5-55.0	45.8%					
	SS-13	58.5-60.0	24.1%					
	SS-14	63.5-65.0	19.6%					
	SS-15	68.5-70.0	22.5%					
	SS-16	73.5-75.0	20.0%					
	SS-17	78.5-80.0	23.6%					
	SS-18	83.5-85.0	25.4%					
	SS-19	88.5-90.0	23.2%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
67+50	SS-1	1.0-2.5	13.0%					
	SS-2	3.5-5.0	15.6%					
	SS-3	6.0-7.5	17.9%					
	SS-4	8.5-10.0	29.4%					
	SS-5	13.5-15.0	17.5%					
	SS-6	18.5-20.0	23.7%					
	SS-7	23.5-25.0	39.9%					
	SS-8	28.5-30.0	46.9%					
	SS-9	33.5-35.0	21.6%					
	SS-10	38.5-40.0	24.0%					
	SS-11	43.5-45.0	7.6%					
	SS-12	48.5-50.0	27.8%					
	SS-13	53.5-55.0	35.4%					
	SS-14	58.5-60.0	35.7%					
	SS-15	63.5-65.0	24.6%					
	SS-16	68.5-70.0	22.1%					
	SS-17	73.5-75.0	21.3%					
	SS-18	78.5-80.0	22.8%					
	SS-19	83.5-85.0	23.2%					
	SS-20	88.5-90.0	18.8%					
72+50	SS-1	1.0-2.5	12.8%					
	SS-2	3.5-5.0	28.5%					
	SS-3	6.0-7.5	25.7%					
	SS-4	8.5-10.0	17.1%					
	SS-5	13.5-15.0	22.4%					
	SS-6	18.5-20.0	53.9%					
	SS-7	23.5-25.0	45.7%					
	SS-8	28.5-30.0	45.4%					
	SS-9	33.5-35.0	41.6%					
	SS-10	38.5-40.0	46.3%					
	SS-11	43.5-45.0	51.5%					
	SS-12	48.5-50.0	50.7%					
	SS-13	53.5-55.0	54.5%					
	SS-14	58.5-60.0	40.8%					
	SS-15	63.5-65.0	24.9%					
	SS-16	68.5-70.0	21.2%					
	SS-17	73.5-75.0	21.9%					
	SS-18	78.5-80.0	19.3%					
	SS-19	88.5-90.0	22.0%					

SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
77+50	SS-1	1.0-2.5	9.8%					
	SS-2	3.5-5.0	45.2%					
	SS-3	6.0-7.5	15.6%					
	SS-4	8.5-10.0	15.5%					
	SS-5	13.5-15.0	20.0%					
	SS-6	18.5-20.0	27.3%					
	SS-7	23.5-25.0	23.4%					
	SS-8	28.5-30.0	38.4%					
	SS-9	38.5-40.0	42.1%					
	SS-10	43.5-45.0	24.3%					
	SS-11	48.5-50.0	37.0%					
	SS-12	53.5-55.0	41.9%					
	SS-13	58.5-60.0	28.7%					
	SS-14	63.5-65.0	24.6%					
	SS-15	68.5-70.0	25.3%					
	SS-16	73.5-75.0	20.3%					
	SS-17	78.5-80.0	16.9%					
	SS-18	83.5-85.0	21.9%					
	SS-19	88.5-90.0	16.5%					
82+50	SS-1	1.0-2.5	7.0%					
	SS-2	3.5-5.0	18.8%					
	SS-3	6.0-7.5	40.9%					
	SS-4	8.5-10.0	40.3%					
	SS-5	13.5-15.0	17.5%					
	SS-6	18.5-20.0	22.7%					9
	SS-7	23.5-25.0	22.1%					
	SS-8	28.5-30.0	38.4%					
	SS-9	33.5-35.0	41.2%					
	SS-10	43.5-45.0	33.0%					
	SS-11	48.5-50.0	13.5%					
	SS-12	53.5-55.0	44.1%					
	SS-13	58.5-60.0	25.4%					
	SS-14	63.5-65.0	24.2%					41.1
	SS-15	68.5-70.0	18.6%					
	SS-16	73.5-75.0	22.9%					
	SS-17	78.5-80.0	16.7%					
	SS-18	83.5-85.0	19.5%					
	SS-19	88.5-90.0	22.1%					

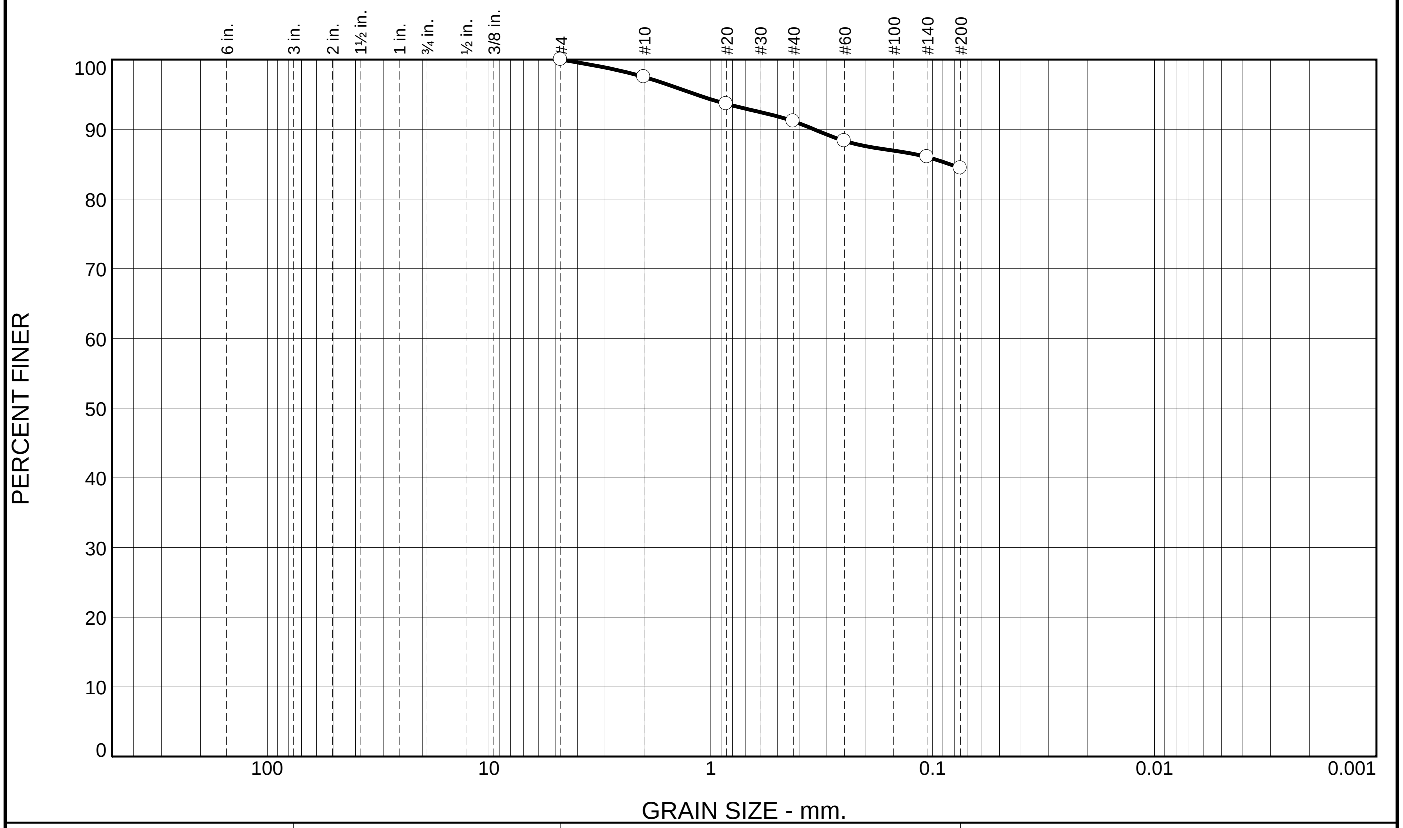
SOIL DATA SUMMARY
Chemours Barrier Wall - Fayetteville, North Carolina
GEOServices Project No. 41-20500

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	% Passing #200
				LL	PL	PI		
87+50	SS-1	1.0-2.5	22.9%					
	SS-2	3.5-5.0	21.5%					
	SS-3	6.0-7.5	50.3%					
	SS-4	8.5-10.0	45.8%					
	SS-5	13.5-15.0	18.9%					
	SS-6	18.5-20.0	33.2%					
	SS-7	23.5-25.0	45.1%					
	SS-8	28.5-30.0	25.6%					8.7
	SS-9	33.5-35.0	48.8%					
	SS-10	38.5-40.0	27.5%					7.8
	SS-11	43.5-45.0	20.0%					
	SS-12	48.5-50.0	39.2%					
	SS-13	53.5-55.0	38.0%					
	SS-14	63.5-65.0	46.4%					
	SS-15	68.5-70.0	41.2%					
	SS-16	73.5-75.0	18.9%					
	SS-17	78.5-80.0	25.5%					
	SS-18	83.5-85.0	21.5%					
	SS-19	88.5-90.0	18.8%					

GEOServices, LLC, Geotechnical and Materials Engineers

Particle Size Analysis

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.5	6.4	6.7	84.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	97.5		
#20	93.6		
#40	91.1		
#60	88.3		
#140	86.0		
#200	84.4		

* (no specification provided)

Soil Description

Dark Gray Clay

Atterberg Limits

PL= 25 LL= 81 PI= 56

Coefficients

D_{90}= 0.3433 D_{85}= 0.0841 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(52)

Remarks

Location: 0+00
Depth: 38'-40'

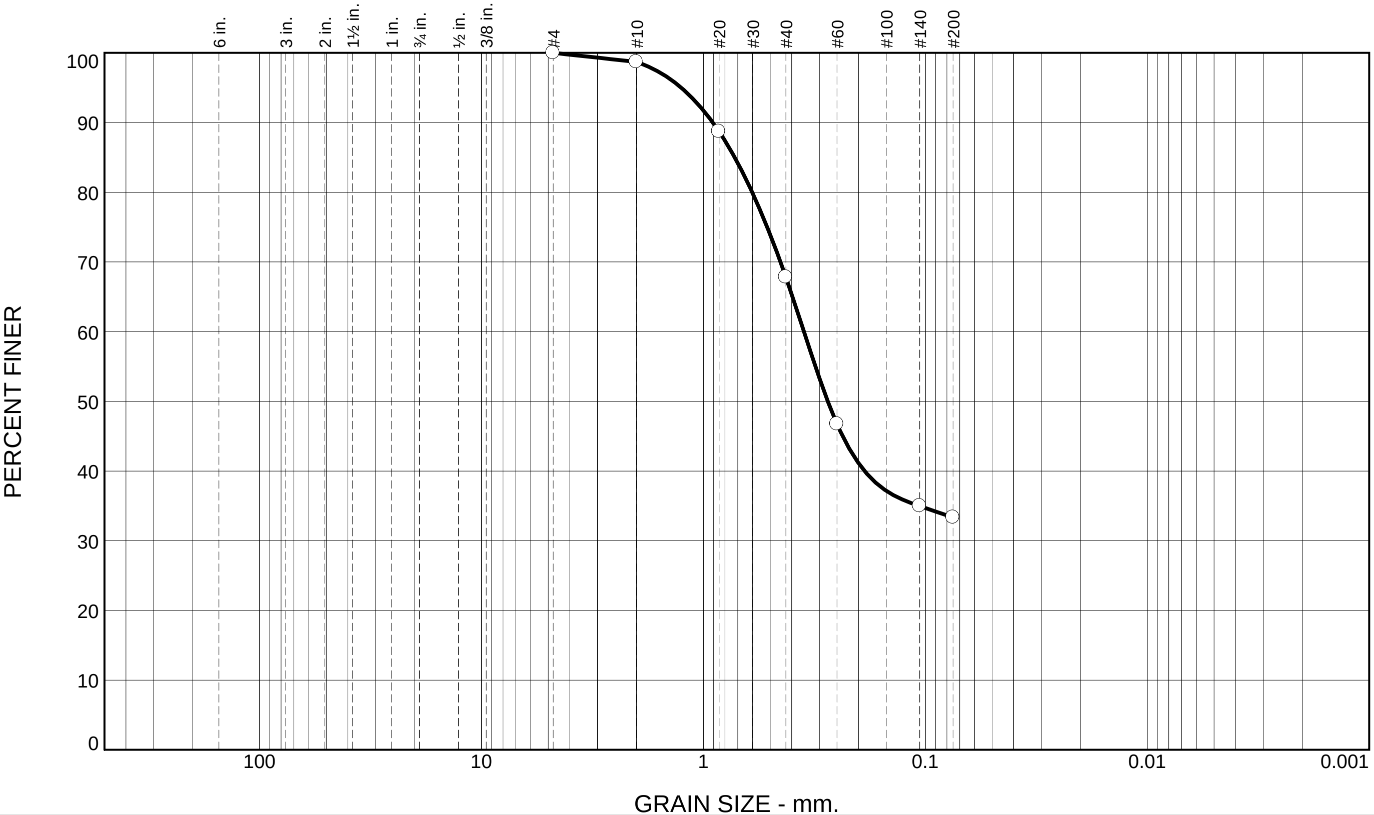
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.3	30.9	34.5	33.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.7		
#20	88.7		
#40	67.8		
#60	46.7		
#140	35.0		
#200	33.3		

* (no specification provided)

Soil Description

Light Gray Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.9074 D_{85}= 0.7230 D_{60}= 0.3525
D_{50}= 0.2751 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: 5+00
Depth: 80'-82'

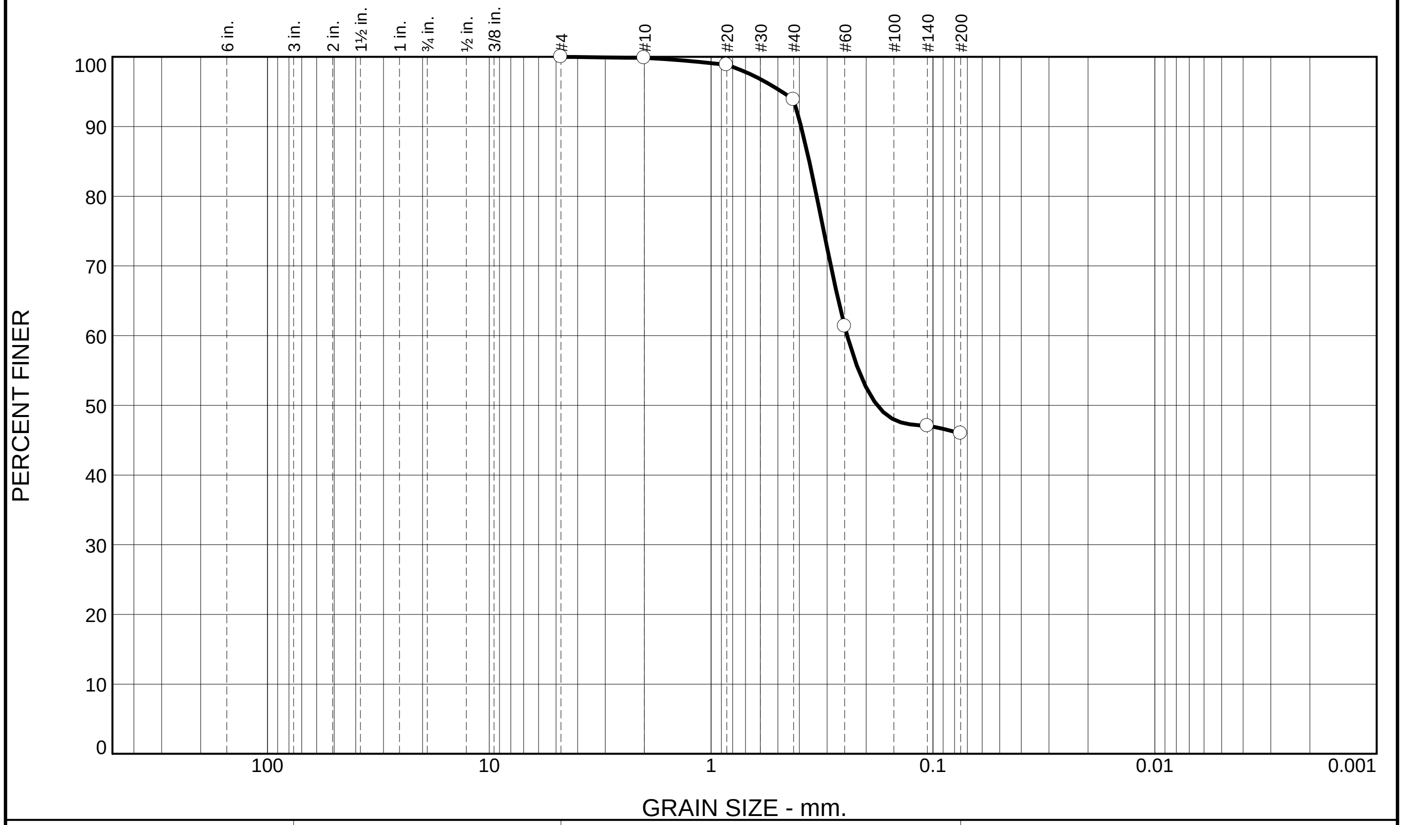
Date:

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	6.0	47.8	46.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	98.8		
#40	93.8		
#60	61.3		
#140	47.0		
#200	46.0		

* (no specification provided)

Soil Description

Light Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.3930 D_{85}= 0.3612 D_{60}= 0.2436
D_{50}= 0.1783 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: 15+00 - Bottom
Depth: 35'-37'

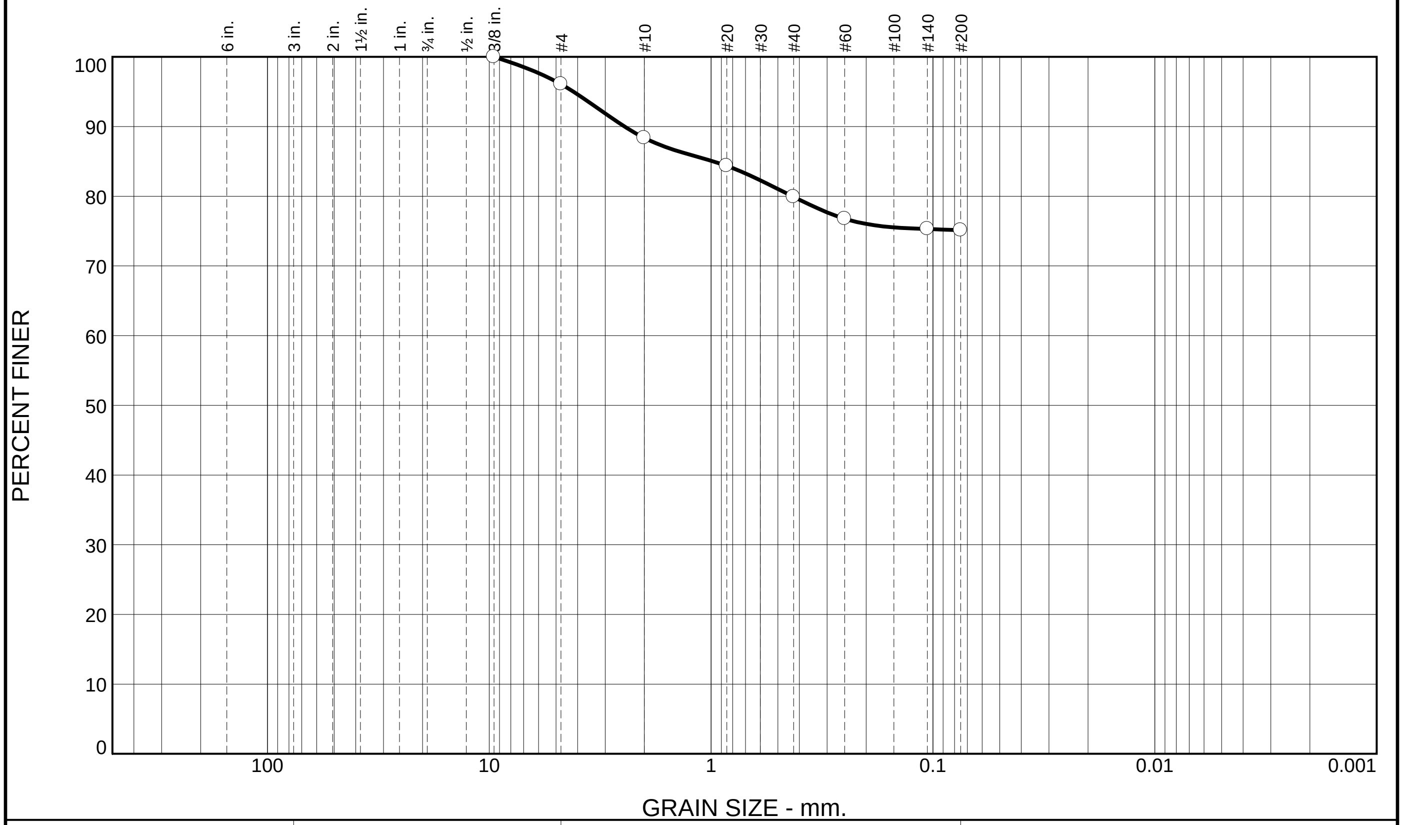
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	7.7	8.5	4.8	75.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.1		
#10	88.4		
#20	84.4		
#40	79.9		
#60	76.8		
#140	75.3		
#200	75.1		

* (no specification provided)

Soil Description

Dark Gray Clay with Sand

Atterberg Limits

PL= 20 LL= 56 PI= 36

Coefficients

D_{90}= 2.4551 D_{85}= 0.9789 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(27)

Remarks

Location: 15+00 - Top
Depth: 35'-37'

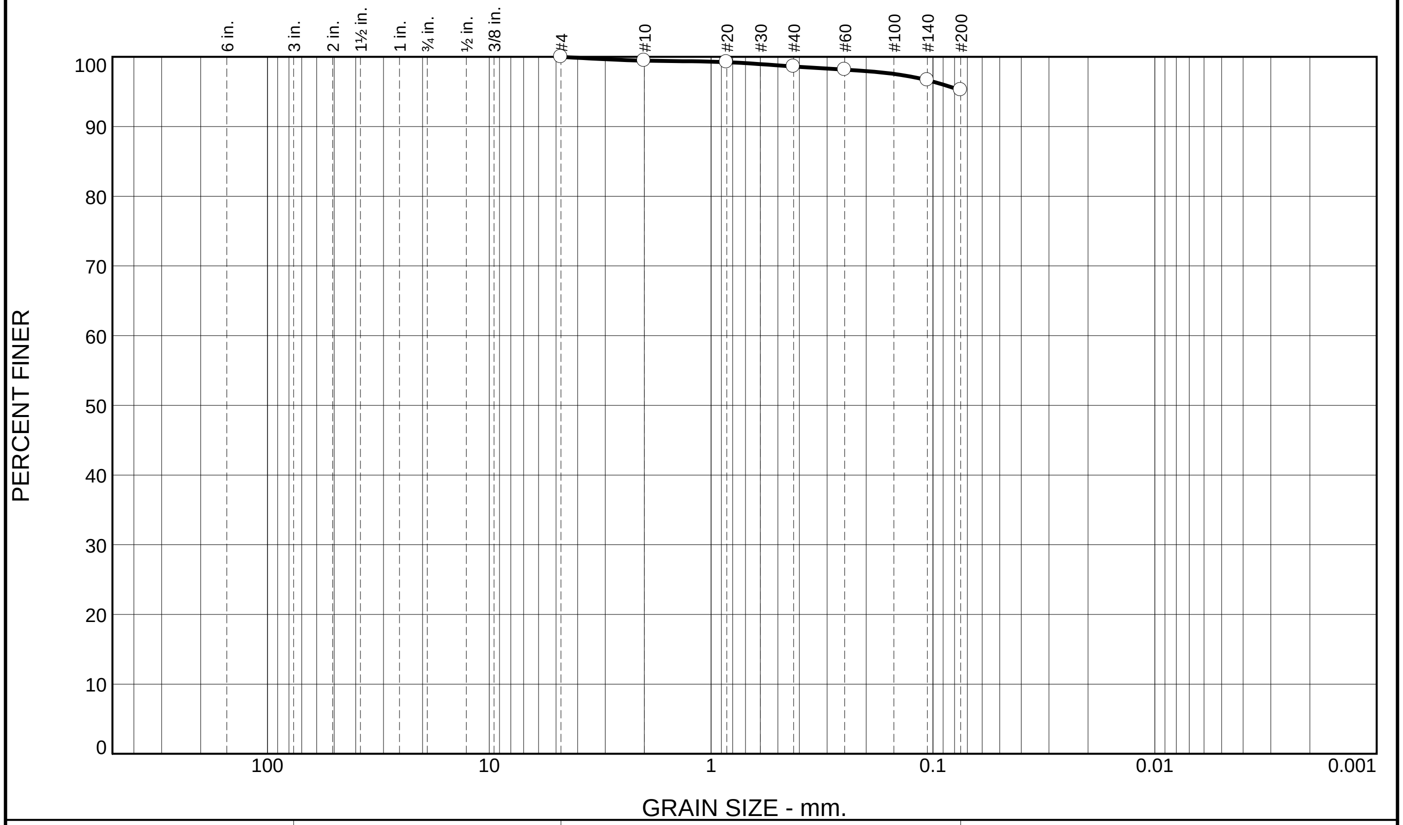
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	0.9	3.4	95.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.5		
#20	99.2		
#40	98.6		
#60	98.2		
#140	96.7		
#200	95.2		

* (no specification provided)

Soil Description

Dark Gray Clay

Atterberg Limits

PL= 26 LL= 70 PI= 44

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(48)

Remarks

Location: 20+00
Depth: 35'-37'

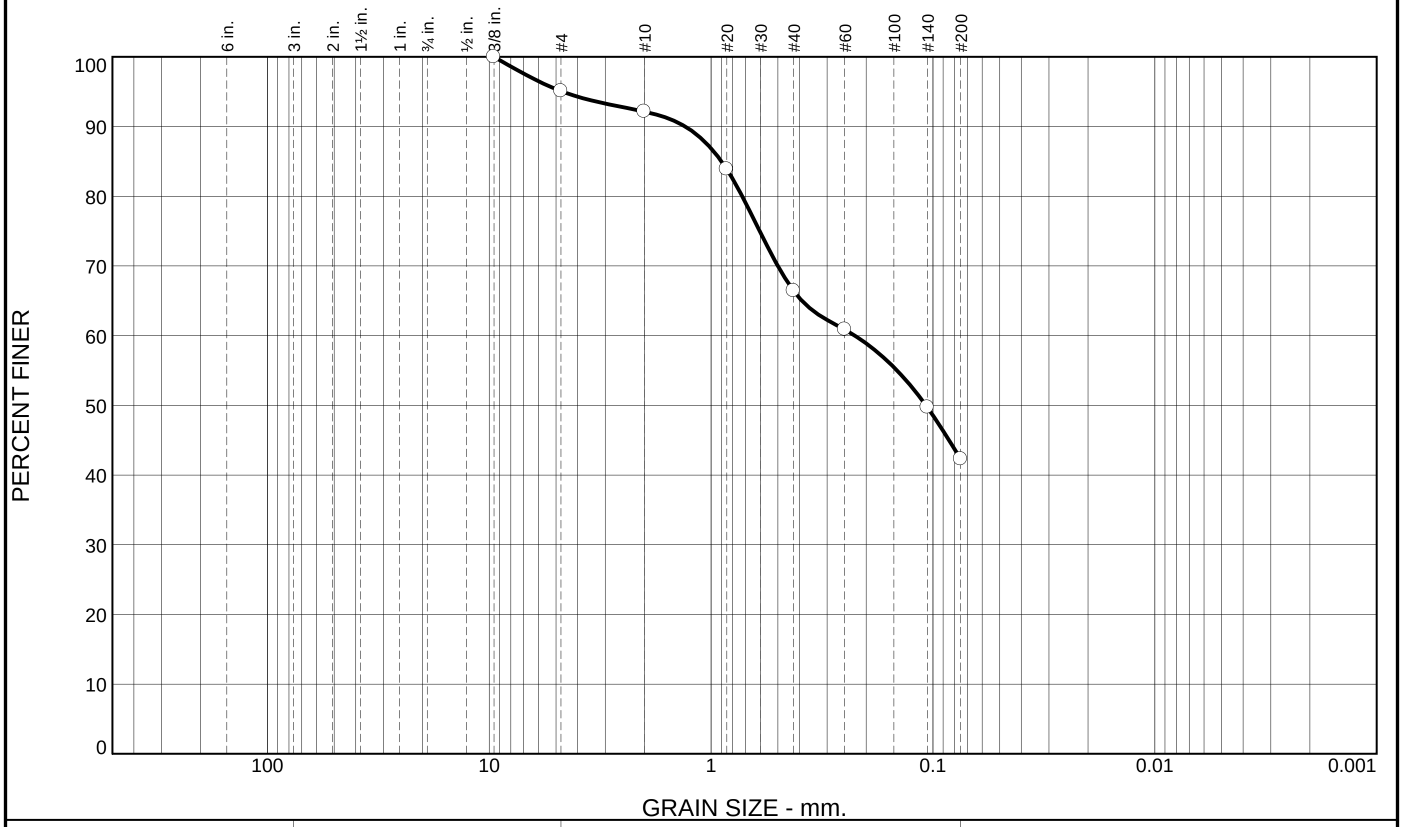
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.9	3.0	25.7	24.1	42.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.1		
#10	92.1		
#20	83.9		
#40	66.4		
#60	60.9		
#140	49.7		
#200	42.3		

* (no specification provided)

Soil Description

Yellow Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.3080 D_{85}= 0.8985 D_{60}= 0.2250
D_{50}= 0.1076 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: 20+00
Depth: 45'-47'

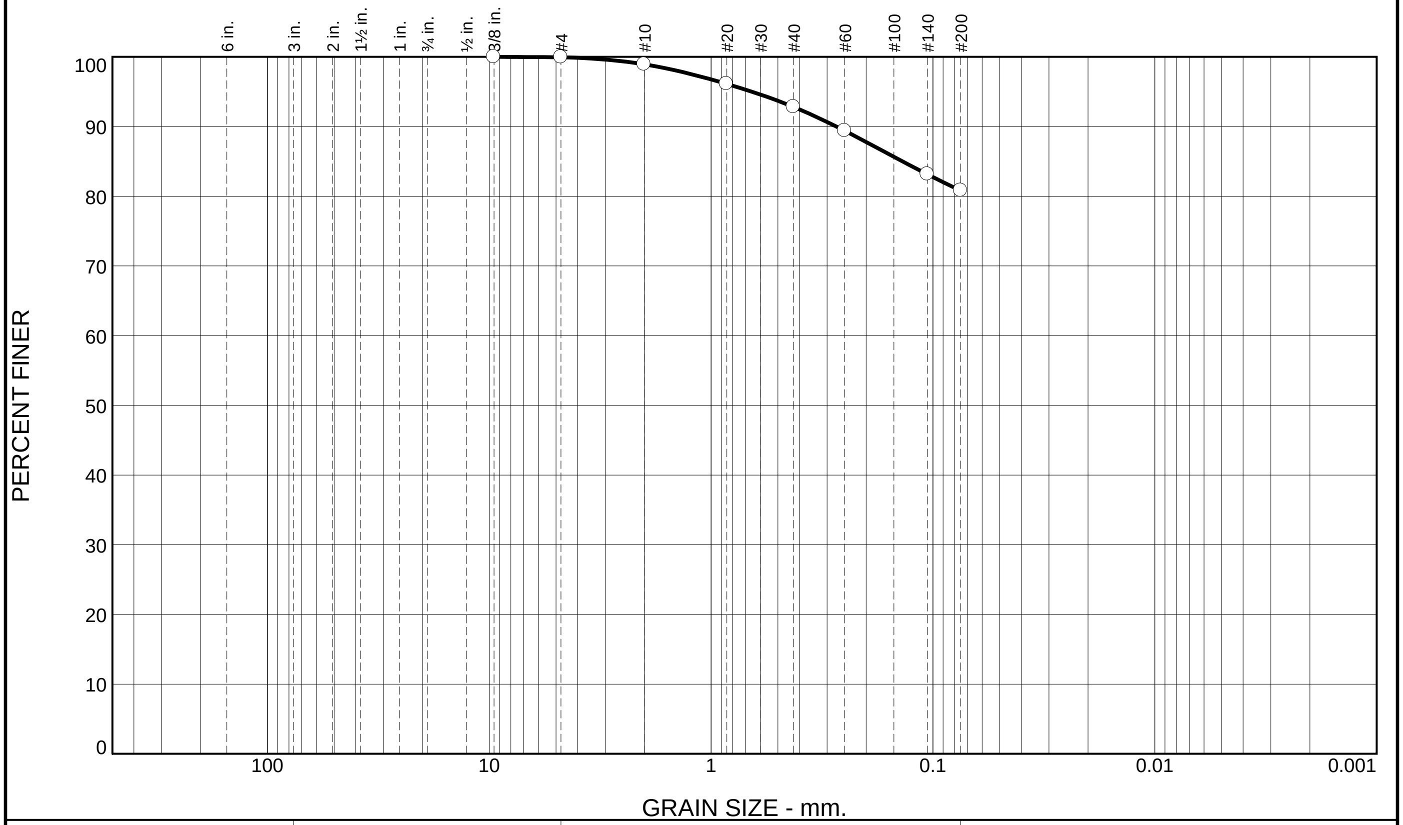
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.0	6.1	12.0	80.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	98.9		
#20	96.1		
#40	92.8		
#60	89.4		
#140	83.1		
#200	80.8		

* (no specification provided)

Soil Description

Light Gray Clay

Atterberg Limits

PL= 17 LL= 52 PI= 35

Coefficients

D_{90}= 0.2729 D_{85}= 0.1372 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(28)

Remarks

Location: 25+00
Depth: 72'-74'

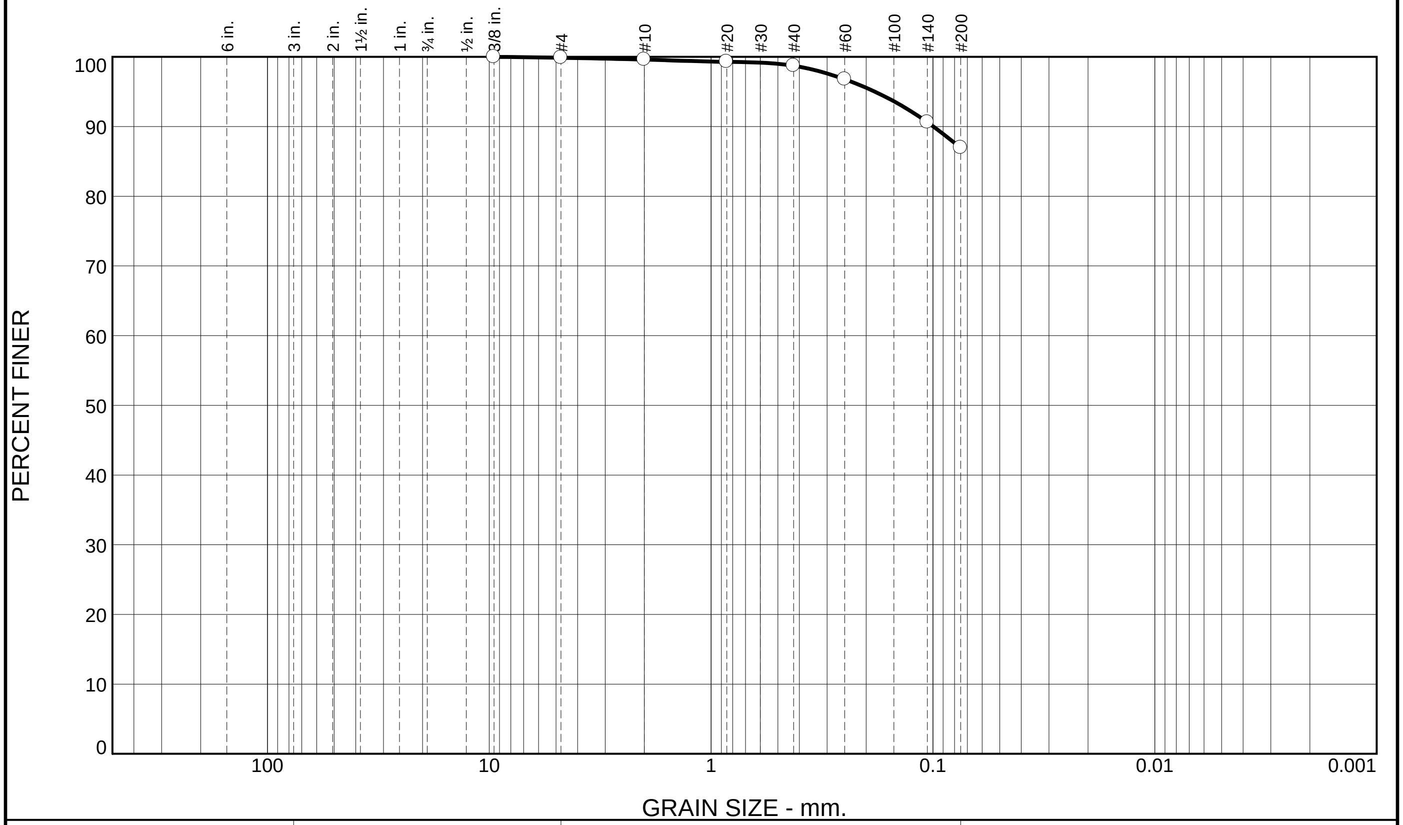
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.3	0.9	11.7	87.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.6		
#20	99.3		
#40	98.7		
#60	96.8		
#140	90.6		
#200	87.0		

* (no specification provided)

Soil Description

Dark Gray Clay with Sand

Atterberg Limits

PL= 17
LL= 43
PI= 26

Coefficients

D_{90}= 0.0996
D_{85}=
D_{60}=
D_{50}=
D_{30}=
D_{15}=
D_{10}=
C_u=
C_c=

Classification

USCS= CL
AASHTO= A-7-6(23)

Remarks

Location: 30+00
Depth: 70'-72'

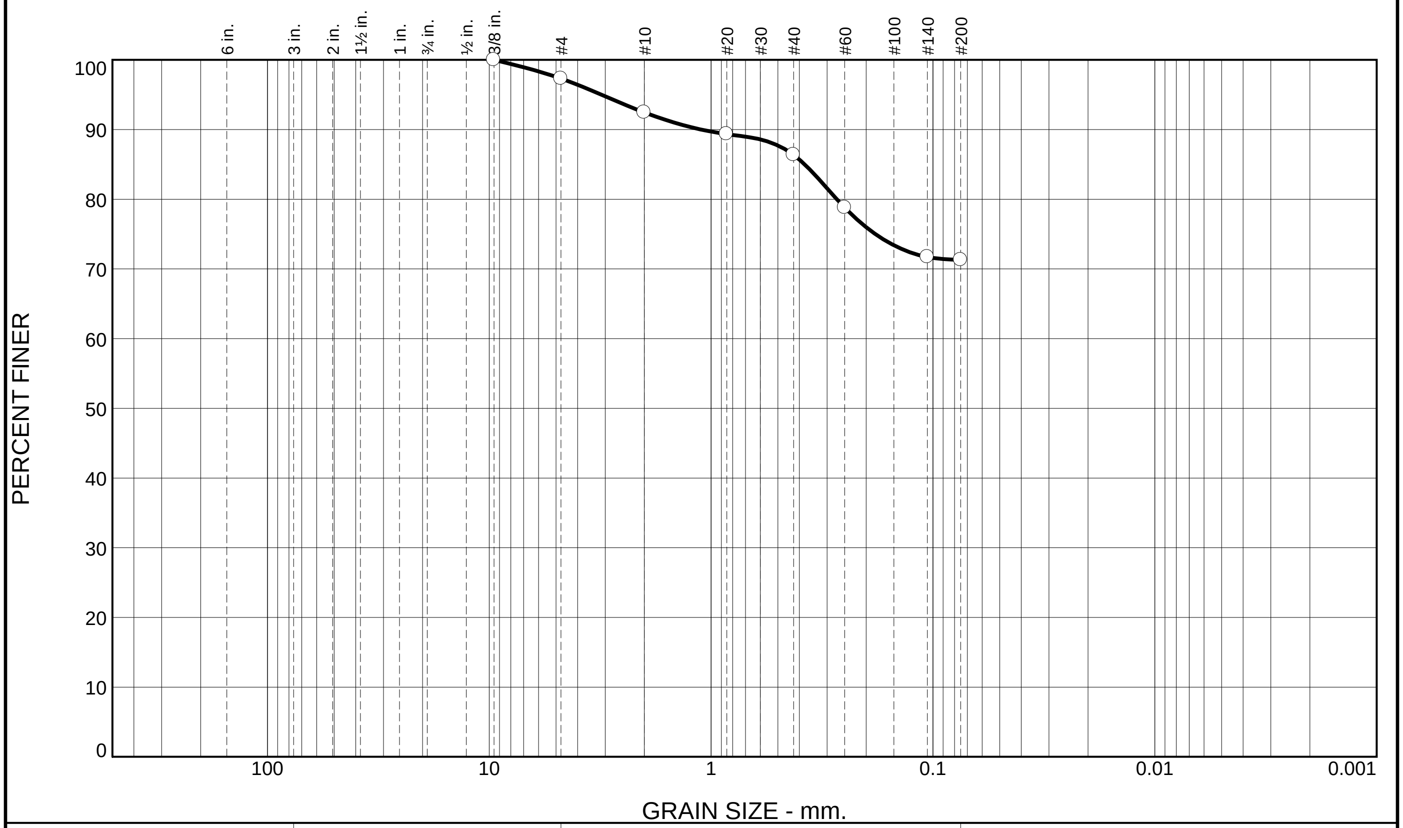
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500
Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.7	4.8	6.1	15.1	71.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.3		
#10	92.5		
#20	89.3		
#40	86.4		
#60	78.8		
#140	71.7		
#200	71.3		

* (no specification provided)

Soil Description

Gray Clay with Sand

Atterberg Limits

PL= 21 LL= 49 PI= 28

Coefficients

D_{90}= 1.1096 D_{85}= 0.3790 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(19)

Remarks

Location: 33+50 - Bottom
Depth: 80'-82'

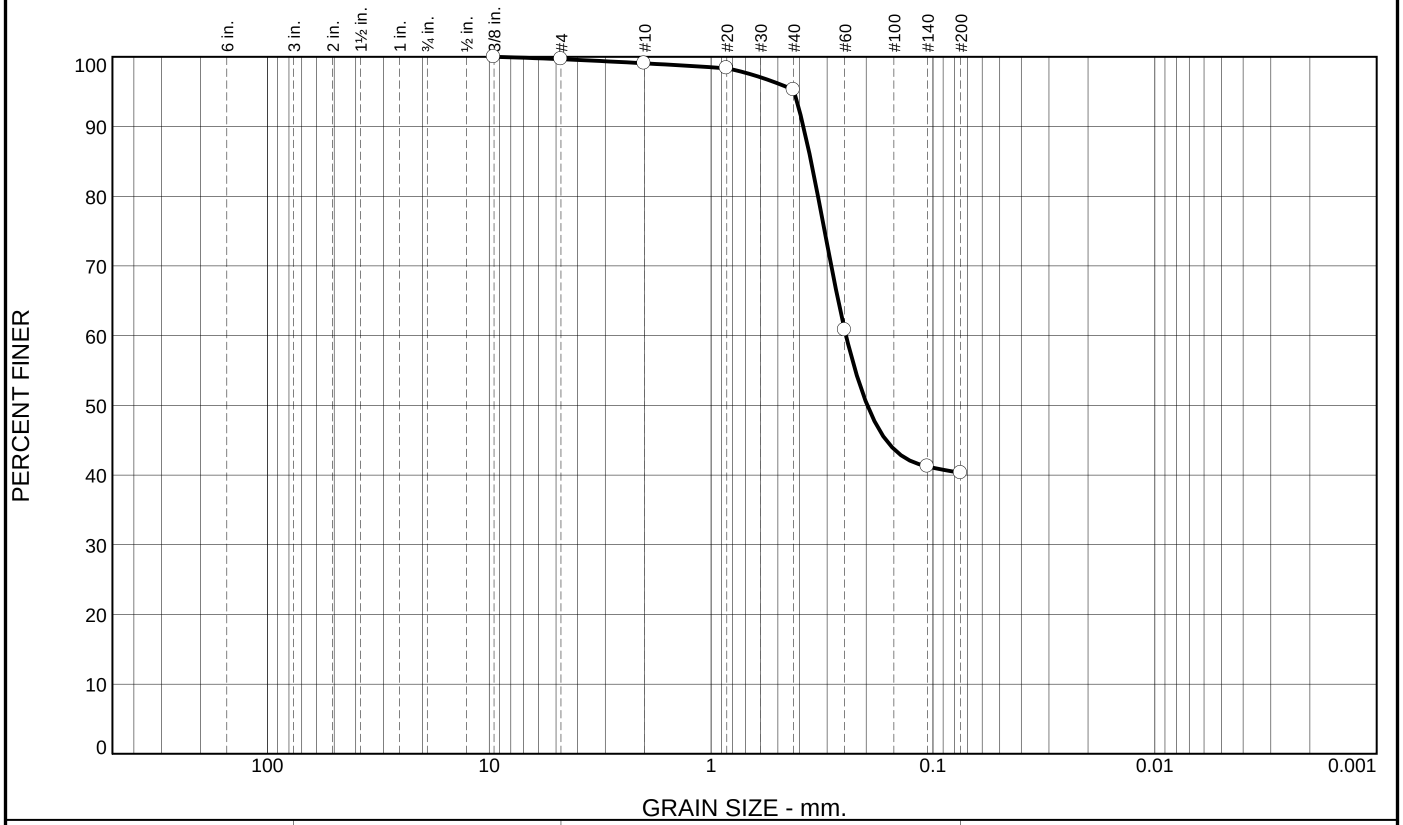
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.6	3.8	55.0	40.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	99.1		
#20	98.4		
#40	95.3		
#60	60.8		
#140	41.2		
#200	40.3		

* (no specification provided)

Soil Description

Light Gray Sand

Atterberg Limits

PL= NP
LL= NV
PI= NP

Coefficients

D_{90}= 0.3838
D_{85}= 0.3547
D_{60}= 0.2466
D_{50}= 0.1976
D_{30}=
D_{15}=
D_{10}=
C_u=
C_c=

Classification

USCS= SM
AASHTO= A-4(0)

Remarks

Location: 33+50 - Top
Depth: 80'-82'

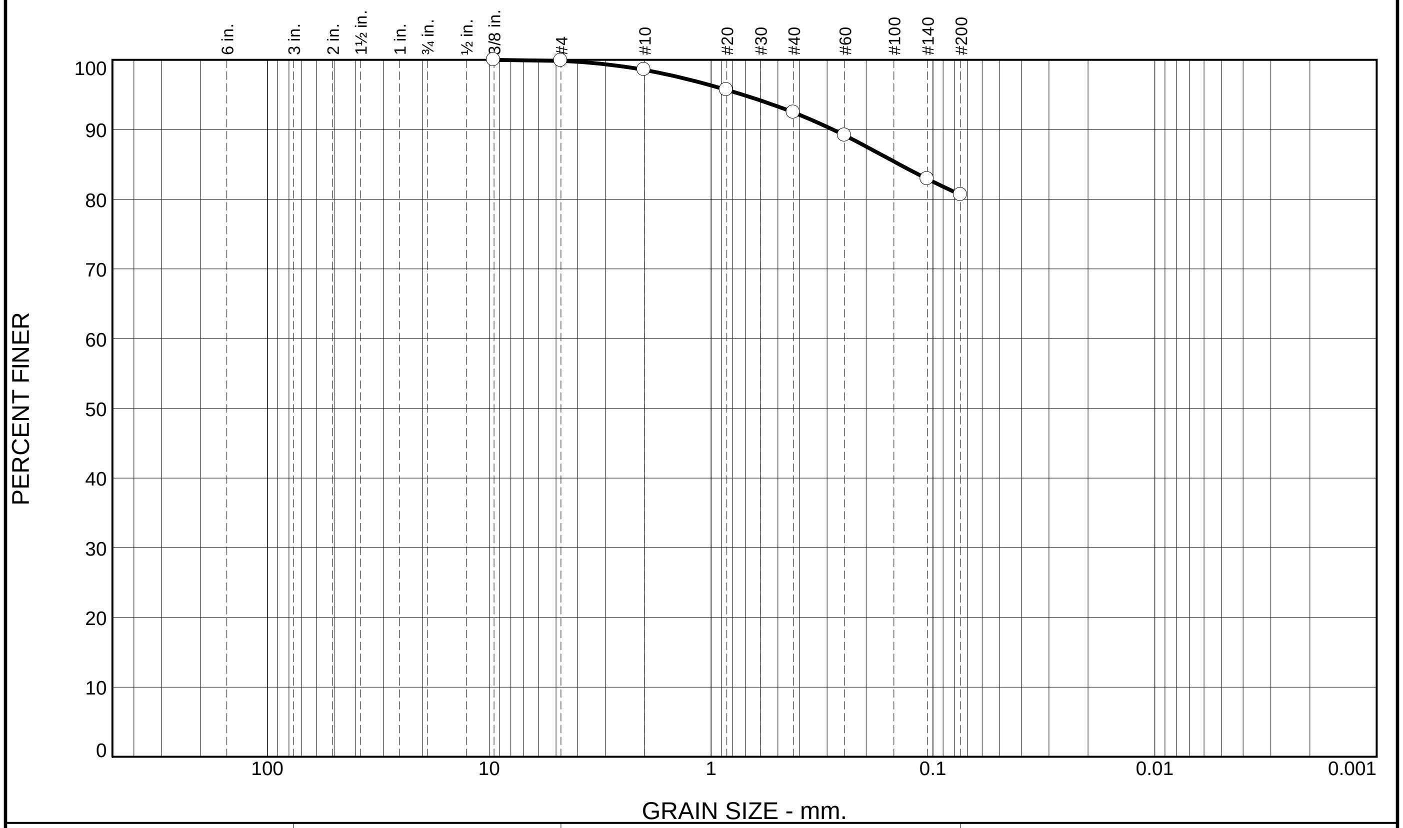
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500
Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.3	6.2	11.8	80.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	98.6		
#20	95.7		
#40	92.4		
#60	89.2		
#140	82.9		
#200	80.6		

* (no specification provided)

Soil Description

Dark Gray Clay

Atterberg Limits

PL= 17 LL= 27 PI= 10

Coefficients

D_{90}= 0.2832 D_{85}= 0.1419 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(6)

Remarks

Location: 42+50
Depth: 50'-52'

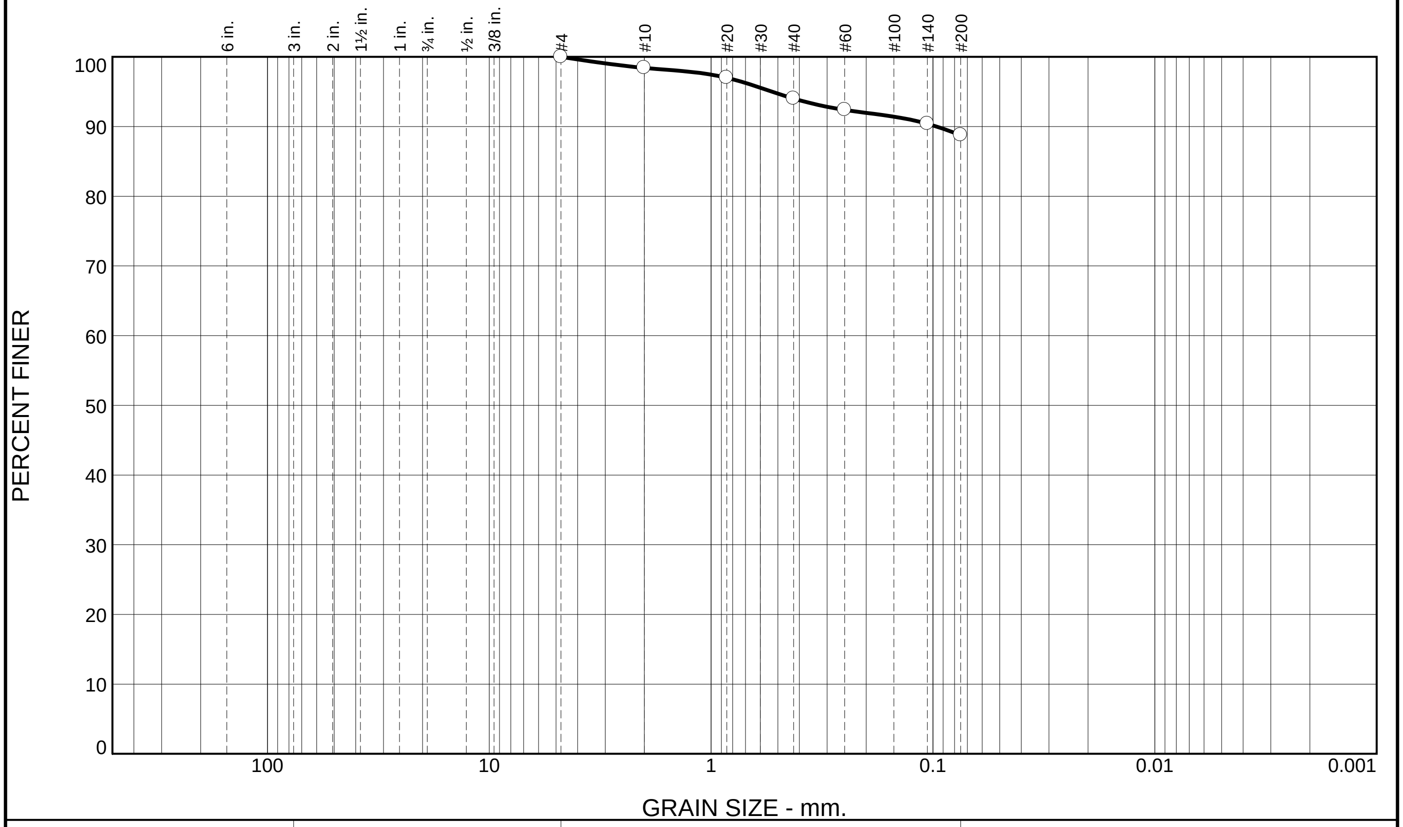
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.6	4.4	5.2	88.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.4		
#20	97.0		
#40	94.0		
#60	92.4		
#140	90.4		
#200	88.8		

* (no specification provided)

Soil Description

Dark Gray Clay

Atterberg Limits

PL= 22 LL= 41 PI= 19

Coefficients

D_{90}= 0.0964 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: 57+50
Depth: 32'-34'

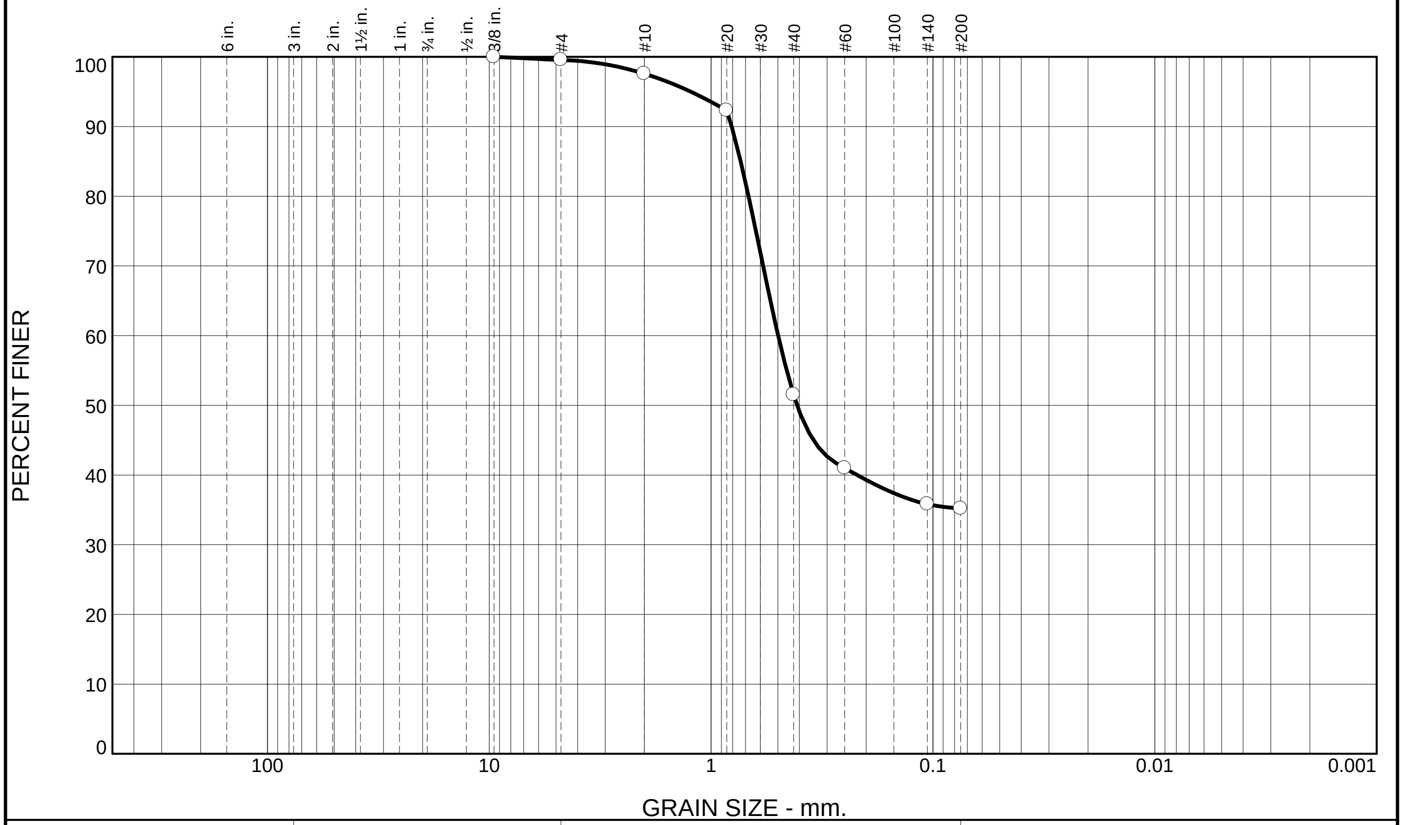
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	1.9	46.1	16.3	35.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.5		
#10	97.6		
#20	92.3		
#40	51.5		
#60	41.0		
#140	35.8		
#200	35.2		

* (no specification provided)

Soil Description

Brown Silty Sand

Atterberg Limits

PL= NP LL= NP PI= NV

Coefficients

D_{90}= 0.8083 D_{85}= 0.7362 D_{60}= 0.4989
D_{50}= 0.4098 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: 67+50
Depth: 35'-37'

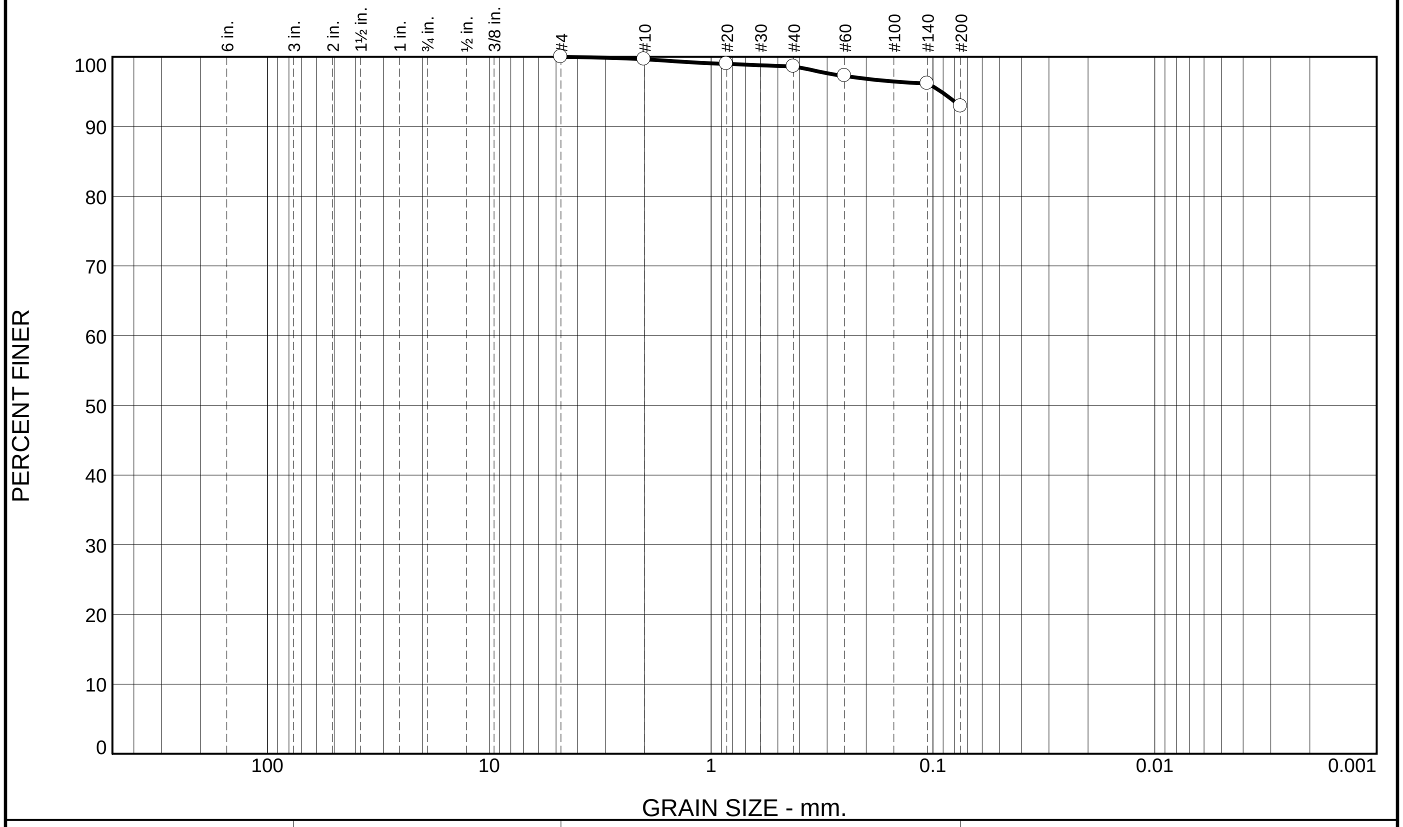
Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	1.0	5.7	92.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	99.0		
#40	98.6		
#60	97.3		
#140	96.2		
#200	92.9		

* (no specification provided)

Soil Description

Light Gray Clay

Atterberg Limits

PL= 23 LL= 61 PI= 38

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(40)

Remarks

Location: 72+50
Depth: 80'-82'

Date: 12/4/20

GEOServices, LLC, Knoxville, Tennessee

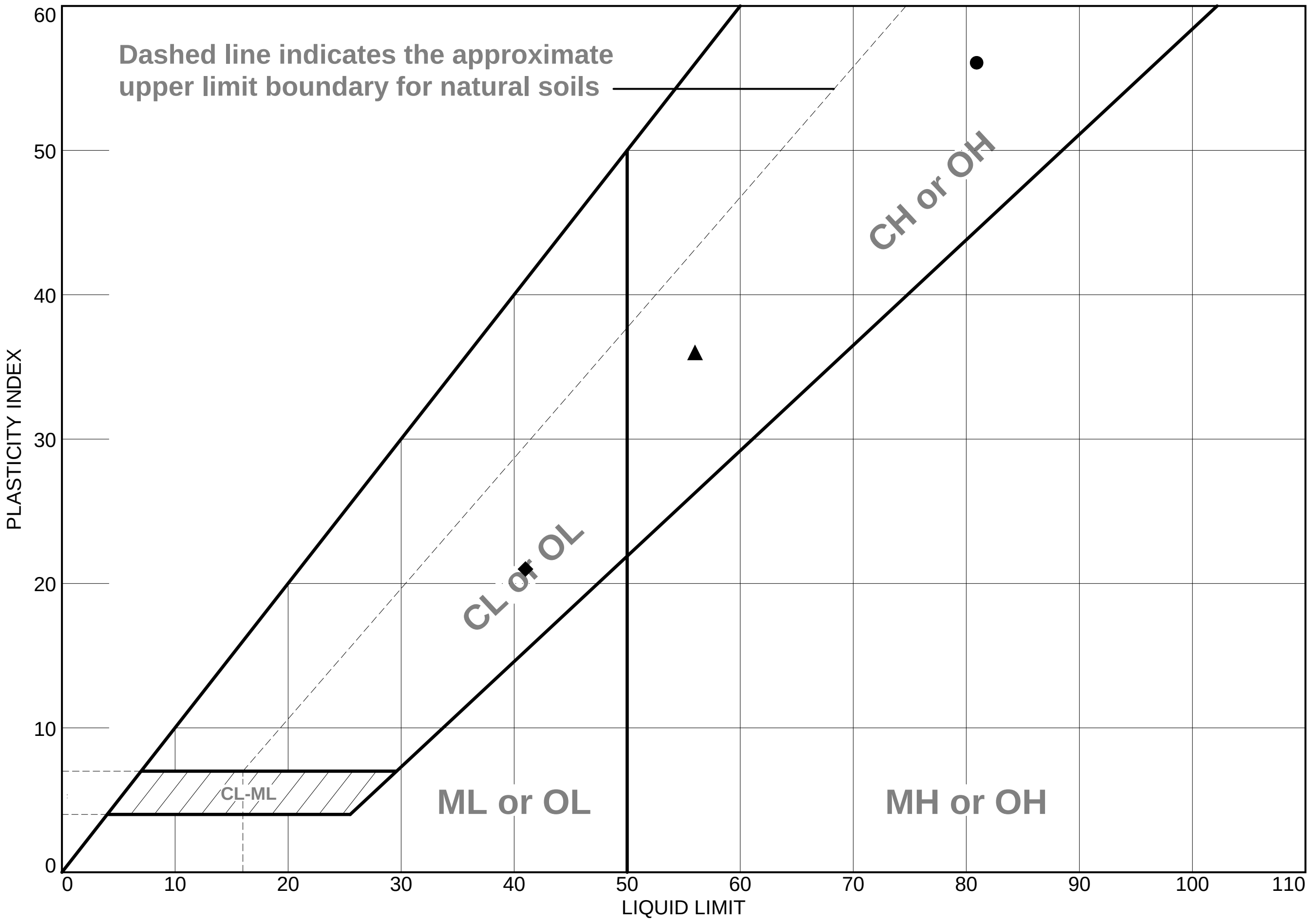
Client: Chemours
Project: Chemours Barrier Wall

Project No: 42-20500 **Figure**

GEOServices, LLC, Geotechnical and Materials Engineers

Atterberg Limits Testing

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Clay	81	25	56	91.1	84.4	CH
■	Light Gray Silty Sand	NV	NP	NP	67.8	33.3	SM
▲	Dark Gray Clay with Sand	56	20	36	79.9	75.1	CH
◆	Dark Gray Clay with Sand	41	20	21			
▼	Light Brown Silty Sand	NV	NP	NP	93.8	46.0	SM

Project No. 42-20500 **Client:** Chemours

Project: Chemours Barrier Wall

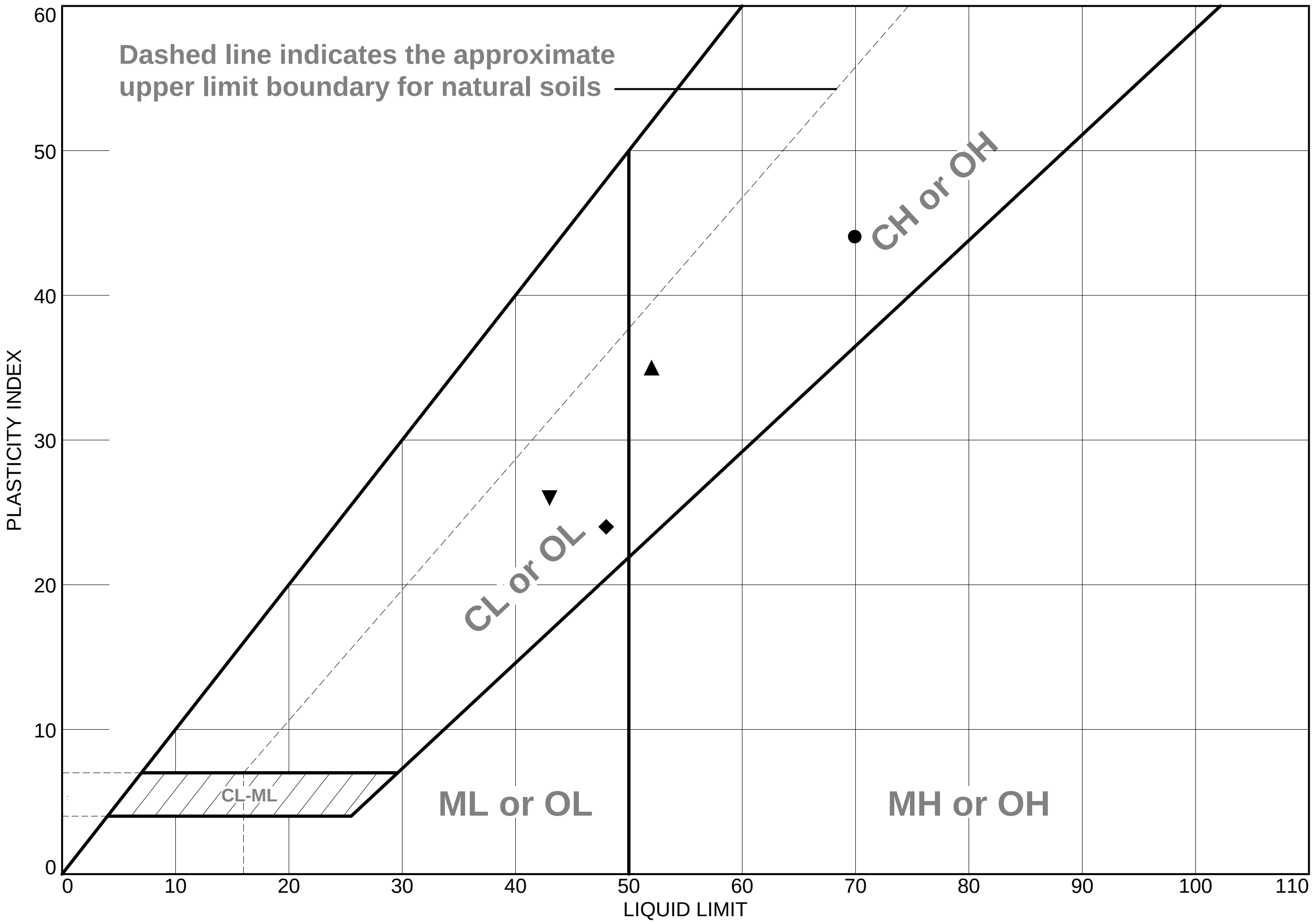
●**Location:** 0+00 **Depth:** 38'-40'
■**Location:** 5+00 **Depth:** 80'-82'
▲**Location:** 15+00 - Top **Depth:** 35'-37'
◆**Location:** 15+00 - Top (Post Perm) **Depth:** 35'-37'
▼**Location:** 15+00 - Bottom **Depth:** 35'-37'

GEOServices, LLC, Knoxville, Tennessee

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Clay	70	26	44	98.6	95.2	CH
■	Yellow Brown Silty Sand	NV	NP	NP	66.4	42.3	SM
▲	Light Gray Clay	52	17	35	92.8	80.8	CH
◆	Light Gray Clay	48	24	24	93.7	80.3	CL
▼	Dark Gray Clay with Sand	43	17	26	98.7	87.0	CL

Project No. 42-20500 **Client:** Chemours

Project: Chemours Barrier Wall

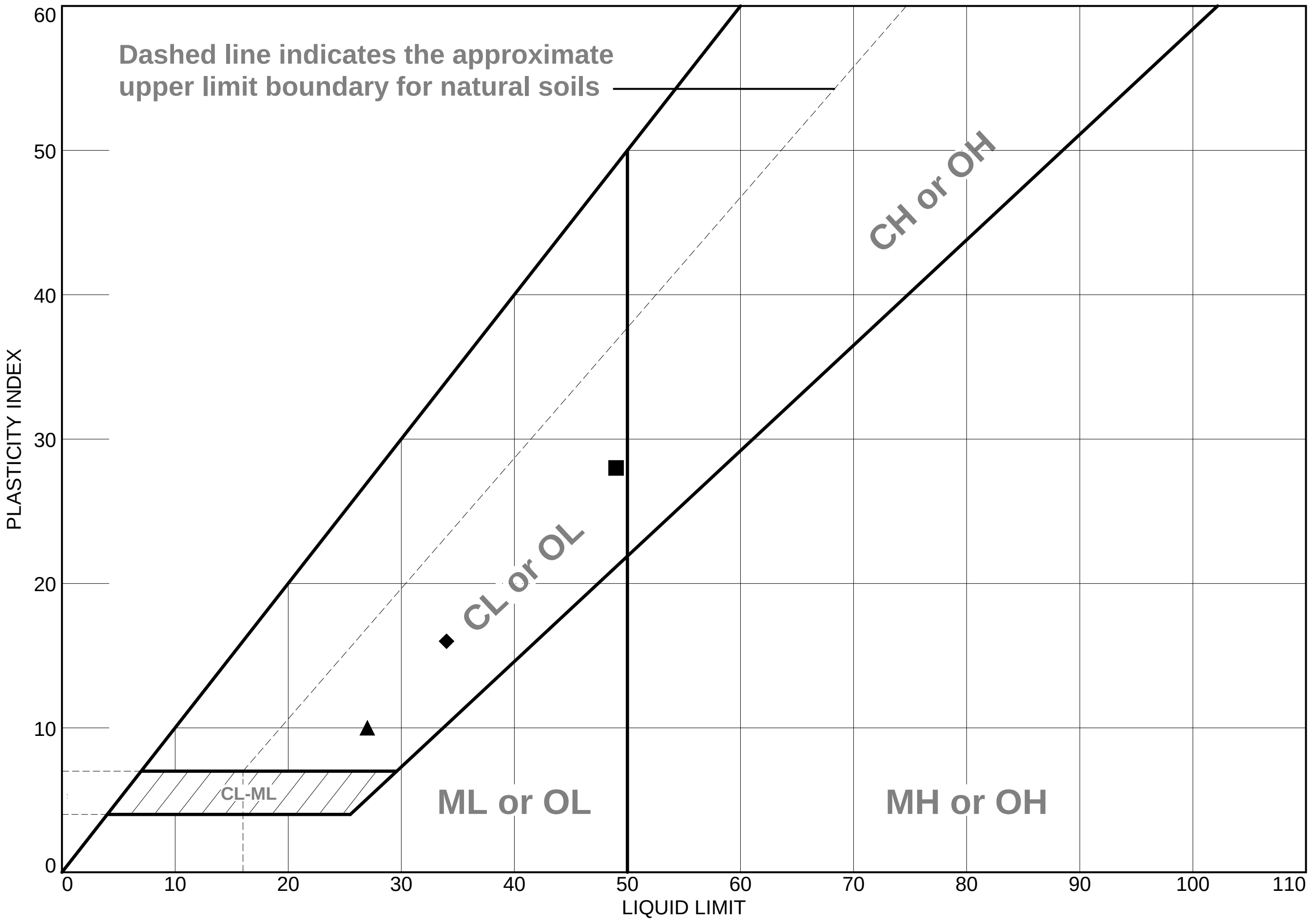
●**Location:** 20+00 **Depth:** 35'-37'
■**Location:** 20+00 **Depth:** 45'-47'
▲**Location:** 25+00 **Depth:** 72'-74'
◆**Location:** 25+00 (Post Perm) **Depth:** 72'-74'
▼**Location:** 30+00 **Depth:** 70'-72'

GEOServices, LLC, Knoxville, Tennessee

Remarks:

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Gray Sand	NV	NP	NP	95.3	40.3	SM
■	Gray Clay with Sand	49	21	28	86.4	71.3	CL
▲	Dark Gray Clay	27	17	10	92.4	80.6	CL
◆	Dark Gray Clay	34	18	16	86.6	73.1	CL

Project No. 42-20500 **Client:** Chemours

Project: Chemours Barrier Wall

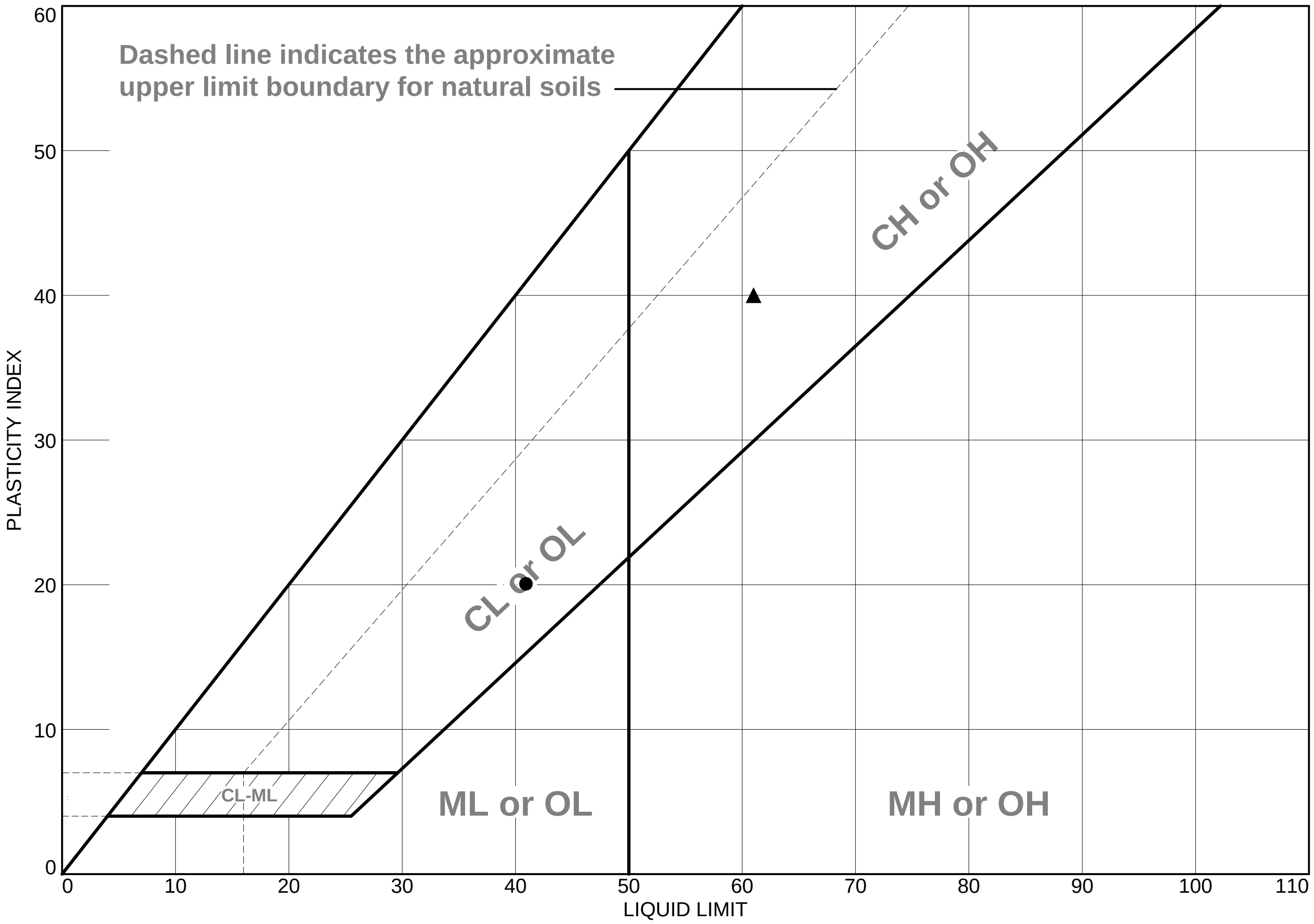
●**Location:** 33+50 - Top **Depth:** 80'-82'
■**Location:** 33+50 - Bottom **Depth:** 80'-82'
▲**Location:** 42+50 **Depth:** 50'-52'
◆**Location:** 42+50 (Post Perm) **Depth:** 50'-52'

Remarks:

GEOServices, LLC, Knoxville, Tennessee

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT


Dashed line indicates the approximate upper limit boundary for natural soils

	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Clay	41	21	20	94.0	88.8	CL
■	Brown Silty Sand	NV	NP	NP	51.5	35.2	SM
▲	Light Gray Clay	61	21	40	98.6	92.9	CH

Project No. 42-20500 **Client:** Chemours

Project: Chemours Barrier Wall

●**Location:** 57+50 **Depth:** 32'-34'
■**Location:** 67+50 **Depth:** 35'-37'
▲**Location:** 72+50 **Depth:** 80'-82'

Remarks:

GEOServices, LLC, Knoxville, Tennessee

Figure

GEOServices, LLC, Geotechnical and Materials Engineers

Wash 200 Testing

Percent Passing #200
ASTM D1140

Project Name: Chemours Barrier Wall
Project Location: Fayetteville, North Carolina
Project Number: 41-20500
Report Date: 11/3/2020
Performed By: D. Vaughan
Log #: N/A

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
0+00	SS-4	8.5-10.0	Light Brown Silty Sand

Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B5	80.69	-	631.57	538.97	550.88	458.28	**16.8**

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
0+00	SS-14	58.5-60.0	Dark Gray Sand with Gravel

Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B4	81.74	-	546.41	509.00	464.67	427.26	**8.1**

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
5+00	SS-5	13.5-15.0	Brown Silty Sand

Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B3	81.47	-	547.23	426.59	465.76	345.12	**25.9**

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
5+00	SS-12	48.5-50.0	Dark Gray Sand

Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B2	85.02	-	576.03	539.11	491.01	454.09	**7.5**

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
20+00	SS-14	58.5-60.0	Gray Sand

Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B6	82.70	-	612.40	578.45	529.70	495.75	**6.4**

Percent Passing #200
ASTM D1140

Project Name: Chemours Barrier Wall
Project Location: Fayetteville, North Carolina
Project Number: 41-20500

Report Date: 11/4/2020
Date Received: D. Vaughan
Log #: N/A

Sample ID				Description			
Boring		Sample #	Depth (ft)				
25+00		5	13.5-15.0	Gray Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B7	109.24	-	681.70	632.63	572.46	523.39	**8.6**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
33+50		13	53.5-55.0	Light Gray Silty Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B2	85.04	-	323.89	273.65	238.85	188.61	**21.0**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
37+50		9	33.5-35.0	Light Gray Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B6	82.72	-	364.25	331.50	281.53	248.78	**11.6**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
42+50		4	8.5-10.0	Light Gray Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
HHH	88.12	-	649.91	603.80	561.79	515.68	**8.2**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
42+50		9	33.5-35.0	Gray Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B7	109.25	-	448.26	403.20	339.01	293.95	**13.3**

GEOServices, LLC, Geotechnical and Materials Engineers

Percent Passing #200
ASTM D1140

Project Name: Chemours Barrier Wall

Project Location: Fayetteville, North Carolina

Project Number: 41-20500

Report Date: 11/5/2020

Date Received: D. Vaughan

Log #: N/A

Sample ID				Description			
Boring		Sample #	Depth (ft)				
57+50		7	23.5-25.0	Gray Silty Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B5	80.71	-	395.54	376.43	314.83	295.72	**6.1**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
57+50		14	63.5-65.0	Light Gray Clayey Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B3	81.57	-	411.85	335.23	330.28	253.66	**23.2**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
82+50		6	18.5-20.0	Light Brown Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B1	84.69	-	299.96	280.62	215.27	195.93	**9.0**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
82+50		14	63.5-65.0	Light Gray Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
B4	81.70	-	295.47	207.62	213.77	125.92	**41.1**

Sample ID				Description			
Boring		Sample #	Depth (ft)				
87+50		8	28.5-30.0	Light Gray Silty Sand			
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
EEE	87.96	-	290.37	272.83	202.41	184.87	**8.7**

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Percent Passing #200
ASTM D1140

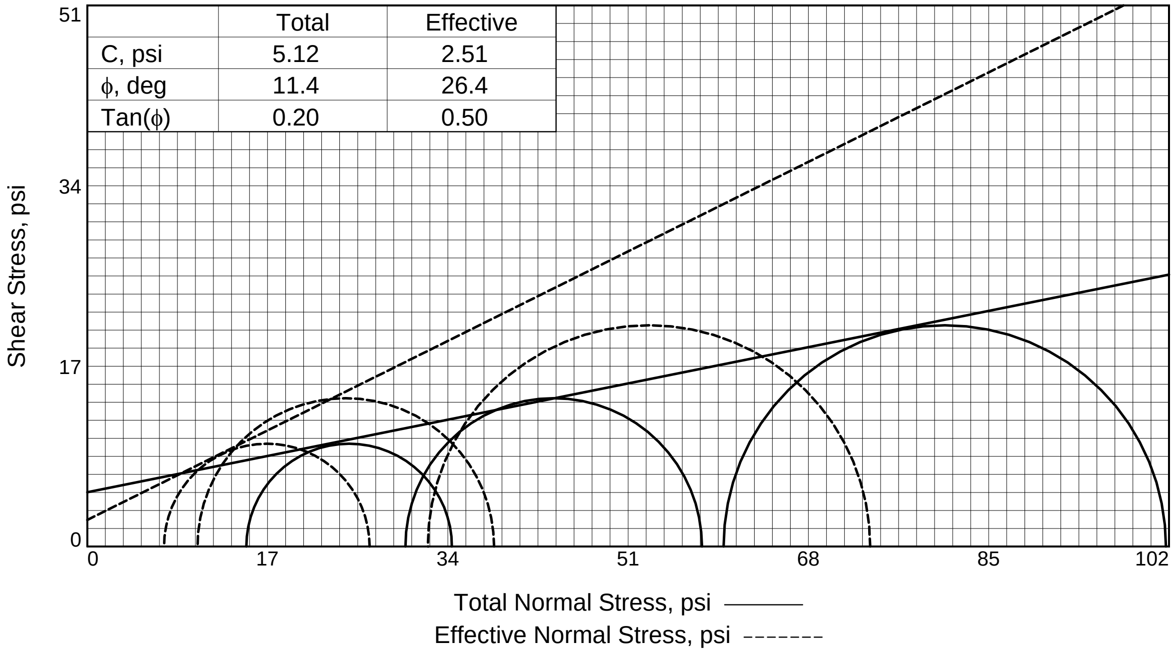
Project Name:	Chemours Barrier Wall	Report Date:	11/5/2020
Project Location:	Fayetteville, North Carolina	Date Received:	D. Vaughan
Project Number:	41-20500	Log #:	N/A

Sample ID			**Description**
Boring	**Sample #**	**Depth (ft)**	
87+50	10	38.5-40.0	Gray Sand

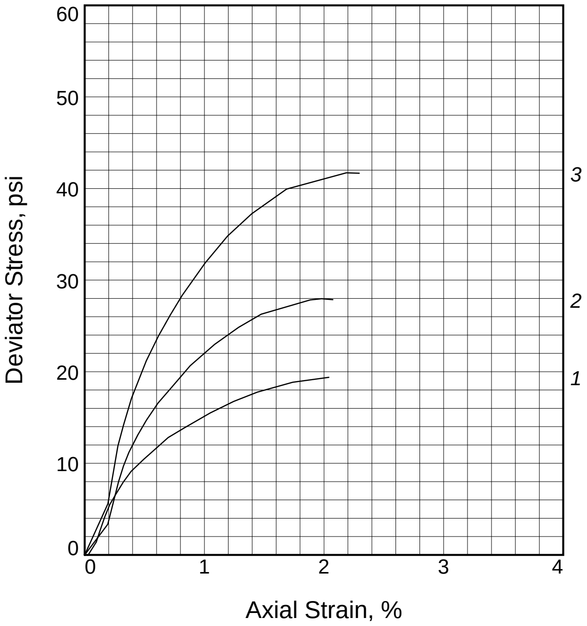
Tare ID	Tare Weight	Pre Wash Soil & Tare (wet)	Pre Wash Soil & Tare (dry)	Post Wash Soil & Tare (dry)	Initial Soil Wt.	Final Soil Wt.	**% Passing #200**
FFF	81.23	-	379.06	355.94	297.83	274.71	**7.8**

GEOServices, LLC, Geotechnical and Materials Engineers

Consolidated Undrained (CU) Triaxial Testing



	Total	Effective
C, psi	5.12	2.51
ϕ, deg	11.4	26.4
Tan(ϕ)	0.20	0.50



	Specimen No.	1	2	3
Initial	Water Content, %	30.8	30.8	30.8
	Dry Density, pcf	86.8	87.3	86.7
	Saturation, %	92.1	93.2	89.8
	Void Ratio	0.8693	0.8592	0.9085
	Diameter, in.	2.84	2.85	2.85
	Height, in.	5.68	5.61	5.65
At Test	Water Content, %	32.6	32.5	33.7
	Dry Density, pcf	87.8	88.0	87.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8481	0.8444	0.8933
	Diameter, in.	2.83	2.84	2.84
	Height, in.	5.66	5.60	5.64
	Strain rate, in./min.	0.000	0.000	0.000
	Eff. Cell Pressure, psi	15.0	30.0	60.0
	Fail. Stress, psi	19.4	28.0	41.7
	Total Pore Pr., psi	47.8	59.6	67.9
	Strain, %	2.0	2.0	2.2
	Ult. Stress, psi			
	Total Pore Pr., psi			
	Strain, %			
	$\bar{\sigma}_1$ Failure, psi	26.6	38.4	73.8
	$\bar{\sigma}_3$ Failure, psi	7.2	10.4	32.1

Type of Test:
CU with Pore Pressures

Sample Type: Shelby Tube

Description:

Assumed Specific Gravity= 2.6

Remarks:

Figure ________

Client: Chemours

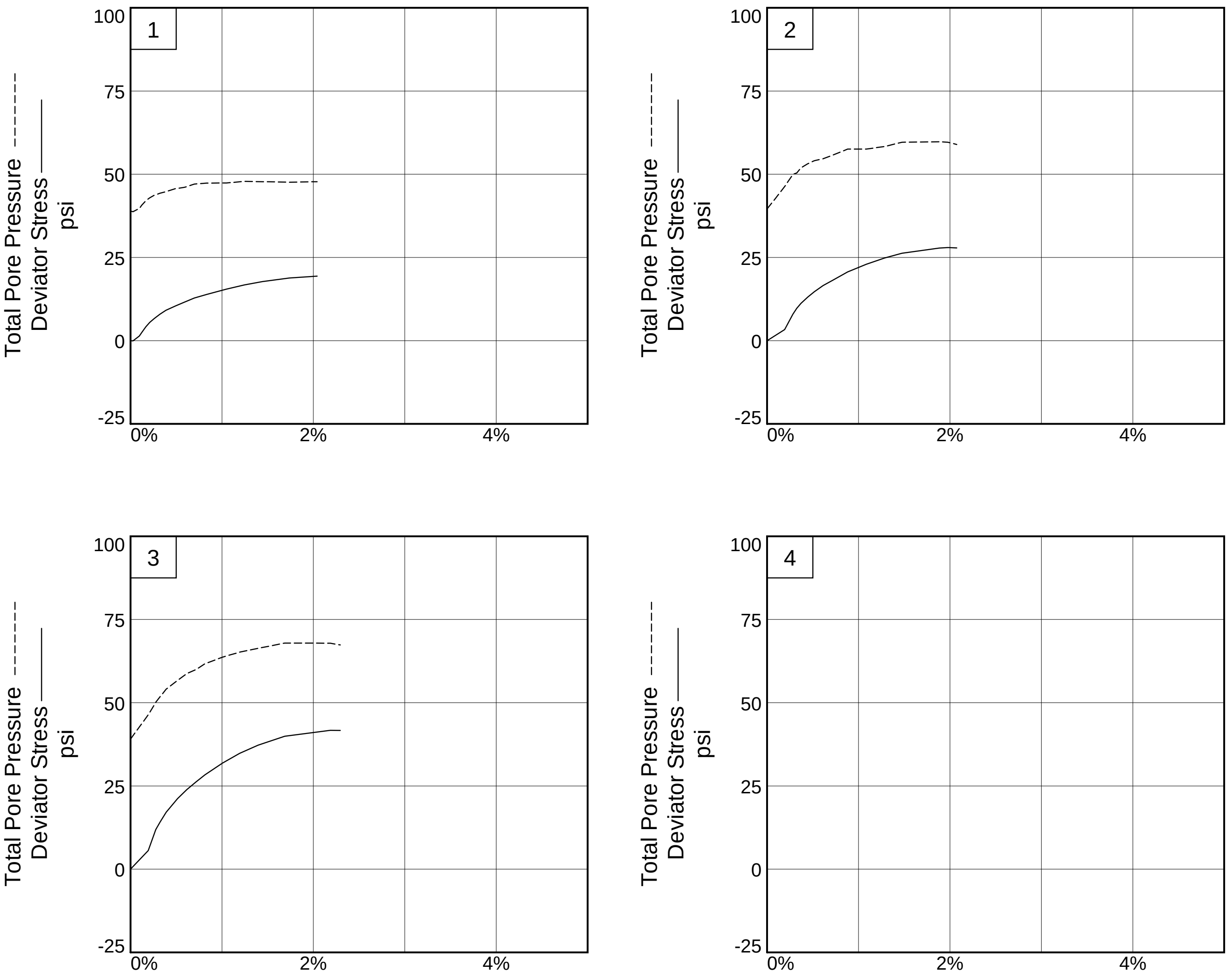
Project: Chemours Barrier Wall

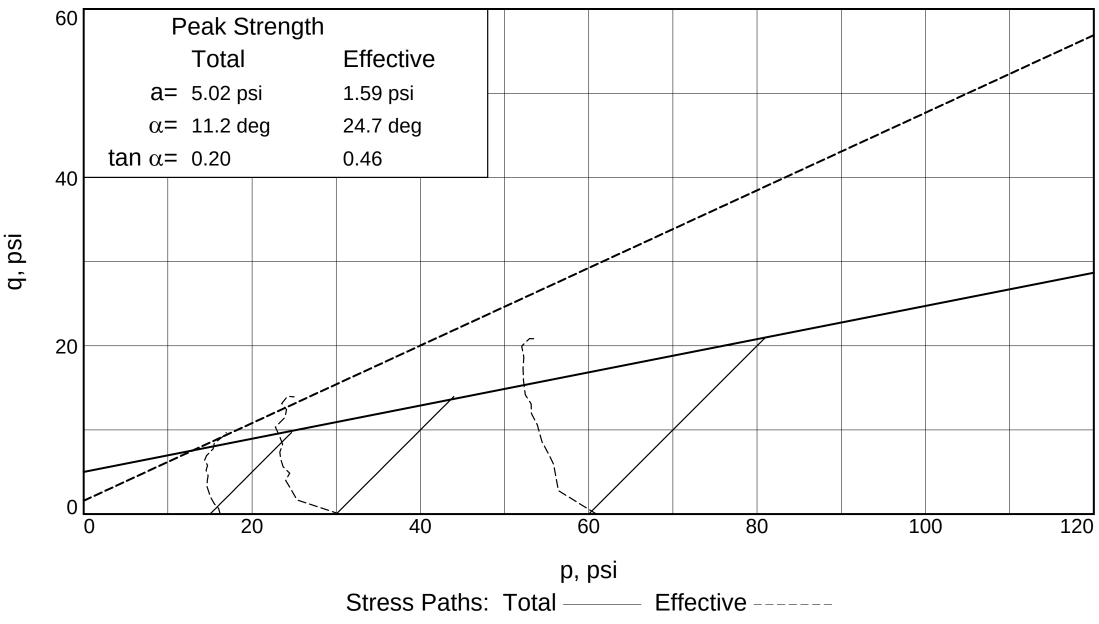
Location: 62+50 (S-14)

Depth: 35 - 37'

Proj. No.: 42-20500 **Date Sampled:**

GEOServices, LLC, Knoxville, Tennessee





Peak Strength

	Total	Effective
a=	5.02 psi	1.59 psi
α=	11.2 deg	24.7 deg
tan α=	0.20	0.46

Client: Chemours

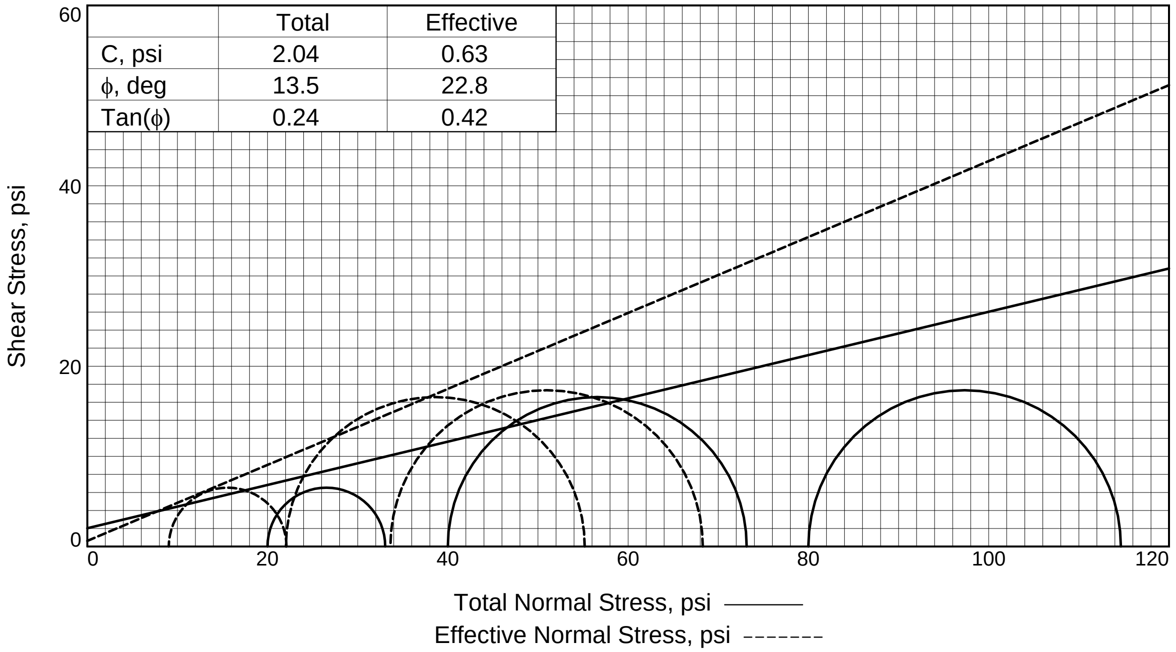
Project: Chemours Barrier Wall

Location: 62+50 (S-14) **Depth:** 35 - 37'

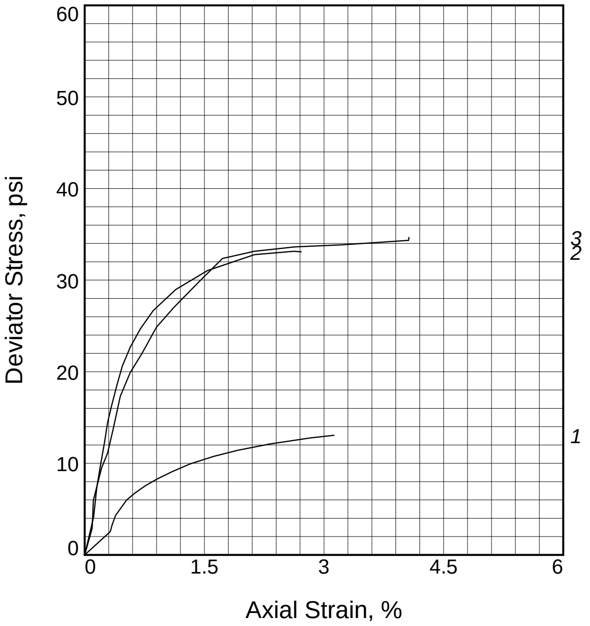
Project No.: 42-20500

Figure ________

GEOServices, LLC



	Total	Effective
C, psi	2.04	0.63
ϕ, deg	13.5	22.8
Tan(ϕ)	0.24	0.42



Specimen No.		1	2	3
Initial	Water Content, %	35.6	32.9	32.9
	Dry Density, pcf	81.5	85.6	78.8
	Saturation, %	93.5	95.4	80.7
	Void Ratio	0.9912	0.8960	1.0585
	Diameter, in.	2.87	2.87	2.86
	Height, in.	5.75	5.25	5.74
At Test	Water Content, %	34.2	30.4	37.2
	Dry Density, pcf	85.9	90.6	82.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8888	0.7911	0.9680
	Diameter, in.	2.82	2.82	2.82
	Height, in.	5.65	5.15	5.66
Strain rate, in./min.		0.000	0.000	0.000
Eff. Cell Pressure, psi		20.0	40.0	80.0
Fail. Stress, psi		13.1	33.2	34.7
Total Pore Pr., psi		41.0	48.0	76.4
Strain, %		3.1	2.6	4.1
Ult. Stress, psi				
Total Pore Pr., psi				
Strain, %				
$\bar{\sigma}_1$ Failure, psi		22.1	55.2	68.3
$\bar{\sigma}_3$ Failure, psi		9.0	22.0	33.6

Type of Test:
CU with Pore Pressures

Sample Type: Shelby Tube

Description: Dark Gray Clay (blocky structure)

Assumed Specific Gravity= 2.6

Remarks:

Figure ________

Client: Chemours

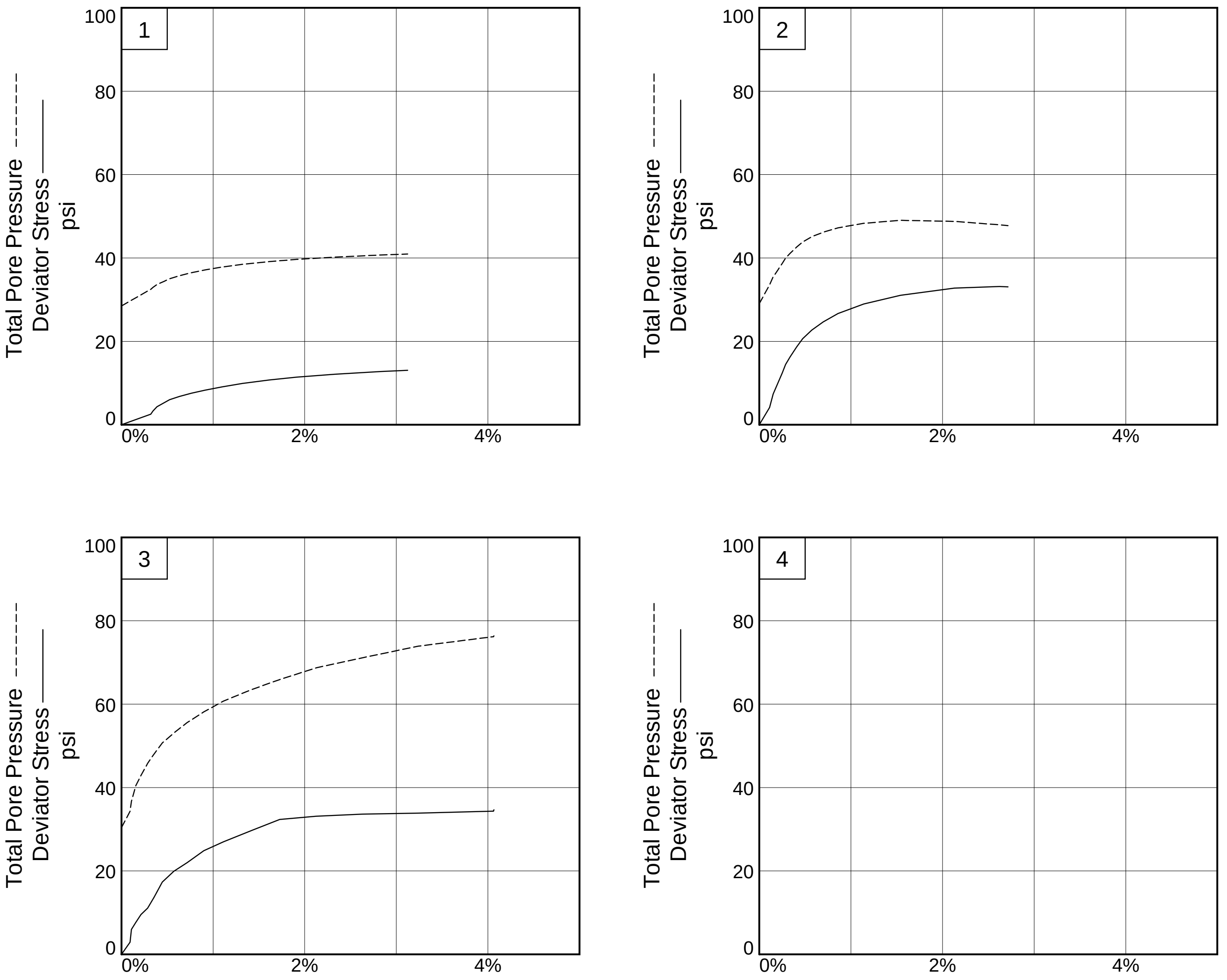
Project: Chemours Barrier Wall

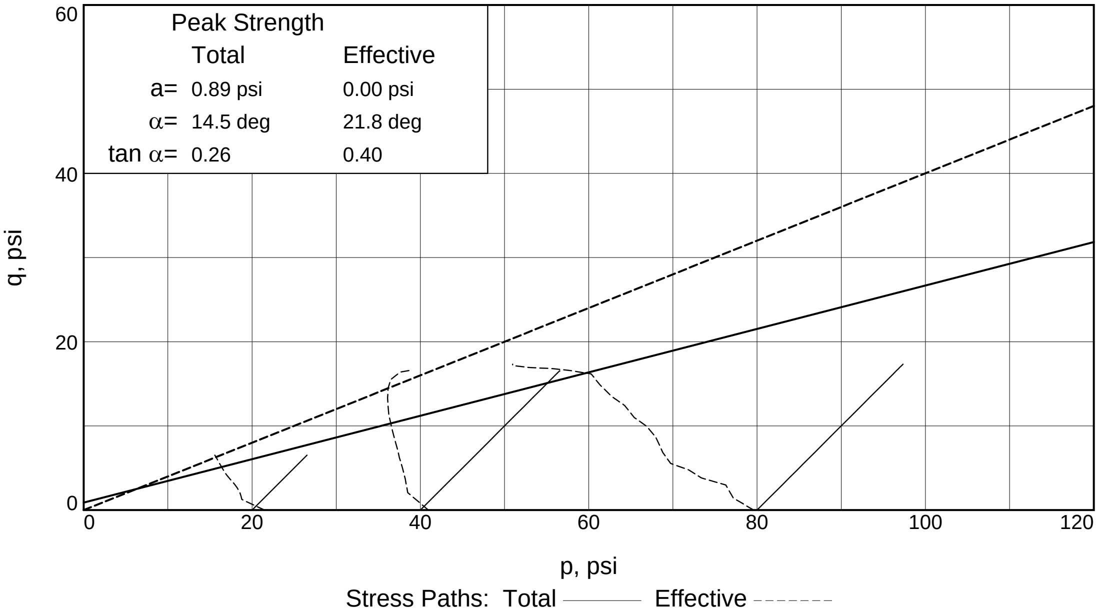
Location: 87+50 (S-19)

Depth: 55 - 57'

Proj. No.: 42-20500 **Date Sampled:**

GEOServices, LLC, Knoxville, Tennessee





Peak Strength

	Total	Effective
a=	0.89 psi	0.00 psi
α=	14.5 deg	21.8 deg
tan α=	0.26	0.40

Client: Chemours

Project: Chemours Barrier Wall

Location: 87+50 (S-19) **Depth:** 55 - 57'

Project No.: 42-20500 **Figure** ________

GEOServices, LLC

GEOServices, LLC, Geotechnical and Materials Engineers

Hydraulic Conductivity Testing

GEOServices, LLC, Geotechnical and Materials Engineers

SUMMARY OF HYDRAULIC CONDUCTIVITY

ASTM D 5084

Project Name:	Chemours Barrier Wall	Report Date:	December 3, 2020
Project Number:	41-20500	Date Received:	October 27, 2020

Sample Location	Depth FT	Material Description	Wet Density PCF	Dry Density PCF	Percent Moisture	Hydraulic Conductivity cm/sec
0+00	38-40	Dark Gray Clay	130.9	92.7	41.3	2.33E-08
5+00	82-84	Gray Sandy Clay	129.3	107.7	20.0	7.20E-09
15+00	35-36	Dark Gray Clay	101.2	66.0	53.4	1.04E-08
15+00	36-37	Light Brown Silty Sand	112.3	93.3	20.4	3.20E-04
20+00	35-37	Dark Gray Clay	103.2	65.7	56.7	2.18E-08
20+00 *	45-47	Ylw Brown Silty Sand	--	--	23.4	> 10x-04
25+00	72-74	Light Gray Clay	119.3	90.9	31.2	2.02E-08
30+00	70-72	Dark Gray Clay	128.1	104.2	22.9	3.70E-09
33+50	80-82	Gray Clay	112.6	88.6	27.1	1.10E-09
42+50	50-52	Dark Gray Clay	133.8	102.6	30.4	2.29E-08
47+50	72-74	Gray Clay	127.1	103.5	22.8	2.37E-08
52+50	80-82	Light Gray Sandy Clay	129.5	107.2	20.8	5.22E-08
57+50	32-34	Dark Gray Clay	70.8	50.1	41.6	2.46E-08
67+50	36-37	Dark Gray Sandy Clay	99.0	76.7	29.1	4.74E-08
72+50	80-82	Light Gray Clay	86.8	74.9	15.9	1.11E-08
82+50	35-37	Dark Gray Clay	109.1	83.8	30.9	3.71E-08

Notes: * Basically loose sand

GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX E

Representative Photographs

GEOServices, LLC, Geotechnical and Materials Engineers

SPT Photographs

Boring at Station 0+00


Sample No. 1, Depth 1’ to 2 ½’


Sample No. 2, Depth 3 ½’ to 5’


Sample No. 3, Depth 6’ to 7 ½’


Sample No. 4, Depth 8 ½’ to 10’


Sample No. 5, Depth 13 ½’ to 15’


Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½’ to 25’

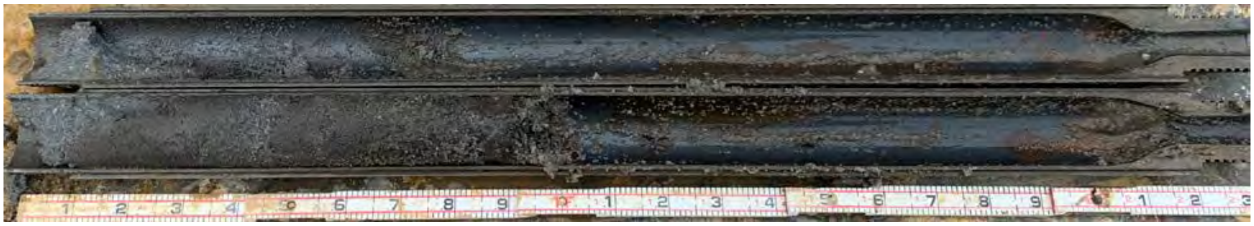
Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 11, Depth 43 ½’ to 45’

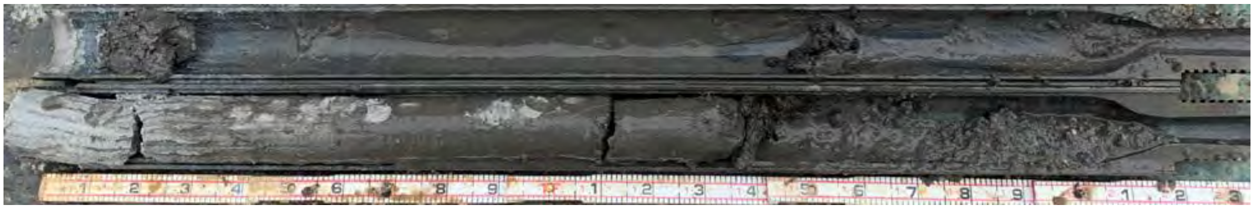
Sample No. 12, Depth 48 ½’ to 50’



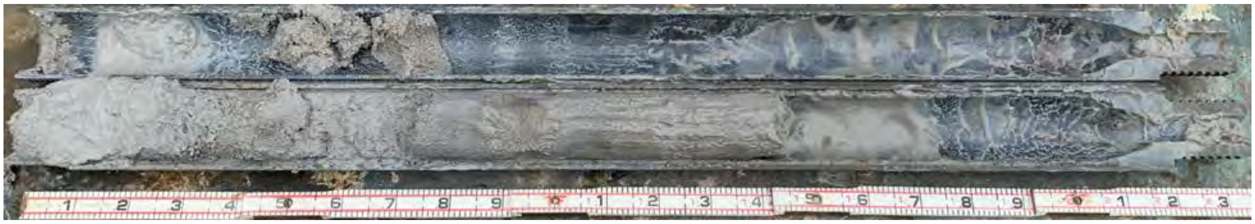
Sample No. 13, Depth 53 ½' to 55'

Sample No. 14, Depth 58 ½' to 60'

Sample No. 15, Depth 63 ½' to 65'

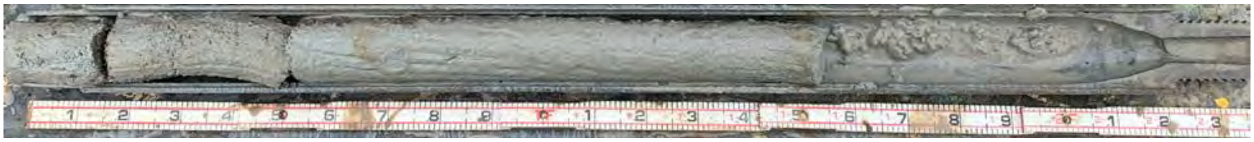


Sample No. 16, Depth 68 ½' to 70'



Sample No. 17, Depth 73 ½' to 75'

Sample No. 18, Depth 78 ½' to 80'



Sample No. 19, Depth 83 ½' to 85'

Sample No. 20, Depth 88 ½' to 90'

Boring at Station 5+00


Sample No. 1, Depth 1′ to 2 ½′


Sample No. 2, Depth 3 ½′ to 5′


Sample No. 3, Depth 6′ to 7 ½′


Sample No. 4, Depth 8 ½′ to 10′


Sample No. 5, Depth 13 ½′ to 15′


Sample No. 6, Depth 18 ½′ to 20′


Sample No. 7, Depth 23 ½′ to 25′

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 12, Depth 48 ½’ to 50’

Sample No. 13, Depth 53 ½’ to 55’

Sample No. 14, Depth 58 ½’ to 60’

Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½' to 70'

Sample No. 17, Depth 73 ½' to 75'

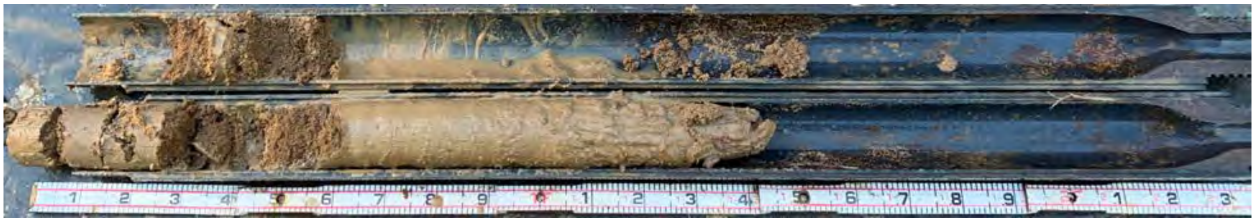
Sample No. 18, Depth 78 ½' to 80'

Sample No. 19, Depth 88 ½' to 90'

Boring at Station 10+00

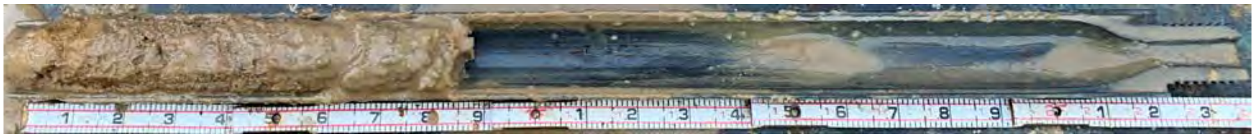
Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’



Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’



Sample No. 5, Depth 13 ½’ to 15’

Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½’ to 25’

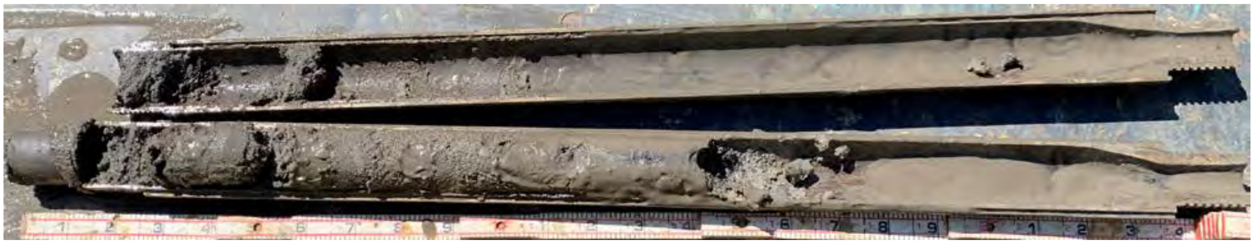
Sample No. 8 Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 11, Depth 43 ½’ to 45’

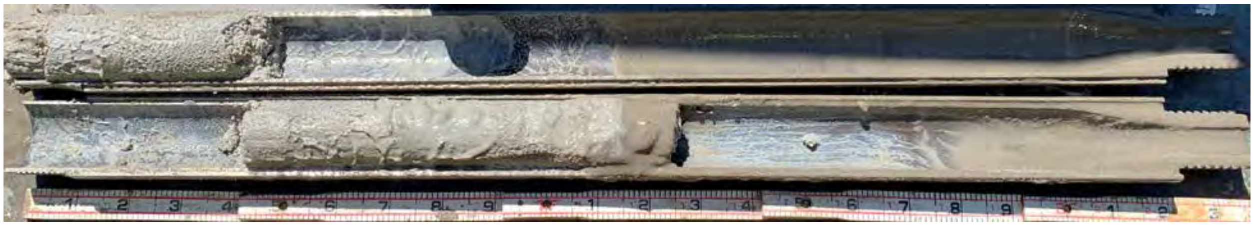
Sample No. 12, Depth 48 ½’ to 50’



Sample No. 13, Depth 53 ½’ to 55’

Sample No. 14, Depth 58 ½’ to 60’

Sample No. 15, Depth 63 ½’ to 65’



Sample No. 16, Depth 68 ½’ to 70’

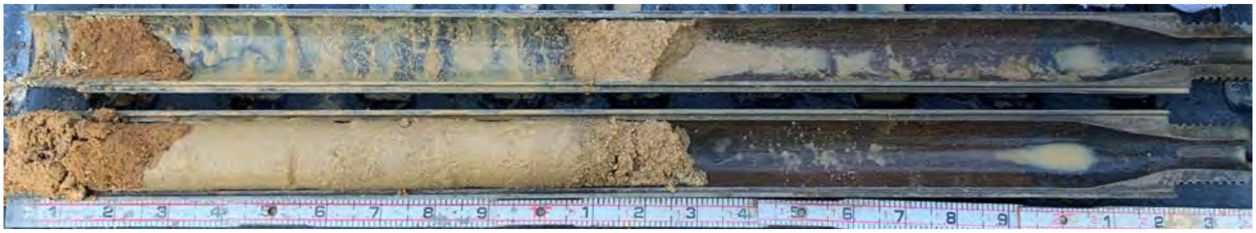
Sample No. 17, Depth 73 ½’ to 75’

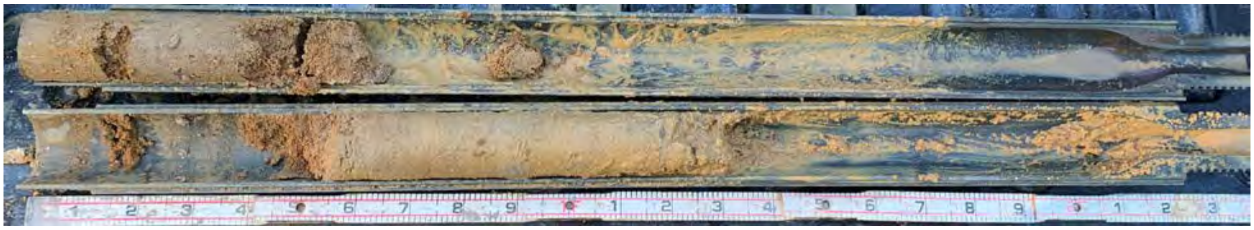
Sample No. 18, Depth 78 ½’ to 80’

Sample No. 19, Depth 88 ½’ to 90’

Boring at Station 15+00

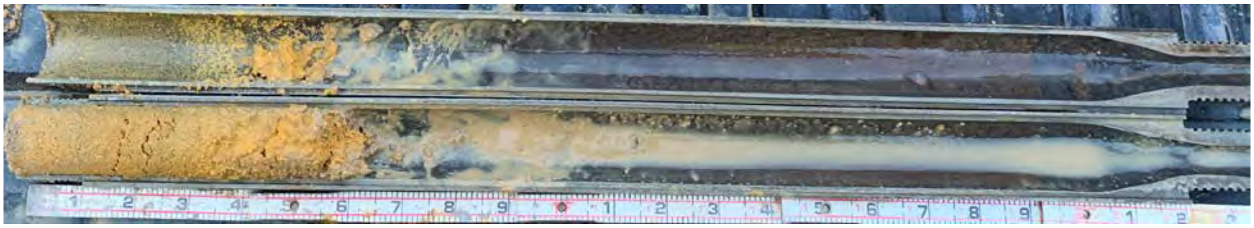

Sample No. 1, Depth 1’ to 2 ½’

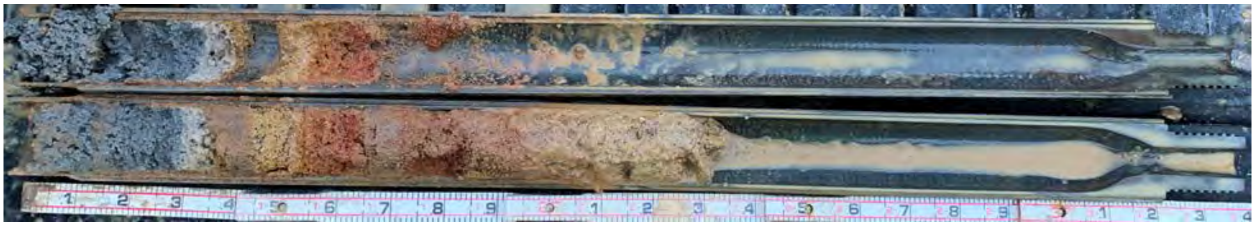

Sample No. 2, Depth 3 ½’ to 5’


Sample No. 3, Depth 6’ to 7 ½’


Sample No. 4, Depth 8 ½’ to 10’


Sample No. 5, Depth 13 ½’ to 15’


Sample No. 6, Depth 18 ½’ to 20’



Sample No. 7, Depth 23 ½' to 25'

Sample No. 8, Depth 28 ½' to 30'

Sample No. 9, Depth 33 ½' to 35'

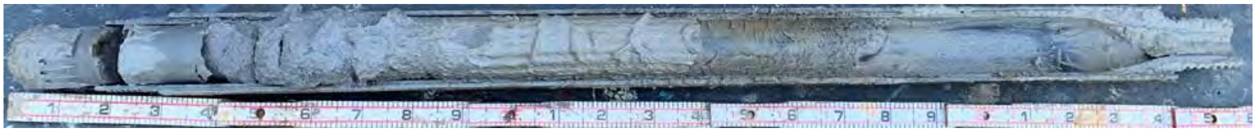
Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'

Sample No. 12, Depth 48 ½' to 50'

Sample No. 13, Depth 53 ½’ to 55’

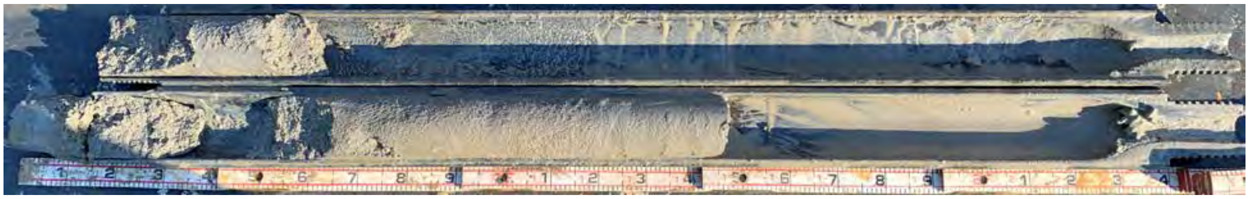
Sample No. 14, Depth 58 ½’ to 60’



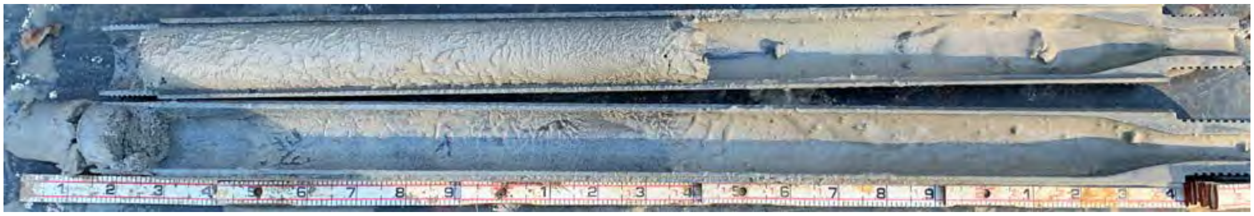
Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½’ to 70’

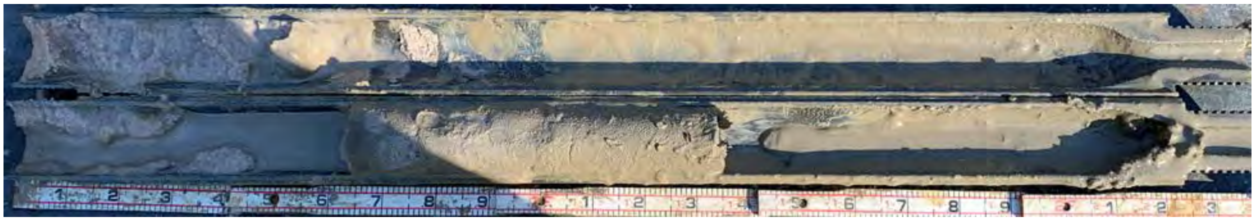
Sample No. 17, Depth 73 ½’ to 75’



Sample No. 18, Depth 78 ½’ to 80’



Sample No. 19, Depth 83 ½’ to 85’



Sample No. 20, Depth 88 ½’ to 90’

Boring at Station 20+00


Sample No. 1, Depth 1’ to 2 ½’


Sample No. 2, Depth 3 ½’ to 5’


Sample No. 3, Depth 6’ to 7 ½’


Sample No. 4, Depth 8 ½’ to 10’


Sample No. 5, Depth 13 ½’ to 15’


Sample No. 6, Depth 18 ½’ to 20’


Sample No. 7, Depth 23 ½’ to 25’

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 11, Depth 43 ½’ to 45’

Sample No. 12, Depth 48 ½’ to 50’

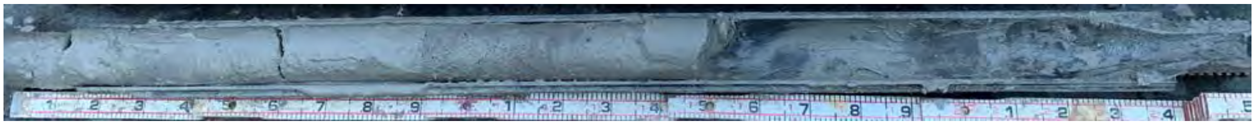
Sample No. 13, Depth 53 ½’ to 55’

Sample No. 14, Depth 58 ½’ to 60’

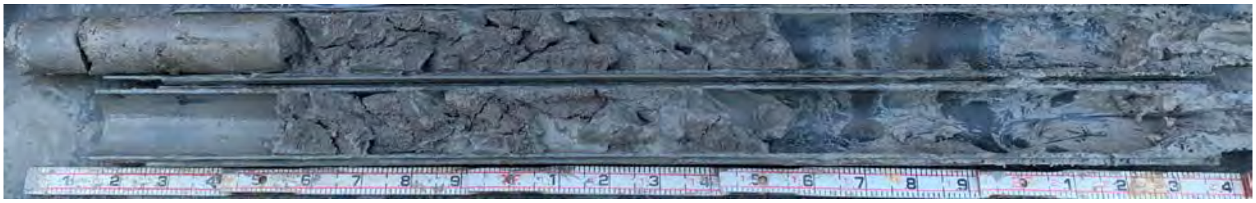
Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½’ to 70’

Sample No. 17, Depth 73 ½’ to 75’



Sample No. 19, Depth 83 ½’ to 85’



Sample No. 20, Depth 88 ½’ to 90’

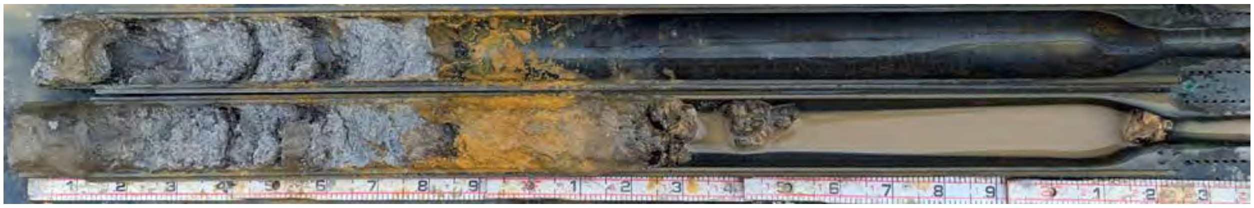
Boring at Station 25+00

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’

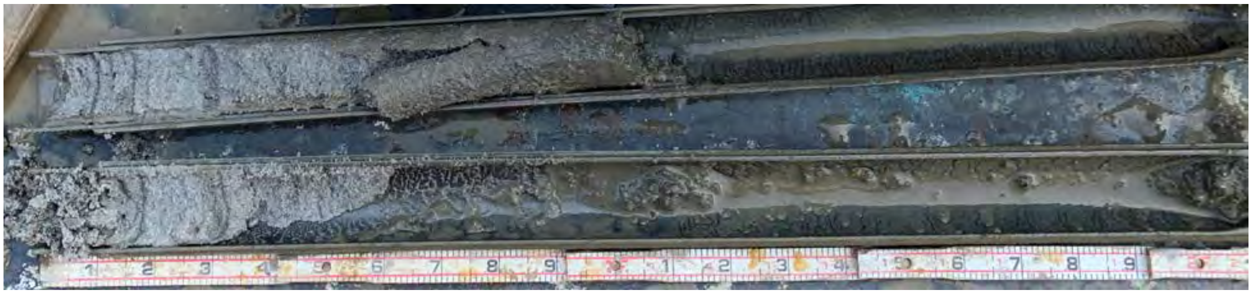
Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

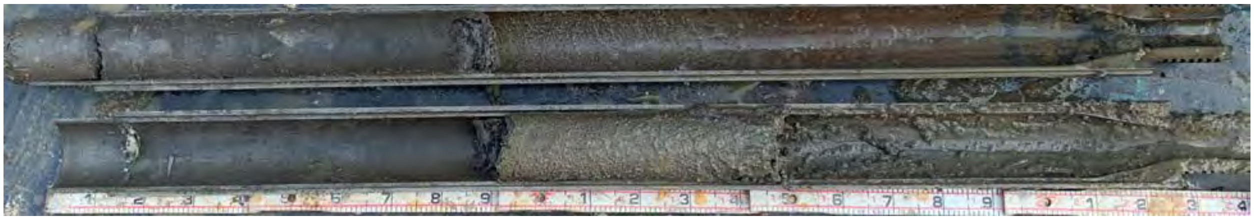


Sample No. 5, Depth 13 ½’ to 15’

Sample No. 6, Depth 18 ½’ to 20’



Sample No. 7, Depth 23 ½’ to 25’



Sample No. 8, Depth 28 ½’ to 30’

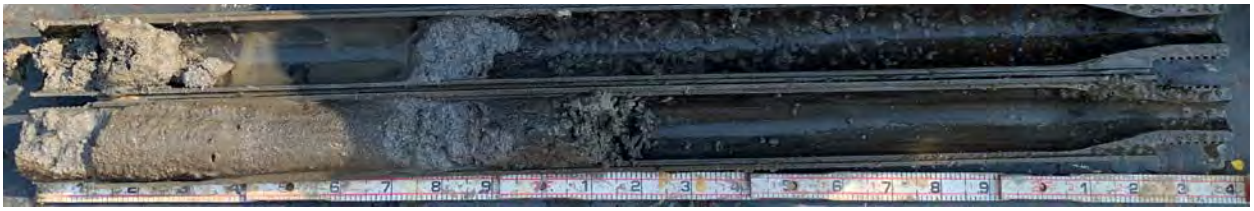
Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 11, Depth 43 ½’ to 45’

Sample No. 12, Depth 48 ½’ to 50’

Sample No. 13, Depth 53 ½’ to 55’



Sample No. 14, Depth 58 ½’ to 60’

Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½’ to 70’

Sample No. 17, Depth 78 ½’ to 80’

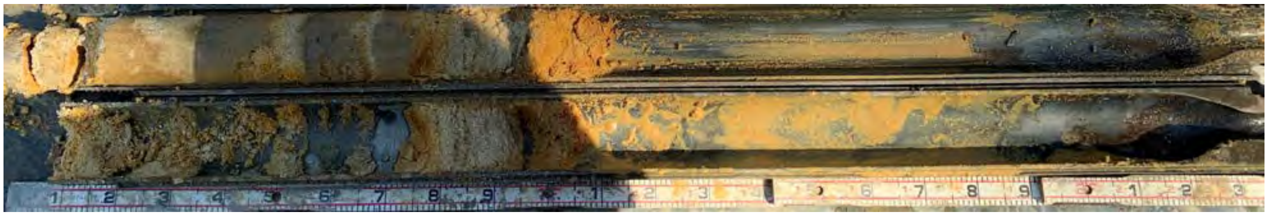
Sample No. 18, Depth 83 ½’ to 85’

Sample No. 19, Depth 88 ½’ to 90’

Boring at Station 30+00

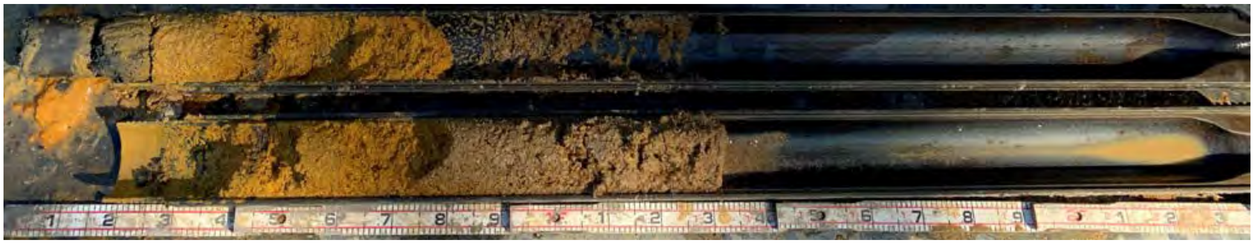
Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’

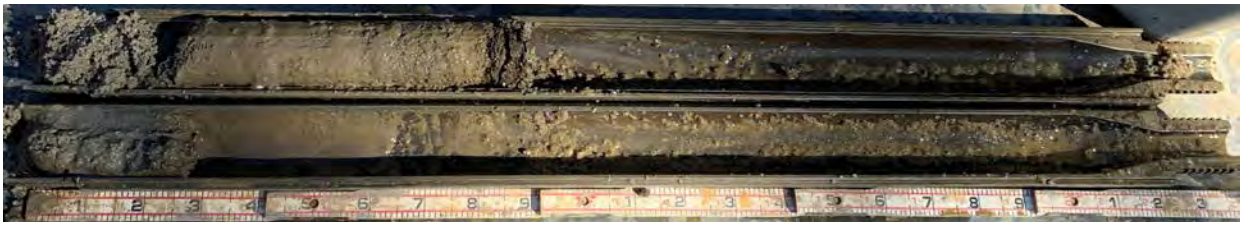


Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’



Sample No. 5, Depth 13 ½’ to 15’



Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½' to 25'

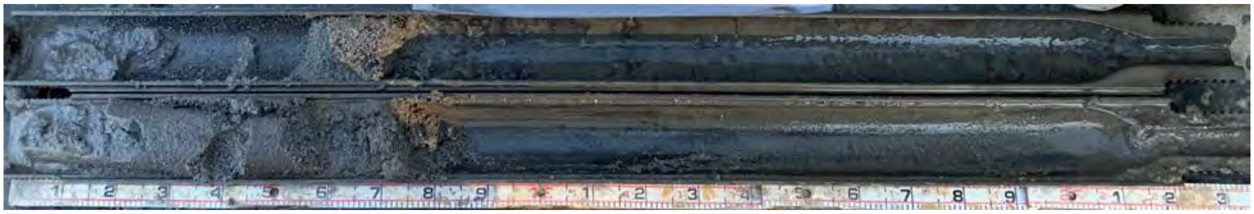
Sample No. 8, Depth 28 ½' to 30'

Sample No. 9, Depth 33 ½' to 35'

Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'

Sample No. 12, Depth 48 ½' to 50'



Sample No. 13, Depth 53 ½’ to 55’

Sample No. 14, Depth 58 ½’ to 60’

Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½’ to 70’

Sample No. 17, Depth 78 ½’ to 80’

Sample No. 18, Depth 83 ½’ to 85’

Sample No. 19, Depth 88 ½’ to 90’

Boring at Station 33+50

Sample No. 1, Depth 1' to 2 ½'

Sample No. 2, Depth 3 ½' to 5'

Sample No. 3, Depth 6' to 7 ½'

Sample No. 4, Depth 8 ½' to 10'

Sample No. 5, Depth 13 ½' to 15'

Sample No. 6, Depth 18 ½' to 20'

Sample No. 7, Depth 23 ½' to 25'

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 38 ½’ to 40’

Sample No. 11, Depth 43 ½’ to 45’

Sample No. 12, Depth 48 ½’ to 50’

Sample No. 13, Depth 53 ½’ to 55’

Sample No. 14, Depth 58 ½’ to 60’

Sample No. 15, Depth 63 ½' to 65'

Sample No. 16, Depth 68 ½' to 70'

Sample No. 17, Depth 73 ½' to 75'

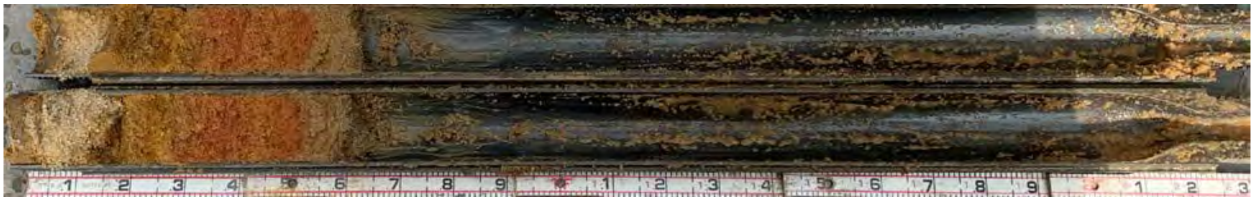
Sample No. 18, Depth 78 ½' to 80'

Sample No. 19, Depth 88 ½' to 90'

Boring at Station 37+50

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’



Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

Sample No. 5, Depth 13 ½’ to 15’

Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½' to 25'

Sample No. 8, Depth 28 ½' to 30'

Sample No. 9, Depth 33 ½' to 35'

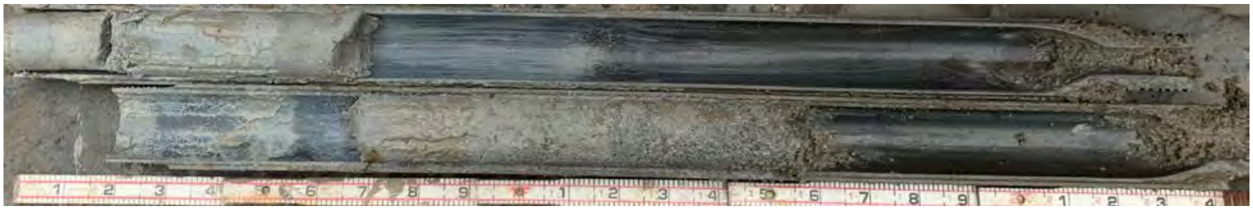
Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'

Sample No. 12, Depth 48 ½' to 50'

Sample No. 13, Depth 53 ½' to 55'

Sample No. 14, Depth 58 ½' to 60'



Sample No. 15, Depth 63 ½' to 65'

Sample No. 16, Depth 68 ½' to 70'

Sample No. 17, Depth 78 ½' to 80'

Sample No. 18, Depth 83 ½' to 85'

Sample No. 19, Depth 88 ½' to 90'

Boring at Station 42+50

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’

Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

Sample No. 5, Depth 13 ½’ to 15’

Sample No. 6, Depth 18 ½’ to 20’

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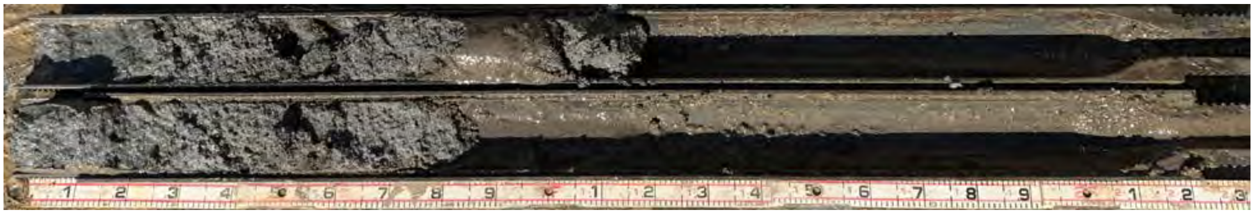
Chemours Barrier Wall
Fayetteville, North Carolina
GEOServices Project No. 41-20500


Sample No. 7, Depth 23 ½’ to 25’


Sample No. 8, Depth 28 ½’ to 30’


Sample No. 9, Depth 33 ½’ to 35’


Sample No. 10, Depth 38 ½’ to 40’


Sample No. 11, Depth 43 ½’ to 45’

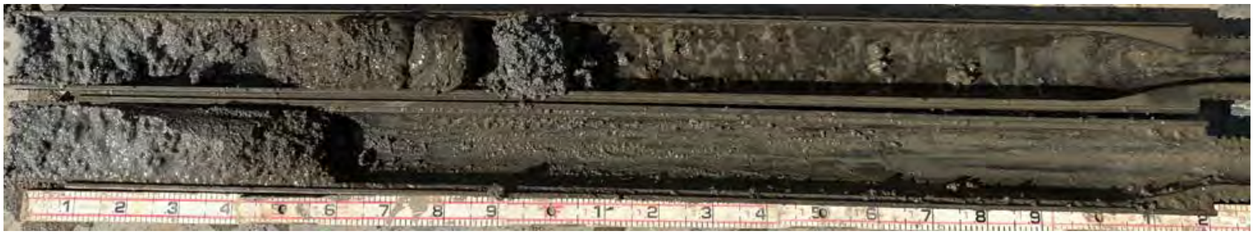

Sample No. 12, Depth 48 ½’ to 50’


Sample No. 13, Depth 53 ½' to 55'


Sample No. 14, Depth 58 ½' to 60'


Sample No. 15, Depth 63 ½' to 65'


Sample No. 16, Depth 68 ½' to 70'


Sample No. 17, Depth 73 ½' to 75'


Sample No. 18, Depth 78 ½' to 80'

Sample No. 19, Depth 83 ½’ to 85’

Sample No. 20, Depth 88 ½’ to 90’

Boring at Station 47+50

Sample No. 1, Depth 1' to 2 ½'

Sample No. 2 Depth 3 ½' to 5'

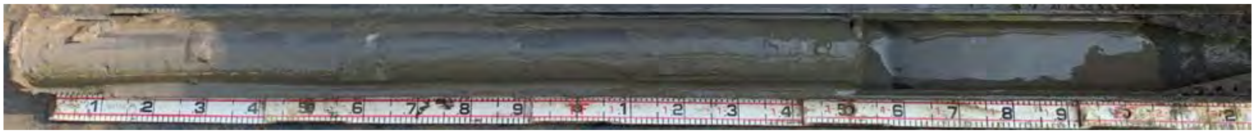
Sample No. 3, Depth 6' to 7 ½'

Sample No. 4, Depth 8 ½' to 10'

Sample No. 5, Depth 13 ½' to 15'

Sample No. 6, Depth 18 ½' to 20'

Sample No. 7, Depth 23 ½' to 25'

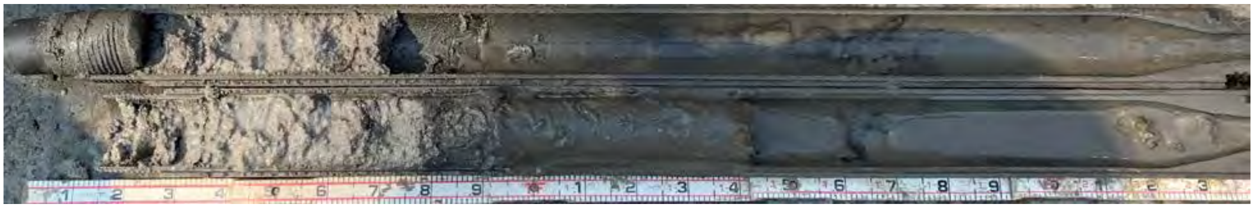


Sample No. 8, Depth 28 ½' to 30'

Sample No. 9, Depth 33 ½' to 35'

Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'



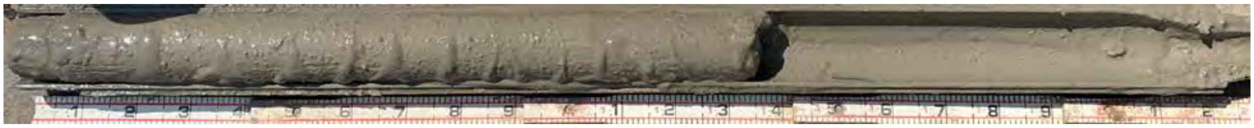
Sample No. 12, Depth 48 ½' to 50'

Sample No. 13, Depth 53 ½' to 55'

Sample No. 14, Depth 58 ½' to 60'

Sample No. 15, Depth 63 ½' to 65'

Sample No. 16, Depth 68 ½' to 70'



Sample No. 17, Depth 78 ½' to 80'

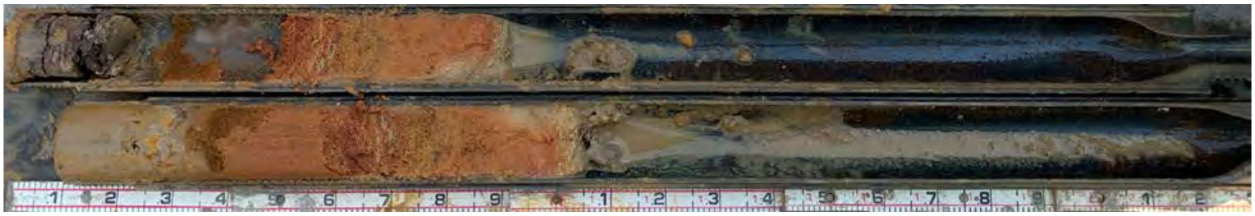
Sample No. 18, Depth 83 ½' to 85'

Sample No. 19, Depth 88 ½' to 90'

Boring at Station 52+50

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’



Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

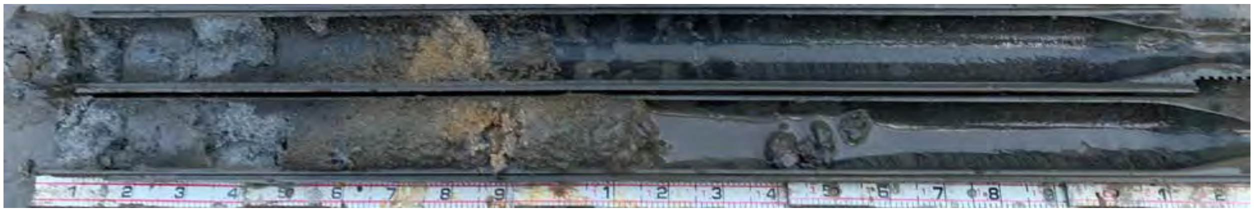
Sample No. 5, Depth 13 ½’ to 15’

Sample No. 6, Depth 18 ½’ to 20’

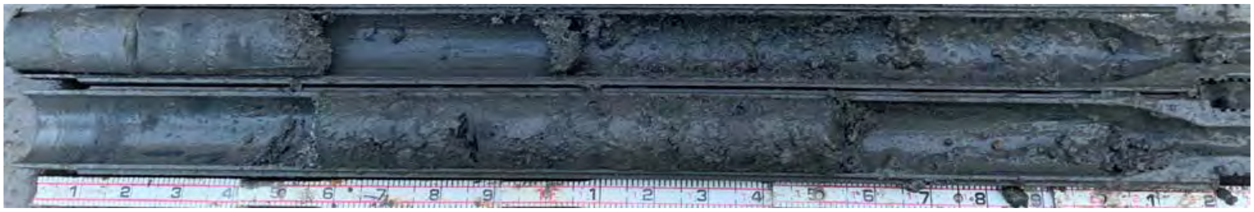
Sample No. 7, Depth 23 ½’ to 25’

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

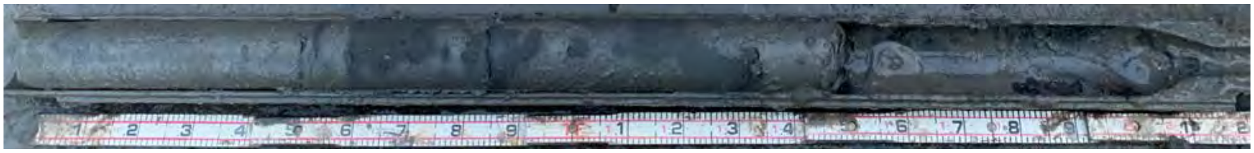


Sample No. 10, Depth 38 ½’ to 40’



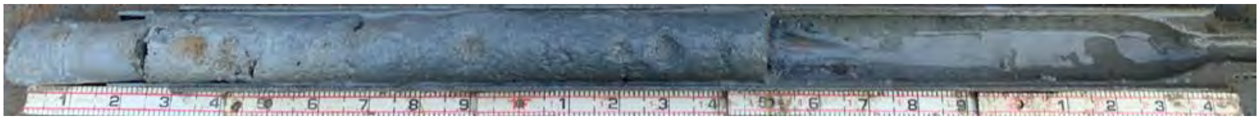
Sample No. 11, Depth 43 ½’ to 45’

Sample No. 12, Depth 48 ½’ to 50’



Sample No. 13, Depth 53 ½’ to 55’

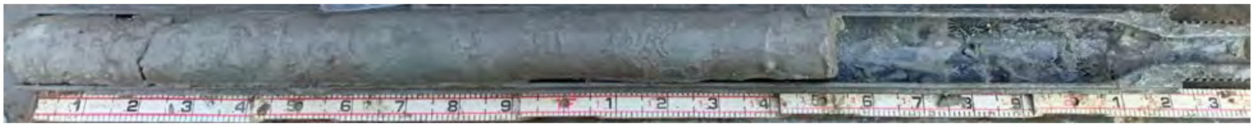
Sample No. 14, Depth 58 ½’ to 60’



Sample No. 15, Depth 63 ½’ to 65’

Sample No. 16, Depth 68 ½' to 70'

Sample No. 17, Depth 73 ½' to 75'



Sample No. 18, Depth 78 ½' to 80'

Sample No. 19, Depth 88 ½' to 90'

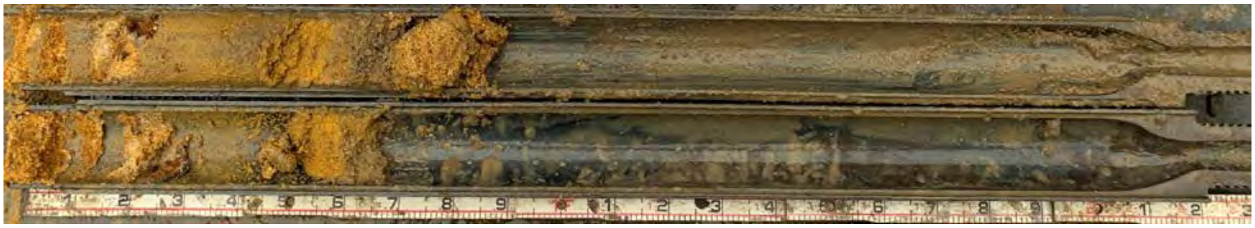
Boring at Station 57+50

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

Sample No. 5, Depth 13 ½’ to 15’



Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½’ to 25’

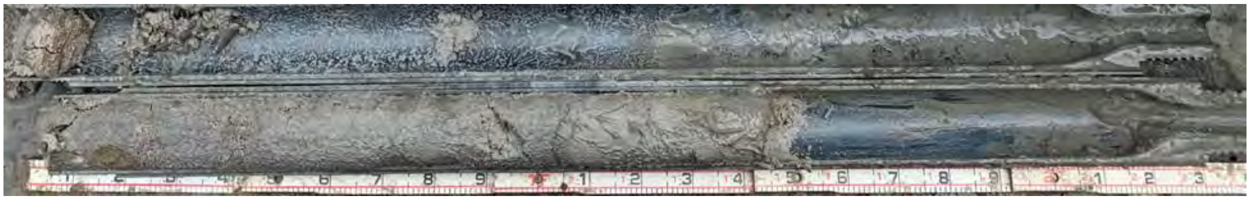
Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 38 ½’ to 40’

Sample No. 10, Depth 43 ½’ to 45’

Sample No. 11, Depth 48 ½’ to 50’

Sample No. 12, Depth 53 ½’ to 55’



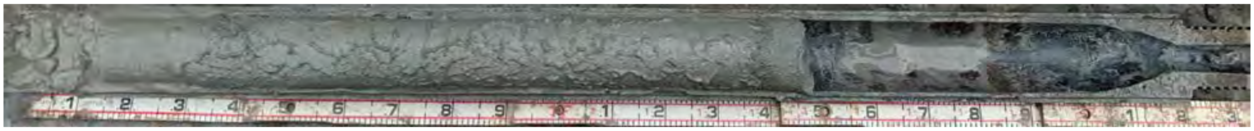
Sample No. 13, Depth 58 ½’ to 60’

Sample No. 14, Depth 63 ½’ to 65’

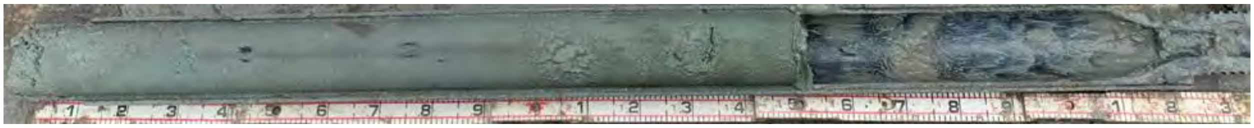
Sample No. 15, Depth 68 ½’ to 70’

Sample No. 16, Depth 73 ½’ to 75’

Sample No. 17, Depth 78 ½’ to 80’



Sample No. 18, Depth 83 ½’ to 85’



Sample No. 19, Depth 88 ½’ to 90’

Boring at Station 62+50

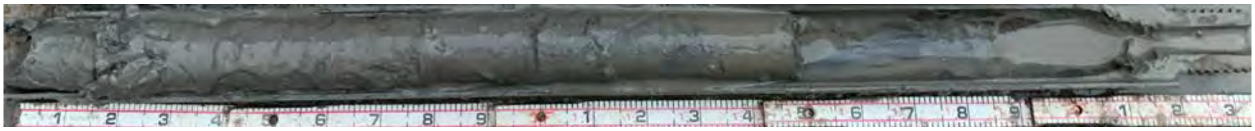
Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’

Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

Sample No. 5, Depth 13 ½’ to 15’



Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½’ to 25’

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 43 ½’ to 45’

Sample No. 11, Depth 48 ½’ to 50’

Sample No. 12, Depth 53 ½’ to 55’

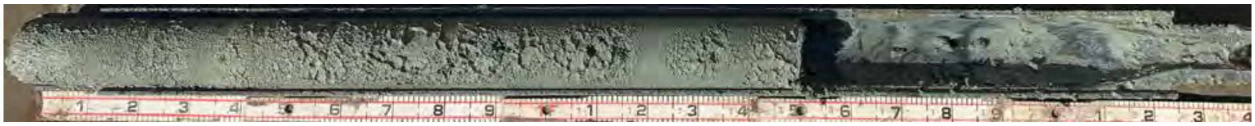
Sample No. 13, Depth 58 ½’ to 60’

Sample No. 14, Depth 63 ½’ to 65’

Sample No. 15, Depth 68 ½’ to 70’

Sample No. 16, Depth 73 ½' to 75'

Sample No. 17, Depth 78 ½' to 80'



Sample No. 18, Depth 83 ½' to 85'

Sample No. 19, Depth 88 ½' to 90'

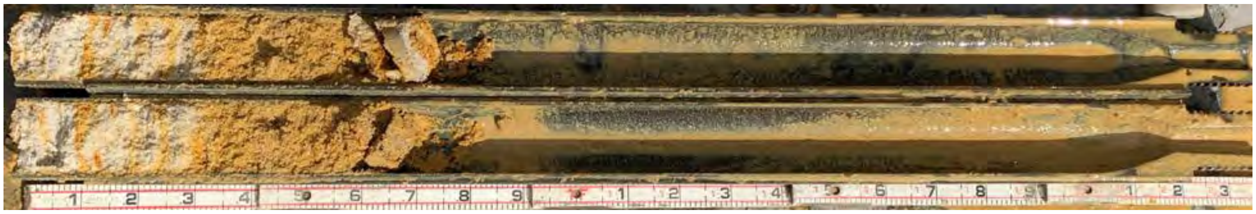
Boring at Station 67+50

Sample No. 1, Depth 1’ to 2 ½’

Sample No. 2, Depth 3 ½’ to 5’

Sample No. 3, Depth 6’ to 7 ½’

Sample No. 4, Depth 8 ½’ to 10’

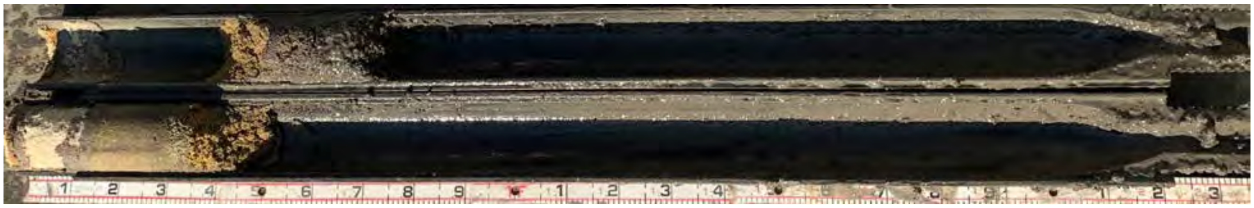


Sample No. 5, Depth 13 ½’ to 15’

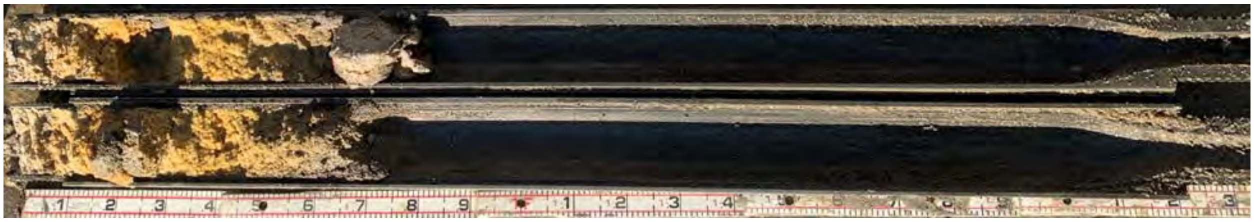
Sample No. 6, Depth 18 ½’ to 20’

Sample No. 7, Depth 23 ½’ to 25’

Sample No. 8, Depth 28 ½’ to 30’



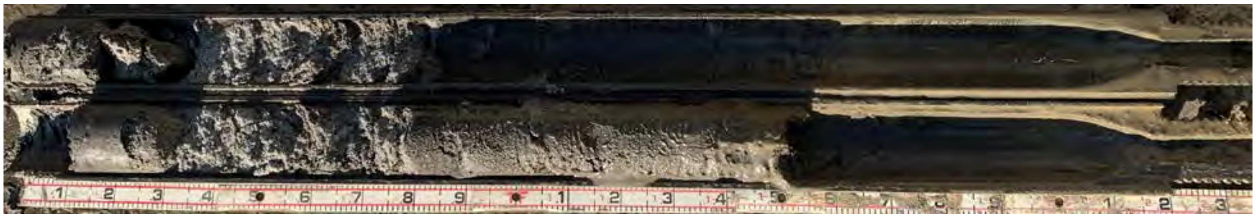
Sample No. 9, Depth 33 ½' to 35'



Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'

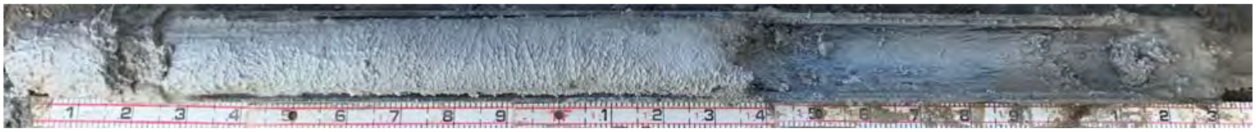
Sample No. 12, Depth 48 ½' to 50'



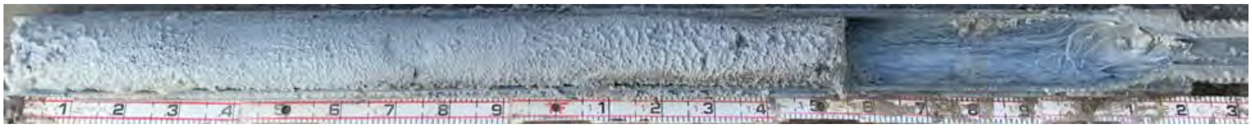
Sample No. 13, Depth 53 ½' to 55'

Sample No. 14, Depth 58 ½' to 60'

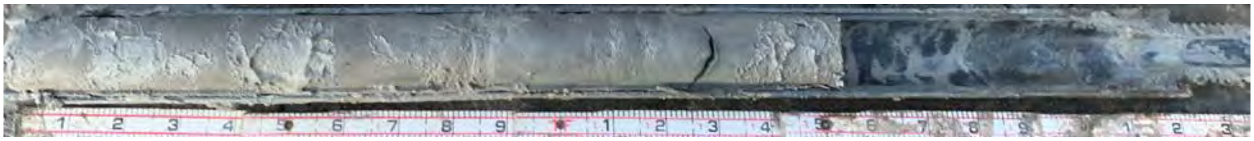
Sample No. 15, Depth 63 ½’ to 65’



Sample No. 16, Depth 68 ½’ to 70’

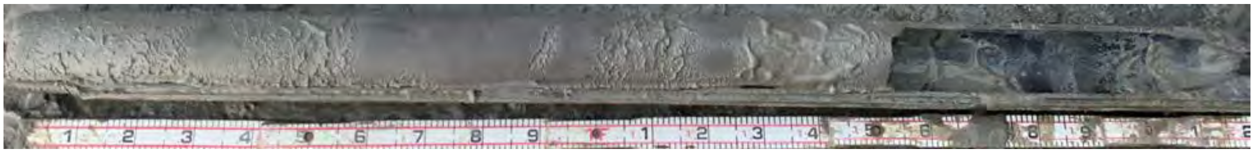


Sample No. 17, Depth 73 ½’ to 75’



Sample No. 18, Depth 78 ½’ to 80’

Sample No. 19, Depth 83 ½’ to 85’



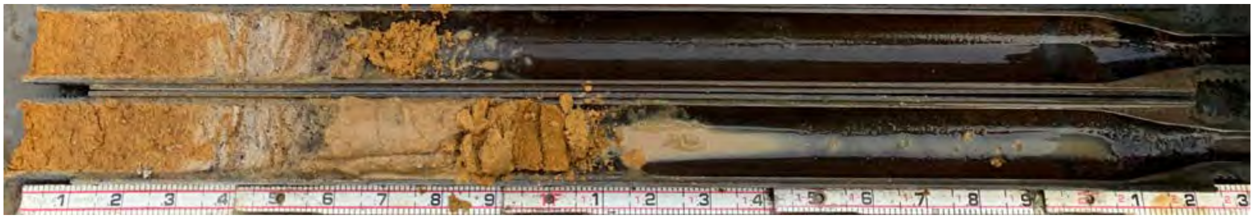
Sample No. 20, Depth 88 ½’ to 90’

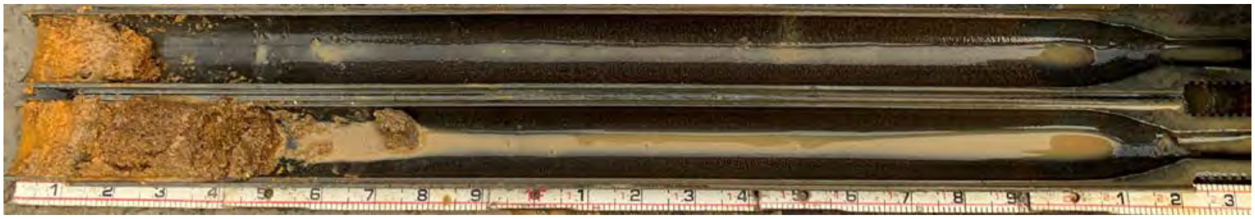
Boring at Station 72+50


Sample No. 1, Depth 1' to 2 ½'


Sample No. 2, Depth 3 ½' to 5'


Sample No. 3, Depth 6' to 7 ½'


Sample No. 4, Depth 8 ½' to 10'

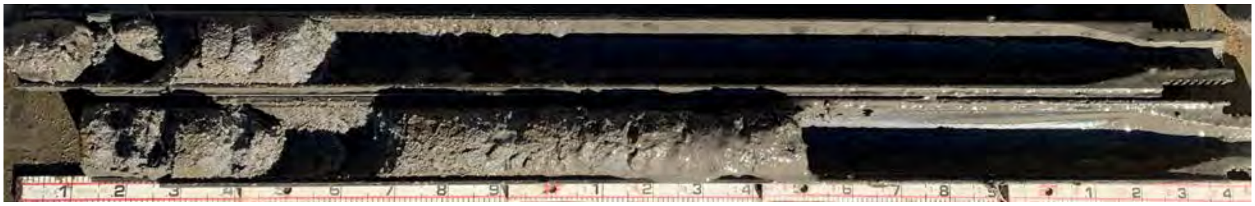

Sample No.5, Depth 13 ½' to 15'


Sample No. 6, Depth 18 ½' to 20'


Sample No. 7, Depth 23 ½' to 25'

Sample No. 8, Depth 28 ½' to 30'

Sample No. 9, Depth 33 ½' to 35'



Sample No. 10, Depth 38 ½' to 40'

Sample No. 11, Depth 43 ½' to 45'

Sample No. 12, Depth 48 ½' to 50'

Sample No. 13, Depth 53 ½' to 55'

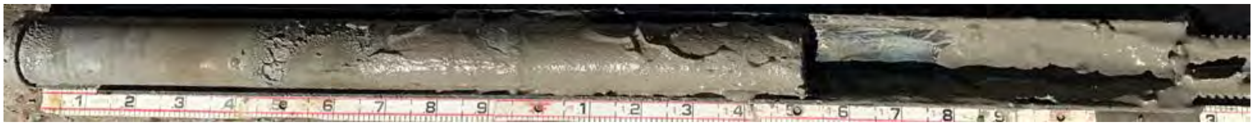
Sample No. 14, Depth 58 ½' to 60'

Sample No. 15, Depth 63 ½' to 65'

Sample No. 16, Depth 68 ½' to 70'

Sample No. 17, Depth 73 ½' to 75'

Sample No. 18, Depth 78 ½' to 80'

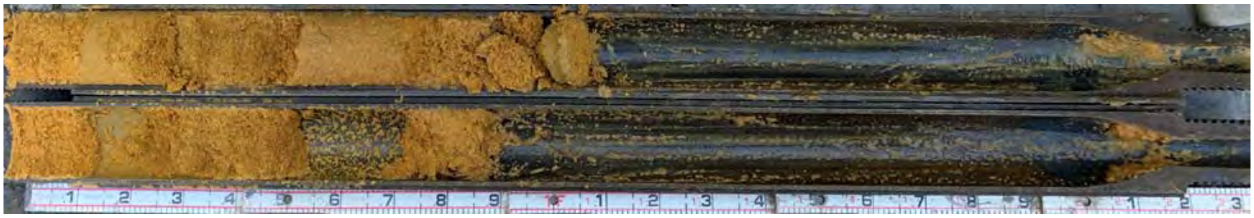


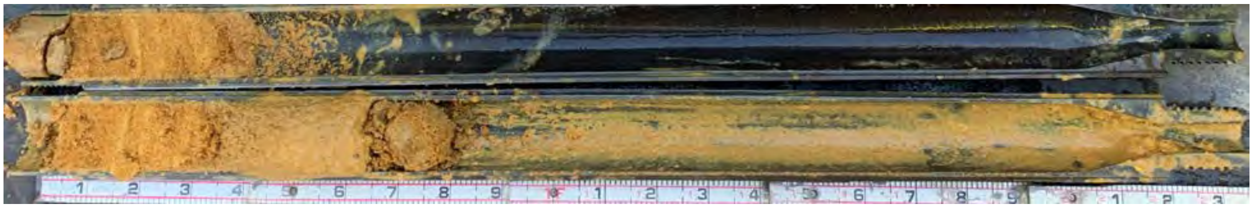
Sample No. 19, Depth 88 ½' to 90'

Boring at Station 77+50


Sample No. 1, Depth 1’ to 2 ½’


Sample No. 2, Depth 3 ½’ to 5’


Sample No. 3, Depth 6’ to 7 ½’


Sample No. 4, Depth 8 ½’ to 10’


Sample No. 5, Depth 13 ½’ to 15’

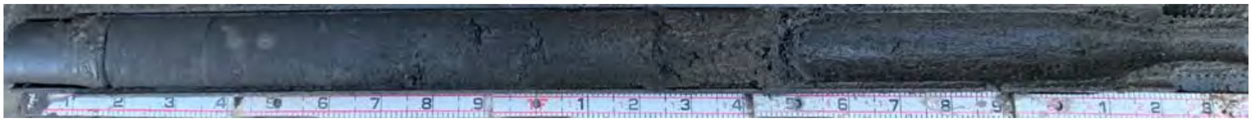

Sample No. 6, Depth 18 ½’ to 20’


Sample No. 7, Depth 23 ½’ to 25’

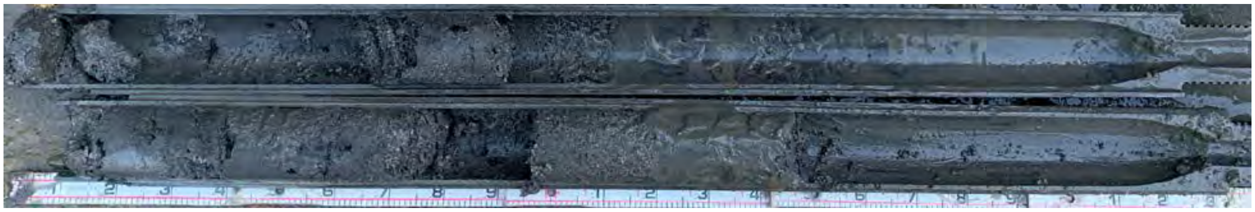

Sample No. 8, Depth 28 ½’ to 30’


Sample No. 9, Depth 38 ½’ to 40’


Sample No. 10, Depth 43 ½’ to 45’

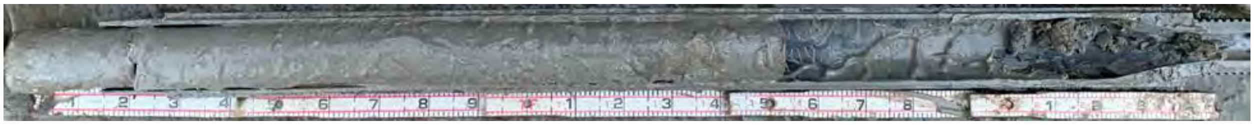

Sample No. 11, Depth 48 ½’ to 50’


Sample No. 12, Depth 53 ½’ to 55’


Sample No. 13, Depth 58 ½’ to 60’


Sample No. 14, Depth 63 ½’ to 65’

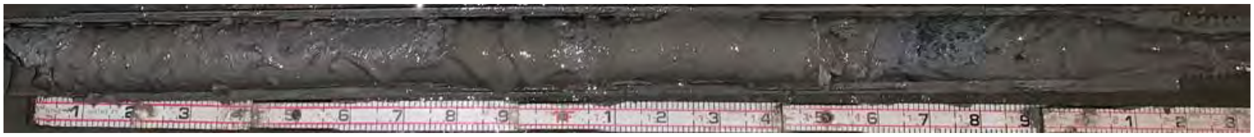
Sample No. 15, Depth 68 ½' to 70'



Sample No. 16, Depth 73 ½' to 75'

Sample No. 17, Depth 78 ½' to 80'

Sample No. 18, Depth 83 ½' to 85'



Sample No. 19, Depth 88 ½' to 90'

Boring at Station 82+50


Sample No. 1, Depth 1’ to 2 ½’

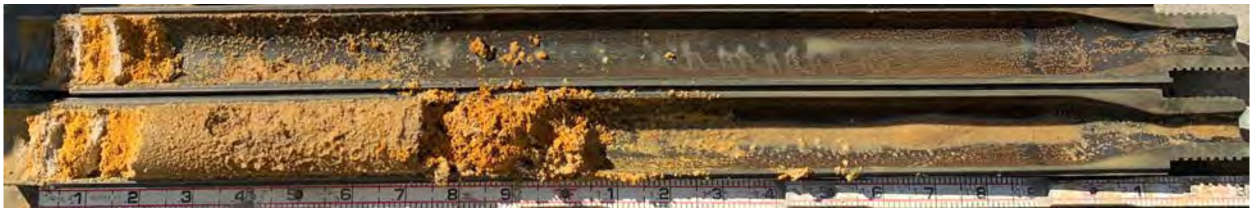

Sample No. 2, Depth 3 ½’ to 5’


Sample No. 3, Depth 6’ to 7 ½’


Sample No. 4, Depth 8 ½’ to 10’


Sample No. 5, Depth 13 ½’ to 15’


Sample No. 6, Depth 18 ½’ to 20’



Sample No. 7, Depth 23 ½’ to 25’

Sample No. 8, Depth 28 ½’ to 30’

Sample No. 9, Depth 33 ½’ to 35’

Sample No. 10, Depth 43 ½’ to 45’

Sample No. 11, Depth 48 ½’ to 50’

Sample No. 12, Depth 53 ½’ to 55’

Sample No. 13, Depth 58 ½’ to 60’

Sample No. 14, Depth 63 ½’ to 65’

Sample No. 15, Depth 68 ½’ to 70’

Sample No. 16, Depth 73 ½’ to 75’

Sample No. 17, Depth 78 ½’ to 80’

Sample No. 18, Depth 83 ½’ to 85’

Sample No. 19, Depth 88 ½’ to 90’

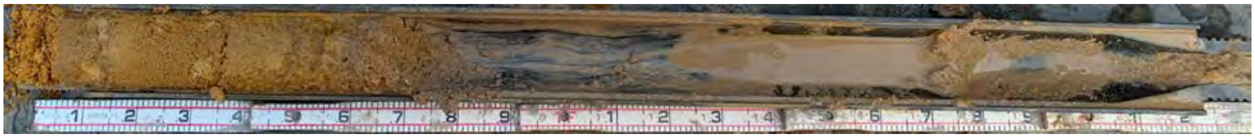
Boring at Station 82+50

Sample No. 1, Depth 1' to 2 ½'

Sample No. 2, Depth 3 ½' to 5'

Sample No. 3, Depth 6' to 7 ½'

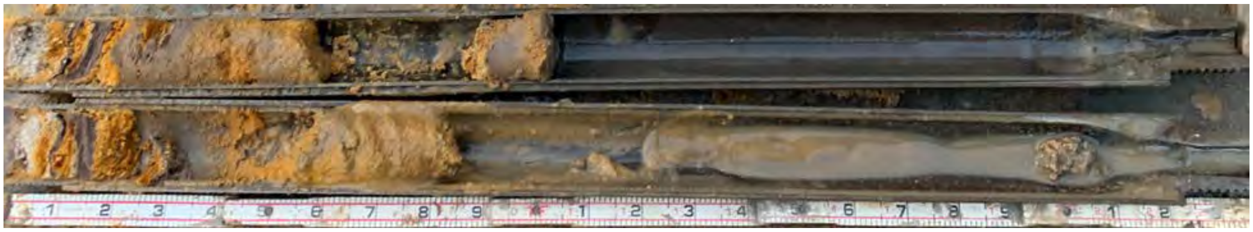
Sample No. 4, Depth 8 ½' to 10'



Sample No. 5, Depth 13 ½' to 15'

Sample No. 6, Depth 18 ½' to 20'

Sample No. 7, Depth 23 ½' to 25'



Sample No. 8, Depth 28 ½' to 30'


Sample No. 9, Depth 33 ½' to 35'


Sample No. 10, Depth 38 ½' to 40'


Sample No. 11, Depth 43 ½' to 45'


Sample No. 12, Depth 48 ½' to 50'


Sample No. 13, Depth 53 ½' to 55'


Sample No. 14, Depth 63 ½' to 65'


Sample No. 15, Depth 68 ½' to 70'

Sample No. 16, Depth 73 ½' to 75'

Sample No. 17, Depth 78 ½' to 80'

Sample No. 18, Depth 83 ½' to 85'

Sample No. 19, Depth 88 ½' to 90'

GEOS

GEOServices, LLC, Geotechnical and Materials Engineers

Shelby Tube Sample Photographs

0+00 Offset, Depth 38’ to 40’

0+00, ST2, Depth 38’ to 40’

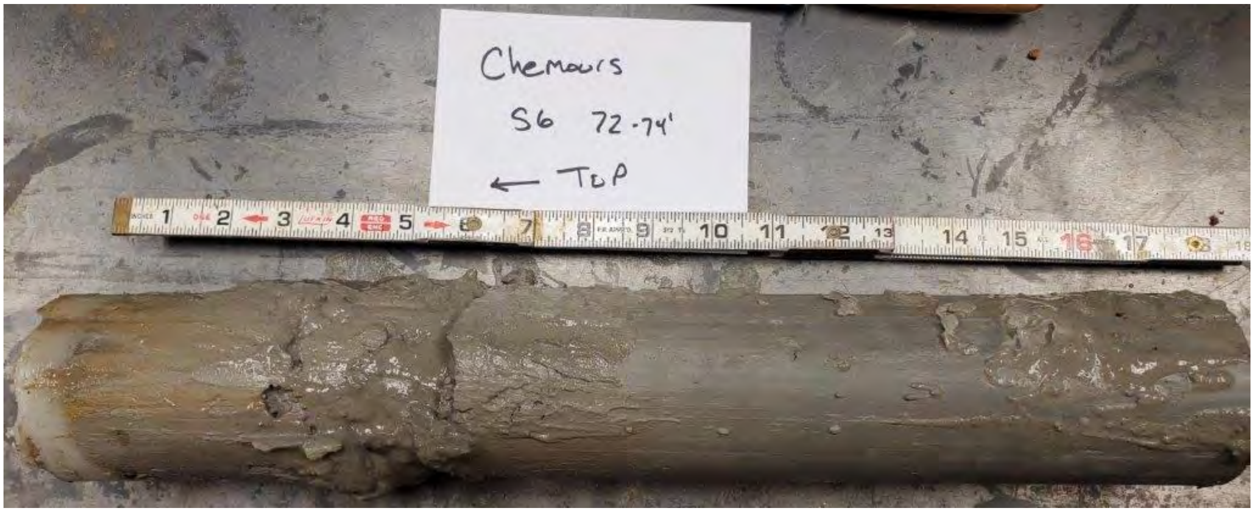
5+00, Depth 82’ to 84’

5+00, Depth 82’ to 84’ #2

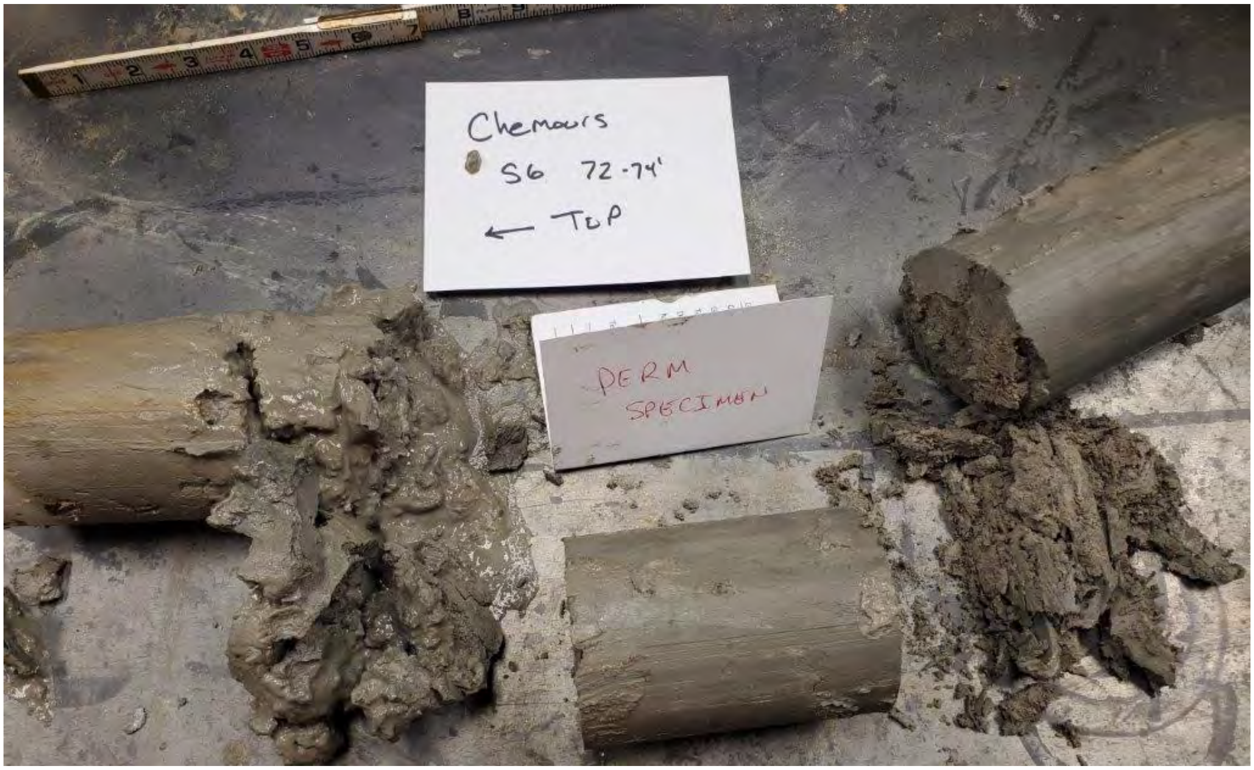
15+00, Depth 35’ to 37’

20+00, Offset, Depth 45’ to 47’

20+00, ST1, Depth 35' to 37'



25+00, Depth 72' to 74'



25+00, Depth 72’ to 74’ #2

30+00, Depth 70’ to 72’

30+00, Depth 70' to 72' #2

33+50, Depth 80' to 82'

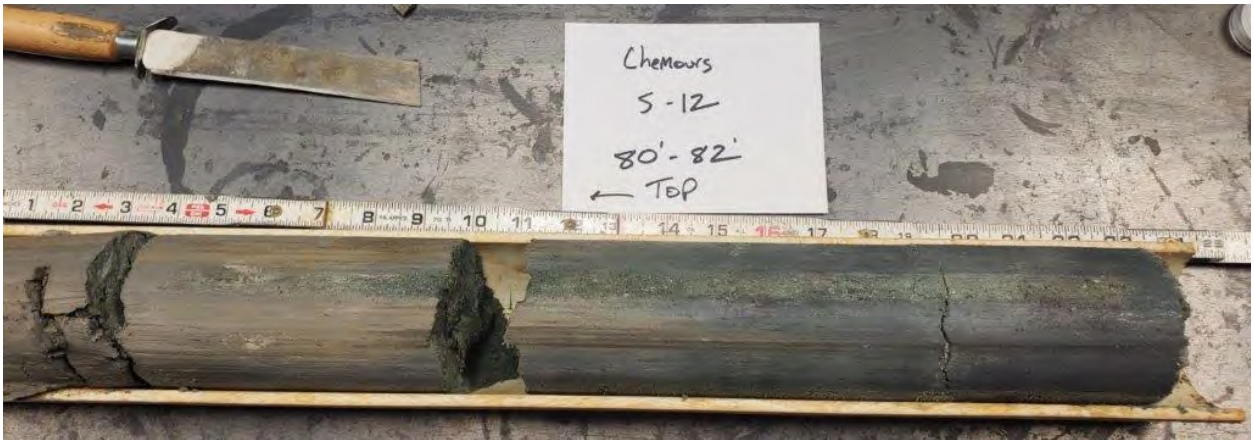
33+50, Depth 80’ to 82’ #2

33+50, Depth 80' to 82' #3

42+50, Depth 50' to 52'

47+50, Depth 72' to 74'

47+50, Depth 72' to 74' #2

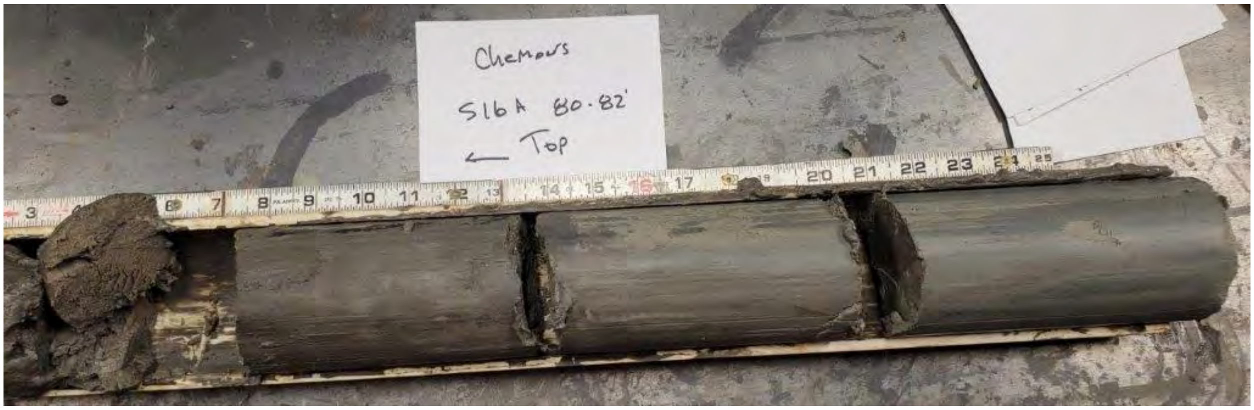


52+50, Depth 80’ to 82’

57+50, Depth 32’ to 34’

62+50, Depth 35’ to 37’

67+50, Depth 35’ to 37’



72+50, Depth 80’ to 82’

82+50, Depth 35’ to 37’

87+50, Depth 55' to 57'

GEOServices, LLC, Geotechnical and Materials Engineers

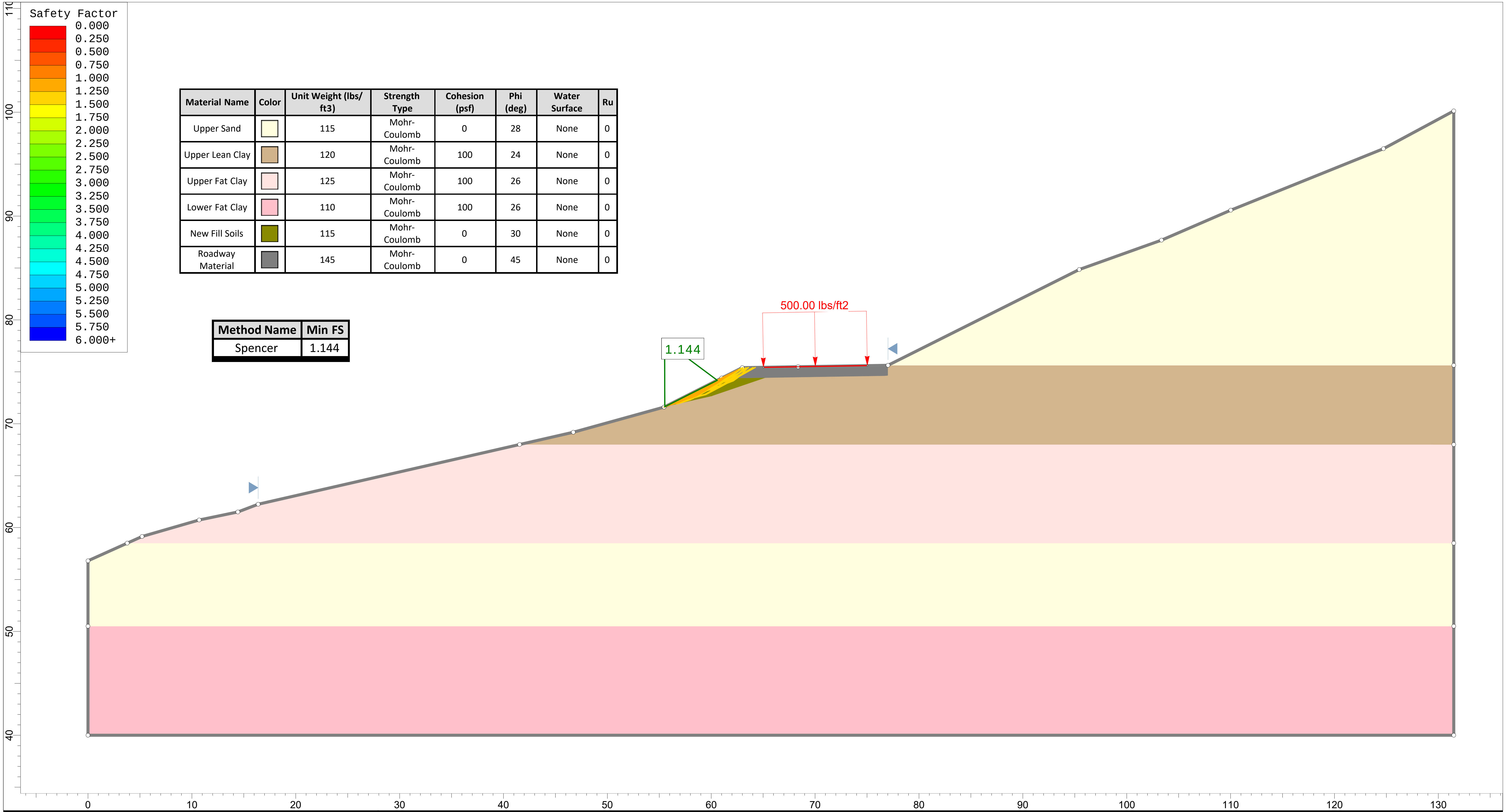
APPENDIX F

Sample Slope Stability Calculations

GEOServices, LLC, Geotechnical and Materials Engineers

Station 55+00

Lower Slope Proposed



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	🟨	115	Mohr-Coulomb	0	28	None	0
Upper Lean Clay	🟫	120	Mohr-Coulomb	100	24	None	0
Upper Fat Clay	⬜	125	Mohr-Coulomb	100	26	None	0
Lower Fat Clay	🟪	110	Mohr-Coulomb	100	26	None	0
New Fill Soils	🟩	115	Mohr-Coulomb	0	30	None	0
Roadway Material	⬛	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.144

rocscience

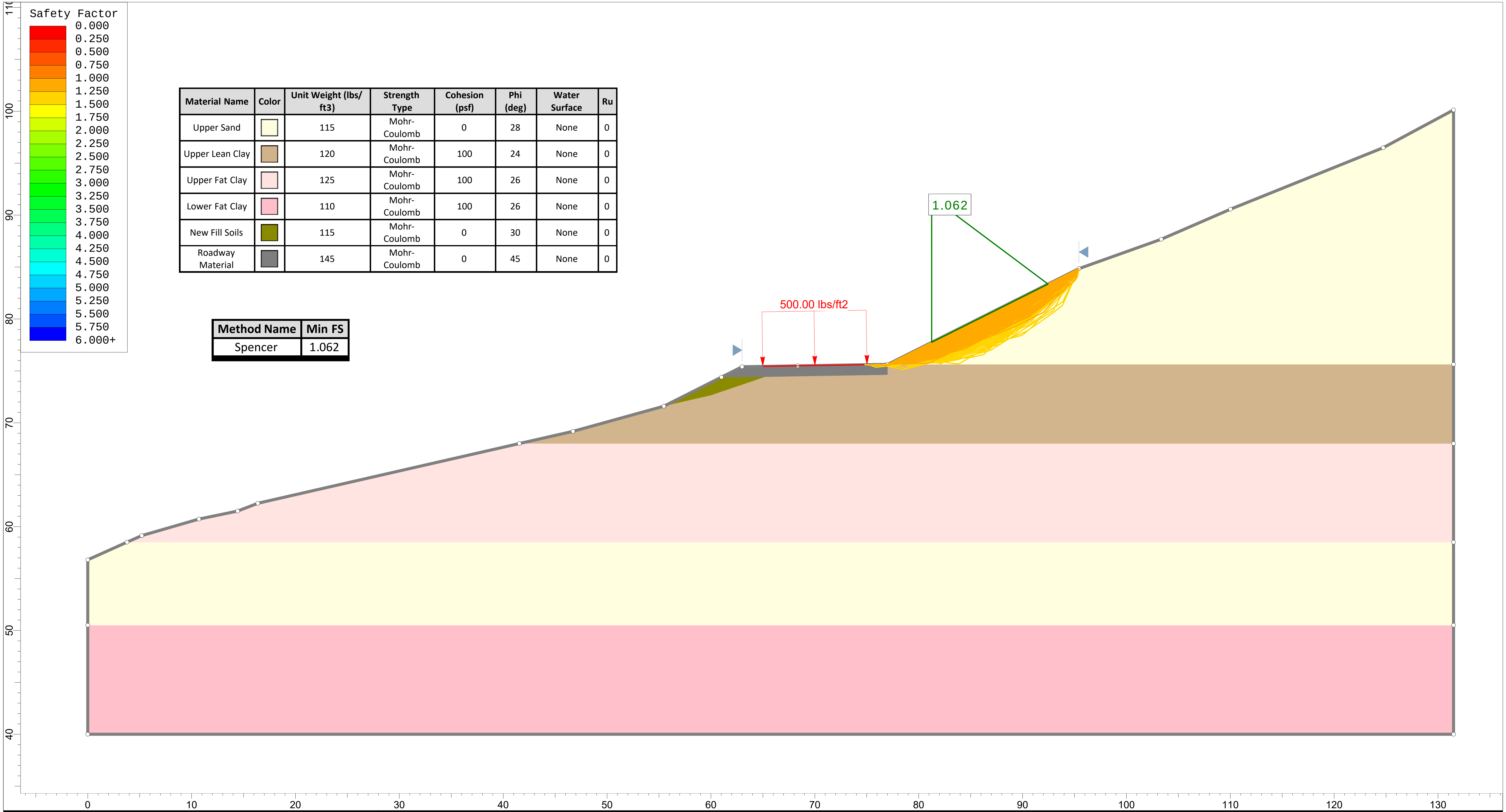
SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 55+00 - Lower Slope - 2H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 1.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 55+00

Upper Slope Proposed



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	■	115	Mohr-Coulomb	0	28	None	0
Upper Lean Clay	■	120	Mohr-Coulomb	100	24	None	0
Upper Fat Clay	■	125	Mohr-Coulomb	100	26	None	0
Lower Fat Clay	■	110	Mohr-Coulomb	100	26	None	0
New Fill Soils	■	115	Mohr-Coulomb	0	30	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.062

rocscience

SLIDEINTERPRET 9.008

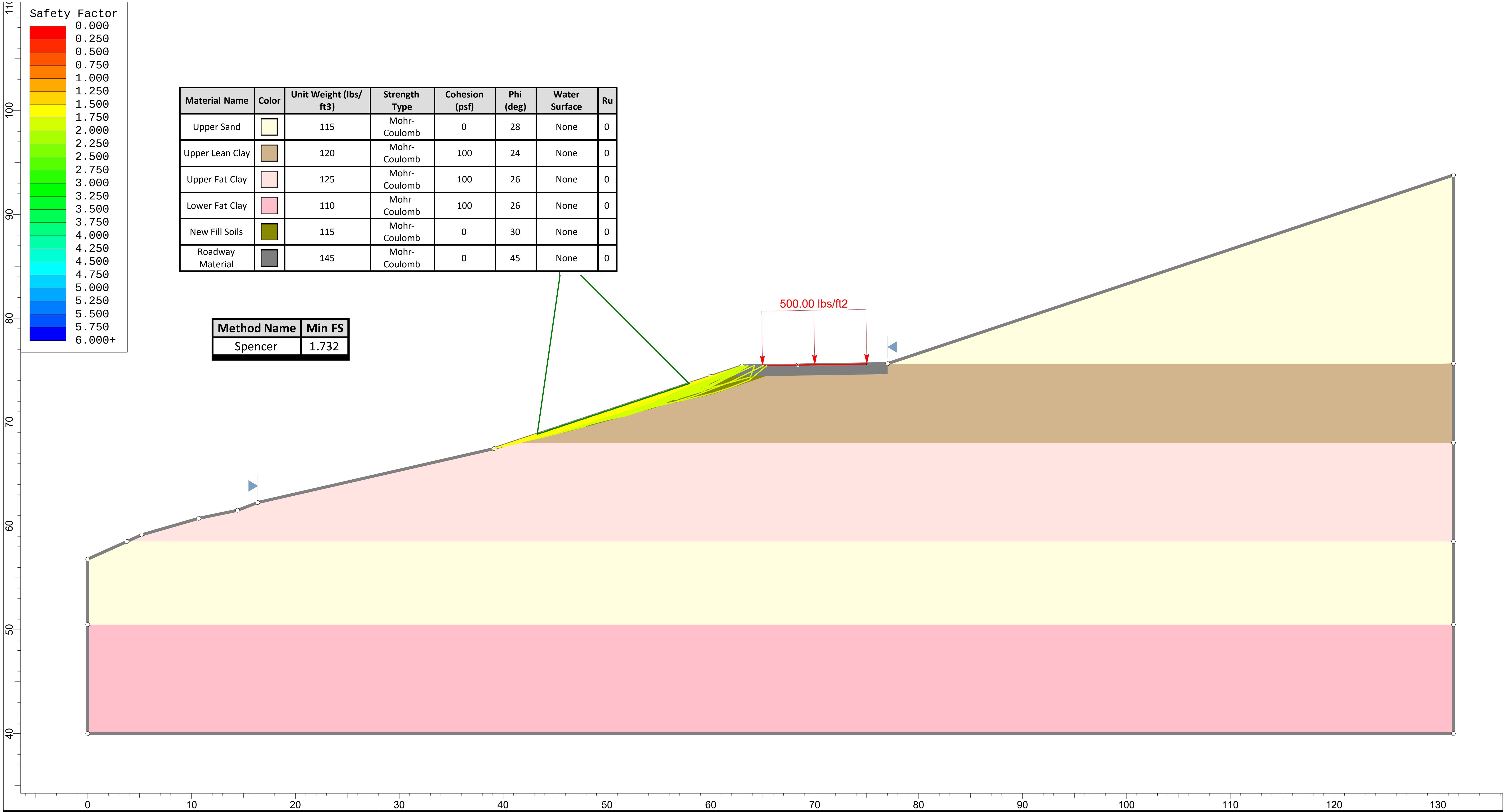
Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 55+00 - Upper Slope - 2H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 1.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 55+00

Lower Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	■	115	Mohr-Coulomb	0	28	None	0
Upper Lean Clay	■	120	Mohr-Coulomb	100	24	None	0
Upper Fat Clay	■	125	Mohr-Coulomb	100	26	None	0
Lower Fat Clay	■	110	Mohr-Coulomb	100	26	None	0
New Fill Soils	■	115	Mohr-Coulomb	0	30	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.732

rocscience

SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 55+00 - Lower Slope - 3H:1V Inclination

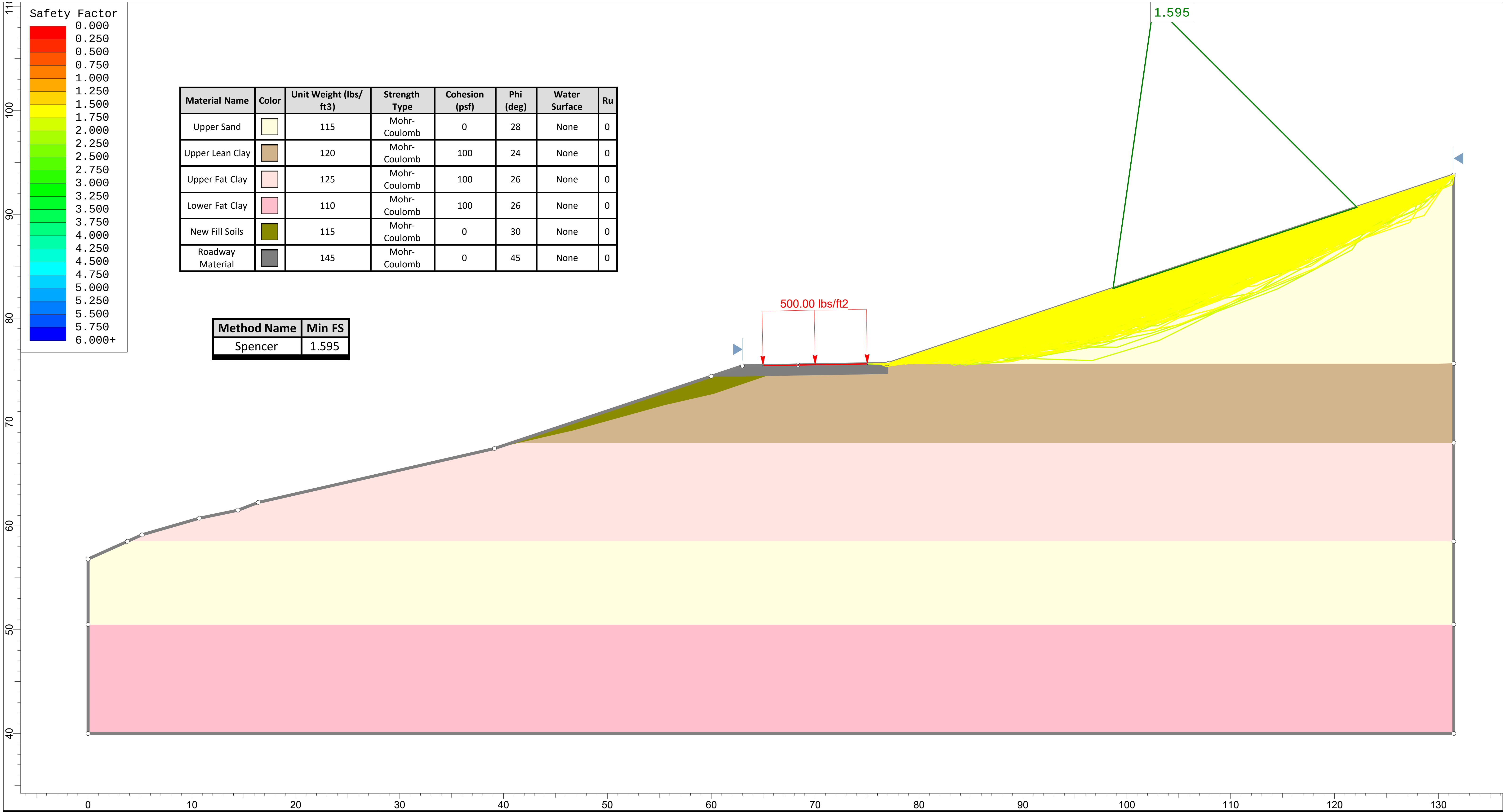
Drawn By	Jeremy Haley	*Company*	GEOServices
Date	12/3/2020	*File Name*	Slope Section 1.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 55+00

Upper Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	🟨	115	Mohr-Coulomb	0	28	None	0
Upper Lean Clay	🟫	120	Mohr-Coulomb	100	24	None	0
Upper Fat Clay	⬜	125	Mohr-Coulomb	100	26	None	0
Lower Fat Clay	🟥	110	Mohr-Coulomb	100	26	None	0
New Fill Soils	🟩	115	Mohr-Coulomb	0	30	None	0
Roadway Material	⬛	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.595

rocscience

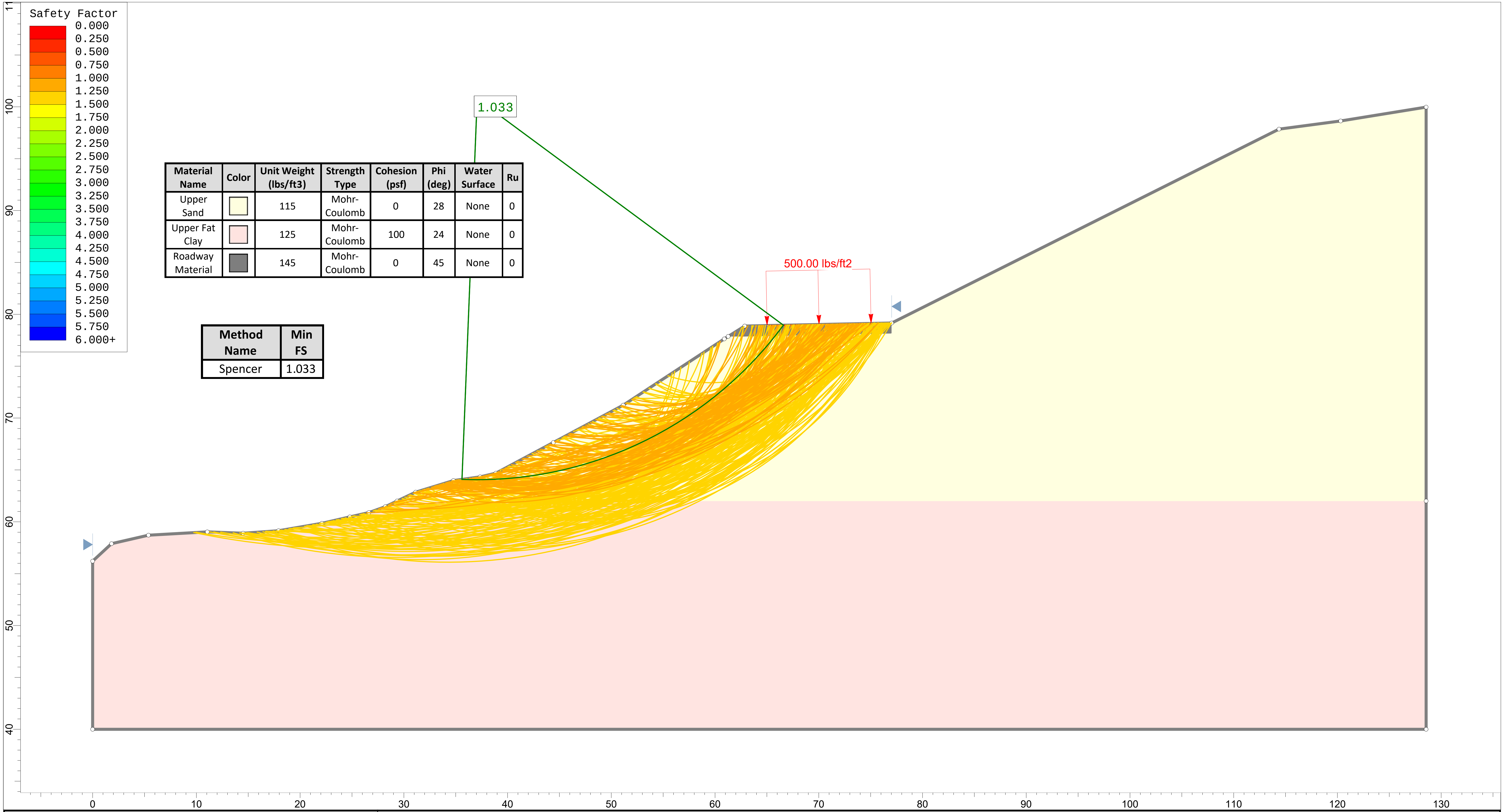
SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 55+00 - Upper Slope - 3H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 1.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 75+00

Lower Slope Proposed



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	☐	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	☐	125	Mohr-Coulomb	100	24	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.033

rocscience

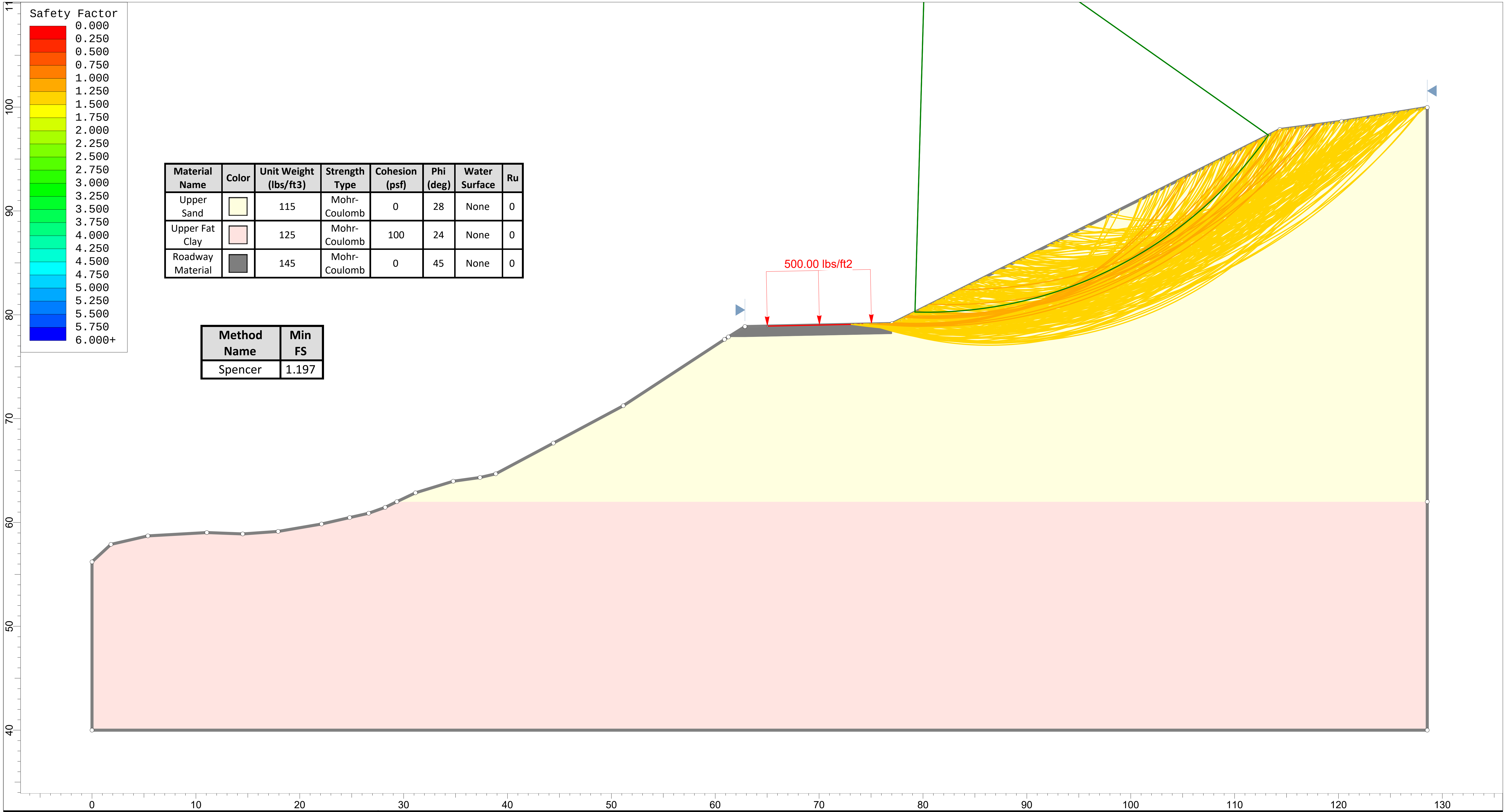
SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 75+00 - Lower Slope - 2H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 75+00

Upper Slope Proposed



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	□	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	□	125	Mohr-Coulomb	100	24	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.197

rocscience

SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 75+00 - Upper Slope - 2H:1V Inclination

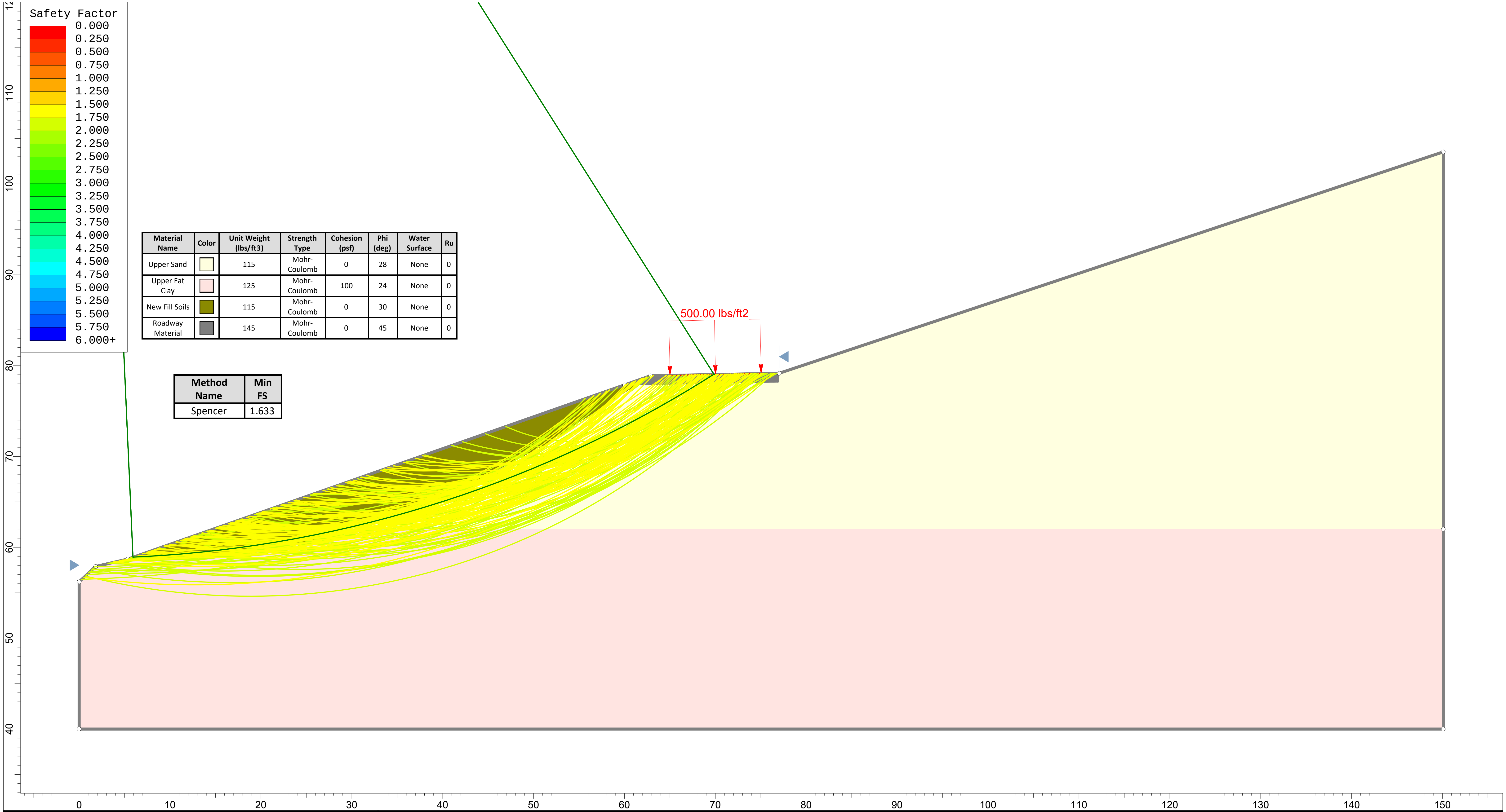
Drawn By	Jeremy Haley	*Company*	GEOServices
Date	12/3/2020	*File Name*	Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 75+00

Lower Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	■	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	■	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	■	115	Mohr-Coulomb	0	30	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.633

SLIDEINTERPRET 9.008

Project
Chemours Barrier Wall - Fayetteville, North Carolina

Analysis Description
Alternate 1 - Station 75+00 - Lower Slope - 3H:1V Inclination

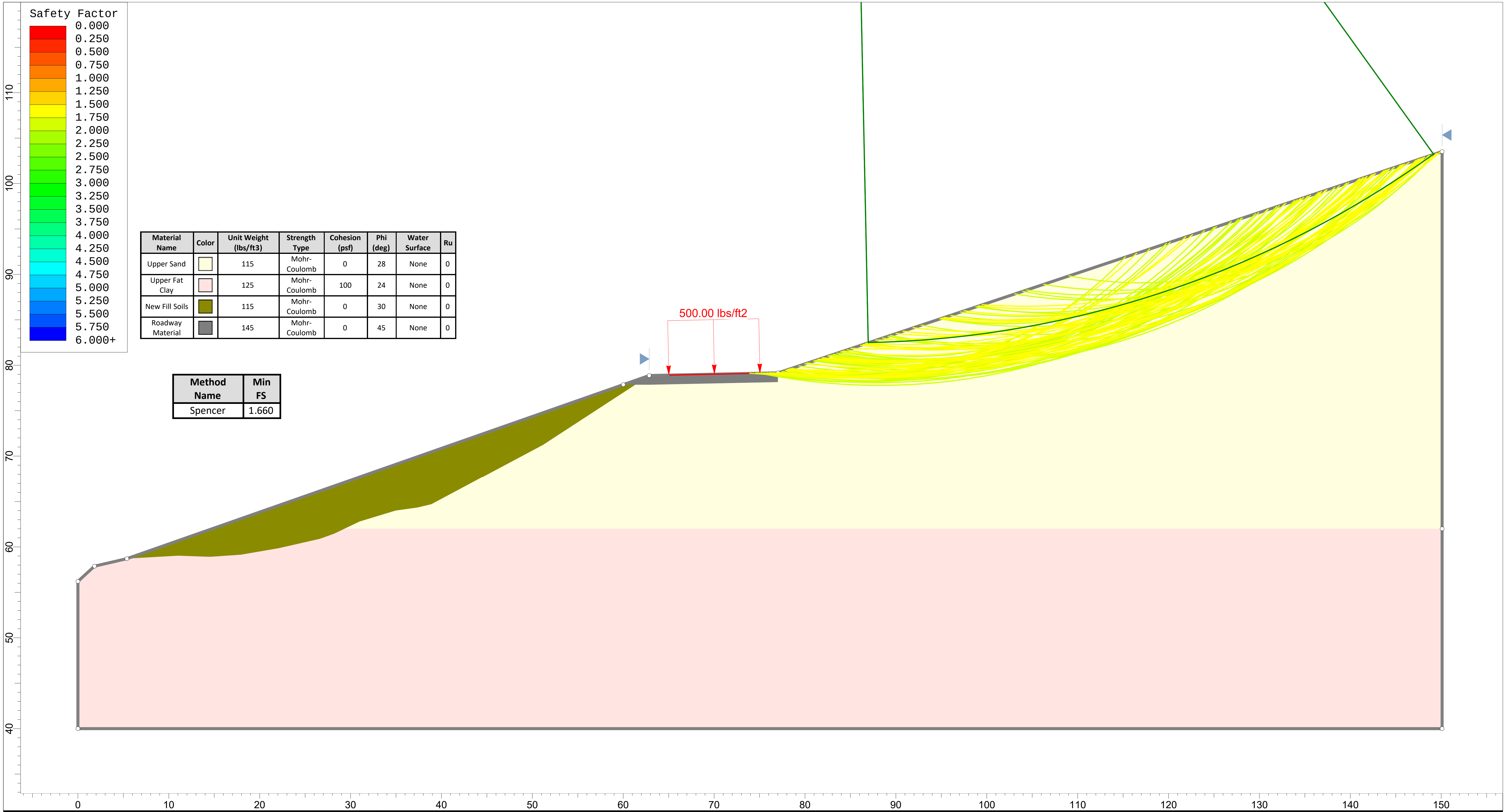
Drawn By	Jeremy Haley	*Company*	GEOServices
Date	12/3/2020	*File Name*	Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 75+00

Upper Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	🟨	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	🟥	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	🟫	115	Mohr-Coulomb	0	30	None	0
Roadway Material	⬛	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.660

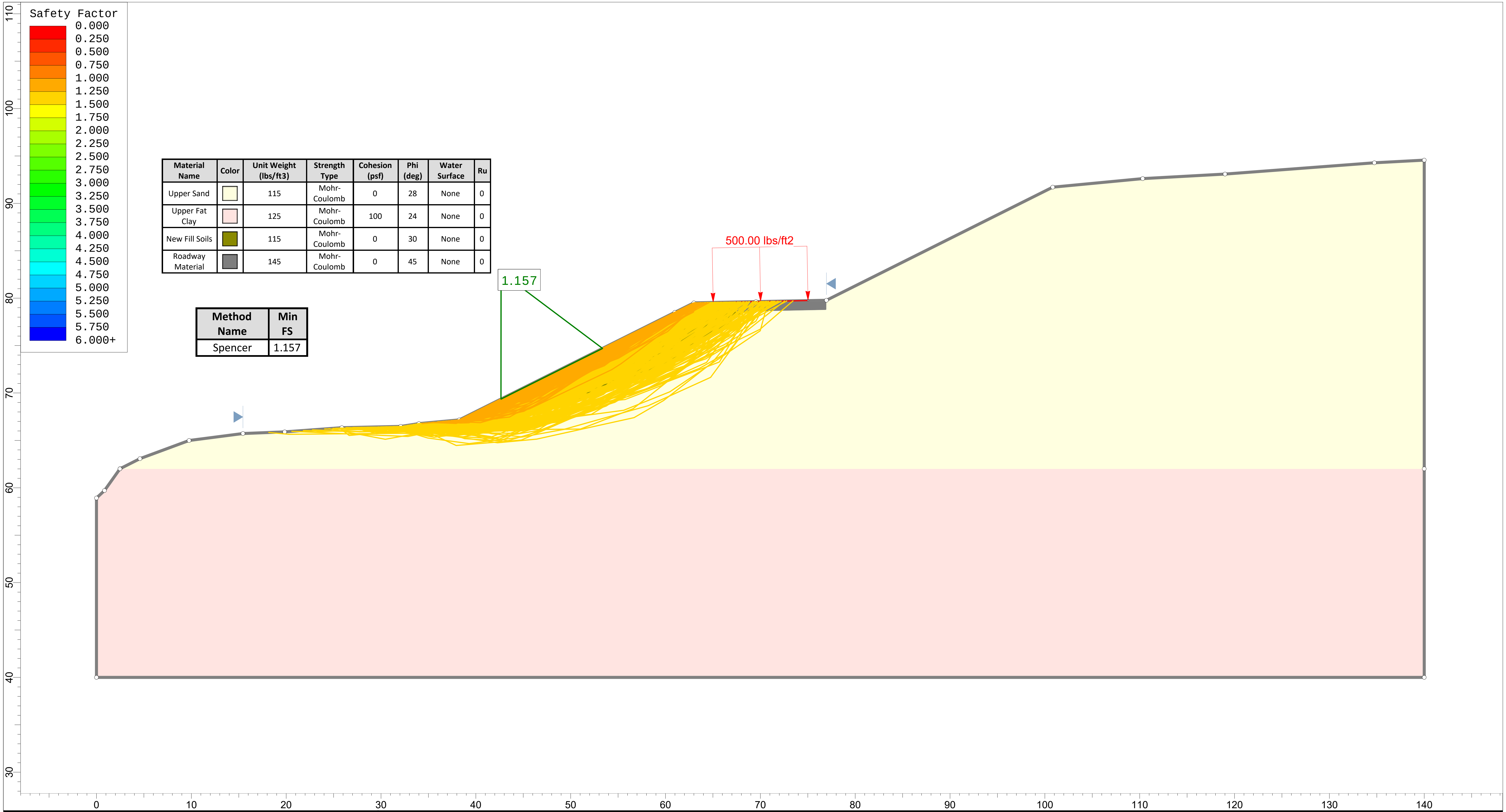
Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 75+00 - Upper Slope - 3H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 2 & 3.slmd

SLIDEINTERPRET 9.008

GEOServices, LLC, Geotechnical and Materials Engineers

Station 76+00

Lower Slope Proposed



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	⬜	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	⬜	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	🟫	115	Mohr-Coulomb	0	30	None	0
Roadway Material	⬛	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.157

rocscience

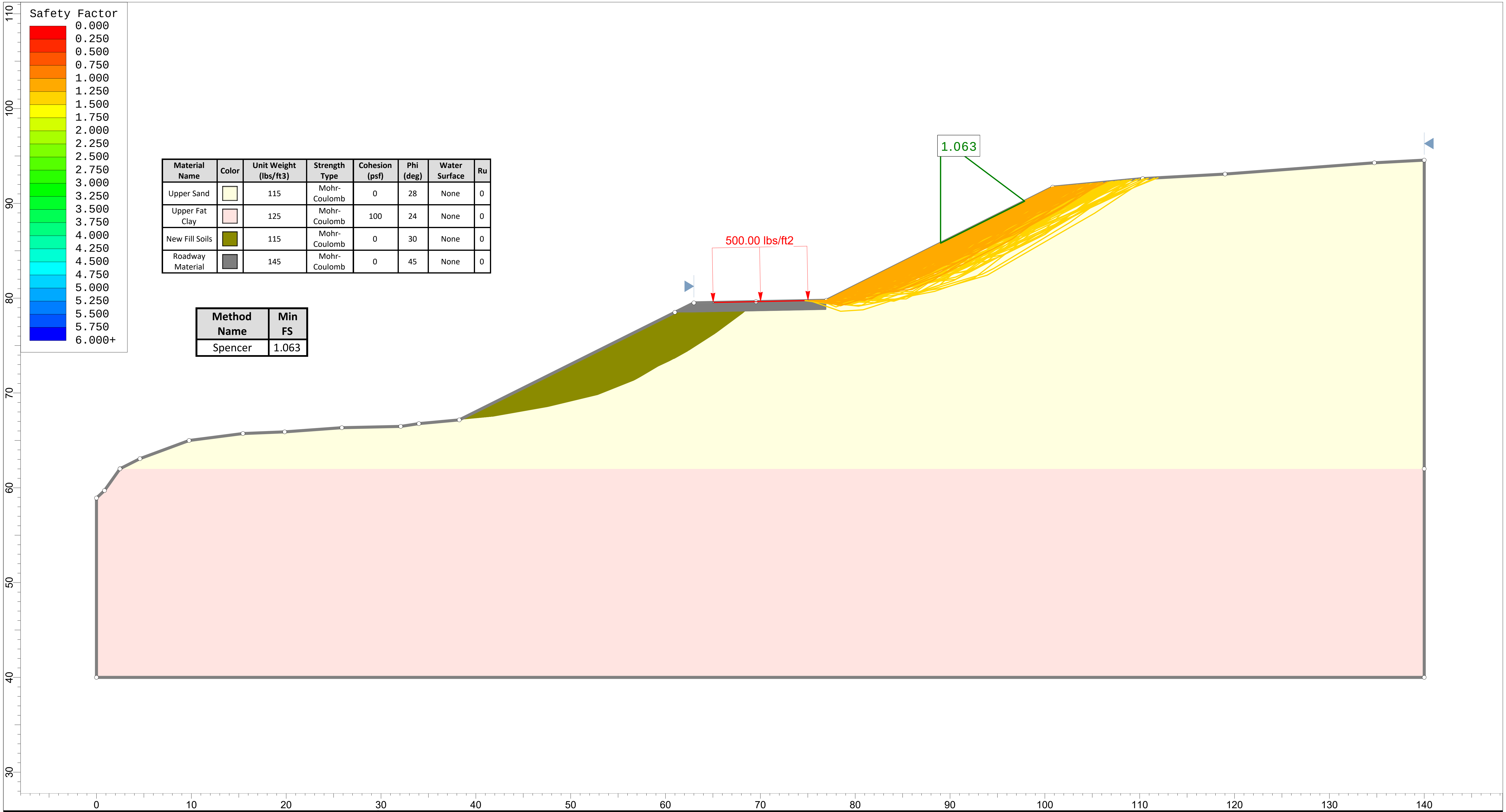
SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 76+00 - Lower Slope - 2H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 76+00

Upper Slope Proposed



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	▨	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	▨	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	▨	115	Mohr-Coulomb	0	30	None	0
Roadway Material	▨	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.063

rocscience

SLIDEINTERPRET 9.008

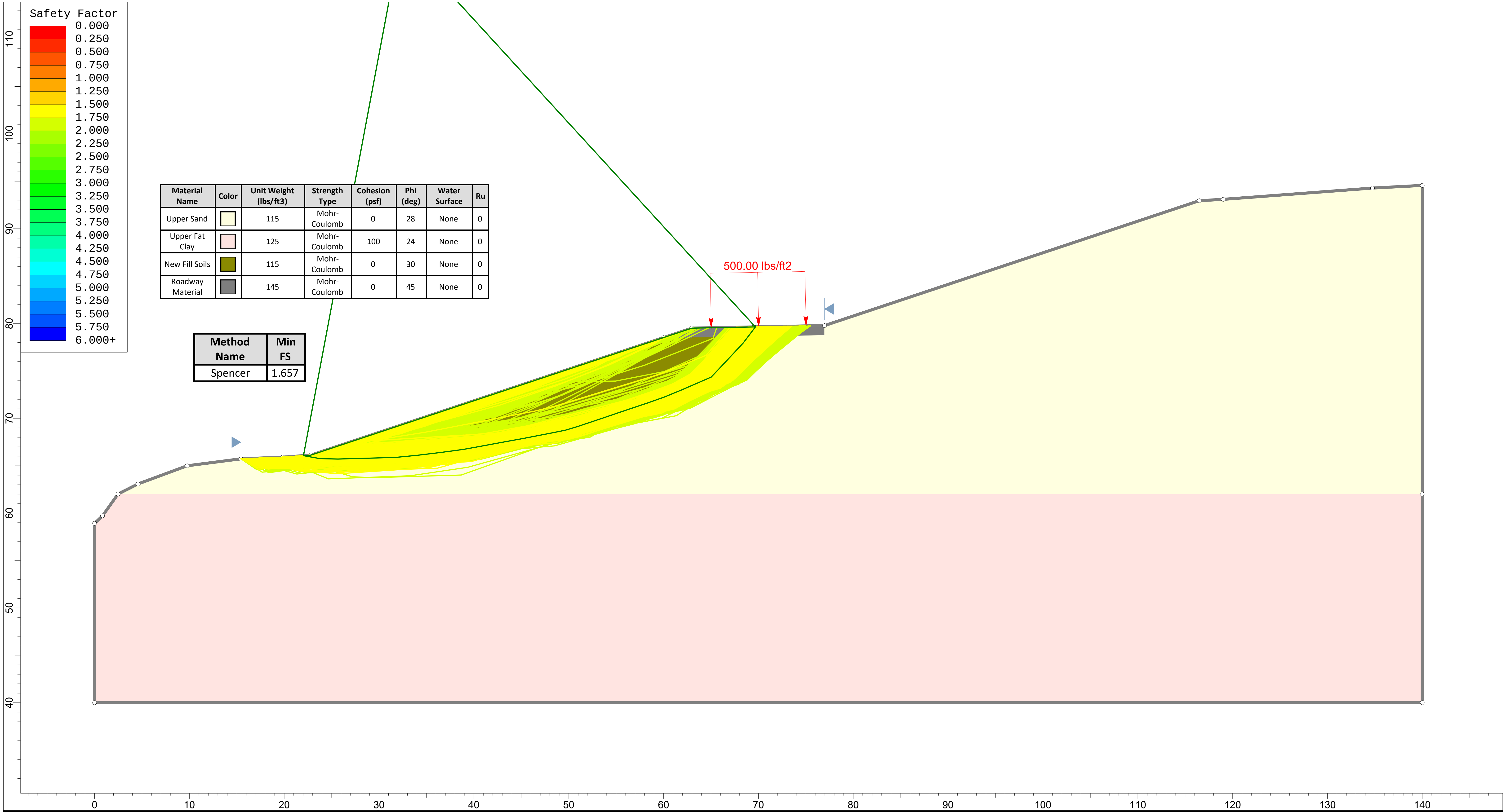
Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 76+00 - Upper Slope - 2H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 76+00

Lower Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	🟨	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	🟥	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	🟩	115	Mohr-Coulomb	0	30	None	0
Roadway Material	⬛	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.657

rocscience

SLIDEINTERPRET 9.008

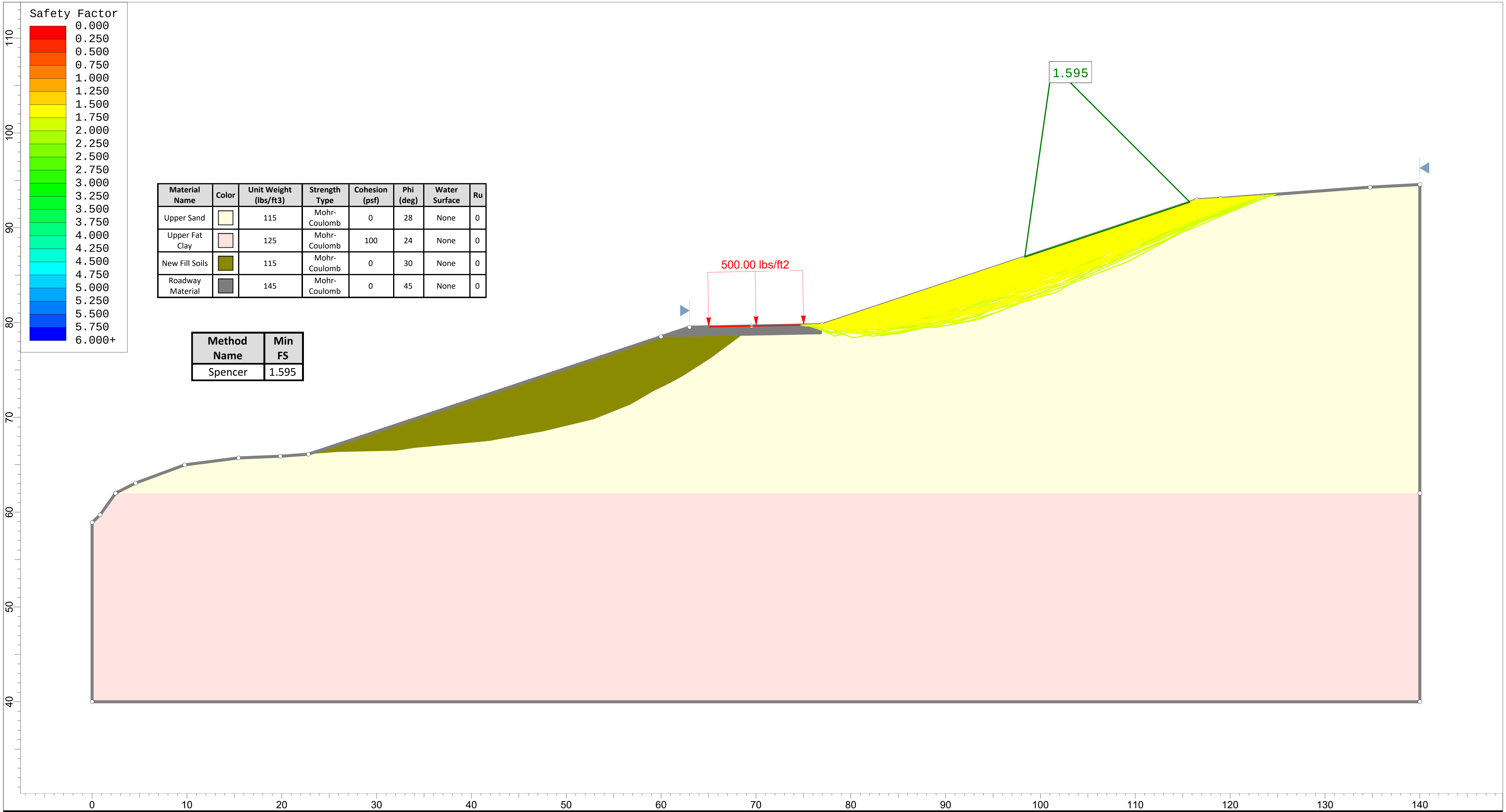
Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 76+00 - Lower Slope - 3H:1V Inclination
Drawn By Jeremy Haley	*Company* GEOServices
Date 12/3/2020	*File Name* Slope Section 2 & 3.slmd

GEOServices, LLC, Geotechnical and Materials Engineers

Station 76+00

Upper Slope Proposed

(3H:1V)



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Upper Sand	■	115	Mohr-Coulomb	0	28	None	0
Upper Fat Clay	■	125	Mohr-Coulomb	100	24	None	0
New Fill Soils	■	115	Mohr-Coulomb	0	30	None	0
Roadway Material	■	145	Mohr-Coulomb	0	45	None	0

Method Name	Min FS
Spencer	1.595

rocscience

SLIDEINTERPRET 9.008

Project	Chemours Barrier Wall - Fayetteville, North Carolina
Analysis Description	Alternate 1 - Station 76+00 - Upper Slope - 3H:1V Inclination
Drawn By	Jeremy Haley
Company	GEOServices
Date	12/3/2020
File Name	Slope Section 2 & 3.slmd

Draft For Discussion
CONFIDENTIAL -- ATTORNEY CLIENT PRIVILEGED –
ATTORNEY WORK PRODUCT

Geotechnical, Environmental and Materials Engineers

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Appendix E
Investigation Derived Waste

TABLE E1
PDI DRILLING INVESTIGATION DERIVED WASTE
Chemours Fayetteville Works, North Carolinaa

Drum Count	Contents	Location of Staged Drums	Associated Event/Date	Correspondence and Notes
1	100% soil cuttings	Graveled laydown area near Quality Carriers truck parking	PDI Well Installation 10/2020	Labeled and prepped for processing.
2	100% soil cuttings			
3	100% soil cuttings			
4	100% soil cuttings			
5	100% soil cuttings			
6	100% soil cuttings			
7	100% soil cuttings			
8	100% soil cuttings			
9	100% soil cuttings			
10	100% soil cuttings			
11	100% soil cuttings			
12	100% soil cuttings			
13	100% soil cuttings			
14	100% soil cuttings			
15	100% soil cuttings			
16	100% soil cuttings			
17	100% soil cuttings			
18	100% soil cuttings			
19	100% soil cuttings			
20	100% drilling fluid/mud			
21	100% drilling fluid/mud			
22	100% drilling fluid/mud			
23	100% drilling fluid/mud			
24	100% drilling fluid/mud			
25	100% drilling fluid/mud			
26	100% drilling fluid/mud			
27	100% drilling fluid/mud			
28	100% drilling fluid/mud			
29	100% drilling fluid/mud			
30	100% drilling fluid/mud			
31	100% drilling fluid/mud			
32	100% drilling fluid/mud			
33	100% drilling fluid/mud			
34	100% drilling fluid/mud			
35	100% drilling fluid/mud			
36	100% drilling fluid/mud			
37	100% drilling fluid/mud			
38	100% drilling fluid/mud			
39	100% drilling fluid/mud			
40	100% drilling fluid/mud			
41	100% drilling fluid/mud			
42	100% drilling fluid/mud			
43	100% drilling fluid/mud			
44	100% drilling fluid/mud			
45	100% drilling fluid/mud			
46	100% drilling fluid/mud			
47	100% drilling fluid/mud			
48	100% drilling fluid/mud			
49	100% drilling fluid/mud			
50	100% drilling fluid/mud			
51	100% drilling fluid/mud			
52	100% drilling fluid/mud			
53	100% drilling fluid/mud			
54	100% drilling fluid/mud			
55	100% drilling fluid/mud			
56	100% drilling fluid/mud			
57	100% drilling fluid/mud			
58	100% drilling fluid/mud			
59	100% drilling fluid/mud			
60	100% drilling fluid/mud			
61	100% drilling fluid/mud			
62	100% drilling fluid/mud			
63	100% drilling fluid/mud			
64	100% drilling fluid/mud			
65	100% drilling fluid/mud			
66	100% drilling fluid/mud			
67	100% drilling fluid/mud			
68	100% drilling fluid/mud			

TABLE E1
PDI DRILLING INVESTIGATION DERIVED WASTE
Chemours Fayetteville Works, North Carolinaa

Drum Count	Contents	Location of Staged Drums	Associated Event/Date	Correspondence and Notes
69	100% drilling fluid/mud	Graveled laydown area near Quality Carriers truck parking	PDI Well Installation 10/2020	Labeled and prepped for processing.
70	100% drilling fluid/mud			
71	100% drilling fluid/mud			
72	100% drilling fluid/mud			
73	100% drilling fluid/mud			
74	100% drilling fluid/mud			
75	100% drilling fluid/mud			
76	100% drilling fluid/mud			
77	100% drilling fluid/mud			
78	100% drilling fluid/mud			
79	100% drilling fluid/mud			
80	100% drilling fluid/mud			
81	100% drilling fluid/mud			
82	100% drilling fluid/mud			
83	100% drilling fluid/mud			
84	100% drilling fluid/mud			
85	100% drilling fluid/mud			
86	100% drilling fluid/mud			
87	100% drilling fluid/mud			
88	100% drilling fluid/mud			
89	100% drilling fluid/mud			
90	100% drilling fluid/mud			
91	100% drilling fluid/mud			
92	100% drilling fluid/mud			
93	100% drilling fluid/mud			
94	100% drilling fluid/mud			
95	100% drilling fluid/mud			
96	100% drilling fluid/mud			
97	100% drilling fluid/mud			
98	100% drilling fluid/mud			
99	100% drilling fluid/mud			
100	100% drilling fluid/mud			
101	100% drilling fluid/mud			
102	100% drilling fluid/mud			
103	100% drilling fluid/mud			
104	100% drilling fluid/mud			
105	100% drilling fluid/mud			
106	100% drilling fluid/mud			
107	100% drilling fluid/mud			
108	100% drilling fluid/mud			
109	100% drilling fluid/mud			
110	100% drilling fluid/mud			
111	100% drilling fluid/mud			
112	100% drilling fluid/mud			
113	100% drilling fluid/mud			
114	100% drilling fluid/mud			
115	100% drilling fluid/mud			
116	100% drilling fluid/mud			
117	100% drilling fluid/mud			
118	100% drilling fluid/mud			
119	100% drilling fluid/mud			
120	100% drilling fluid/mud			
121	100% drilling fluid/mud			
122	100% soil cuttings			
123	100% soil cuttings			
124	100% soil cuttings			
125	100% soil cuttings			
126	100% soil cuttings			
127	100% soil cuttings			
128	100% drilling fluid/mud			
129	100% drilling fluid/mud			
130	100% drilling fluid/mud			
131	100% drilling fluid/mud			
132	100% drilling fluid/mud			
133	100% drilling fluid/mud			
134	100% drilling fluid/mud			
135	100% drilling fluid/mud			
136	100% drilling fluid/mud			
137	100% drilling fluid/mud			
138	100% drilling fluid/mud			
139	100% drilling fluid/mud			
140	100% drilling fluid/mud			
141	100% drilling fluid/mud			
142	100% drilling fluid/mud			
143	100% drilling fluid/mud			

TABLE E1
PDI DRILLING INVESTIGATION DERIVED WASTE
Chemours Fayetteville Works, North Carolinaa

Drum Count	Contents	Location of Staged Drums	Associated Event/Date	Correspondence and Notes
144	100% drilling fluid/mud	Staging area near planned cutoff wall alignment	PDI Geotechnical Refinement March 2021	Labeled and prepped for processing.
145	100% drilling fluid/mud			
146	100% drilling fluid/mud			
147	100% drilling fluid/mud			
148	100% slurry			
149	100% slurry			
150	100% slurry			
151	100% slurry			
152	100% slurry			
153	100% slurry			
154	100% slurry			
155	100% slurry			
156	100% slurry			
157	100% slurry			
158	100% slurry			
159	100% slurry			
160	100% slurry			
161	100% slurry			
162	100% slurry			
163	100% slurry			
164	100% slurry			
165	100% slurry			
166	100% slurry			
167	100% slurry			
168	100% slurry			
169	100% slurry			
170	100% slurry			
171	100% slurry			
172	100% slurry			
Estimated an additional 30 drums	100% slurry	Staging area near planned cutoff wall alignment	PDI Geotechnical Refinement April 2021	Labeled and prepped for processing.

TABLE E2
PDI GROUNDWATER
INVESTIGATION DERIVED WASTE
Chemours Fayetteville Works, North Carolina

Groundwater Investigation Derived Waste Tranferred to Treatment System			
Source	Date Discharged to Treatment System	Number of Loads Transferred	Estimated Volume (gallons)
EW-2	11/19/2020	15	45,000
EW-2	11/20/2020	8	24,000
EW-2	11/30/2020	3	9,000
EW-2	12/1/2020	2	6,000
EW-1	12/3/2020	1	3,000
EW-3	12/3/2020	3	9,000
Ew-3	12/7/2020	1	3,000
EW-4	12/7/2020	1	3,000
EW-4	12/9/2020	1	3,000
EW-4	12/10/2020	5	15,000
EW-4	12/11/2020	5	15,000
EW-1	12/14/2020	5	15,000
EW-2	12/14/2020	9	27,000
EW-2	12/15/2020	2	5,600
Offsite Poly Tank	12/22/2020	2	6,000
Total Estimated Discharge to Treatment System			188,600

Notes

1. Groundwater IDW derived from well development, low flow sampling, and aquifer testing.
2. Volumes are estimated by the vacuum truck operator.

Appendix F
Perfluoroheptanoic Acid Results

TABLE F1
GROUNDWATER AND SURFACE WATER PFHPA RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	PIW-11	PIW-12	PIW-13	PIW-14	PIW-15	PIW-16D	PIW-16D	PIW-16S
Field Sample ID	PIW-11-20200929	PIW-12-20201001	PIW-13-20201001	PIW-14-20201118	PIW-15-20201002	PIW-16D-20200928	DUP-1-20200928	PIW-16S-20200928
Sample Date	9/29/2020	10/1/2020	10/1/2020	11/18/2020	10/2/2020	9/28/2020	9/28/2020	9/28/2020
QA/QC							Field duplicate	
Sample Matrix	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Sample Delivery Group (SDG)	280-141161-1	280-141161-1	280-141161-1	320-67054-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1
Lab Sample ID	280-141161-5	280-141161-6	280-141161-7	320-67054-2	280-141161-20	280-141161-2	280-141161-19	280-141161-1
PFHpA	**3.1 B**	**4.8 B**	**4.3 B**	<9.4	<9.4	**2.9 B**	**2.3 B**	**13 B**

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	WC-1	WC-2	WC-2	WC-IP-1	WC-IP-2	WC-IP-3	WC-IP-4	EB
Field Sample ID	WC-1-20200930	WC-2-20200930	SW-DUP-1-20200930	WC-IP-1-20200930	WC-IP-2-20200930	WC-IP-3-20200930	WC-IP-4-20200930	EQBLK-1-20200929
Sample Date	9/30/2020	9/30/2020	9/30/2020	9/30/2020	9/30/2020	9/30/2020	9/30/2020	9/29/2020
QA/QC			Field duplicate					Equipment Blank
Sample Matrix	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Sample Delivery Group (SDG)	280-141161-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1
Lab Sample ID	280-141161-13	280-141161-14	280-141161-10	280-141161-15	280-141161-16	280-141161-17	280-141161-18	280-141161-4
PFHpA	**4.8 B**	**4.9 B**	**4.4 B**	**3.8 B**	**5.4 B**	**4.6 B**	**4.5 B**	**3.3**

Sampling Program	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**	**CSM Groundwater Sampling**
Location ID	EB	FBLK	FBLK	FBLK	FBLK	FBLK
Field Sample ID	EQBLK-SW-1-20200930	FBLK-GW-1-20200928	FBLK-SW-1-20200930	FBLK-GW-2-20201001	FBLK-GW-3-20201002	FBLK-20201118
Sample Date	9/30/2020	9/28/2020	9/30/2020	10/1/2020	10/2/2020	11/18/2020
QA/QC	Equipment Blank	Field Blank	Field Blank	Field Blank	Field Blank	Field Blank
Sample Matrix	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Sample Delivery Group (SDG)	280-141161-1	280-141161-1	280-141161-1	280-141161-1	280-141161-1	320-67054-1
Lab Sample ID	280-141161-11	280-141161-3	280-141161-12	280-141161-8	280-141161-9	320-67054-1
PFHpA	**2.3**	**2.3**	**3.1**	**2.7**	**3.3**	<2

Notes:

Bold - Analyte detected above associated reporting limit

PFHpA - Perfluoroheptanoic Acid

B - Not detected substantially above the level reported in the laboratory or field blanks.

ng/L - nanogram per liter

QA/QC - Quality assurance/ quality control

< - Analyte not detected above associated reporting limit

TABLE F2
PFM RESIN PFHPA RESULTS
Chemours Fayetteville Works, North Carolina

Sampling Program	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**
Location ID	**PIW-10DR**	**PIW-11**	**PIW-12**	**PIW-13**	**PIW-14**	**PIW-15**	**PIW-15**	**PIW-1D**	**PIW-2D**
Field Sample ID	**PIW-10DR-48-58-R**	**PIW-11-47-57-R**	**PIW-12-64-74-R**	**PIW-13-54-64-R**	**PIW-14-56-66-R**	**PIW-15-34-44-R**	**DUP-1R**	**PIW-1D-25-30-R**	**PIW-2D-40-50-R**
Sample Date	**10/21/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**48-58**	**47-57**	**64-74**	**54-64**	**56-66**	**34-44**	**34-44**	**25-30**	**40-50**
QA/QC							**Field duplicate**		
Sample Matrix	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**
Sample Type	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-1**	**280-141986-14**	**280-141986-15**	**280-141986-16**	**280-141986-11**	**280-141986-17**	**280-141986-18**	**280-141986-13**	**280-141986-12**
PFHpA	<10,000	<1,000	<1,000	<1,000	<1,000	<11,000	<10,000	<12,000	<1,000

Sampling Program	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**	**PFM Sampling**
Location ID	**PIW-3D**	**PIW-4D**	**PIW-6S**	**PIW-7D**	**PIW-7S**	**PIW-8D**	**PIW-9D**	**PW-10R**	**PW-11**
Field Sample ID	**PIW-3D-20-25-R**	**PIW-4D-32-37-R**	**PIW-6S-18-28-R**	**PIW-7D-29-34-R**	**PIW-7S-7-17-R**	**PIW-8D-35-40-R**	**PIW-9D-40-45-R**	**PW-10R-57-67-R**	**PW-11-54-64-R**
Sample Date	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/22/2020**	**10/21/2020**	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**20-25**	**32-37**	**18-28**	**29-34**	**7-17**		**40-45**	**57-67**	**54-64**
QA/QC									
Sample Matrix	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**	**Solid**
Sample Type	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**	**Resin**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-10**	**280-141986-9**	**280-141986-8**	**280-141986-4**	**280-141986-5**	**280-141986-3**	**280-141986-2**	**280-141986-6**	**280-141986-7**
PFHpA	<13,000	<1,000	<30,000	<49,000	<32,000	<73,000	<11,000	<58,000	<29,000

Sampling Program	**PFM Sampling**	**PFM Sampling**
Location ID	**Blank Resin**	**FBLK**
Field Sample ID	**Blank Resin-102220**	**PFM-Field blank**
Sample Date	**10/22/2020**	**10/22/2020**
Sample Depth (ft bgs)	**-**	**-**
QA/QC	**Field Blank**	**Field Blank**
Sample Matrix	**Solid**	**Liquid**
Sample Type	**Resin**	**Liquid**
Sample Delivery Group (SDG)	**280-141986-1**	**280-141986-1**
Lab Sample ID	**280-141986-20**	**280-141986-19**
PFHpA	<1,000	<2

Notes:

PFHpA - Perfluoroheptanoic Acid

ng/kg - nanogram per kilogram

ng/L - nanogram per liter

QA/QC - Quality assurance/ quality control

< - Analyte not detected above associated reporting limit

Appendix G
Laboratory Reports and DVM Narrative Reports

Laboratory Reports were provided via a shared OneDrive file to NCDEQ

ADQM Data Review

Site: Fayetteville

Project: PFM Sampling

Project Reviewer: Michael Aucoin

Sampling Date(s): October 21 – 22, 2020

Analytical Protocol

Laboratory	Method	Parameters
TestAmerica Sacramento	Cl. Spec. Table 3 Compound SOP	21 compounds incl HFPO-DA
TestAmerica Sacramento	D2216-90	Percent Moisture/Solids

ADQM Data Review Checklist

Item	Description	Yes	No*	DVM Narrative Report	Laboratory Report	Exception Report (ER) #
A	Did samples meet method acceptability requirements upon receipt at the laboratory (i.e., temperature, preservation, headspace, broken bottles)?	X				
B	Were samples received by the laboratory in agreement with the associated chain of custody?	X				
C	Was the chain of custody properly completed by the field team?	X				
D	Were all samples prepped/analyzed within method holding times?		X	X		
E	Were method QA/QC criteria met by the laboratory for all samples (i.e., blanks, LCSs/LCSDs, MSs/MSDs, PDSs, SDs, duplicates/replicates, surrogates, total/dissolved differences, dual column RPDs)	X				
F	Were all field/equipment/trip blanks (if collected) detected at levels not requiring sample data qualification?	X				
G	Were all reported results within the laboratory's calibration range?	X				

ER#	Description

Other QA/QC Items to Note: The dry weight corrected detects were manually qualified J as estimated because the associated percent moisture/solids analysis was performed beyond hold time.

The DVM Narrative report is attached. The lab reports due to a large page count are stored on a network shared drive and are available to be posted on external shared drives, or on a flash drive.

* See DVM Narrative Report, Lab Report, or ER # for further details as indicated.

Data Verification Module (DVM)

The DVM is an internal review process used by the ADQM group to assist with the determination of data usability. The electronic data deliverables received from the laboratory are loaded into the Locus EIM™ database and processed through a series of data quality checks, which are a combination of software (Locus EIM™ database Data Verification Module (DVM)) and manual reviewer evaluations. The data is evaluated against the following data usability checks:

- Field and laboratory blank contamination
- US EPA hold time criteria
- Missing Quality Control (QC) samples
- Matrix spike (MS)/matrix spike duplicate (MSD) recoveries and the relative percent differences (RPDs) between these spikes
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) recoveries and the RPD between these spikes
- Surrogate spike recoveries for organic analyses
- Difference/RPD between field duplicate sample pairs
- RPD between laboratory replicates for inorganic analyses
- Difference/percent difference between total and dissolved sample pairs.

There are two qualifier fields in EIM:

Lab Qualifier is the qualifier assigned by the lab and may not reflect the usability of the data. This qualifier may have many different meanings and can vary between labs and over time within the same lab. Please refer to the laboratory report for a description of the lab qualifiers. As they are lab descriptors they are not to be used when evaluating the data.

Validation Qualifier is the 3rd party formal validation qualifier if this was performed. Otherwise this field contains the qualifier resulting from the ADQM DVM review process. This qualifier assesses the usability of the data and may not equal the lab qualifier. The DVM applies the following data evaluation qualifiers to analysis results, as warranted:

Qualifier	**Definition**
B	Not detected substantially above the level reported in the laboratory or field blanks.
R	Unusable result. Analyte may or may not be present in the sample.
J	Analyte present. Reported value may not be accurate or precise.
UJ	Not detected. Reporting limit may not be accurate or precise.

The **Validation Status Code** field is set to “DVM” if the ADQM DVM process has been performed. If the DVM has not been run, the field will be blank.

If the DVM has been run (**Validation Status Code** equals “DVM”), use the **Validation Qualifier.**

If the data has been validated by a third party, the field **“Validated By”** will be set to the validator (e.g., ESI for Environmental Standards, Inc.).

DVM Narrative Report

Site: Fayetteville **Sampling Program:** PFM SAMPLING **Validation Options:** LABSTATS

Validation Reason The analysis hold time for this sample was exceeded. The reported result may be biased low.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
Blank Resin-102220	10/22/2020	280-141986-20	Percent Moisture	56.7	%	PQL		0.1	J	D2216-90		
Blank Resin-102220	10/22/2020	280-141986-20	Percent Solids	43.3	%	PQL		0.1	J	D2216-90		
DUP-1R	10/22/2020	280-141986-18	Percent Moisture	61.3	%	PQL		0.1	J	D2216-90		
DUP-1R	10/22/2020	280-141986-18	Percent Solids	38.7	%	PQL		0.1	J	D2216-90		
PIW-10DR-48-58-R	10/21/2020	280-141986-1	Percent Moisture	63.9	%	PQL		0.1	J	D2216-90		
PIW-10DR-48-58-R	10/21/2020	280-141986-1	Percent Solids	36.1	%	PQL		0.1	J	D2216-90		
PIW-11-47-57-R	10/22/2020	280-141986-14	Percent Moisture	66.1	%	PQL		0.1	J	D2216-90		
PIW-11-47-57-R	10/22/2020	280-141986-14	Percent Solids	33.9	%	PQL		0.1	J	D2216-90		
PIW-12-64-74-R	10/22/2020	280-141986-15	Percent Moisture	69.1	%	PQL		0.1	J	D2216-90		
PIW-12-64-74-R	10/22/2020	280-141986-15	Percent Solids	30.9	%	PQL		0.1	J	D2216-90		
PIW-13-54-64-R	10/22/2020	280-141986-16	Percent Moisture	66.8	%	PQL		0.1	J	D2216-90		
PIW-13-54-64-R	10/22/2020	280-141986-16	Percent Solids	33.2	%	PQL		0.1	J	D2216-90		
PIW-14-56-66-R	10/22/2020	280-141986-11	Percent Moisture	68.1	%	PQL		0.1	J	D2216-90		
PIW-14-56-66-R	10/22/2020	280-141986-11	Percent Solids	31.9	%	PQL		0.1	J	D2216-90		
PIW-15-34-44-R	10/22/2020	280-141986-17	Percent Moisture	62.1	%	PQL		0.1	J	D2216-90		
PIW-15-34-44-R	10/22/2020	280-141986-17	Percent Solids	37.9	%	PQL		0.1	J	D2216-90		
PIW-1D-25-30-R	10/22/2020	280-141986-13	Percent Moisture	66.9	%	PQL		0.1	J	D2216-90		
PIW-1D-25-30-R	10/22/2020	280-141986-13	Percent Solids	33.1	%	PQL		0.1	J	D2216-90		
PIW-2D-40-50-R	10/22/2020	280-141986-12	Percent Moisture	66.1	%	PQL		0.1	J	D2216-90		
PIW-2D-40-50-R	10/22/2020	280-141986-12	Percent Solids	33.9	%	PQL		0.1	J	D2216-90		
PIW-3D-20-25-R	10/22/2020	280-141986-10	Percent Moisture	70.3	%	PQL		0.1	J	D2216-90		
PIW-3D-20-25-R	10/22/2020	280-141986-10	Percent Solids	29.7	%	PQL		0.1	J	D2216-90		

Site: Fayetteville **Sampling Program:** PFM SAMPLING **Validation Options:** LABSTATS

Validation Reason The analysis hold time for this sample was exceeded. The reported result may be biased low.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
PIW-4D-32-37-R	10/22/2020	280-141986-9	Percent Moisture	71.6	%	PQL		0.1	J	D2216-90		
PIW-4D-32-37-R	10/22/2020	280-141986-9	Percent Solids	28.4	%	PQL		0.1	J	D2216-90		
PIW-6S-18-28-R	10/22/2020	280-141986-8	Percent Moisture	65.3	%	PQL		0.1	J	D2216-90		
PIW-6S-18-28-R	10/22/2020	280-141986-8	Percent Solids	34.7	%	PQL		0.1	J	D2216-90		
PIW-7D-29-34-R	10/22/2020	280-141986-4	Percent Moisture	72.1	%	PQL		0.1	J	D2216-90		
PIW-7D-29-34-R	10/22/2020	280-141986-4	Percent Solids	27.9	%	PQL		0.1	J	D2216-90		
PIW-7S-7-17-R	10/22/2020	280-141986-5	Percent Moisture	65.4	%	PQL		0.1	J	D2216-90		
PIW-7S-7-17-R	10/22/2020	280-141986-5	Percent Solids	34.6	%	PQL		0.1	J	D2216-90		
PIW-8D-35-40-R	10/22/2020	280-141986-3	Percent Moisture	68.7	%	PQL		0.1	J	D2216-90		
PIW-8D-35-40-R	10/22/2020	280-141986-3	Percent Solids	31.3	%	PQL		0.1	J	D2216-90		
PIW-9D-40-45-R	10/21/2020	280-141986-2	Percent Moisture	65.9	%	PQL		0.1	J	D2216-90		
PIW-9D-40-45-R	10/21/2020	280-141986-2	Percent Solids	34.1	%	PQL		0.1	J	D2216-90		
PW-10R-57-67-R	10/22/2020	280-141986-6	Percent Moisture	68.5	%	PQL		0.1	J	D2216-90		
PW-10R-57-67-R	10/22/2020	280-141986-6	Percent Solids	31.5	%	PQL		0.1	J	D2216-90		
PW-11-54-64-R	10/22/2020	280-141986-7	Percent Moisture	64.0	%	PQL		0.1	J	D2216-90		
PW-11-54-64-R	10/22/2020	280-141986-7	Percent Solids	36.0	%	PQL		0.1	J	D2216-90		

ADQM Data Review

Site: Fayetteville

Project: CSM Groundwater Sampling

Project Reviewer: Michael Aucoin

Sampling Date(s): September 28 – 30, 2020

October 1 – 2, 2020

November 18, 2020

Analytical Protocol

Laboratory	Method	Parameters
TestAmerica Sacramento	Cl. Spec. Table 3 Compound SOP	21 compounds incl HFPO-DA
TestAmerica Sacramento	Chemours(TB6)	6 compounds

ADQM Data Review Checklist

Item	Description	Yes	No*	DVM Narrative Report	Laboratory Report	Exception Report (ER) #
A	Did samples meet method acceptability requirements upon receipt at the laboratory (i.e., temperature, preservation, headspace, broken bottles)?	X				
B	Were samples received by the laboratory in agreement with the associated chain of custody?	X				
C	Was the chain of custody properly completed by the field team?	X				
D	Were all samples prepped/analyzed within method holding times?	X				
E	Were method QA/QC criteria met by the laboratory for all samples (i.e., blanks, LCSs/LCSDs, MSs/MSDs, PDSs, SDs, duplicates/replicates, surrogates, total/dissolved differences, dual column RPDs)		X	X		
F	Were all field/equipment/trip blanks (if collected) detected at levels not requiring sample data qualification?		X	X		
G	Were all reported results within the laboratory's calibration range?	X				

ER#	**Description**

Other QA/QC Items to Note: The lab reports due to a large page count are stored on a network shared drive and are available to be posted on external shared drives, or on a flash drive.

* See DVM Narrative Report, Lab Report, or ER # for further details as indicated.

Data Verification Module (DVM)

The DVM is an internal review process used by the ADQM group to assist with the determination of data usability. The electronic data deliverables received from the laboratory are loaded into the Locus EIM™ database and processed through a series of data quality checks, which are a combination of software (Locus EIM™ database Data Verification Module (DVM)) and manual reviewer evaluations. The data is evaluated against the following data usability checks:

- Field and laboratory blank contamination
- US EPA hold time criteria
- Missing Quality Control (QC) samples
- Matrix spike (MS)/matrix spike duplicate (MSD) recoveries and the relative percent differences (RPDs) between these spikes
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) recoveries and the RPD between these spikes
- Surrogate spike recoveries for organic analyses
- Difference/RPD between field duplicate sample pairs
- RPD between laboratory replicates for inorganic analyses
- Difference/percent difference between total and dissolved sample pairs.

There are two qualifier fields in EIM:

Lab Qualifier is the qualifier assigned by the lab and may not reflect the usability of the data. This qualifier may have many different meanings and can vary between labs and over time within the same lab. Please refer to the laboratory report for a description of the lab qualifiers. As they are lab descriptors they are not to be used when evaluating the data.

Validation Qualifier is the 3rd party formal validation qualifier if this was performed. Otherwise this field contains the qualifier resulting from the ADQM DVM review process. This qualifier assesses the usability of the data and may not equal the lab qualifier. The DVM applies the following data evaluation qualifiers to analysis results, as warranted:

Qualifier	Definition
B	Not detected substantially above the level reported in the laboratory or field blanks.
R	Unusable result. Analyte may or may not be present in the sample.
J	Analyte present. Reported value may not be accurate or precise.
UJ	Not detected. Reporting limit may not be accurate or precise.

The **Validation Status Code** field is set to “DVM” if the ADQM DVM process has been performed. If the DVM has not been run, the field will be blank.

If the DVM has been run (**Validation Status Code** equals “DVM”), use the **Validation Qualifier.**

If the data has been validated by a third party, the field **“Validated By”** will be set to the validator (e.g., ESI for Environmental Standards, Inc.).

DVM Narrative Report

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

Validation Reason Contamination detected in Method Blank(s). Sample result does not differ significantly from the analyte concentration detected in the associated method blank(s).

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
DUP-1-20200928	09/28/2020	280-141161-19	Perfluoroheptanoic Acid	0.0023	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-11-20200929	09/29/2020	280-141161-5	Perfluoroheptanoic Acid	0.0031	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-12-20201001	10/01/2020	280-141161-6	Perfluoroheptanoic Acid	0.0048	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-13-20201001	10/01/2020	280-141161-7	Perfluoroheptanoic Acid	0.0043	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-16D-20200928	09/28/2020	280-141161-2	Perfluoroheptanoic Acid	0.0029	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-16D-20200928	09/28/2020	280-141161-2	Perfluoroheptanoic Acid	0.0025	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-16S-20200928	09/28/2020	280-141161-1	Perfluoroheptanoic Acid	0.013	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
SW-DUP-1-20200930	09/30/2020	280-141161-10	Perfluoroheptanoic Acid	0.0044	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-1-20200930	09/30/2020	280-141161-13	Perfluoroheptanoic Acid	0.0048	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	Perfluoroheptanoic Acid	0.0049	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	Perfluoroheptanoic Acid	0.0057	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-IP-1-20200930	09/30/2020	280-141161-15	Perfluoroheptanoic Acid	0.0038	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-IP-2-20200930	09/30/2020	280-141161-16	Perfluoroheptanoic Acid	0.0054	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-IP-3-20200930	09/30/2020	280-141161-17	Perfluoroheptanoic Acid	0.0046	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-IP-4-20200930	09/30/2020	280-141161-18	Perfluoroheptanoic Acid	0.0045	UG/L	PQL		0.0020	B	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

Validation Reason High relative percent difference (RPD) observed between field duplicate and parent sample. The reported result may be imprecise.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
PIW-16D-20200928	09/28/2020	280-141161-2	R-PSDA	0.0020	UG/L	PQL		0.0020	UJ	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-16D-20200928	09/28/2020	280-141161-2	R-PSDA	0.0020	UG/L	PQL		0.0020	UJ	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

Validation Reason Associated MS and/or MSD analysis had relative percent recovery (RPR) values less than the lower control limit. The actual detection limits may be higher than reported.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
WC-2-20200930	09/30/2020	280-141161-14	MTP	0.034	UG/L	PQL		0.034	UJ	Chemours(TB6)		3535_PFC_28D
WC-2-20200930	09/30/2020	280-141161-14	MTP	0.034	UG/L	PQL		0.034	UJ	Chemours(TB6)		3535_PFC_28D

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

Validation Reason Associated LCS and/or LCSD analysis had relative percent recovery (RPR) values higher than the upper control limit. The reported result may be biased high.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
PIW-14-20201118	11/18/2020	320-67054-2	DFSA	88	UG/L	PQL		0.080	J	Chemours(TB6)		3535_PFC_28D

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

Validation Reason Associated MS and/or MSD analysis had relative percent recovery (RPR) values higher than the upper control limit. The reported result may be biased high.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
SW-DUP-1-20200930	09/30/2020	280-141161-10	R-PSDA	0.029	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	R-PSDA	0.031	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	R-PSDA	0.032	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	R-EVE	0.012	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
PIW-16D-20200928	09/28/2020	280-141161-2	DFSA	0.014	UG/L	PQL		0.0040	J	Chemours(TB6)		3535_PFC_28D
PIW-16D-20200928	09/28/2020	280-141161-2	DFSA	0.015	UG/L	PQL		0.0040	J	Chemours(TB6)		3535_PFC_28D
WC-2-20200930	09/30/2020	280-141161-14	DFSA	0.17	UG/L	PQL		0.080	J	Chemours(TB6)		3535_PFC_28D
WC-2-20200930	09/30/2020	280-141161-14	DFSA	0.17	UG/L	PQL		0.080	J	Chemours(TB6)		3535_PFC_28D

Site: Fayetteville **Sampling Program:** CSM Groundwater Sampling **Validation Options:** LABSTATS

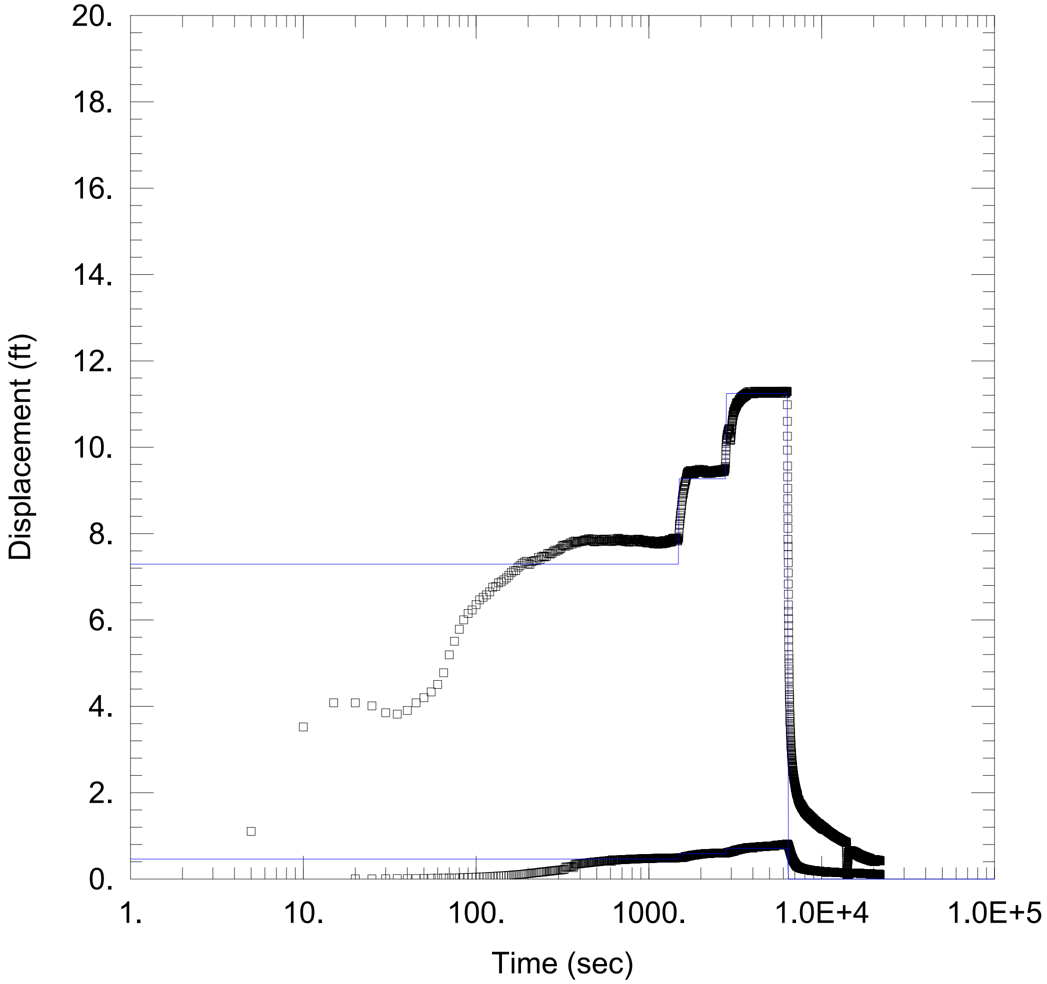
Validation Reason High relative percent difference (RPD) observed between field duplicate and parent sample. The reported result may be imprecise.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
SW-DUP-1-20200930	09/30/2020	280-141161-10	R-EVE	0.0091	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	R-EVE	0.014	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
DUP-1-20200928	09/28/2020	280-141161-19	R-PSDA	0.0074	UG/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep

Validation Reason Associated MS and/or MSD analysis had relative percent recovery (RPR) values less than the lower control limit but above the rejection limit. The reported result may be biased low.

Field Sample ID	Date Sampled	Lab Sample ID	Analyte	Result	Units	Type	MDL	PQL	Validation Qualifier	Analytical Method	Pre-prep	Prep
WC-2-20200930	09/30/2020	280-141161-14	PPF Acid	0.16	UG/L	PQL		0.035	J	Chemours(TB6)		3535_PFC_28D
WC-2-20200930	09/30/2020	280-141161-14	PPF Acid	0.15	UG/L	PQL		0.035	J	Chemours(TB6)		3535_PFC_28D
WC-2-20200930	09/30/2020	280-141161-14	PFMOAA	0.032	ug/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep
WC-2-20200930	09/30/2020	280-141161-14	PFMOAA	0.034	ug/L	PQL		0.0020	J	Cl. Spec. Table 3 Compound SOP		PFAS_DI_Prep

Appendix H
Step Drawdown Test Data



EW-1 Step Drawdown Test

Data Set: C:\Users\rgabelman\Desktop\Step Drawdown Tests\EW-1 Cluster\EW-1-step dd test.aqt
Date: 12/03/20 Time: 18:32:55

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-1 Step Test
Test Date: 09/03/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-1	0	0
□ PIW-2D	20	0

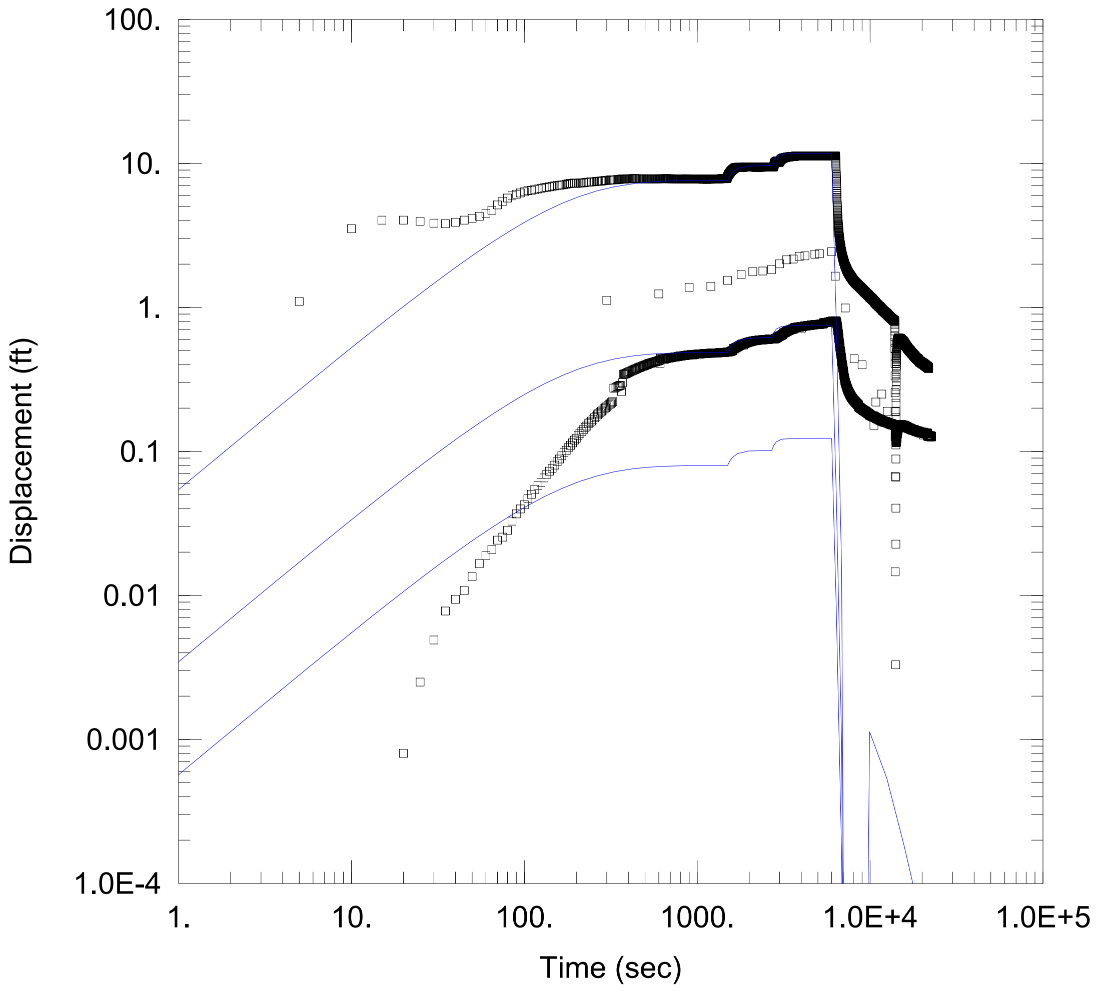
SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush-Jacob

T = 0.0009826 ft^2/sec
1/B = 0.06673 ft^{-1}
b = 20. ft

S = 2.986E-16
Kz/Kr = 1.



EW-1 Step Drawdown Test

Data Set: C:\Projects\TR0795\temp\EW-1-step dd test.aqt
Date: 02/08/21 Time: 14:32:29

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-1 Step Test
Test Date: 09/03/2020

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 10. ft
Aquitard Thickness (b"): 10. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-1	0	0

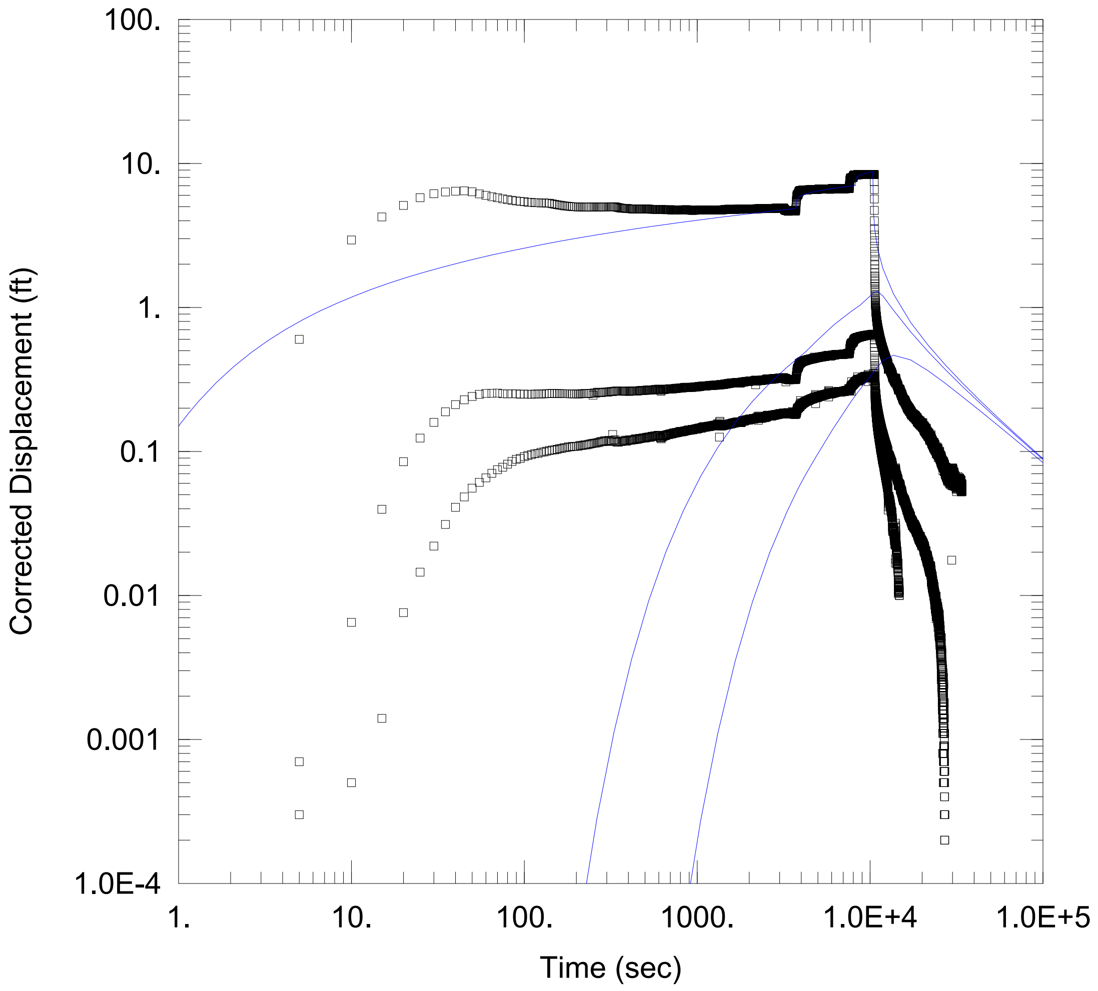
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-1	0	0
□ OW-1	10	0
□ PIW-2D	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Moench (Case 1)

T = 0.0007648 ft^2/sec
S = 2.986E-20
1/B' = 0.1488 ft^{-1}
ß'/r = 4.0E-5 ft^{-1}
1/B" = 0. ft^{-1}
ß"/r = 0. ft^{-1}
Sw = 0.
r(w) = 0.25 ft
r(c) = 0.25 ft



EW-2 STEP DRAWDOWN TEST

Data Set: C:\Projects\TR0795\temp\EW-2-step dd test.aqt
Date: 02/08/21 Time: 14:34:50

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2 Step Test
Test Date: 09/08/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

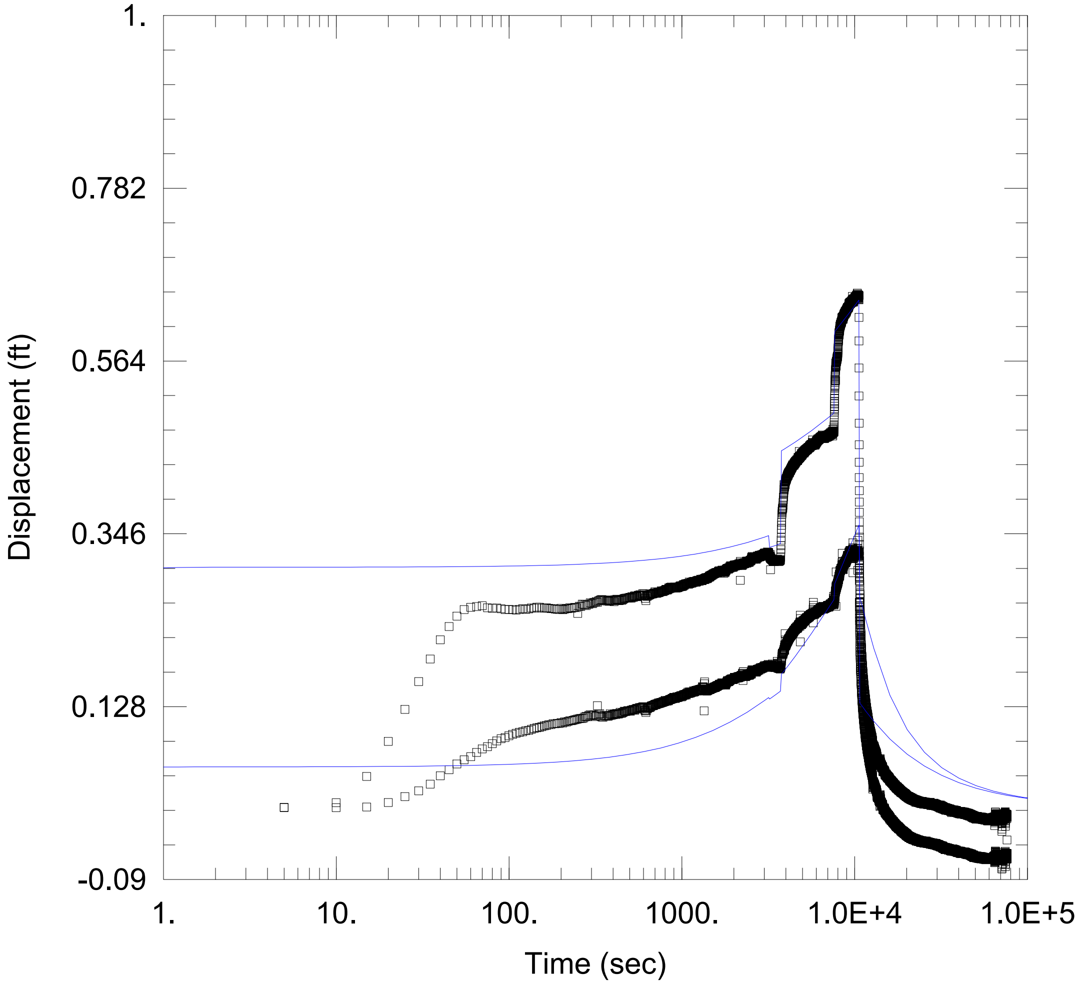
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-2	0	0
□ OW-6	10	0
□ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 0.003365 ft^2/sec
S = 0.2058
Kz/Kr = 1.
b = 25. ft



EW-2 STEP DRAWDOWN TEST

Data Set: \...\EW-2-step dd test.aqt
Date: 12/11/20 Time: 13:44:36

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2 Step Test
Test Date: 09/08/2020

AQUIFER DATA

Saturated Thickness: 25. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

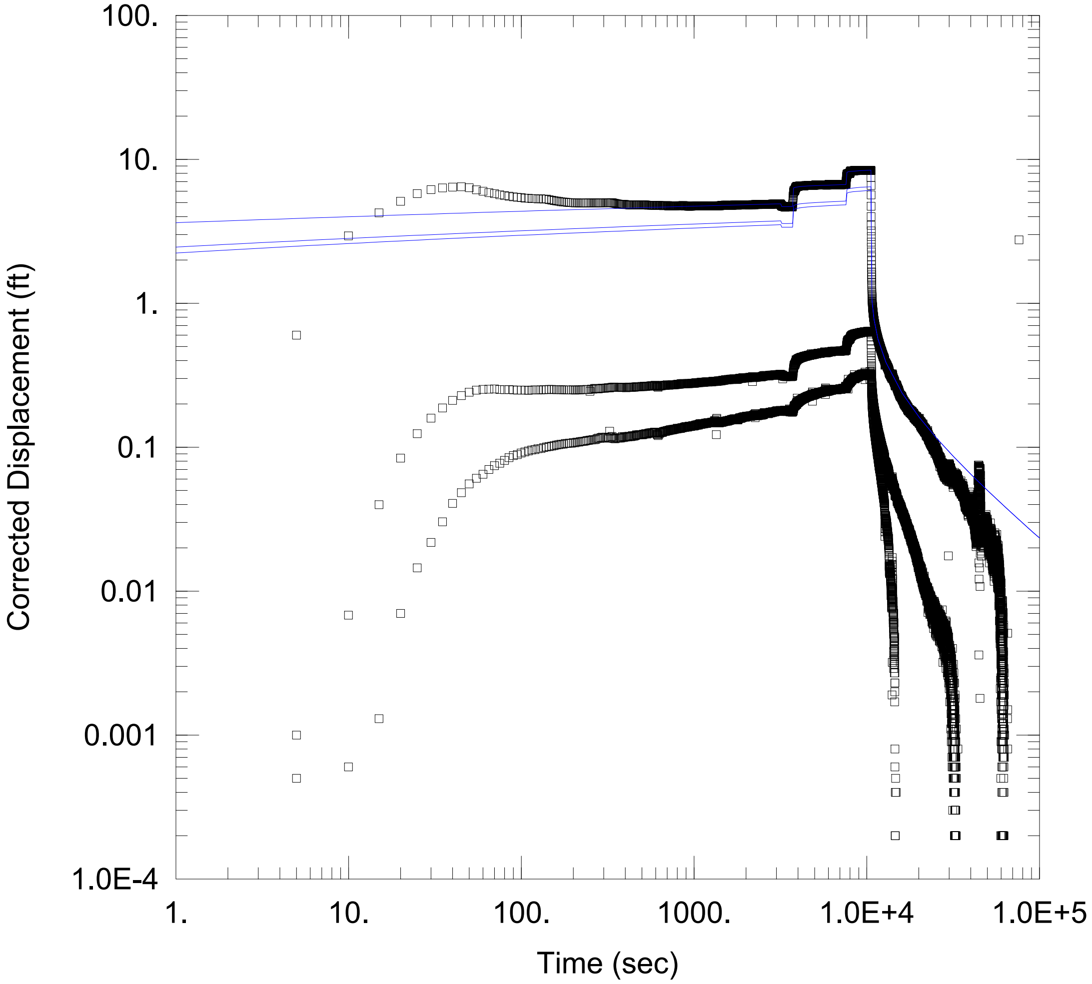
Observation Wells

Well Name	X (ft)	Y (ft)
□ OW-6	10	0
□ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Neuman

T = 0.02534 ft^2/sec
S = 3.074E-6
Sy = 0.06235
Kz/Kr = 0.1



EW-2 STEP DRAWDOWN TEST

Data Set: \...\EW-2-step dd test.aqt
Date: 12/11/20
Time: 12:31:04

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2 Step Test
Test Date: 09/08/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

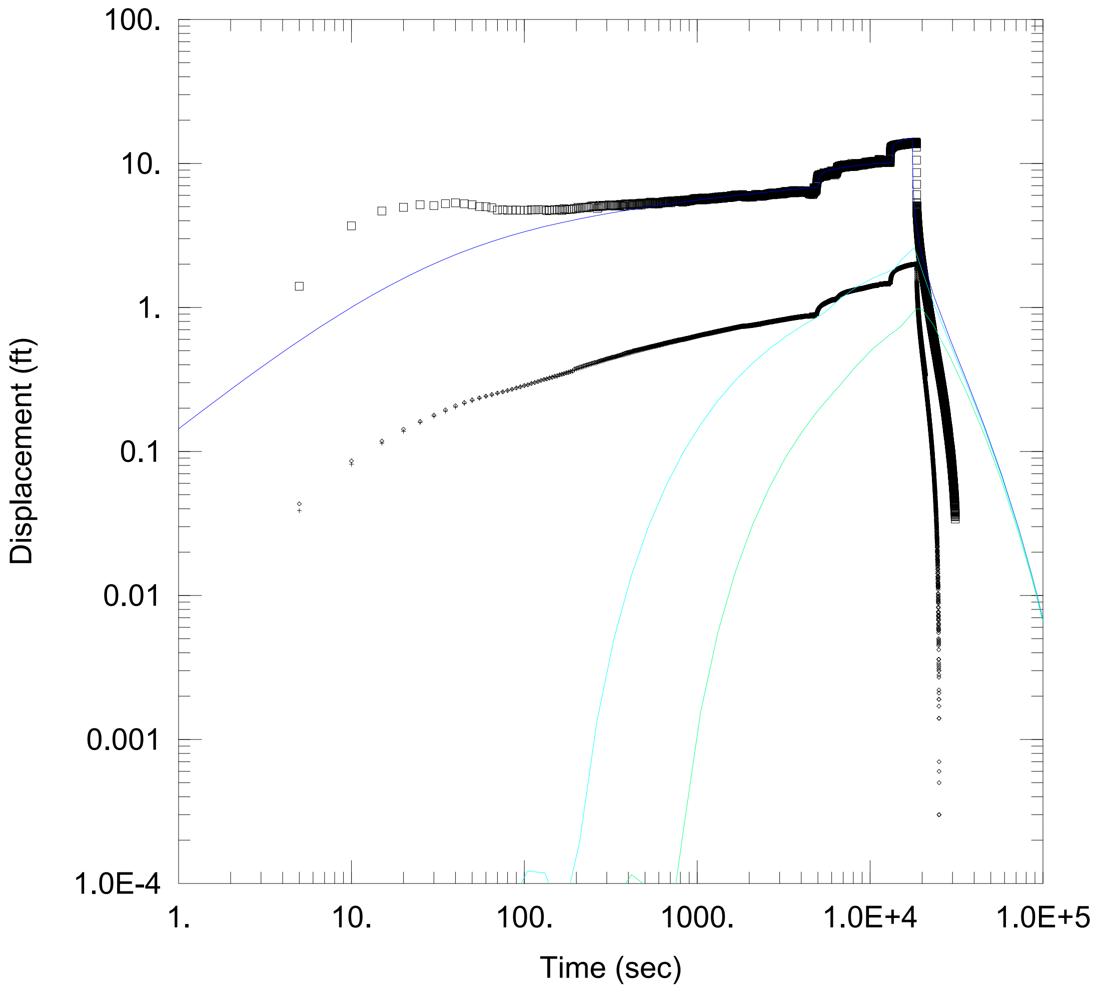
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-2	0	0
□ OW-6	10	0
□ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 0.01339 ft^2/sec
S = 5.831E-11
Kz/Kr = 1.
b = 25. ft



EW-3 STEP DRAWDOWN TEST

Data Set: C:\Projects\TR0795\temp\EW-3-step dd test.aqt
Date: 02/08/21 Time: 14:38:42

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-3 Step Test
Test Date: 09/04/2020

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 10. ft
Aquitard Thickness (b"): 10. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-3	0	0

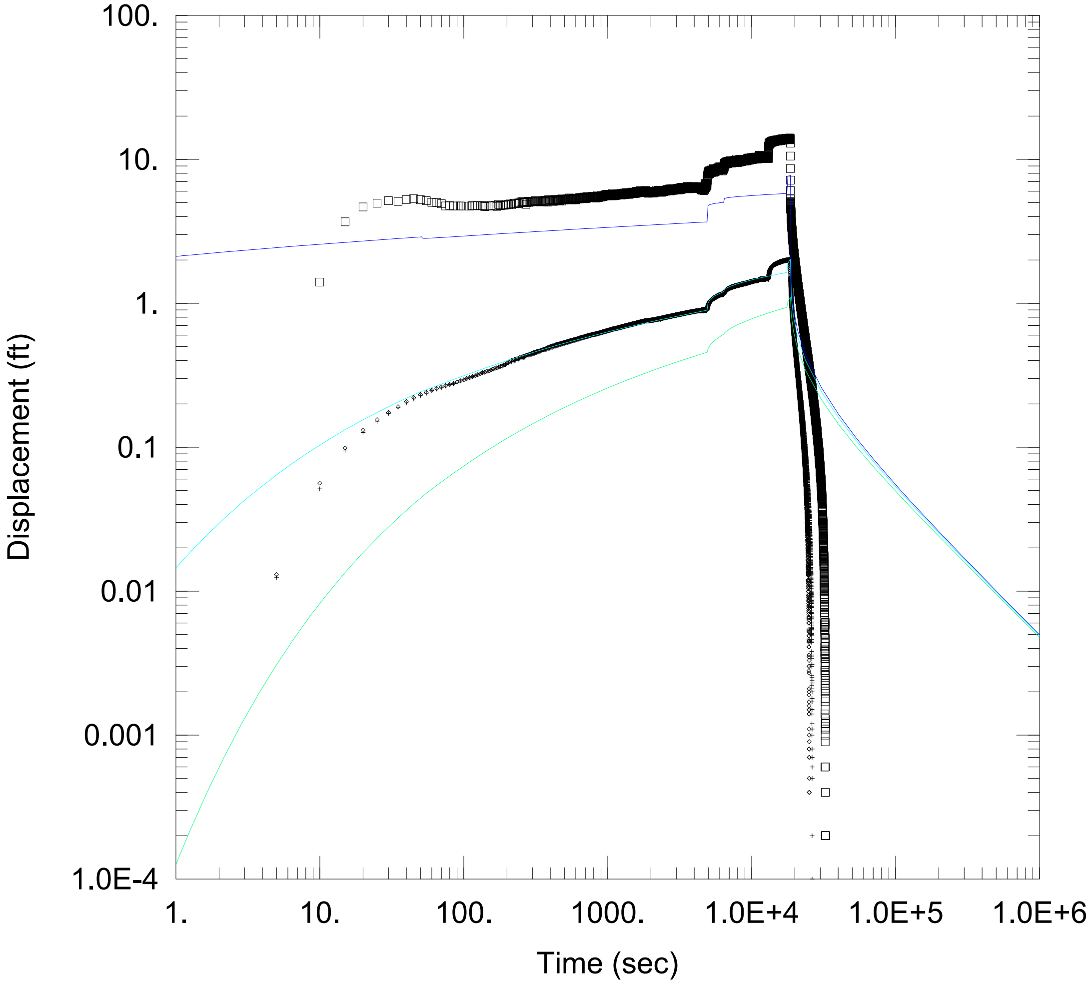
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-3	0	0
◦ OW-4	10	0
◦ OW-5	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Moench (Case 1)

T = 0.003048 ft^2/sec
S = 0.1365
1/B' = 0.04257 ft^{-1}
ß'/r = 0.0001004 ft^{-1}
1/B" = 0. ft^{-1}
ß"/r = 0. ft^{-1}
Sw = 0.
r(w) = 0.25 ft
r(c) = 0.25 ft



EW-3 STEP DRAWDOWN TEST

Data Set: \...\EW-3-step dd test.aqt
Date: 12/11/20 Time: 16:12:53

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-3 Step Test
Test Date: 09/04/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-3	0	0

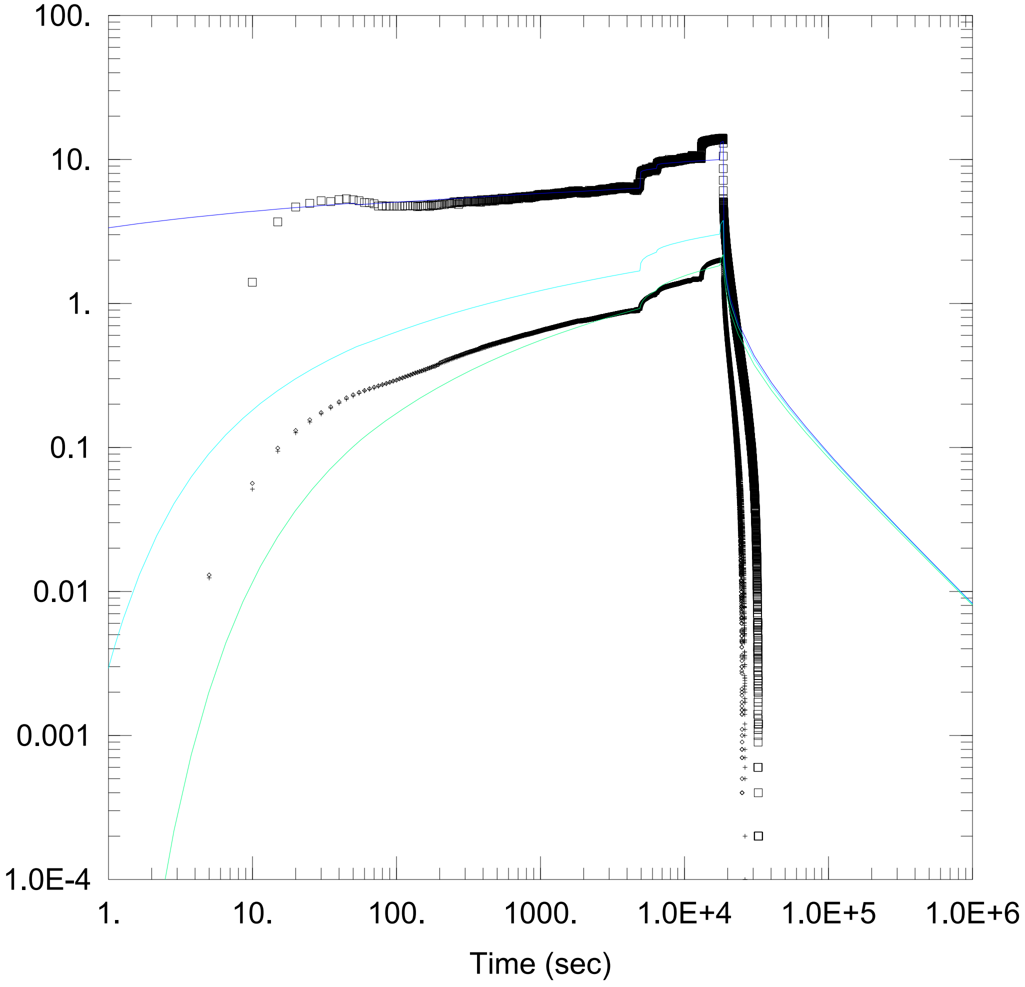
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-3	0	0
+ OW-4	10	0
◇ OW-5	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush

T = 0.006714 ft^2/sec
S = 1.207E-6
ß/r = 2.421 ft^{-1}
Kz/Kr = 1.
b = 30. ft



EW-3 STEP DRAWDOWN TEST

Data Set: C:\...\EW-3-step dd test.aqt
Date: 12/03/20 Time: 20:06:45

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-3 Step Test
Test Date: 09/04/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-3	0	0

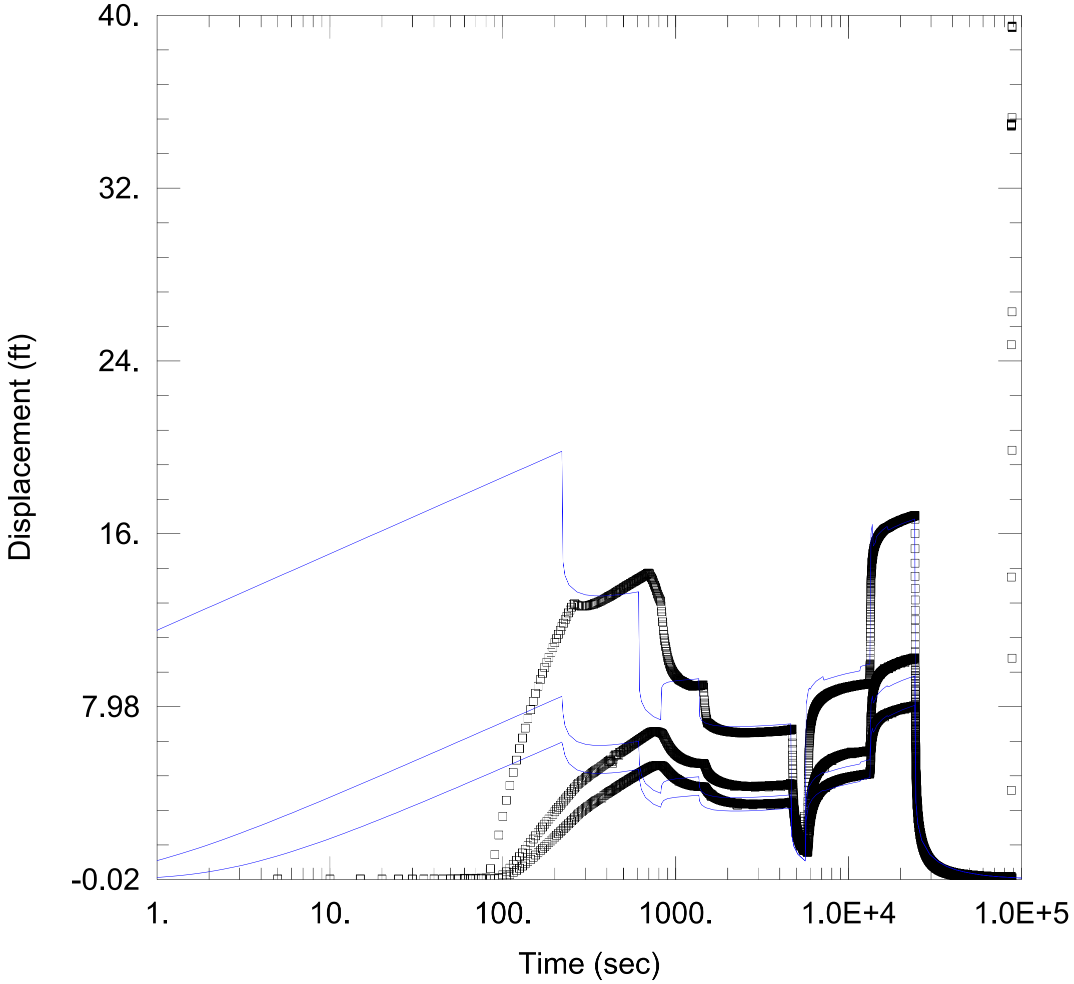
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-3	0	0
+ OW-4	10	0
◇ OW-5	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush

$T = 0.004045\ ft^2/sec$
$S = 0.0004534$
$ß/r = 0.06789\ ft^{-1}$
$Kz/Kr = 1.$
$b = 30.\ ft$



EW-4 STEP DRAWDOWN TEST

Data Set: \...\EW-4.aqt
Date: 12/03/20 Time: 15:04:19

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-4
Test Date: 11/3/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-4	0	0

Observation Wells

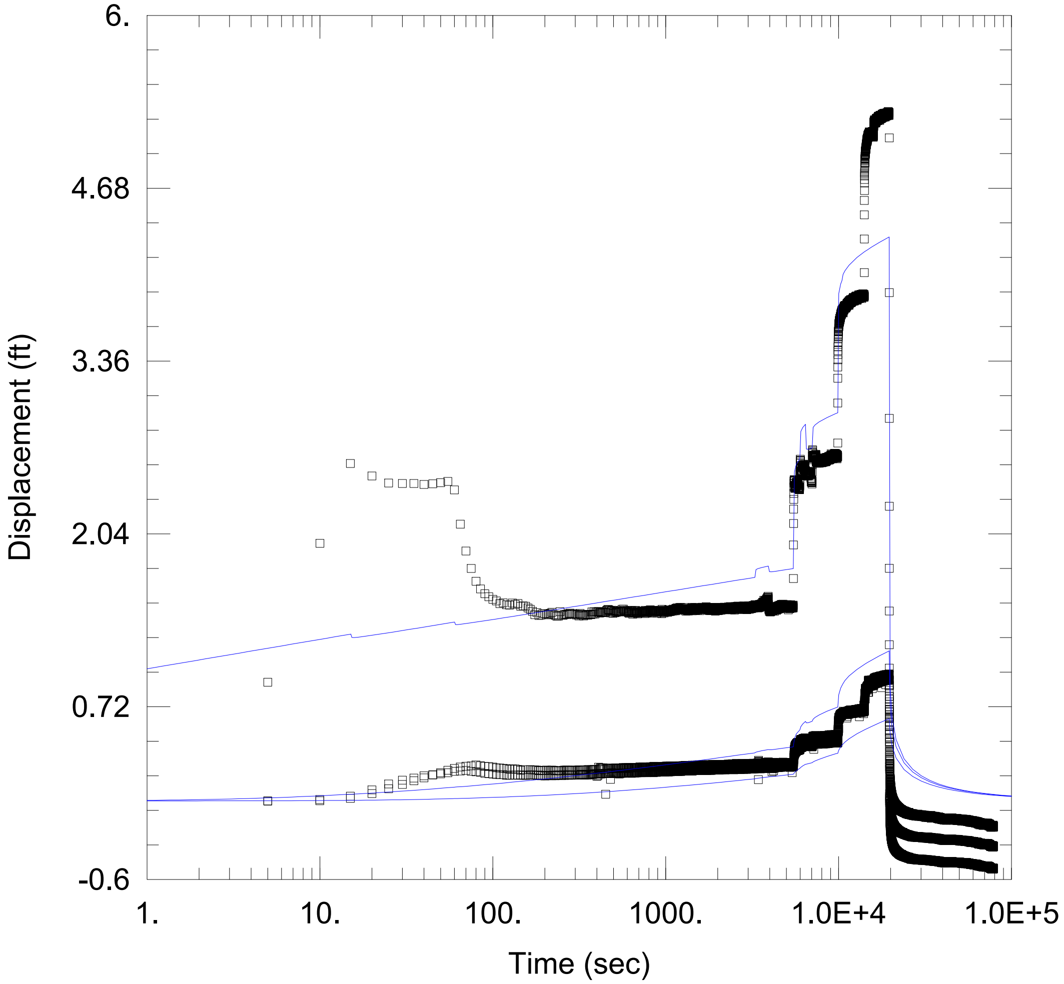
Well Name	X (ft)	Y (ft)
□ EW-4	0	0
□ OW-2	10	0
□ OW-3	20	0

SOLUTION

Aquifer Model: Leaky Solution Method: Hantush-Jacob

T = 0.002304 ft^2/sec
1/B = 0.0006004 ft^{-1}
b = 20. ft

S = 4.647E-5
Kz/Kr = 1.



EW-5 STEP DRAWDOWN TEST

Data Set: C:\Users\rgabelman\Desktop\Step Drawdown Tests\EW-5 Cluster\EW-5_STest.aqt
Date: 12/03/20 Time: 17:54:22

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-5
Test Date: 10/27/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-5	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-5	0	0
□ OW-8	10	0
□ OW-7	20	0

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush

T = 0.008571 ft^2/sec
ß/r = 40. ft^{-1}
b = 30. ft

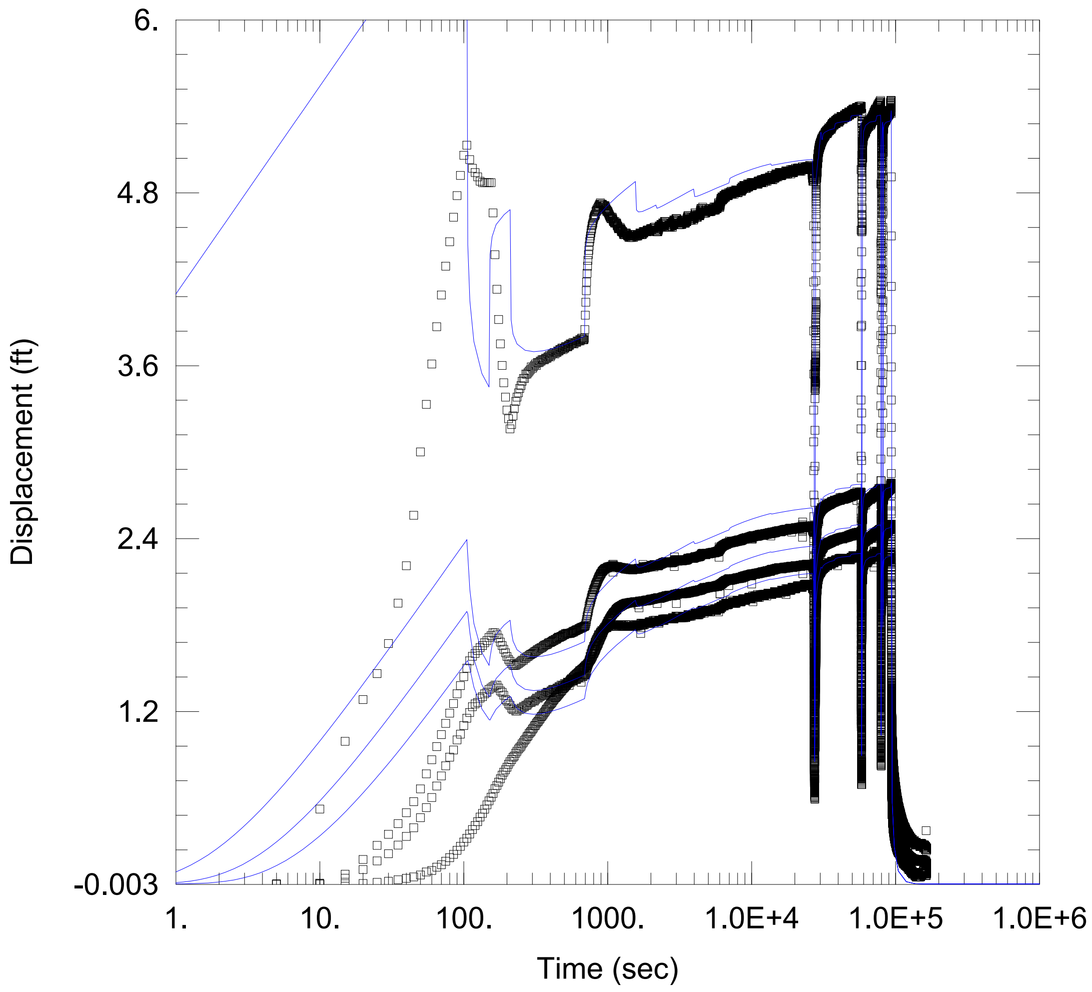
S = 8.633E-9
Kz/Kr = 1.

Geotechnical, Environmental and Materials Engineers

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Appendix I
Constant Rate Test Data



EW-1 CONSTANT RATE TEST

Data Set: \...\EW-1_ConstantR_BE Adjusted.aqt
Date: 02/08/21 Time: 14:37:05

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-1
Test Date: 11/4/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-1	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-1	0	0
□ OW-1	10	0
□ OW-10	15	0
□ PIW-2D	20	0

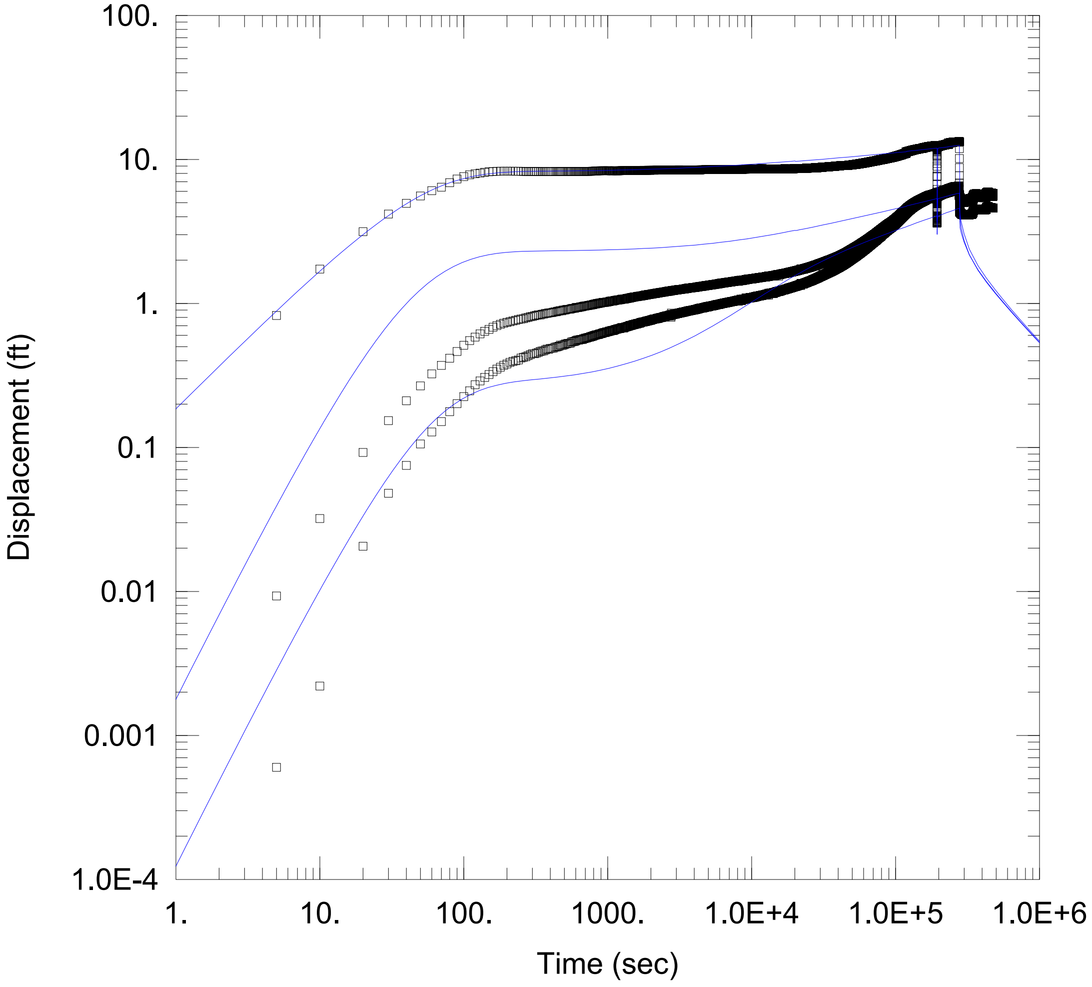
SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush-Jacob

T = 0.003393 ft^2/sec
1/B = 0.002063 ft^{-1}
b = 20. ft

S = 0.0001777
Kz/Kr = 1.



EW-2 CONSTANT RATE TEST

Data Set: C:\Users\fcosme\Desktop\Chemours\02 - Aquifer Test\EW-2_ConstantR-fmc.aqt
Date: 12/16/20 Time: 07:08:15

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2
Test Date: 11/16/2020

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 0.3147

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

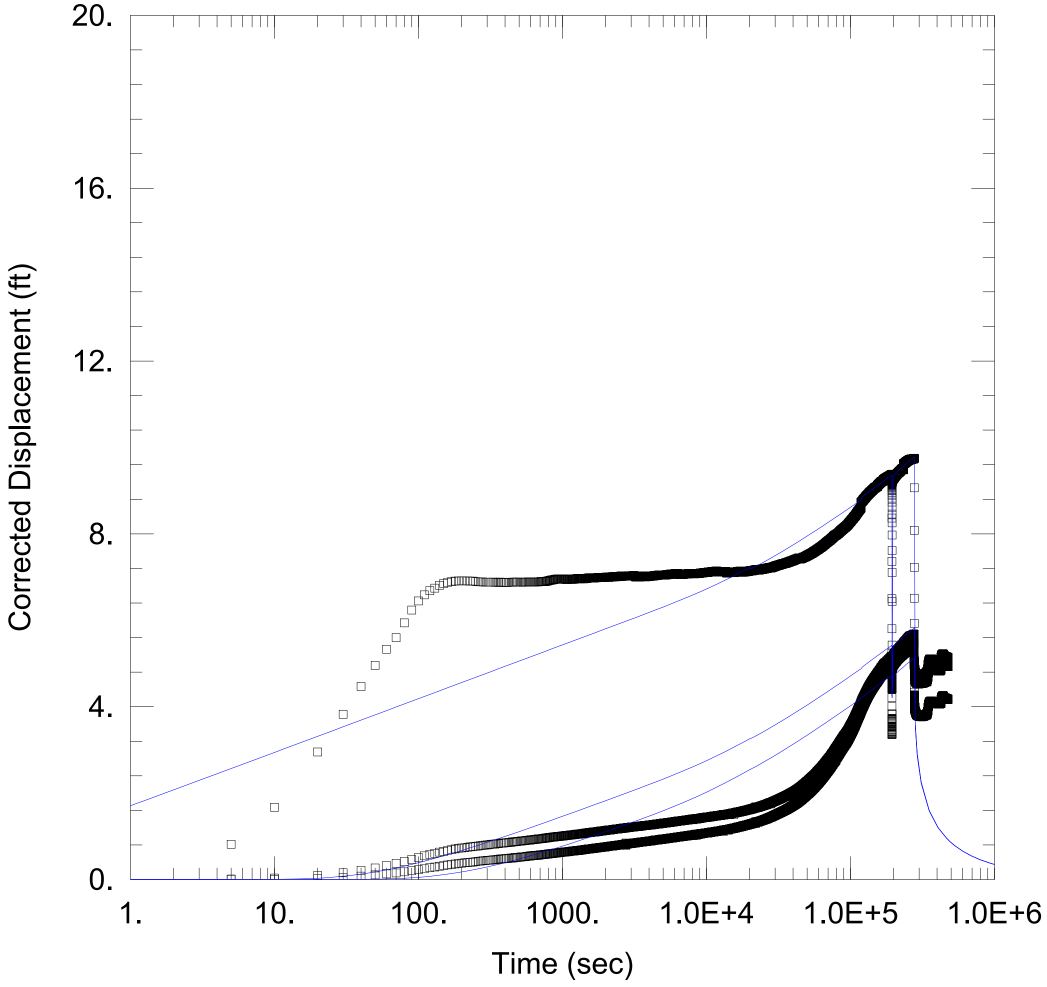
Observation Wells

Well Name	X (ft)	Y (ft)
☐ EW-2	0	0
☐ OW-6	10	0
☐ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Moench

T = 0.003222 ft^2/sec
S = 1.0E-14



EW-2 CONSTANT RATE TEST

Data Set: \...\EW-2_ConstantR.aqt
Date: 12/11/20 Time: 16:02:52

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2
Test Date: 11/16/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

Observation Wells

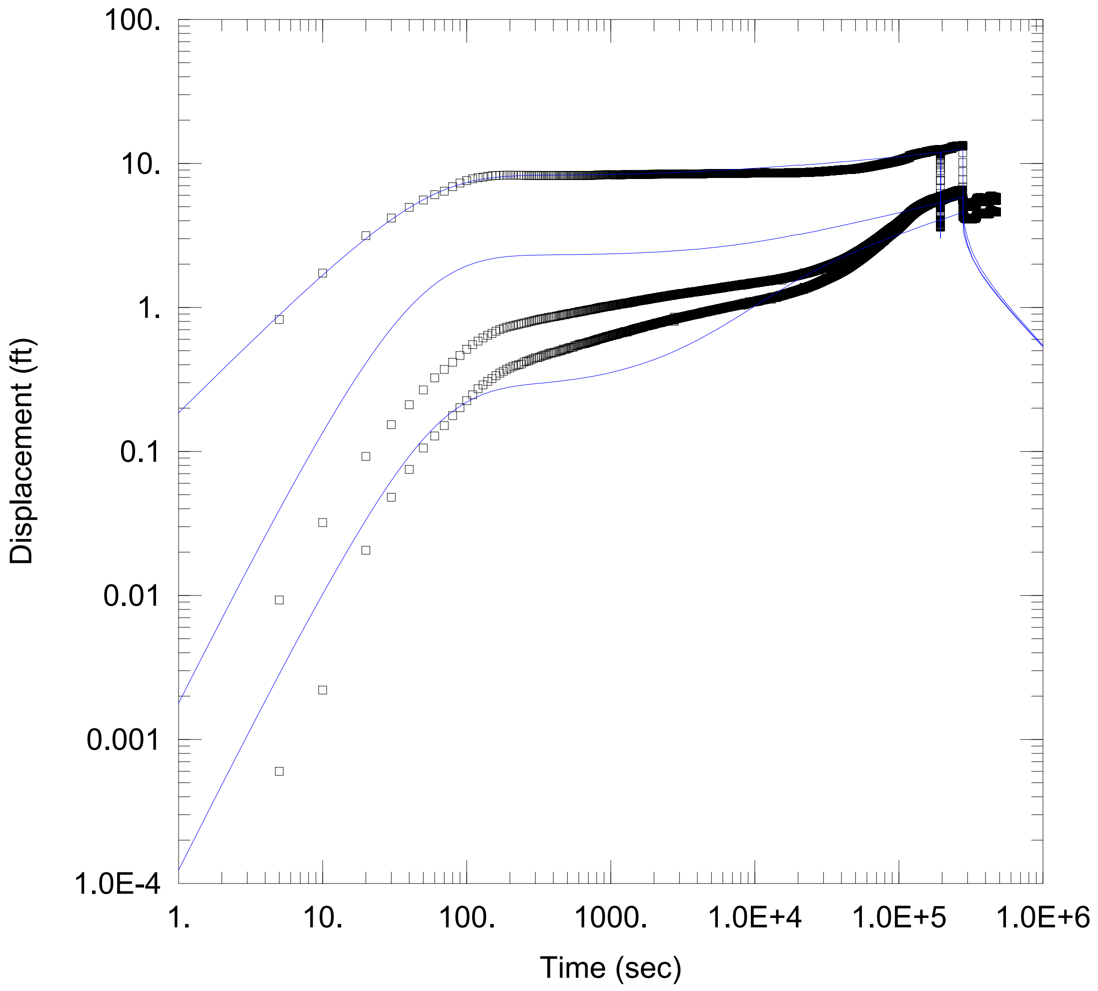
Well Name	X (ft)	Y (ft)
□ EW-2	0	0
□ OW-6	10	0
□ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined Solution Method: Theis

T = 0.00541 ft^2/sec
Kz/Kr = 1.

S = 0.008492
b = 25. ft



EW-2 CONSTANT RATE TEST

Data Set: C:\Projects\TR0795\temp\EW-2_ConstantR-fmc.aqt
Date: 02/08/21 Time: 15:14:29

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-2
Test Date: 11/16/2020

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 0.3147

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-2	0	0

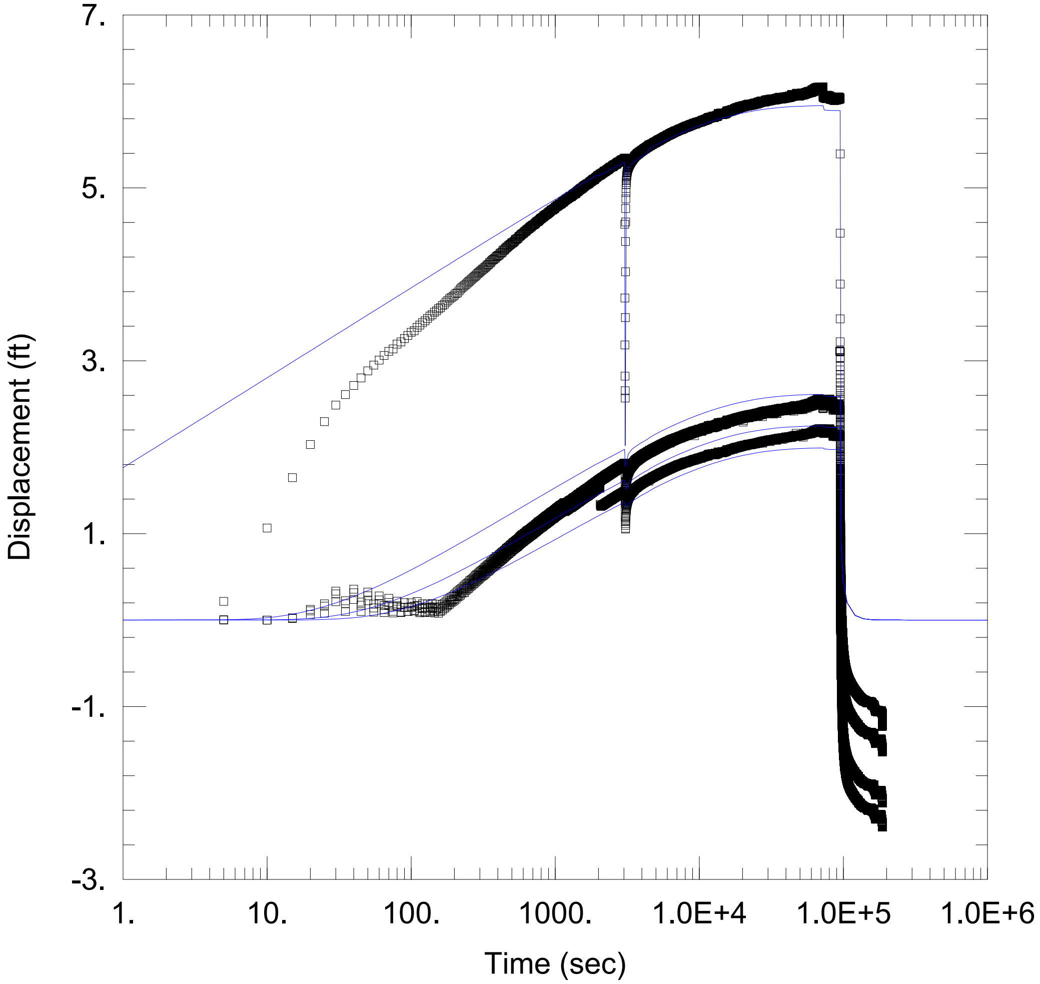
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-2	0	0
□ OW-6	10	0
□ PIW-9D	20	0

SOLUTION

Aquifer Model: Unconfined
Solution Method: Moench

T = 0.003222 ft^2/sec
Sy = 0.05529
Sw = 0.
r(c) = 0.25 ft
S = 1.0E-14
Kz/Kr = 0.3147
r(w) = 0.25 ft
alpha = 1.0E+6 sec^{-1}



EW-3 CONSTANT RATE TEST

Data Set: \...\EW-3_ConstantR.aqt
Date: 12/07/20 Time: 14:53:13

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-3
Test Date: 11/9/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-3	0	0

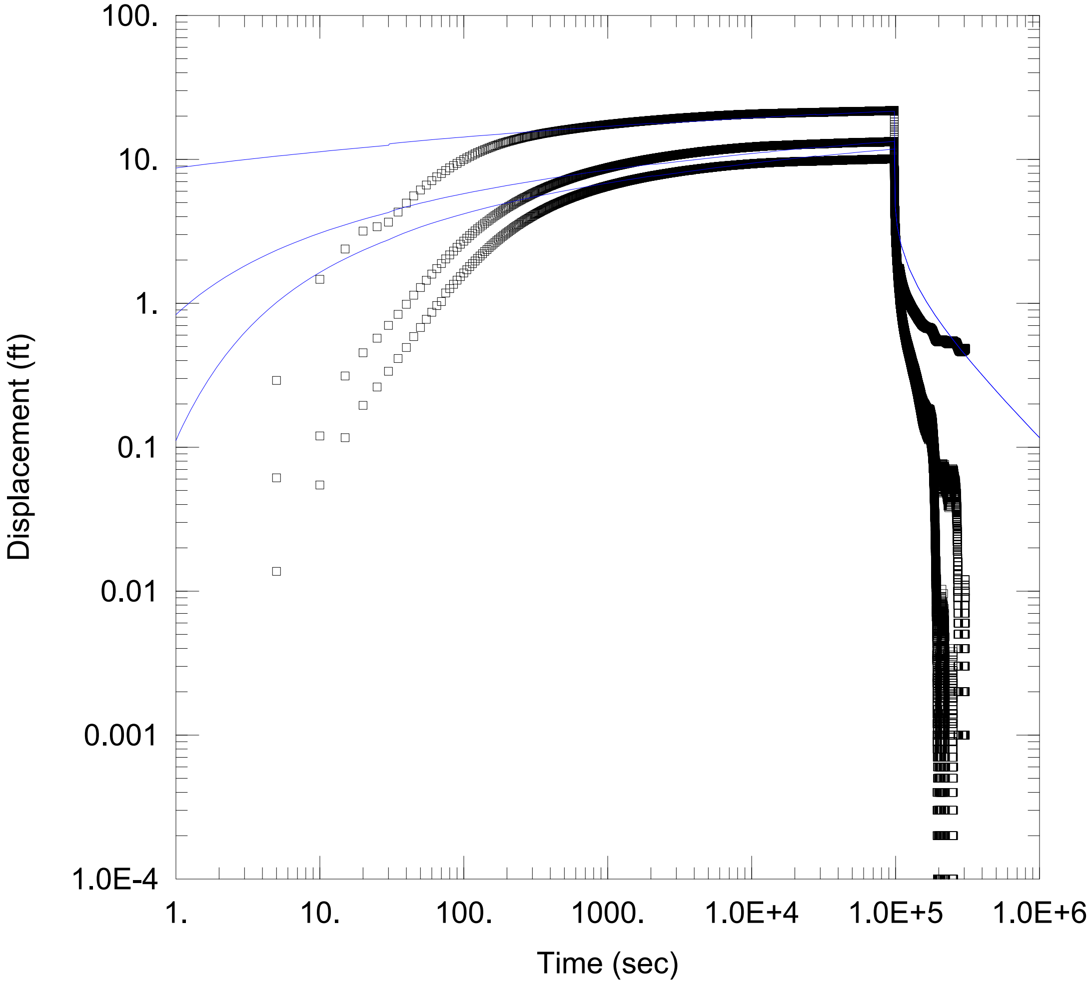
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-3	0	0
□ OW-4	10	0
□ OW-5	20	0
□ OW-9	15	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.007824 ft^2/sec
1/B = 0.006315 ft^{-1}
b = 30. ft
S = 0.005821
Kz/Kr = 1.



EW-4 CONSTANT RATE TEST

Data Set: \...\EW-4_ConstantRate.aqt
Date: 12/17/20 Time: 14:48:38

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-4
Test Date: 11/3/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-4	0	0

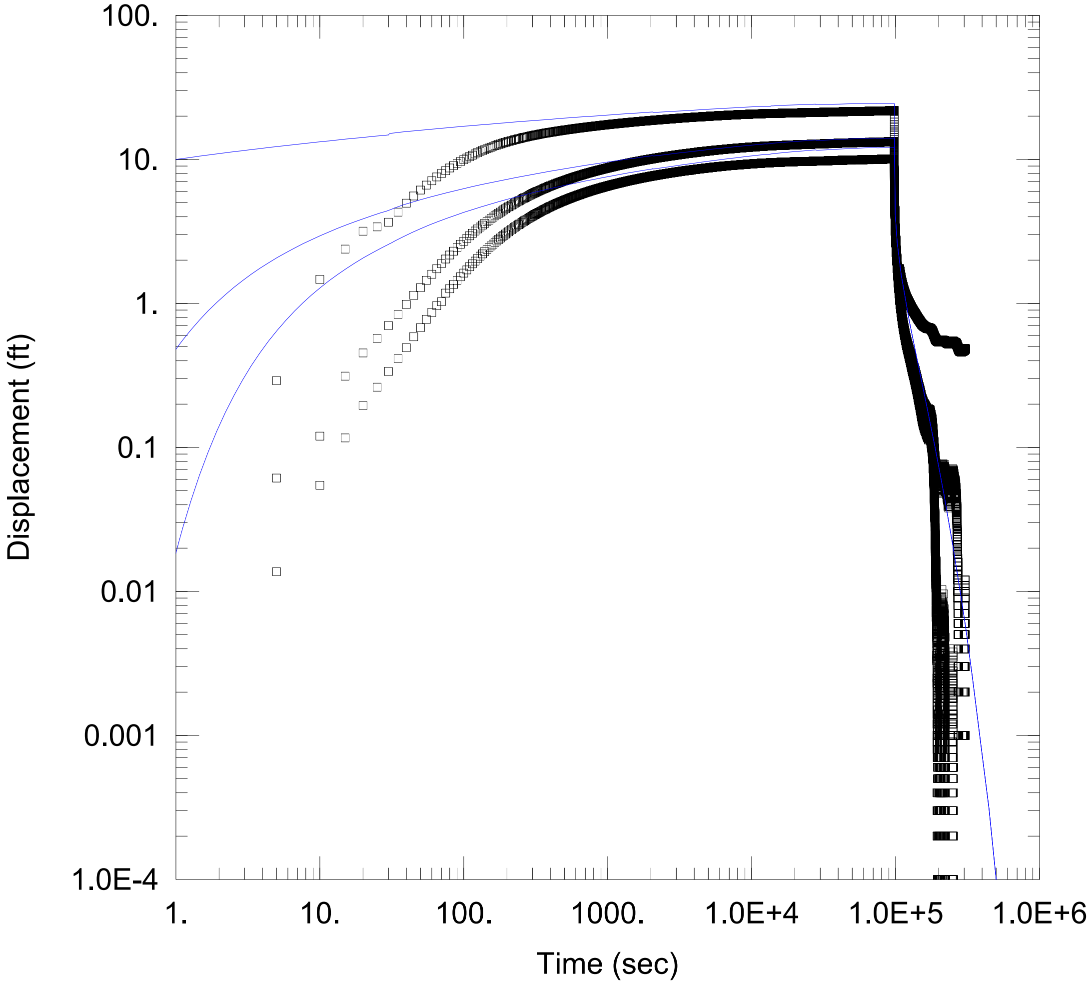
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-4	0	0
□ OW-2	10	0
□ OW-3	20	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 0.002533 ft^2/sec
S = 3.814E-5
Kz/Kr = 1.
b = 20. ft



EW-4 CONSTANT RATE TEST

Data Set: C:\...\EW-4_ConstantRate.aqt
Date: 01/07/21 Time: 12:47:00

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-4
Test Date: 11/3/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-4	0	0

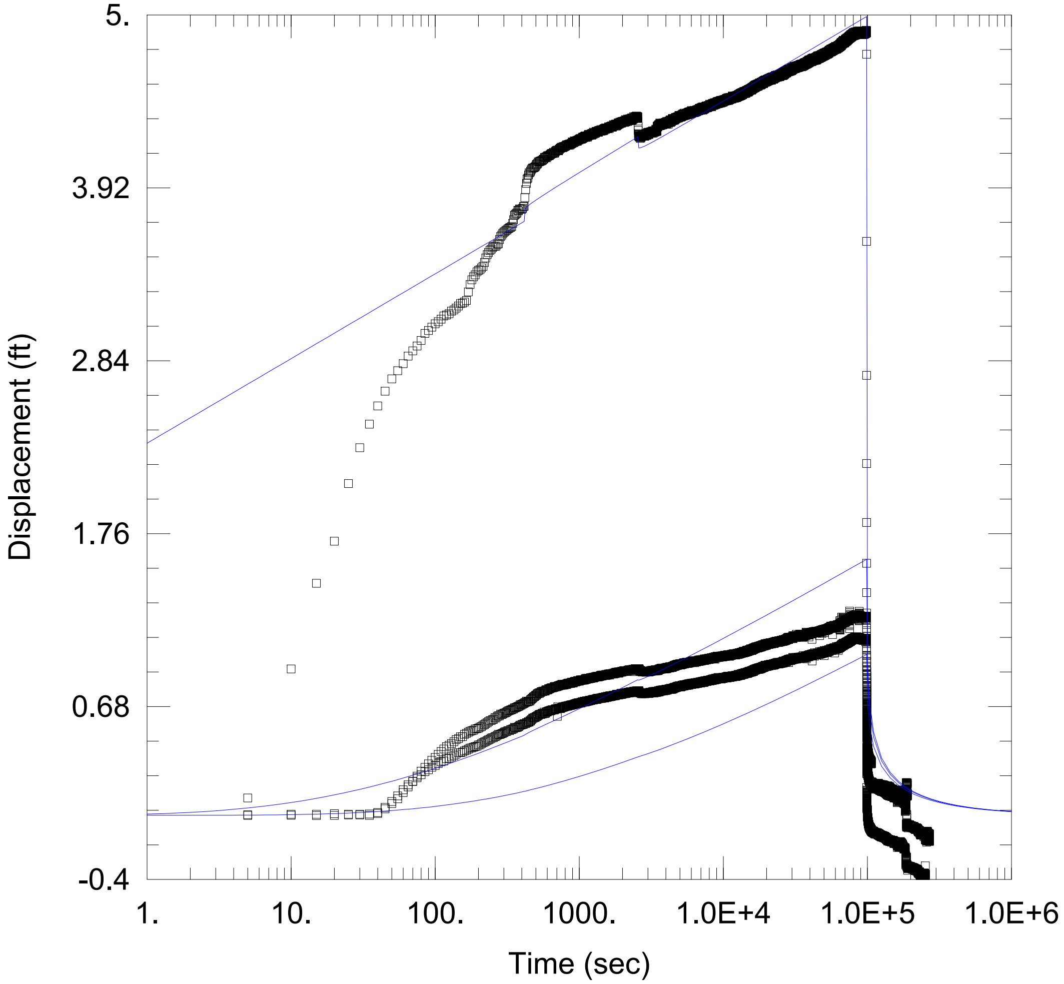
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-4	0	0
□ OW-2	10	0
□ OW-3	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.002012 ft^2/sec
S = 6.034E-5
1/B = 0.0007443 ft^{-1}
Kz/Kr = 1.
b = 20. ft



EW-5 CONSTANT RATE TEST

Data Set: \...\EW-5_ConstantR.aqt
Date: 12/11/20 Time: 19:07:18

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-5
Test Date: 11/30/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-5	0	0

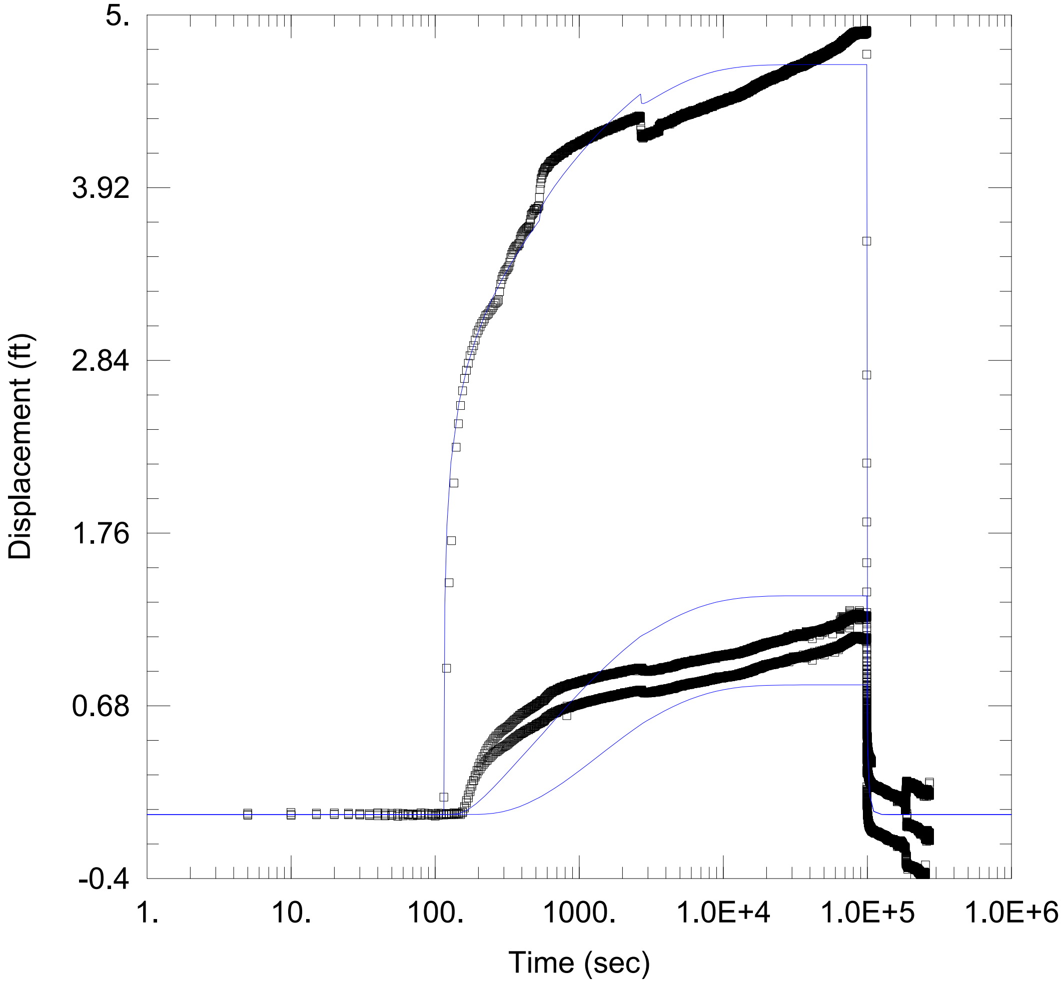
Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-5	0	0
□ OW-7	10	0
□ OW-8	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush

T = 0.01 ft^2/sec
S = 1.319E-5
ß/r = 1.204 ft^{-1}
Kz/Kr = 1.
b = 30. ft



EW-5 CONSTANT RATE TEST

Data Set: \...\EW-5_ConstantR.aqt
Date: 12/07/20 Time: 17:12:31

PROJECT INFORMATION

Company: Geosyntec
Client: Chemours
Project: TR0795
Location: Fayetteville, NC
Test Well: EW-5
Test Date: 11/30/2020

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
EW-5	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ EW-5	0	0
□ OW-7	10	0
□ OW-8	20	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.01016 ft^2/sec
S = 0.03907
1/B = 0.02608 ft^{-1}
Kz/Kr = 1.
b = 30. ft

Appendix J
Numerical Model Results

3D GROUNDWATER FLOW MODEL

1. INTRODUCTION

The 3D transient finite element numerical groundwater flow model was refined from the model developed during the preparation of the CAP to evaluate the migration pathways at the Site under current conditions. The updated model improves on the subsurface delineation of the hydrostratigraphic units and aquifer properties investigated in 2020. This model has been further updated since the submittal of the PDI Report, version 1 to incorporate field data generated in 2021.

The 3D model was constructed using FEFLOW, version 7.2 (DHI-WASY), which incorporates the Richards' equation, the conservation of mass, and nonlinear relationships between capillary pressure (P_c) and wetting phase saturation (S_w) and between S_w and hydraulic conductivity (K) to solve for hydraulic heads. The model was constructed using field-observed parameters, which were interpolated to approximate aquifer conditions across the model domain and assumed to be representative in between measured locations.

2. 3D GROUNDWATER FLOW MODEL CONSTRUCTION AND CALIBRATION

2.1 Model Domain and Grid

The model domain covers an area approximately 72,690,473 feet^2 (2.61 square miles). The revised grid consists of 2,099,240 nodes and 4,154,656 elements and 7 model hydrostatigraphic units. The number of nodes and elements were increased to refine the model domain from the edge of the bluff to Cape Fear River. The model domain and grid locations are presented in Figure J.01.

The model uses 7 hydrostratigraphic units to represent, from surface downward, the Floodplain deposits, Perched Zone, Perched Clay, Surficial aquifer, Black Creek Confining unit, Black Creek aquifer, and Cape Fear Confining unit. The model varies in thickness from about 170 ft near the plant to 55 ft at the base of the bluff adjacent to the Cape Fear River.

The NC Dept. of Public Safety Light Detection and Ranging (LiDAR) elevation model was imported to represent ground surface topography (NC DPS, 2015), while topography of the underlying model layers were based on lithostratigraphic data obtained from Site monitoring wells, soil borings, HPT, and CPT contained in the three-dimensional visualization model, EVS^{TM}.

2.2 Flow Boundary Conditions

Boundary conditions are used to simulate flow of water into and out of a model domain. Upgradient regional conditions, river and recharge boundaries are used in the updated model to simulate Site conditions. Figure J.02 presents the locations of the boundary conditions within the model domain. The numerical model extent was closely tied to the boundary conditions chosen for the model:

Top Boundary: Established as the ground surface, taken from a combination of LiDAR data and topographic surveys performed along Willis Creek and the Outfall. Boundary conditions on the top boundary were either constant flux (to simulate rainfall recharge) or constant head equal to elevation (with a no inward flow constraint) to simulate seepage faces on the bluffs. Initial rainfall recharge values were selected with reference to the annual precipitation and evapotranspiration estimates for the Mid-Atlantic Coastal Plain (United States Geological Survey (USGS), 2005).

Bottom Boundary: Chosen as flat at an elevation of -20 ft above MSL which is located within the Upper Cape Fear confining unit. A no-flow hydraulic condition was applied to the entire bottom boundary of the model.

Northern Boundary: Willis Creek forms a hydraulic boundary north of the model domain. The creek is treated as a spatially-varying constant hydraulic head boundary from the northwest model corner to the outflow to the Cape Fear River located at the northeast model corner. The uppermost active nodes in the mesh along the Willis Creek boundary were linearly interpolated, from west to east along the creek, from a hydraulic head equal to the ground surface elevation at the westmost part of Willis Creek to a hydraulic head equal to the constant hydraulic head boundary value of the Cape Fear River. Application of this constant head condition to only the upper nodes in the mesh forces all groundwater flowing towards the boundary to discharge into the creek (as all nodes below the upper nodes were assigned a no-flow condition).

Eastern Boundary: The Cape Fear River forms a hydraulic boundary east of the model domain. The river is treated as a constant hydraulic head boundary in the uppermost active nodes with an elevation representative of a daily median water elevation in the river, as measured at the W.O. Huske Dam (United States Geological Survey (USGS) 2105500). The river wraps partially around the northeast and southeast corners of the model. Application of this constant head condition to only the uppermost nodes in the mesh forces all groundwater flowing towards the boundary to discharge into the river.

Southern Boundary: The model domain southern extent was chosen to represent a flow line from the western boundary to the eastern boundary. This selection was based on the available measured hydraulic head data and professional judgement (Geosyntec, 2019). A no flow condition was applied to the southern boundary.

Western Boundary: The western model boundary is not bounded by any clearly defined hydraulic features and may be a flow divide beneath a topographic high. This boundary was chosen as parallel to the Cape Fear River as limited hydraulic information was available to make a more refined choice. This boundary is located more than a quarter mile from the manufacturing area of the Site. Spatially-varying constant hydraulic head boundary conditions were applied linearly ranging from 125 ft (in the shallower portion of the domain) or 122 ft (in the deeper portion of the domain) at the southern end of the boundary to the elevation of Willis Creek at the northern end of the boundary.

2.3 Hydraulic Parameters

The model parameters were chosen based on the available field data, such as CPT, HPT and aquifer test data collected from 2018 to 2020. Where ranges in data existed, mid-points of the ranges were chosen as the initial set of parameters.

Hydraulic conductivity, specific storage (S_s), unsaturated-flow porosity (θ), residual wetting phase saturation (S_r), and Brooks-Corey-Burdine P_c-S_w-K constitutive parameters (alpha (α), lambda (λ), delta (δ)) are the main hydraulic parameters in the model. The distribution and assignment of these parameters is based on the conceptual model hydrostratigraphy. Hydraulic parameter distribution in the model was uniform across individual hydrostratigraphic units. The parameter values for each hydrostratigraphic unit were determined during the flow model calibration process (Section 3) and presented in Table 1.

Table 1: Calibrated Model Hydraulic Parameters For Each Hydrostratigraphic Unit

Hydrostratigraphic Unit	**K (ft/day)**	**S_s (m^{-1})**	**θ**	**S_r (-)**	**α (m^{-1})**	**λ (-)**	**δ (-)**
Floodplain Deposits	1.4	1.0×10^{-8}	0.32	0.2	0.5	0.15	25
Perched Zone	2.6	1.0×10^{-3}	0.3	0.1	11.5	0.56	7.3
Perched Clay	0.0014	1.0×10^{-8}	0.5	0.2	0.5	0.15	25
Surficial Aquifer	25 to 72	1.0×10^{-3}	0.33	0.1	11.5	0.56	7.3
Black Creek Confining Unit	0.43	1.0×10^{-8}	0.55	0.2	0.5	0.15	25
Black Creek Aquifer	3.8 to 102	5.1×10^{-5}	0.34	0.1	11.5	0.56	7.3
Cape Fear Confining Unit	1.1	1.0×10^{-8}	0.28	0.2	0.5	0.15	25

S_r and the Brooks-Corey-Burdine (α, λ, δ) constitutive parameters for each hydrostratigraphic unit were selected based on the soil textural class and the estimated model parameters reviewed from Madi et al. (2018), Matlan et al. (2014), and Shao and Irannejad (1999). These parameter assignments were simplified for the model by separating the hydrostratigraphic units as either aquifers or aquitards after performing the first set of flow model calibration runs where each hydrostratigraphic unit was assigned distinct parameter sets. Aquifer units were assigned S_r and Brooks-Corey-Burdine constitutive parameters representative of sands; aquitard units were assigned S_r and Brooks-Corey-Burdine constitutive parameters representative of sandy clay, silty clay, and clay soil types.

2.4 Selection of Calibration Targets

The flow model calibration targets were water level measurements taken at 139 monitoring wells synoptically surveyed between October 15, 2019 and December 08, 2020, screened in the Perched Zone, Surficial Aquifer, and Black Creek Aquifer units. Of these 139 monitoring wells, 60 wells were located in the Perched Zone. 32 wells were located in the Surficial Aquifer and 47 wells were located in the Black Creek Aquifer. Figure J.03 shows the locations of the monitoring wells on-Site. The focus of this modeling study was on flow behaviors in the Black Creek Aquifer, and to a lesser extent the flow behaviors in the Surficial Aquifer and Perched Zone. Computed nodal hydraulic heads at the approximate reference well screen midpoint elevations in the FEFLOW model domain were compared to the field measured hydraulic heads at these 139 wells. FEFLOW calculates hydraulic heads at individual nodes rather than nodal intervals, therefore only monitoring well locations which had field measured hydraulic heads greater or equal to their respective well screen midpoints were included in the calibration analysis.

3. FLOW MODEL CALIBRATION

Model calibration is an iterative process where the initial parameter values (e.g. hydraulic conductivities, boundary conditions, recharge) are adjusted incrementally to produce a better match between the simulated and observed water level elevations.

Figure J.04 presents the calibration statistics and flow simulation results. Calibration statistics that are presented include the maximum and minimum residuals (in the Perched, Surficial and Black Creek Aquifers), the residual mean, the absolute residual mean, the standard error of the estimate, the root mean squared, the normalized root mean squared, correlation coefficient, and the flow mass balance.

The maximum residual (difference between observed and calculated head) occur in the Perched zone at MW-27 (8.52 feet), Surficial aquifer at SMW-09 (13.5 feet) and in the Black Creek at PW-10R (10.27 feet). The residual mean is a measure of the average residual head. Because it is possible that over-calculated and under-calculated values will negate each other thus producing a residual mean value closer to zero (which is ideal), it is preferable to use the absolute residual mean as an indicator of model calibration. The residual mean was -0.66 foot; the absolute residual mean was 2.94 foot.

The root mean square (RMS) is a statistical measure of the magnitude of the residual and useful as an indicator of error where values are both positive and negative. The normalized root mean square (NRMS) is the RMS divided by the maximum difference in observed head values, expressed in percent (%). A model is considered to be well calibrated when the NRMS is below 10%. The RMS for the Perched zone was 4.34 foot; the NRMS was 23.9%, the RMS for the Surficial aquifer was 5.65 foot; the NRMS was 6.4% and the RMS for the Black Creek Aquifer was 4.58 foot; the NRMS was 5.2%.

The flow mass balance is a measure of the volume and rates of water entering and leaving the system through the flow boundary conditions, and from aquifer storage at the end of each stress period (in the case of transient simulations). Ideally, the flow balance should be as close as practicable to a discrepancy of 0%. The flow mass balance in this model has a discrepancy of 0.76%.

3.1 Sensitivity Analysis

Following model calibration, a sensitivity analysis was performed to key variables modified during the calibration process or chosen based on literature values:

- Perched Zone Hydraulic Conductivity;
- Surficial Aquifer Hydraulic Conductivity;
- Black Creek Aquifer Hydraulic Conductivity;

The sensitivity of the model calibration to each variable is assessed qualitatively and quantitatively (where possible) in Table 2.

Table 2: Calibrated Model Sensitivity to Model Boundary Conditions and Hydraulic Parameters

Sensitivity Variable	Change	Sensitivity	NRMS Error
Calibrated Model	N/A	N/A	12.2%
Perched Zone K	+/- 50%	Low	11.3%/13.3%
Surficial K	+/- 20%	Low	12.1%/12.3%
Black Creek K	+/- 20%	Low	12.1%/12.3%

The higher calibration assessment statistics (poorer fit) of the model in the Perched Zone are primarily due to the small range of observed hydraulic heads in the system (as compared to the Surficial and Black Creek Aquifers). The distribution of hydraulic heads in the Perched Zone is likely dependent on the actual locations of anthropogenic recharge which have been spatially variable over time. The model used a uniform spatially distributed recharge (in addition to rainfall recharge) to replicate the general mounding observed at the Site. This approach captured the overall behavior but does not capture the detailed spatial variability to a high degree of certainty.

3.1.1 Pumping Test Verification

To verify the calibration, the model was set up to simulate the constant rate pumping tests that were conducted at the extraction wells EW-1, EW-2, EW-3, EW-4 and EW-5. Table 3 presents the constant rate drawdown test simulated in the model.

Table 3: Comparison of Observed and Model Calculated Drawdowns at Constant Rate

Extraction Well ID	Model Calculated Drawdown (feet)	Observed Drawdown (feet)	Absolute Difference (feet)
EW-1	MW1 – 2.72 MW2 – 2.45 MW3 – 2.2	MW1 – 2.67 MW2 – 2.39 MW3 – 2.21	MW1 – 0.05 MW2 – 0.06 MW3 – 0.01
EW-2	OW-6 – 6.43 PIW-9D – 6.08	OW-6 – 6.55 PIW-9D – 6.19	OW-6 – 0.12 PIW-9D – 0.11

EW-3	OW-4 – 0.87 OW-5 – 0.88	OW-4 – 0.94 OW-5 – 0.96	OW-4 – 0.07 OW-5 – 0.08
EW-4	OW-2 – 13.15 OW-3 – 9.81	OW-2 – 13.33 OW-3 – 10.1	OW-2 – 0.18 OW-3 – 0.29
EW-5	OW-7 – 1.19 OW-8 – 1.31	OW-7- 1.1 OW-8 – 1.2	OW-7 – 0.09 OW-8 – 0.11

Results indicate that the model simulation compares reasonably well with the observed drawdown in monitoring wells. This outcome provides more validation of the groundwater model's ability to simulate the field conditions.

3.2 Assumptions and Limitations

Simulation of groundwater flow involves using specific measured data (e.g., groundwater elevations, hydraulic conductivities) and regional data (e.g., recharge, soil parameters) that are used to develop Site-wide distributions of hydraulic heads and compound concentrations. By nature, a groundwater model is an approximation based on a limited number of data points, and thus in a complex environment there are unavoidably a number of uncertainties. Numerical groundwater flow model, therefore, are approximations of real-world hydrogeological systems. Nevertheless, models are commonly used as a means of representing the available data on a specific groundwater system and performing groundwater remedial design. This model was constructed based on field-observed parameters, which were then interpolated to approximate aquifer conditions across the model domain and assumed to be representative in between the measured points. The modeling was conducted for the sole purpose of the intended objectives stated above.

3.3 Summary and Next Steps

The calibrated FEFLOW model will support remedy and design evaluations at the Site. The calibrated model is deemed sufficiently accurate for the modeling goals of this work however new data should be incorporated into both the conceptual and numerical models when it becomes available.

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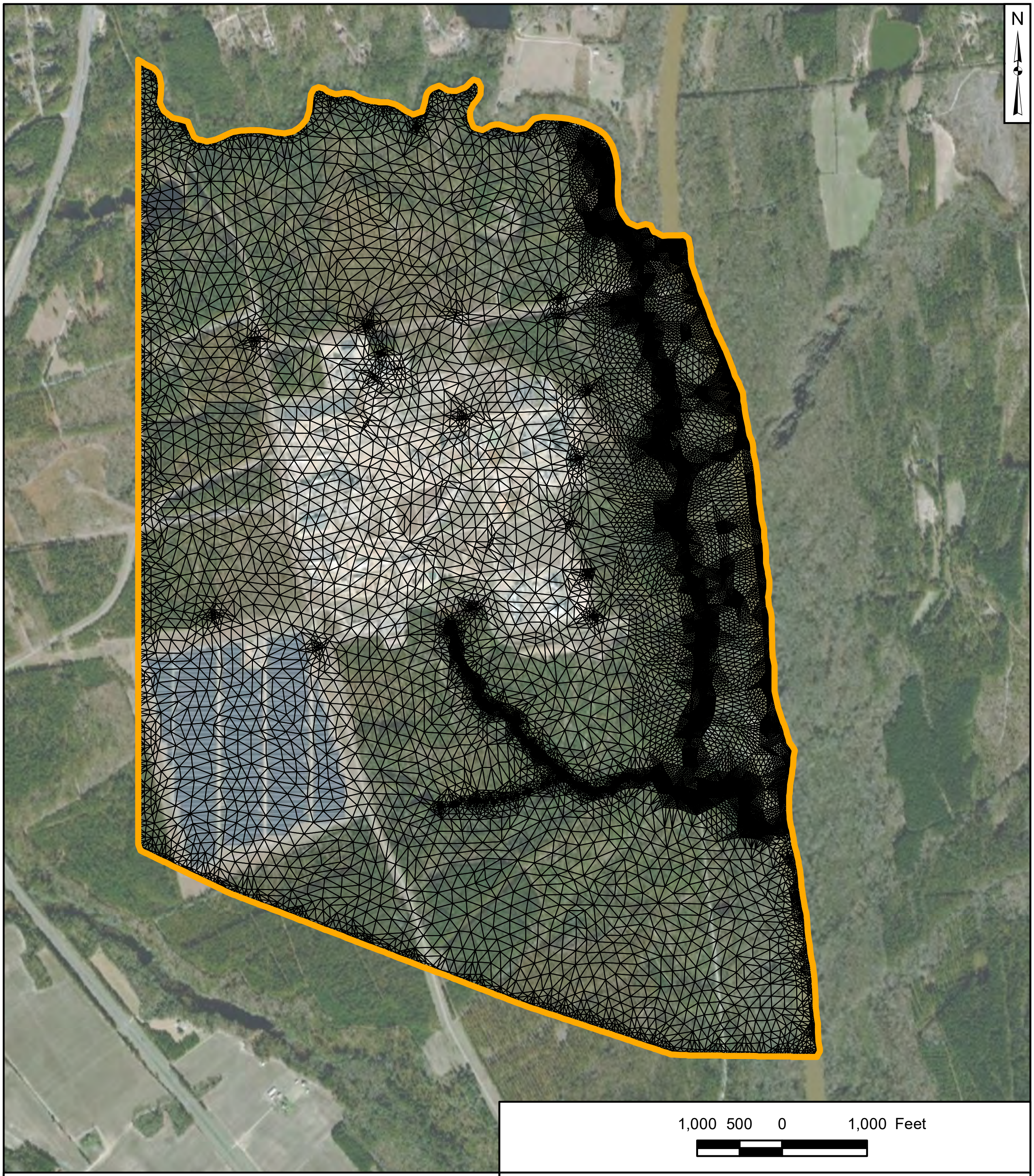

Legend

🟧 Model Boundary

☐ Model Grid

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Domain and Grid

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

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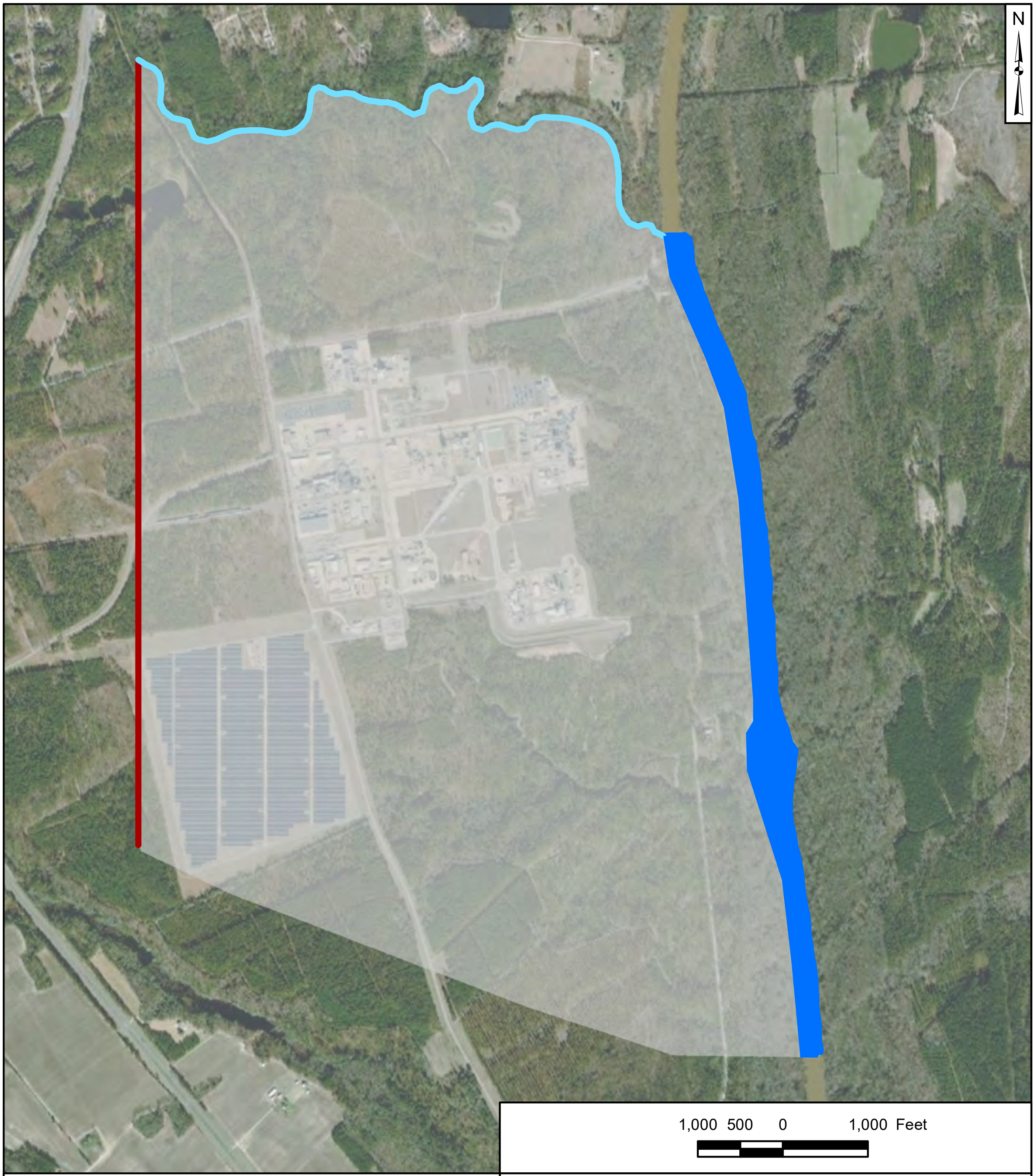
NC License No.: C-3500 and C-295

Raleigh

June 2021

Figure

J.01



Legend

▬ Constant Head Boundary

▬ River Boundary (Willis Creek)

▬ River Boundary (Cape Fear)

▨ Recharge Area

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Boundary Conditions

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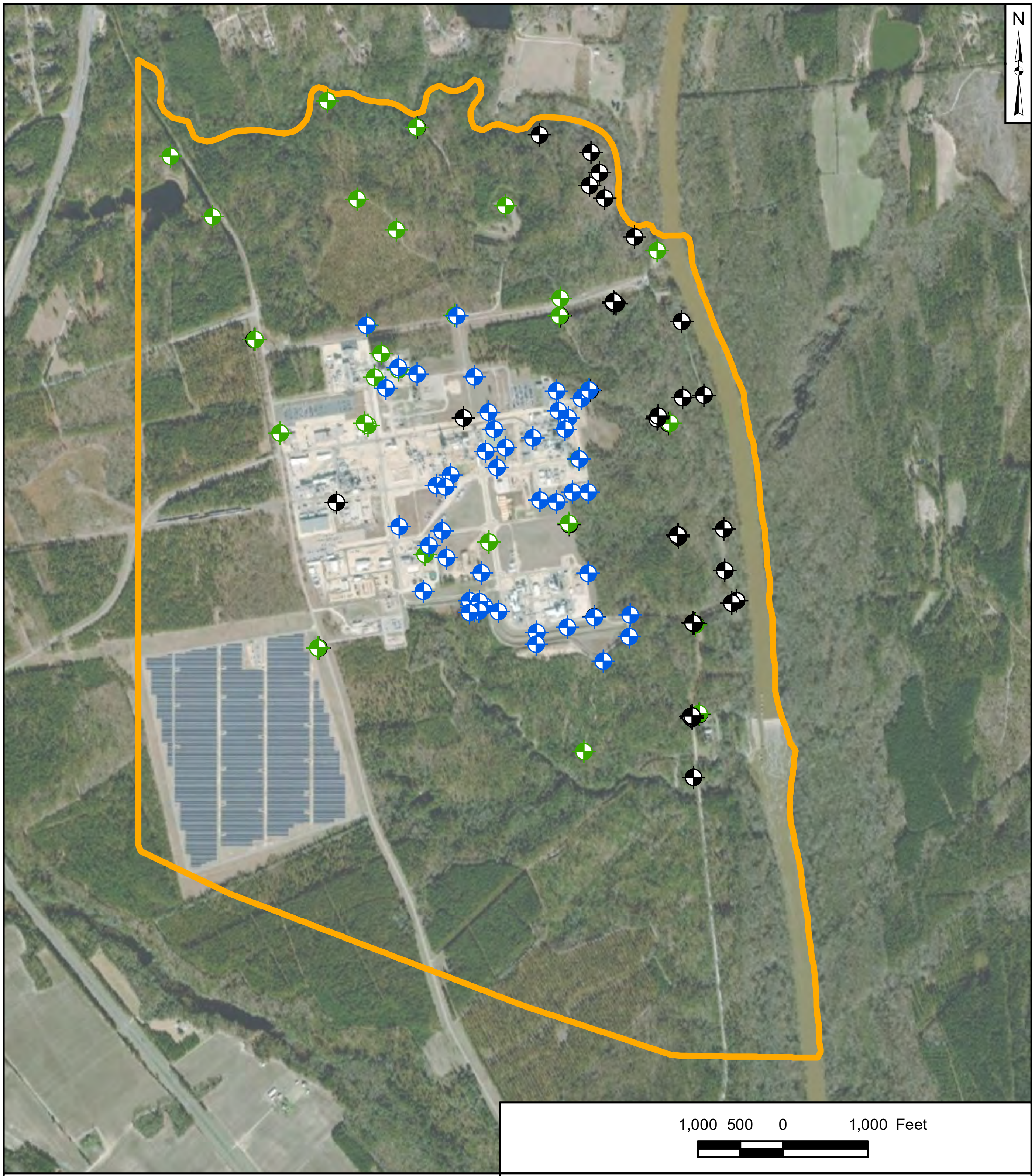
Figure

J.02



Legend

⊕ Perched Zone

⊕ Surficial Aquifer

⊕ Black Creek Aquifer

▭ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Calibration Targets

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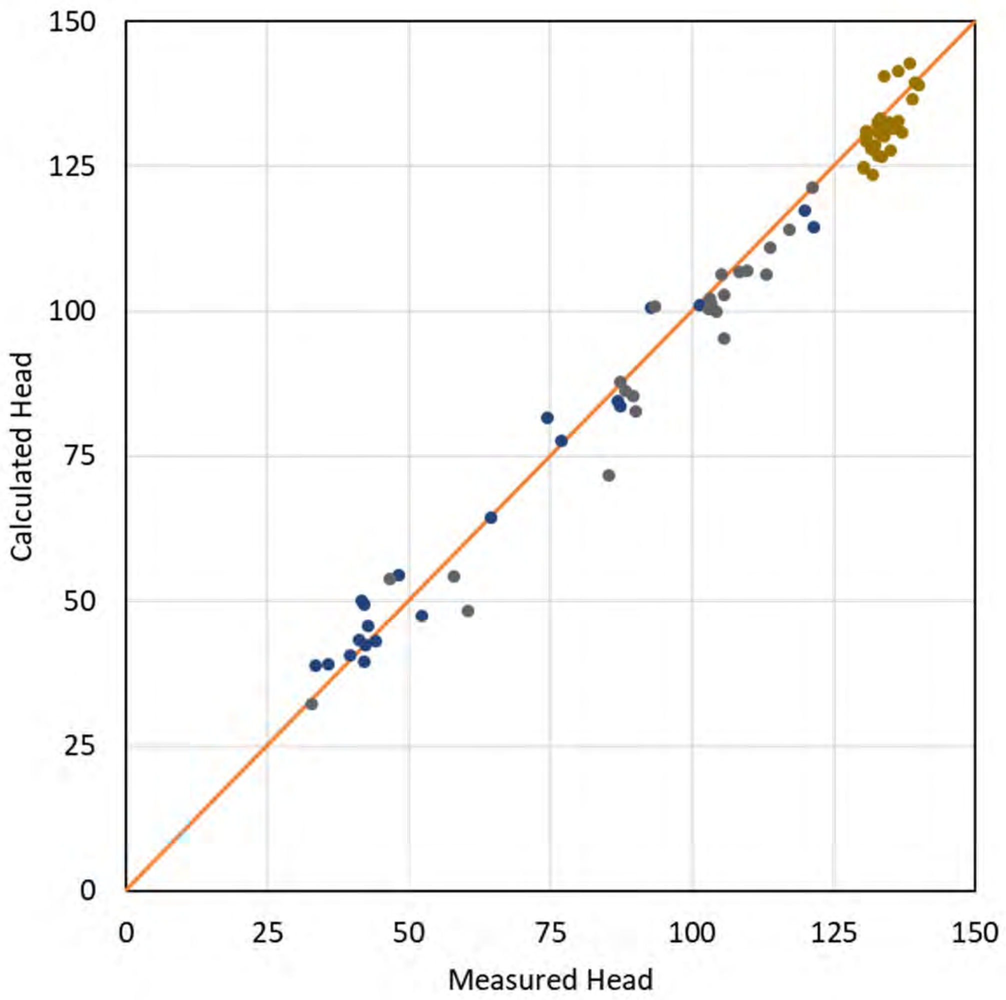
Raleigh	June 2021	Figure **J.03**



Calibration Results	
Correlation Coefficient	0.98
Flow Mass Balance	-0.76%
Normalized RMS	23.9% (Perched zone) 6.4% (Surficial Aquifer) 5.2% (Black Creek)
Maximum Residual	6.57 ft(Perched zone) 7.32 ft (Surficial Aquifer) 8.34 ft (Black Creek)
Minimum Residual	-8.52 ft(Perched zone) -13.54 ft (Surficial Aquifer) -7.14 ft (Black Creek)
Residual Mean	-0.53 (ft)
Absolute Residual Mean	2.66 (ft)
Root Mean Square	4.34 ft(Perched zone) 5.65 ft (Surficial Aquifer) 4.58 ft (Black Creek)

Legend

● Black Creek Aquifer ● Surficial Aquifer ● Perched Zone

Flow Model Calibration Results

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Figure

J.04

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GEOServices, LLC, Geotechnical and Materials Engineers

Appendix B
Groundwater Flow Model Report

Geosyntec consultants

engineers | scientists | innovators

3-Dimensional Groundwater Flow Model

Chemours Fayetteville Works

Prepared for

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Geosyntec Project Number TR0795

August 2021

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Acronyms and Abbreviations

α	alpha
δ	delta
λ	lambda
θ	unsaturated-flow porosity
3D	three-dimensional
CAP	Corrective Action Plan
cm/s	centimeter per second
CO	Consent Order
COA	Addendum to Consent Order Paragraph 12
CPT	piezoCone Penetration Tests
ft	feet
ft/d	feet per day
ft^2	feet square
gpm	gallons per minute
HPT	hydraulic profiling tool
K	hydraulic conductivity
LiDAR	Light Detection and Ranging
NRMS	normalized root mean square
P_c	capillary pressure
PDI	Predesign Investigation
PFAS	per- and polyfluoroalkyl substances
ROI	radii of influence
RMS	root mean square
S_r	residual wetting phase saturation
S_s	specific storage
S_w	wetting phase saturation
USGS	United States Geological Survey

1. Introduction and Objectives

This groundwater modeling report was prepared by Geosyntec Consultants of NC, P.C. (Geosyntec) for The Chemours Company FC, LLC (Chemours) to describe the numerical groundwater model used to develop the basis of design for the groundwater remedy to be implemented pursuant to paragraph 3 of the Addendum to Consent Order Paragraph 12 (COA) among Chemours, the North Carolina Department of Environmental Quality and Cape Fear River Watch. Geosyntec initially developed a three-dimensional (3D) numerical groundwater transient flow model in the Corrective Action Plan (Geosyntec, 2019). The model has been further refined to incorporate results of the Pre-Design Investigation (PDI) efforts (Geosyntec, 2021). The updated model incorporates refinements of the hydrostratigraphic units and aquifer properties that were completed in 2020. The model was used as the basis of design for the groundwater remedy including preparing estimates the amount of collected water that would require treatment. Modeling objectives included:

- Simulate the capacity of a vertical physical barrier parallel to the Cape Fear River to control discharge of groundwater to the River.
- Simulate capacity of a groundwater extraction system, upgradient of the vertical barrier to control discharge of groundwater to the River.
- Utilize the model to evaluate possible optimal combinations of groundwater extraction and physical barrier scenarios that would sufficiently control discharge of groundwater to Cape Fear River, which would inform the basis of design for the overall remedy.

1.1 Scope of Work

The scope of work to achieve the above objectives included modifications to the model and the incorporation of data acquired during the PDI. The majority of the changes to the model focused on the area surrounding the proposed vertical barrier and extraction well network. The scope of work included:

- Refining the grid cell spacing near the vertical barrier.
- Modifying the recharge zonation to better simulate site conditions.
- Modifying the hydraulic conductivity zonation based on data collected during the PDI.
- Examining and modifying the river stages in the various simulated surface water bodies in the model.
- Re-calibrating the modified model to October 2019 and November 2020 measured groundwater elevations.

The current conditions base model was calibrated using statistical analysis and used as the basis for several predictive scenarios. Each scenario was sequentially constructed to be able to assess the performance of the hydraulic containment required in accordance with the objectives set forth in COA Paragraph 3 (NCDEQ, 2020).

1.2 Report Organization

The remainder of this report includes the following subsections:

- Section 2 – Groundwater model software selection
- Section 3 – Groundwater model setup
- Section 4 – Groundwater model calibration
- Section 5 – Remedial design simulations
- Section 6 – Summary
- Section 7 – References

2. Groundwater Model Software Selection

The 3D model was constructed using FEFLOW, version 7.2 (DHI-WASY), which incorporates the Richards' equation, the conservation of mass, and nonlinear relationships between capillary pressure (P_c) and wetting phase saturation (S_w) and between S_w and hydraulic conductivity (K) to solve for hydraulic heads. The model was constructed using field-observed parameters, which were interpolated to approximate aquifer conditions across the model domain and assumed to be representative in between measured locations.

2.1 Model Limitations

Simulation of groundwater flow involves using specific measured data (e.g., groundwater elevation, hydraulic conductivity) and regional data (e.g., recharge) that are used to develop site-wide fields of hydraulic heads. By nature, the groundwater model is an approximation based on a limited number of data points, and thus in a complex environment, there are unavoidable uncertainties. The groundwater model was constructed based on field-observed parameters, which were then interpolated to approximate aquifer conditions across the model domain and assumed to be representative in between the measured points. Numerical groundwater flow models, therefore, are approximations of real-world hydrogeological systems. Nevertheless, models are commonly used as a means of representing the available data on a specific groundwater system and evaluating groundwater remedial design alternatives.

The model calibration was conducted for the purpose of the simulating potential groundwater remedies pursuant to COA paragraph 3. Therefore, the primary importance of calibration results was placed on the flow features salient to the simulation of groundwater flow within the vicinity between the bluff and the Cape Fear River where the vertical barrier and extraction well network are proposed.

The validity and applicability of the model for purposes other than the stated objectives must be independently evaluated based on the professional judgment of the model user.

3. Groundwater Model Setup

The original groundwater flow model developed in 2019 as part of the Corrective Action Plan (CAP) was designed to represent the major physical and hydraulic features of the flow system in the Site Aquifers (Perched, Surficial, and Black Creek) in and around the Chemours Fayetteville Site. Construction and calibration of the original CAP groundwater model are described in Appendix H of the CAP report (Geosyntec, 2019).

Portions of the PDI focused on collecting data for further refining the groundwater model. The scope items included aquifer testing at five locations, a high-resolution cross section, and assessment of per- and polyfluoroalkyl substances (PFAS) chemistry in groundwater along the remedy alignment. This section describes the current version of the model developed for vertical barrier depth design and extraction well network evaluation, and where appropriate, how the model has been modified since inception.

3.1 Model Domain and Grid

The model domain covers an area of 72,690,473 feet square (ft^2) (2.61 square miles). The revised grid consists of 2,099,240 nodes and 4,154,656 elements and 7 model hydrostatigraphic units. The number of nodes and elements were increased to refine the model domain from the edge of the bluff to Cape Fear River. The model domain and grid location are presented in Figure B.01.

The model uses 7 hydrostratigraphic units to represent, from surface downward, the Floodplain deposits, Perched Zone, Perched Clay, Surficial aquifer, Black Creek Confining unit, Black Creek aquifer, and Cape Fear Confining unit. The model varies in thickness from about 170 feet (ft) near the plant to 55 ft at the base of the bluff adjacent to the Cape Fear River.

The Light Detection and Ranging (LiDAR) elevation model prepared by the North Carolina Department of Public Safety was imported to represent ground surface topography (NC DPS, 2015), which was corrected with ground survey data, where available, in areas that could impact performance of the model. The topography of the underlying model layers were based on lithostratigraphic data obtained from Site monitoring wells, soil borings, hydraulic profiling tool (HPT), and piezoCone Penetration Tests (CPT) contained in the three-dimensional visualization model, EVS^{TM}.

3.2 Flow Boundary Conditions

Boundary conditions are used to simulate flow of water into and out of a model domain. Upgradient regional conditions, river and recharge boundaries are used in the updated model to simulate Site conditions. Figure B.02 presents the locations of the boundary conditions within the model domain. The numerical model extent was closely tied to the boundary conditions chosen for the model:

Top Boundary: Established as the ground surface, taken from a combination of LiDAR data and topographic surveys performed along Willis Creek and the Outfall. Boundary conditions on the top boundary were either constant flux (to simulate rainfall recharge) or constant head equal to elevation (with a no inward flow constraint) to simulate seepage faces on the bluffs. Initial rainfall recharge values were selected with reference to the annual precipitation and evapotranspiration estimates for the Mid-Atlantic Coastal Plain (United States Geological Survey [USGS], 2005).

Bottom Boundary: Chosen as flat at an elevation of -20 ft above MSL which is located within the Upper Cape Fear confining unit. A no-flow hydraulic condition was applied to the entire bottom boundary of the model.

Northern Boundary: Willis Creek forms a hydraulic boundary north of the model domain. The creek is treated as a spatially-varying constant hydraulic head boundary from the northwest model corner to the outflow to the Cape Fear River located at the northeast model corner. The uppermost active nodes in the mesh along the Willis Creek boundary were linearly interpolated, from west to east along the creek, from a hydraulic head equal to the ground surface elevation at the western most part of Willis Creek to a hydraulic head equal to the constant hydraulic head boundary value of the Cape Fear River. Application of this constant head condition to only the upper nodes in the mesh forces all groundwater flowing towards the boundary to discharge into the creek (as all nodes below the upper nodes were assigned a no-flow condition).

Eastern Boundary: The Cape Fear River forms a hydraulic boundary east of the model domain. The river is treated as a constant hydraulic head boundary in the uppermost active nodes with an elevation representative of a daily median water elevation in the river, as measured at the W.O. Huske Dam (USGS, 2105500). The river wraps partially around the northeast and southeast corners of the model. Application of this constant head condition to only the uppermost nodes in the mesh forces all groundwater flowing towards the boundary to discharge into the river.

Southern Boundary: The model domain southern extent was chosen to represent a flow line from the western boundary to the eastern boundary. This selection was based on the available measured hydraulic head data and professional judgment (Geosyntec, 2019). A no-flow condition was applied to the southern boundary.

Western Boundary: The western model boundary is not bounded by any clearly defined hydraulic features and maybe a flow divide beneath a topographic high. This boundary was chosen as parallel to the Cape Fear River as limited hydraulic information was available to make a more refined choice. This boundary is located more than a quarter mile from the manufacturing area of the Site. Spatially-varying constant hydraulic head boundary conditions were applied linearly ranging from 125 ft (in the shallower portion of the domain) or 122 ft (in the deeper portion of the domain) at the southern end of the boundary to the elevation of Willis Creek at the northern end of the boundary.

3.3 Hydraulic Parameters

The model parameters were chosen based on the available field data, such as CPT, HPT, and aquifer test data collected from 2018 to 2020. Where ranges in data existed, mid-points of the ranges were chosen as the initial set of parameters.

Hydraulic conductivity, specific storage (S_s), unsaturated-flow porosity (θ), residual wetting phase saturation (S_r), and Brooks-Corey-Burdine P_c-S_w-K constitutive parameters (alpha (α), lambda (λ), delta (δ)) are the main hydraulic parameters in the model. The distribution and assignment of these parameters are based on the conceptual model hydrostratigraphy. Hydraulic parameter distribution in the model was uniform across individual hydrostratigraphic units. The parameter values for each hydrostratigraphic unit were determined during the flow model calibration process (Section 3) and presented in Table 1.

Table ***1: Calibrated Model Hydraulic Parameters For Each Hydrostratigraphic Unit***

Hydrostratigraphic Unit	**K (ft/day)**	**S_s (m^{-1})**	**θ**	**S_r (-)**	**α (m^{-1})**	**λ (-)**	**δ (-)**
Floodplain Deposits	1.4	1.0×10^{-8}	0.32	0.2	0.5	0.15	25
Perched Zone	2.6	1.0×10^{-3}	0.3	0.1	11.5	0.56	7.3
Perched Clay	0.0014	1.0×10^{-8}	0.5	0.2	0.5	0.15	25
Surficial Aquifer	25 to 72	1.0×10^{-3}	0.33	0.1	11.5	0.56	7.3
Black Creek Confining Unit	0.43	1.0×10^{-8}	0.55	0.2	0.5	0.15	25
Black Creek Aquifer	3.8 to 102	5.1×10^{-5}	0.34	0.1	11.5	0.56	7.3
Cape Fear Confining Unit	1.1	1.0×10^{-8}	0.28	0.2	0.5	0.15	25

S_r and the Brooks-Corey-Burdine (α, λ, δ) constitutive parameters for each hydrostratigraphic unit were selected based on the soil textural class and the estimated model parameters reviewed from Madi et al. (2018), Matlan et al. (2014), and Shao and Irannejad (1999). These parameter assignments were simplified for the model by separating the hydrostratigraphic units as either aquifers or aquitards after performing the first set of flow model calibration runs where each hydrostratigraphic unit was assigned distinct parameter sets. Aquifer units were assigned S_r and Brooks-Corey-Burdine constitutive parameters representative of sands; aquitard units were assigned S_r and Brooks-Corey-Burdine constitutive parameters representative of sandy clay, silty clay, and clay soil types.

4. Groundwater Model Calibration

Model calibration is an iterative process where the initial parameters values (e.g., hydraulic conductivities, boundary conditions, recharge) are adjusted incrementally to produce a better match between simulated and observed water level elevations.

Site-wide synoptic water level rounds (July 2020 and December 2020) were collected that incorporated newly installed wells during the PDI.

A total of 96 monitoring well points were used to calibrate the model. Table 2 provides the wells, coordinates, hydrostratigraphic unit, observed and predicted hydraulic heads, and the residual heads. The residual head for each monitoring point is the calculated hydraulic head minus the observed hydraulic head ($X_{cal} – X_{obs}$). Figure B.03 presents the locations of the monitoring wells used to calibrate the base model.

Figure B.04 presents the calibration statistics and a graph of the calculated heads versus observed heads. Calibration statistics presented include the range of residuals, residual mean, absolute residual mean, the standard error of the estimate, the root mean squared error, the normalized root mean squared error, and the flow mass balance.

The maximum residual (difference between observed and calculated head) occurs in the Perched zone at MW-27 (8.52 ft), Surficial aquifer at SMW-09 (13.5 ft), and in the Black Creek at PW-10R (10.27 ft). The residual mean is a measure of the average residual head because it is possible that over-calculated and under-calculated values will negate each other thus producing a residual mean value closer to zero (which is ideal), it is preferable to use the absolute residual mean as an indicator of model calibration. The residual mean was -0.66 ft; the absolute residual mean was 2.94 ft.

The root mean square (RMS) is a statistical measure of the magnitude of the residual and is useful as an indicator of error where values are both positive and negative. The normalized root mean square (NRMS) is the RMS divided by the maximum difference in observed head values, expressed in percent (%). A model is considered to be well calibrated when the NRMS is below 10%. The RMS for the Perched zone was 4.34 ft; the NRMS was 23.9%, the RMS for the Surficial aquifer was 5.65 ft; the NRMS was 6.4% and the RMS for the Black Creek Aquifer was 4.58 ft; the NRMS was 5.2%. The Perched zone NRMS value exceeds 10%, but is unconfined and thin, and the perched zone can be significantly influenced by small scale local recharge patterns making calibration more difficult. The primary targets of the remedy are the Surficial and Black Creek aquifers, not the perched, so calibration does not need to be as refined.

The flow mass balance is a measure of the volume and rates of water entering and leaving the system through the flow boundary conditions, and from aquifer storage at the end of each stress period (in the case of transient simulations). Ideally, the flow balance should be as close as practicable to a discrepancy of 0%. The flow mass balance in this model has a discrepancy of 0.78%.

Figure B.05 presents the simulated equipotential head contours for the Surficial aquifer and Black Creek aquifer layers in the calibrated base model. Field-measured groundwater elevation contours are also included for comparison. Although the focus during model calibration was the area where the vertical barrier and extraction wells will be installed, the model is adequately simulating the groundwater within the plant area.

5. Remedial Design Simulations

The remedial design for Site groundwater includes the installation of a vertical barrier and a groundwater extraction and treatment system to control discharge of PFAS containing groundwater to the Cape Fear River.

The following describes a summary of the conclusions from the PDI and the model results for consideration into the vertical barrier design and groundwater extraction system remedy. The Site geology is highly variable along the groundwater remedy alignment. Consistent with the interpretation of a deltaic depositional environment, the Black Creek aquifer along the alignment is a mixture of high-energy channel sands and lower-energy mud flats. Geosyntec prepared a high-resolution cross section along the groundwater remedy alignment using a combination of data collected during the PDI and previous investigations (Figure is located in PDI document in Appendix A) (Geosyntec, 2021). Three distinct sections of the groundwater remedy alignment are described as follows. Black Creek aquifer soils in the northern portion of the groundwater remedy alignment are dominated by more fine-grained materials indicative of a transition to a low-energy deposition environment. The central portion of the alignment is characterized by higher-energy channel sands and correlates to the locations of a majority of the seeps. The southern portion is similar to the central portion of the alignment but is hydraulically influenced by the Old Outfall.

Particle tracking was incorporated to display flow direction and magnitude between the Site and Cape Fear River under baseline conditions and after the addition of the vertical barrier and the groundwater extraction network. Particle tracking starting locations were released from the Plant Area upgradient of the proposed remedy area.

Particle track and water budget analyses have been completed for various scenarios to quantify groundwater discharge between the Site and the Cape Fear River. This was accomplished using particle tracking and the rate budget analyzer within FEFLOW to assess the groundwater discharge to the Cape Fear River. Groundwater discharge was first estimated under baseline conditions (i.e., Scenario 1, the base case model). As the subsequent scenarios were developed, the particles discharged to Cape Fear River were compared to baseline conditions to evaluate the scenario's control of groundwater flow.

5.1 Scenario 1: Baseline Conditions

The base case model is equivalent to the model calibration conducted during the PDI where the model was adjusted to simulate current conditions prior to remedy implementation.

Figure B.06 presents particle-tracking results for Scenario 1 which uses a 5-year model run time and releases particles from the Plant Area. Under these conditions, particles released from the perimeter of the plant migrate horizontally, then eventually discharge to Cape Fear River.

5.2 Scenario 2: Vertical Barrier Alone

In this scenario, a five-year model simulation, the vertical barrier parallel to the Cape Fear River (shown by the green line in Figure B.07) is simulated to the top of the Upper Cape Fear Confining unit by creating a zone to represent the vertical boundary. The length of the barrier is approximately 9,000 ft, and the depth embeds five feet into the Upper Cape Fear Confining unit. Approximate depth of the barrier ranges from approximately 60 to 80 ft. The barrier is assigned a thickness of 1.6 ft (0.5-meter) and a hydraulic conductivity of 2.8×10^{-3} feet per day (ft/d) (1.0×10^{-6} centimeter per second [cm/s]). Figure B.08 presents the particle-tracking results for Scenario 2. In this five-year simulation, many of the particles released from the Site pass over, around, and through the vertical barrier, and eventually discharge to the Cape Fear River. Specifically, in the area near Seep A and B where there is high transmissivity, particles migrate over, around and through the barrier and discharge to Cape Fear River at a relatively high rate.

Results from the particle tracking and flow analysis indicated that the physical barrier wrap-around flow occurred at the barrier edges after 7 days, breakthrough occurs in multiple locations along the barrier, and groundwater discharges to surface. Specifically, in the areas near Seeps A and B, particles migrate over, around, and through the barrier and discharge to Cape Fear River.

5.3 Scenario 3: Hydraulic Barrier Alone

In Scenario 3, a hydraulic barrier alone was simulated using a groundwater extraction network between the bluff and the Cape Fear River (shown by the wells in Figure B.09). This simulation used 64 extraction wells (10 wells located in the surficial aquifer and 54 wells located in the Black Creek aquifer) to mitigate groundwater discharge to the Cape Fear River.

The simulated extraction well flow rates ranged from 5 to 35 gallons per minute (gpm) depending on location and the total cumulative flow rate for the extraction well network simulated was 980 gpm. Well spacing is generally 200 ft apart; well spacings are closer where there is higher groundwater flux, particularly in the vicinity of Seeps A and B, and along the southern end near the Old Outfall 002. Figure B.10 presents the particle-tracking results for Scenario 3. In this simulation, the particles are released from the Site in the plant area and many are contained by the extraction system. However, some particles are ultimately discharged to the Cape Fear River. Specifically, in the areas near Seeps A and B, particles migrate between some of the extraction wells and discharge to Cape Fear River. An evaluation of the extraction well network indicated insufficient overlap of the radii of influence (ROI) for the extraction wells in many areas of the hydraulic barrier remedy. This results in incomplete capture in the areas where there is increased groundwater flow due to the presence of highly transmissive material.

Additional extraction wells and increased pumping would allow for sufficient overlapping ROI, however, the resulting cone of depression is of sufficient size to begin drawing in Cape Fear River water with limited additional capture of groundwater, reducing overall efficiency. Sensitivity analysis was performed to optimize the well placement and well density along the proposed remedy route. In addition to the spacing specified in the above figures, simulations with a well spacing of 100 ft apart with tighter spacing of 25 feet apart (total of 135 wells) near Seep A, Seep B and near Outfall 003 (higher transmissible areas) were assessed. In the highly transmissive areas, particles from the plant area were still not fully captured by the groundwater extraction well network. Site conditions are such that groundwater from under the plant facility cannot be fully captured without also capturing some portion of Cape Fear River water. It was determined pumping alone could not match the performance of a combination pumping with a physical barrier, Scenario 4 below, with respect to capture.

Notably, in the northern area of the site, where the overall hydraulic conductivity is lower, the ROI of the extraction wells in this area sufficiently overlap and allows for capture of groundwater over the area. Evaluation of the two stand-alone approaches demonstrate that the barrier wall only or pumping only is not sufficient to meet overall Consent Order (CO) objectives. However, the simulation also demonstrated that pumping alone near Willis Creek controls the discharge to surface water in the northern portion.

5.4 Scenario 4: Optimized Scenario

In scenario 4, the vertical barrier and a hydraulic barrier containing 64 extraction wells (10 wells located in the surficial aquifer and 54 wells located in the Black Creek aquifer) were combined and simulated to assess performance of remedy (shown by the wells in Figure B.11).

Attachment 5 to the COA identified that the barrier wall could extend along Willis Creek in the northern alignment. Based on the favorable simulated performance of pumping only (see section 5.3 above) along the northern section and the identified constructability considerations along the northern section (section 3.2.4 of the 60% Design Report), the length of the barrier wall was set to approximately 6,000 ft from near the intake road to near the Old Outfall. The depth of the barrier extends into the upper five ft of the Upper Cape Fear Confining unit, for a total depth of approximately 60 to 80 ft. The barrier is assigned a 1.6-ft (0.5-meter) thickness and hydraulic conductivity of 2.8×10^{-3} ft/d (1.0×10^{-6} cm/s).

The simulated extraction well flow rates range from 5 to 35 gpm depending on location, and the total cumulative flow rate for the extraction well network simulated was 980 gpm. The presence of the vertical barrier effectively reduces overall hydraulic conductivity over the alignment where the barrier wall is present. As a result, the effective ROI of the wells is generally extended to allow sufficient overlap to capture groundwater flow. In those areas where a 200-ft spacing is not sufficient to capture released particles, spacing was tightened to provide adequate overlap of the ROI. Spacing is tighter at the northern and southern ends of the barrier wall and in the vicinity of the Seeps A and B where overall transmissivity is higher and to reduce potential for wrap around.

Figure B.12 presents the particle-tracking results for Scenario 4. In this simulation, the particles released from the Site in the plant area are controlled by the combination vertical and hydraulic barrier. Effectiveness of the simulated remedy was largely equal for both the surficial aquifer above the barrier wall and the Black Creek Aquifer. Groundwater that is present downgradient of the remedy after startup becomes largely stagnant; over time, continuing rainwater recharge and fluctuation of the Cape Fear river slowly drives remaining water present downgradient of the wall toward the Cape Fear River.

Additional sensitivity analyses were performed during the PDI to determine the impacts of key variables on the remedial design; see Appendix A. In addition, precipitation and Cape Fear River model inputs were simulated at the upper range of the observed data to develop upper range of the cumulative flow rates for the extraction well network.

6. Summary

The original groundwater model developed during the CAP and the PDI from 2019 through 2021 was updated to include water level, hydraulic conductivity, and hydrostratigraphic unit elevation data collected during the PDI in 2020/2021. The model was also further discretized vertically and horizontally to allow a more complex simulation of site conditions, simulate potential remedies and help provide a basis for remedy design.

The model was calibrated to synoptic groundwater data collected from 2018 to 2020 by adjusting the hydraulic conductivity distribution, boundary conditions, and recharge. Model calibration statistics indicate a root mean square result of 5.65 ft and a normalized root mean square of 6.4% for the surficial Aquifer and a root mean square result of 4.58 ft and a normalized root mean square of 5.2% for the Black Creek Aquifer and, indicating a well calibrated model. The calibrated model was validated by effectively simulating the pump tests for EW-1, EW-2, EW-3, and EW-4 conducted during the PDI in 2020.

Several model scenarios were completed to assess basis of design for the remedy:

- Scenario 1 simulates the current conditions base model updated with PDI data.
- Scenario 2 simulates a vertical barrier only.
- Scenario 3 simulates a hydraulic barrier via an extraction system only.
- Scenario 4 simulates an optimized remedy that takes advantages of the strengths of both the vertical barrier and hydraulic barrier via an extraction system.

The modeling results indicate that the groundwater in the northern alignment portion can be intercepted using extraction wells alone and that a barrier wall is not required. Particle tracking of the scenario simulations indicate that surficial aquifer to the seeps east of the barrier wall and the Black Creek Aquifer to the Cape Fear River controls groundwater and meets CO objectives under Scenario 4, the optimized solution.

Based on these model results, Scenario 4 was selected as a suitable option for limiting the groundwater discharge to the Cape Fear River and forms the basis of design for the groundwater remedy. Scenario 4 demonstrates that to provide adequate hydraulic containment, 64 extraction wells (10 wells located in the surficial aquifer, and 54 wells located in the Black Creek aquifer) and a vertical barrier wall installed through the central and southern sections of the alignment successfully reduce the groundwater discharging to the Cape Fear River. The estimated cumulative flow rates for the extraction well network is about 980 gpm.

7. References

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Tables

Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
BCA-01	Black Creek Aquifer	Oct-19	87.38	83.58	-3.80
BCA-02	Black Creek Aquifer	Oct-19	74.55	81.52	6.97
BCA-04	Black Creek Aquifer	Oct-19	121.55	114.41	-7.14
BCA-03R	Black Creek Aquifer	Oct-19	101.27	101.05	-0.22
PW-10R	Black Creek Aquifer	Oct-19	48.15	54.43	6.28
PW-12	Black Creek Aquifer	Oct-19	92.65	100.70	8.05
LTW-02	Black Creek Aquifer	Oct-19	42.19	39.36	-2.83
LTW-05	Black Creek Aquifer	Oct-19	42.35	42.42	0.07
PIW-2D	Black Creek Aquifer	Oct-19	64.55	64.30	-0.25
PIW-3D	Black Creek Aquifer	Oct-19	35.8	39.02	3.22
PIW-4D	Black Creek Aquifer	Oct-19	41.68	50.02	8.34
PIW-7D	Black Creek Aquifer	Oct-19	42.69	45.68	2.99
PIW-8D	Black Creek Aquifer	Oct-19	41.11	43.33	2.22
PIW-9D	Black Creek Aquifer	Oct-19	42.08	49.40	7.32
PW-09	Black Creek Aquifer	Oct-19	52.24	47.48	-4.76
PW-11	Black Creek Aquifer	Oct-19	39.6	40.57	0.97
PW-13	Black Creek Aquifer	Oct-19	119.79	117.30	-2.49
PW-14	Black Creek Aquifer	Oct-19	86.86	84.49	-2.37
PW-15R	Black Creek Aquifer	Oct-19	76.96	77.63	0.67
PZ-22	Black Creek Aquifer	Oct-19	44.06	43.02	-1.04
SMW-12	Black Creek Aquifer	Oct-19	33.44	38.88	5.44
LTW-01	Floodplain Deposits	Oct-19	37.3	40.33	3.03
LTW-03	Floodplain Deposits	Oct-19	39.71	39.06	-0.65
LTW-04	Floodplain Deposits	Oct-19	42.55	43.63	1.08
PIW-1S	Floodplain Deposits	Oct-19	32.59	35.56	2.97
PIW-6S	Floodplain Deposits	Oct-19	38.6	41.90	3.30
PIW-7S	Floodplain Deposits	Oct-19	42.51	50.33	7.82
PIW-7S	Floodplain Deposits	Oct-19	42.51	43.21	0.70
MW-13D	Surficial Aquifer	Oct-19	104.33	99.89	-4.44
MW-14D	Surficial Aquifer	Oct-19	109.67	107.09	-2.58
MW-16D	Surficial Aquifer	Oct-19	113.02	106.38	-6.64
MW-17D	Surficial Aquifer	Oct-19	117.09	114.11	-2.98
MW-18D	Surficial Aquifer	Oct-19	87.28	87.89	0.61
MW-19D	Surficial Aquifer	Oct-19	88.24	86.19	-2.05
MW-20D	Surficial Aquifer	Oct-19	89.51	85.37	-4.14
MW-21D	Surficial Aquifer	Oct-19	105.71	102.86	-2.85
MW-22D	Surficial Aquifer	Oct-19	113.82	110.93	-2.89
PIW-1D	Surficial Aquifer	Oct-19	32.81	32.17	-0.64
PIW-5S	Surficial Aquifer	Oct-19	60.46	48.36	-12.10
PW-02	Surficial Aquifer	Oct-19	90.05	82.82	-7.23
PW-05	Surficial Aquifer	Oct-19	121.25	121.37	0.12

Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
MW-15DRR	Surficial Aquifer	Oct-19	103.37	101.34	-2.03
PW-03	Surficial Aquifer	Oct-19	105.57	95.39	-10.18
SMW-03B	Surficial Aquifer	Oct-19	93.4	100.72	7.32
SMW-05P	Surficial Aquifer	Oct-19	105.31	106.23	0.92
SMW-06B	Surficial Aquifer	Oct-19	103.15	102.07	-1.08
SMW-08B	Surficial Aquifer	Oct-19	108.29	106.71	-1.58
SMW-09	Surficial Aquifer	Oct-19	85.2	71.65	-13.55
SMW-10	Surficial Aquifer	Oct-19	46.69	53.70	7.01
SMW-11	Surficial Aquifer	Oct-19	57.87	54.34	-3.53
SMW-04B	Surficial Aquifer	Oct-19	102.94	100.42	-2.52
FTA-02	Perched Zone	Oct-19	133.61	131.69	-1.92
MW-1S	Perched Zone	Oct-19	132.9	130.81	-2.09
MW-2S	Perched Zone	Oct-19	130.69	129.30	-1.39
MW-9S	Perched Zone	Oct-19	130.36	124.57	-5.79
MW-11	Perched Zone	Oct-19	132.81	132.54	-0.27
MW-23	Perched Zone	Oct-19	131.61	128.04	-3.57
MW-24	Perched Zone	Oct-19	133.93	140.50	6.57
MW-26	Perched Zone	Oct-19	133.29	133.17	-0.12
MW-28	Perched Zone	Oct-19	131.99	123.47	-8.52
MW-31	Perched Zone	Oct-19	130.2	124.77	-5.43
MW-33	Perched Zone	Oct-19	132.36	128.58	-3.78
NAF-03	Perched Zone	Oct-19	139.43	139.36	-0.07
NAF-06	Perched Zone	Oct-19	139.99	139.05	-0.94
NAF-08A	Perched Zone	Oct-19	138.92	136.52	-2.40
NAF-09	Perched Zone	Oct-19	138.54	142.64	4.10
NAF-10	Perched Zone	Oct-19	136.38	141.43	5.05
NAF-11A	Perched Zone	Oct-19	135.76	132.42	-3.34
PZ-11	Perched Zone	Oct-19	133.55	126.63	-6.92
PZ-12	Perched Zone	Oct-19	137.02	130.84	-6.18
PZ-13	Perched Zone	Oct-19	130.74	131.00	0.26
PZ-20R	Perched Zone	Oct-19	135.54	131.57	-3.97
PZ-21R	Perched Zone	Oct-19	135.47	131.66	-3.81
PZ-24	Perched Zone	Oct-19	136.22	132.30	-3.92
PZ-25	Perched Zone	Oct-19	133.36	130.49	-2.87
PZ-27	Perched Zone	Oct-19	134.8	132.63	-2.17
PZ-28	Perched Zone	Oct-19	133.97	130.07	-3.90
PZ-29	Perched Zone	Oct-19	135.14	127.78	-7.36
PZ-32	Perched Zone	Oct-19	130.7	130.14	-0.56
PZ-34	Perched Zone	Oct-19	132.72	126.76	-5.96
SMW-03	Perched Zone	Oct-19	136.32	132.76	-3.56
NAF-13	Perched Zone	Oct-19	133.01	139.18	6.17

Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
PZ-17	Perched Zone	Oct-19	135.12	141.51	6.39
SMW-02	Perched Zone	Oct-19	121.81	119.60	-2.21
PZ-12	Perched Zone	Dec-20	132	131.00	1.00
PZ-15	Perched Zone	Dec-20	135.85	141.51	-5.66
PZ-17	Perched Zone	Dec-20	121.85	119.60	2.25
PZ-19R	Perched Zone	Dec-20	137.14	131.57	5.57
PZ-20R	Perched Zone	Dec-20	137.07	131.66	5.41
PZ-21R	Perched Zone	Dec-20	138.62	132.30	6.32
PZ-35	Perched Zone	Dec-20	138.07	132.76	5.31
BCA-01	Black Creek Aquifer	Dec-20	84.43	83.58	0.85
BCA-02	Black Creek Aquifer	Dec-20	75.07	81.52	-6.45
BCA-03R	Black Creek Aquifer	Dec-20	101.29	101.05	0.24
BCA-04	Black Creek Aquifer	Dec-20	122.38	114.41	7.97
EW-1	Perched Zone	Dec-20	60.15	65.66	-5.51
EW-2	Perched Zone	Dec-20	43.35	44.10	-0.75
EW-3	Perched Zone	Dec-20	61.55	57.17	4.38
EW-4	Perched Zone	Dec-20	50.57	48.39	2.18
EW-5	Perched Zone	Dec-20	45.38	43.41	1.97
FTA-01	Perched Zone	Dec-20	134.14	131.69	2.45
FTA-02	Perched Zone	Dec-20	132.88	136.39	-3.51
FTA-03	Perched Zone	Dec-20	133.68	130.81	2.87
LTW-01	Floodplain Deposits	Dec-20	38.88	40.33	-1.45
LTW-02	Black Creek Aquifer	Dec-20	43.2	39.36	3.84
LTW-03	Floodplain Deposits	Dec-20	41.24	39.06	2.18
LTW-04	Floodplain Deposits	Dec-20	44.19	43.63	0.56
LTW-05	Black Creek Aquifer	Dec-20	42.78	42.42	0.36
MW-11	Perched Zone	Dec-20	125.15	125.90	-0.75
MW-12S	Perched Zone	Dec-20	132.56	128.04	4.52
MW-13D	Surficial Aquifer	Dec-20	104.75	99.89	4.86
MW-14D	Surficial Aquifer	Dec-20	110.29	107.09	3.20
MW-15DRR	Surficial Aquifer	Dec-20	103.21	101.34	1.87
MW-16D	Surficial Aquifer	Dec-20	112.89	106.38	6.51
MW-17D	Surficial Aquifer	Dec-20	117.74	114.11	3.63
MW-18D	Surficial Aquifer	Dec-20	88.79	87.89	0.90
MW-19D	Surficial Aquifer	Dec-20	90.03	86.19	3.84
MW-1S	Perched Zone	Dec-20	131.34	129.30	2.04
MW-20D	Surficial Aquifer	Dec-20	90.88	85.37	5.51
MW-21D	Surficial Aquifer	Dec-20	106.77	102.86	3.91
MW-22D	Surficial Aquifer	Dec-20	113.64	110.93	2.71
MW-23	Perched Zone	Dec-20	134.33	140.50	-6.17
MW-24	Perched Zone	Dec-20	128.92	134.53	-5.61

Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
MW-25	Perched Zone	Dec-20	134.11	133.17	0.94
MW-26	Perched Zone	Dec-20	136.5	137.05	-0.55
MW-27	Perched Zone	Dec-20	132.44	123.47	8.97
MW-28	Perched Zone	Dec-20	131.29	124.77	6.52
MW-30	Perched Zone	Dec-20	135.1	139.18	-4.08
MW-31	Perched Zone	Dec-20	131.82	135.53	-3.71
MW-32	Perched Zone	Dec-20	132.24	128.58	3.66
MW-33	Perched Zone	Dec-20	132.47	129.72	2.75
MW-34	Perched Zone	Dec-20	132.13	136.43	-4.30
MW-35	Perched Zone	Dec-20	132.21	129.61	2.60
MW-36	Perched Zone	Dec-20	132.29	135.91	-3.62
MW-7S	Perched Zone	Dec-20	137.49	135.52	1.97
MW-8S	Perched Zone	Dec-20	141.94	147.54	-5.60
MW-9S	Perched Zone	Dec-20	133.39	132.54	0.85
NAF-01	Perched Zone	Dec-20	140.95	140.28	0.67
NAF-02	Perched Zone	Dec-20	141.05	139.36	1.69
NAF-03	Perched Zone	Dec-20	140.92	144.15	-3.23
NAF-06	Perched Zone	Dec-20	134.87	131.08	3.79
NAF-07	Perched Zone	Dec-20	140.6	136.52	4.08
NAF-08A	Perched Zone	Dec-20	140.73	142.64	-1.91
NAF-08B	Perched Zone	Dec-20	95.44	100.44	-5.00
NAF-09	Perched Zone	Dec-20	137.93	141.43	-3.50
NAF-10	Perched Zone	Dec-20	138.54	132.42	6.12
NAF-11A	Perched Zone	Dec-20	136.82	139.97	-3.15
NAF-11B	Perched Zone	Dec-20	94.13	99.26	-5.13
NAF-12	Perched Zone	Dec-20	140.15	136.79	3.36
OW-1	Perched Zone	Dec-20	59.78	62.67	-2.89
OW-1	Perched Zone	Dec-20	59.78	65.69	-5.91
OW-10	Perched Zone	Dec-20	59.82	60.49	-0.67
OW-2	Perched Zone	Dec-20	50.34	53.62	-3.28
OW-3	Perched Zone	Dec-20	50.14	48.81	1.33
OW-4	Perched Zone	Dec-20	61.57	62.16	-0.59
OW-5	Perched Zone	Dec-20	61.78	65.79	-4.01
OW-6	Perched Zone	Dec-20	42.8	42.55	0.25
OW-7	Perched Zone	Dec-20	45.35	44.40	0.95
OW-8	Perched Zone	Dec-20	44.6	45.95	-1.35
OW-9	Perched Zone	Dec-20	61.71	57.79	3.92
PIW-10DR	Perched Zone	Dec-20	61.16	60.94	0.22
PIW-10S	Perched Zone	Dec-20	57.93	53.29	4.64
PIW-11	Perched Zone	Dec-20	45.11	40.55	4.56
PIW-12	Perched Zone	Dec-20	35.53	34.75	0.78

Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
PIW-13	Perched Zone	Dec-20	36.2	31.75	4.45
PIW-14	Perched Zone	Dec-20	37.01	38.24	-1.23
PIW-15	Perched Zone	Dec-20	35.58	33.96	1.62
PIW-16D	Perched Zone	Dec-20	131.11	135.13	-4.02
PIW-16S	Perched Zone	Dec-20	134.79	136.41	-1.62
PIW-1D	Surficial Aquifer	Dec-20	36.37	32.17	4.20
PIW-1S	Floodplain Deposits	Dec-20	35.35	35.56	-0.21
PIW-2D	Black Creek Aquifer	Dec-20	64.4	64.30	0.10
PIW-3D	Black Creek Aquifer	Dec-20	37.56	39.48	-1.92
PIW-4D	Black Creek Aquifer	Dec-20	42.67	47.23	-4.56
PIW-5S	Surficial Aquifer	Dec-20	61.17	48.36	12.81
PIW-6S	Floodplain Deposits	Dec-20	40.19	41.90	-1.71
PIW-7D	Black Creek Aquifer	Dec-20	43.35	45.96	-2.61
PIW-7S	Floodplain Deposits	Dec-20	43.42	50.33	-6.91
PIW-8D	Black Creek Aquifer	Dec-20	41.55	43.33	-1.78
PIW-9D	Black Creek Aquifer	Dec-20	42.49	49.40	-6.91
PIW-9S	Perched Zone	Dec-20	50.81	47.88	2.93
PW-01	Perched Zone	Dec-20	135.72	126.63	9.09
PW-02	Surficial Aquifer	Dec-20	89.99	82.82	7.17
PW-03	Surficial Aquifer	Dec-20	106.2	95.39	10.81
PW-04	Perched Zone	Dec-20	74.81	78.81	-4.00
PW-05	Surficial Aquifer	Dec-20	123.57	121.37	2.20
PW-06	Perched Zone	Dec-20	128.17	131.47	-3.30
PW-07	Perched Zone	Dec-20	118.6	123.45	-4.85
PW-09	Black Creek Aquifer	Dec-20	53.04	47.48	5.56
PW-10R	Black Creek Aquifer	Dec-20	47.18	54.43	-7.25
PW-11	Black Creek Aquifer	Dec-20	38.66	40.57	-1.91
PW-12	Black Creek Aquifer	Dec-20	93.77	100.70	-6.93
PW-13	Black Creek Aquifer	Dec-20	117.22	117.30	-0.08
PW-14	Black Creek Aquifer	Dec-20	86.49	84.49	2.00
PW-15R	Black Creek Aquifer	Dec-20	67.05	77.63	-10.58
PZ-11	Perched Zone	Dec-20	141.57	130.84	10.73
PZ-13	Perched Zone	Dec-20	138.5	134.75	3.75
PZ-14	Perched Zone	Dec-20	136.36	138.10	-1.74
PZ-22	Black Creek Aquifer	Dec-20	44.7	43.02	1.68
PZ-24	Perched Zone	Dec-20	134.15	130.49	3.66
PZ-26	Perched Zone	Dec-20	136.97	132.63	4.34
PZ-27	Perched Zone	Dec-20	133.16	130.07	3.09
PZ-28	Perched Zone	Dec-20	135.47	127.78	7.69
PZ-29	Perched Zone	Dec-20	133.18	133.94	-0.76
PZ-31	Perched Zone	Dec-20	130.16	130.14	0.02

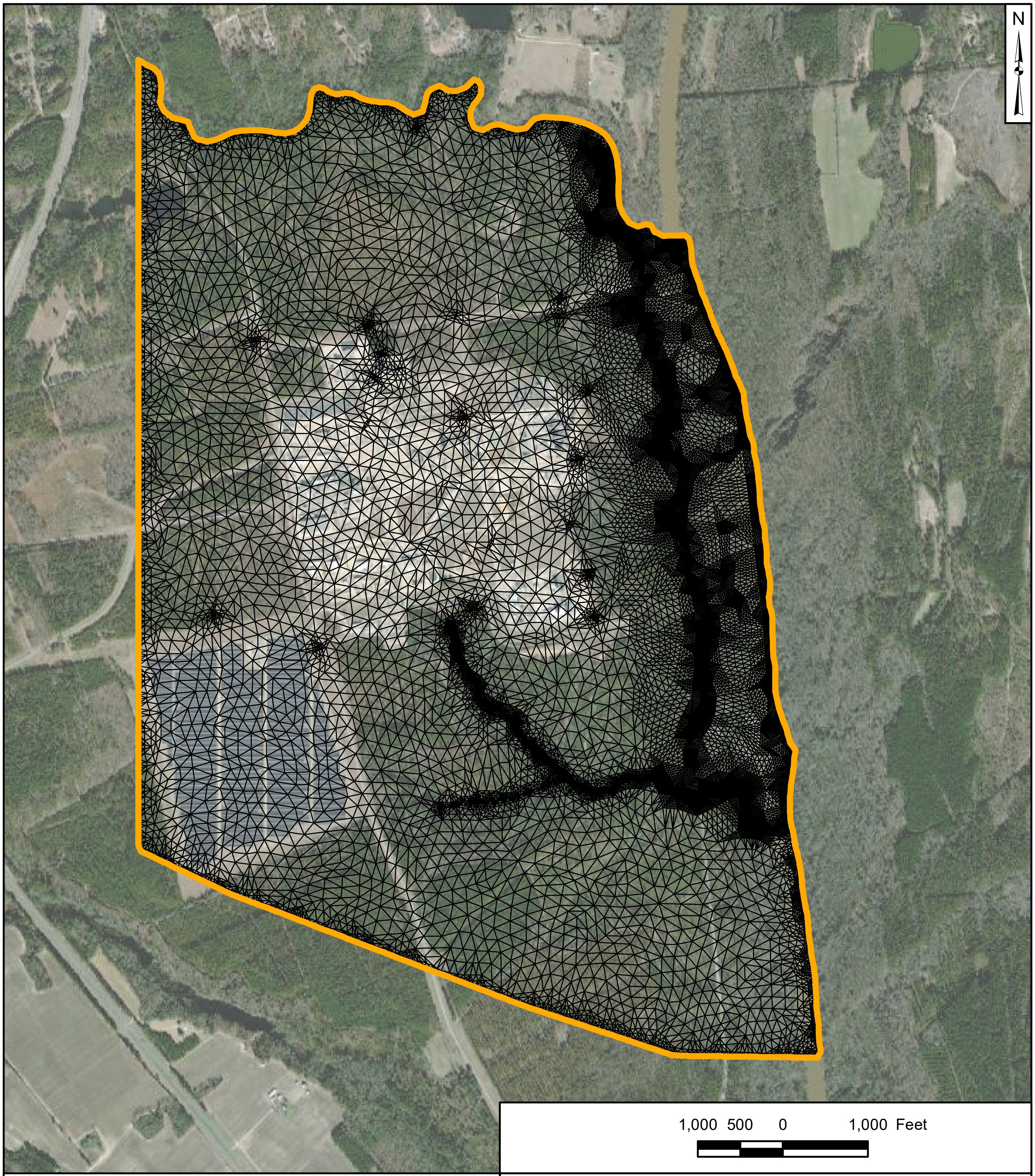
Table B.02: Calibration Results: Observed vs Model Predicted Hydraulic Head Data

Chemours Fayetteville Works, North Carolina

Location Name	Aquifer	Observation Date	Observed Head (ft)	Calculated Head (ft)	Residual (Obs. - Calc.) (ft)
PZ-32	Perched Zone	Dec-20	132.92	138.25	-5.33
PZ-33	Perched Zone	Dec-20	132.67	126.76	5.91
PZ-34	Perched Zone	Dec-20	131.89	127.62	4.27
PZ-36	Perched Zone	Dec-20	132.64	130.52	2.12
PZ-37	Perched Zone	Dec-20	132.8	136.02	-3.22
PZ-38	Perched Zone	Dec-20	131.01	130.93	0.08
PZ-39	Perched Zone	Dec-20	134.26	135.43	-1.17
PZ-40	Perched Zone	Dec-20	134.5	137.68	-3.18
PZ-41	Perched Zone	Dec-20	134.86	132.79	2.07
PZ-42	Perched Zone	Dec-20	134.77	140.74	-5.97
PZ-43	Perched Zone	Dec-20	132.73	134.40	-1.67
PZ-44	Perched Zone	Dec-20	133.27	129.63	3.64
PZ-45	Perched Zone	Dec-20	133.19	135.67	-2.48
PZ-L	Perched Zone	Dec-20	117.82	115.81	2.01
SMW-01	Perched Zone	Dec-20	124.9	127.26	-2.36
SMW-02	Perched Zone	Dec-20	136.55	140.08	-3.53
SMW-02B	Perched Zone	Dec-20	89.2	89.69	-0.49
SMW-03B	Surficial Aquifer	Dec-20	93.84	100.72	-6.88
SMW-04B	Surficial Aquifer	Dec-20	103.26	100.42	2.84
SMW-05	Perched Zone	Dec-20	125.2	121.64	3.56
SMW-05P	Surficial Aquifer	Dec-20	105.5	106.23	-0.73
SMW-06	Perched Zone	Dec-20	125.92	126.41	-0.49
SMW-06B	Surficial Aquifer	Dec-20	103.22	102.07	1.15
SMW-07	Perched Zone	Dec-20	128.15	127.29	0.86
SMW-08	Perched Zone	Dec-20	116.82	119.40	-2.58
SMW-08B	Surficial Aquifer	Dec-20	108.26	106.71	1.55
SMW-09	Surficial Aquifer	Dec-20	85.91	71.65	14.26
SMW-10	Surficial Aquifer	Dec-20	47.37	53.70	-6.33
SMW-11	Surficial Aquifer	Dec-20	59.58	54.34	5.24
SMW-12	Black Creek Aquifer	Dec-20	36.01	38.88	-2.87

Notes:
ft - feet
Obs. - Observed
Calc. - Calculated

Figures



Legend

▭ Model Boundary

▭ Model Grid

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Domain and Grid

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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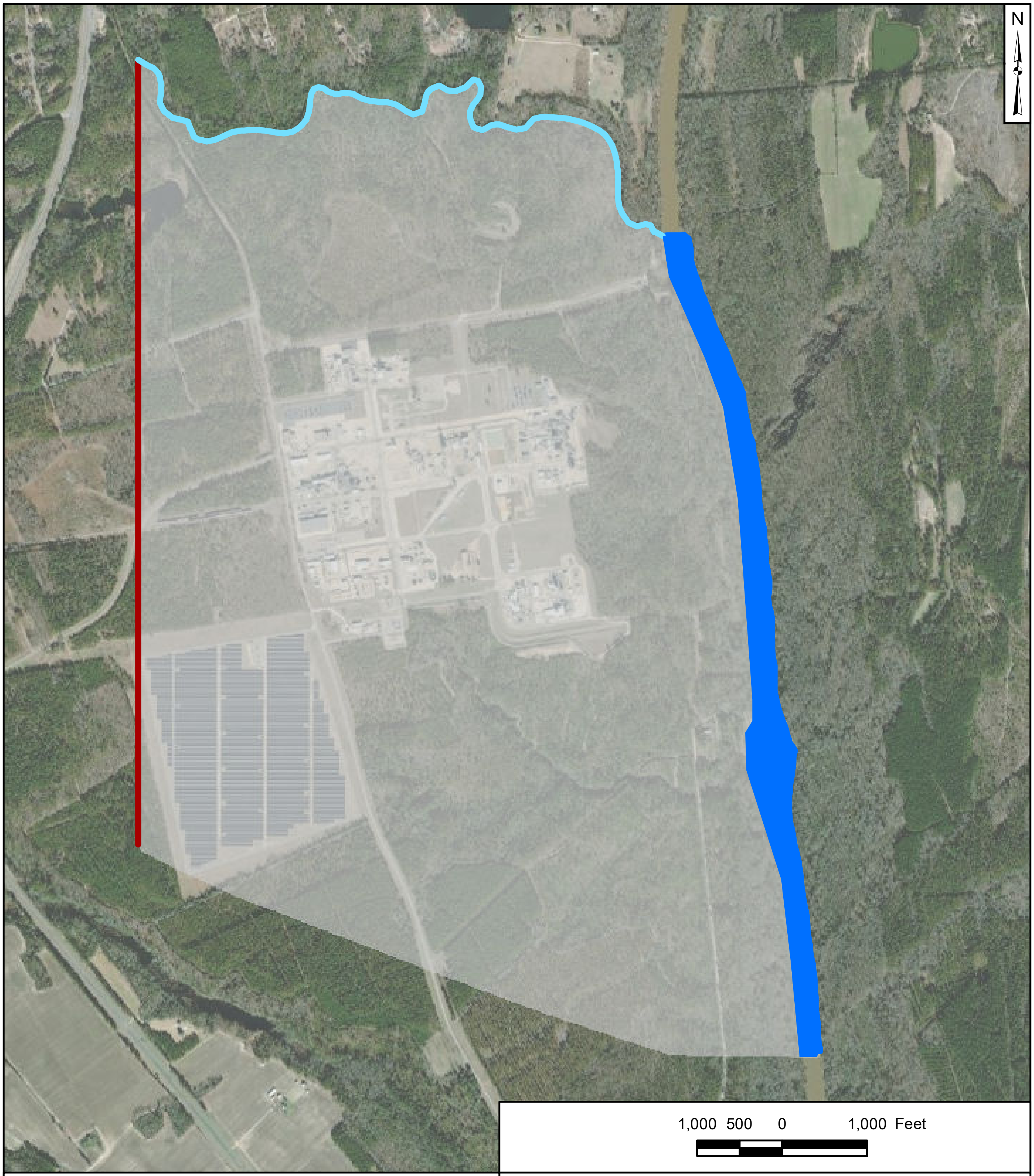
Figure

B.01

Raleigh

August 2021



Legend

- ▬ Constant Head Boundary
- ▬ River Boundary (Willis Creek)
- ▬ River Boundary (Cape Fear)
- ▨ Recharge Area

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Boundary Conditions

Chemours Fayetteville Works, North Carolina

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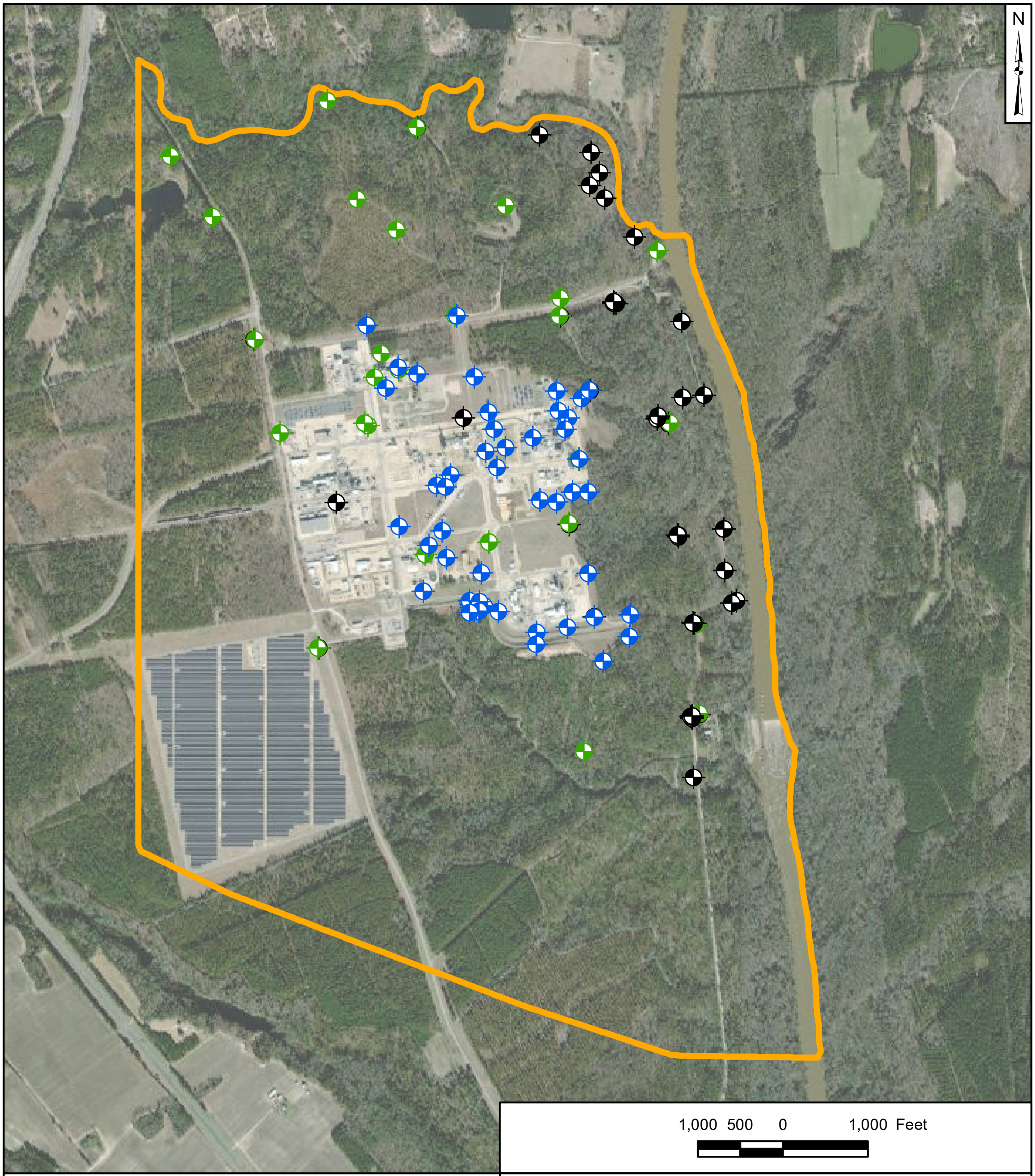
Figure

B.02



Legend

⊕ Perched Zone

⊕ Surficial Aquifer

⊕ Black Creek Aquifer

▭ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Model Calibration Targets

Chemours Fayetteville Works, North Carolina

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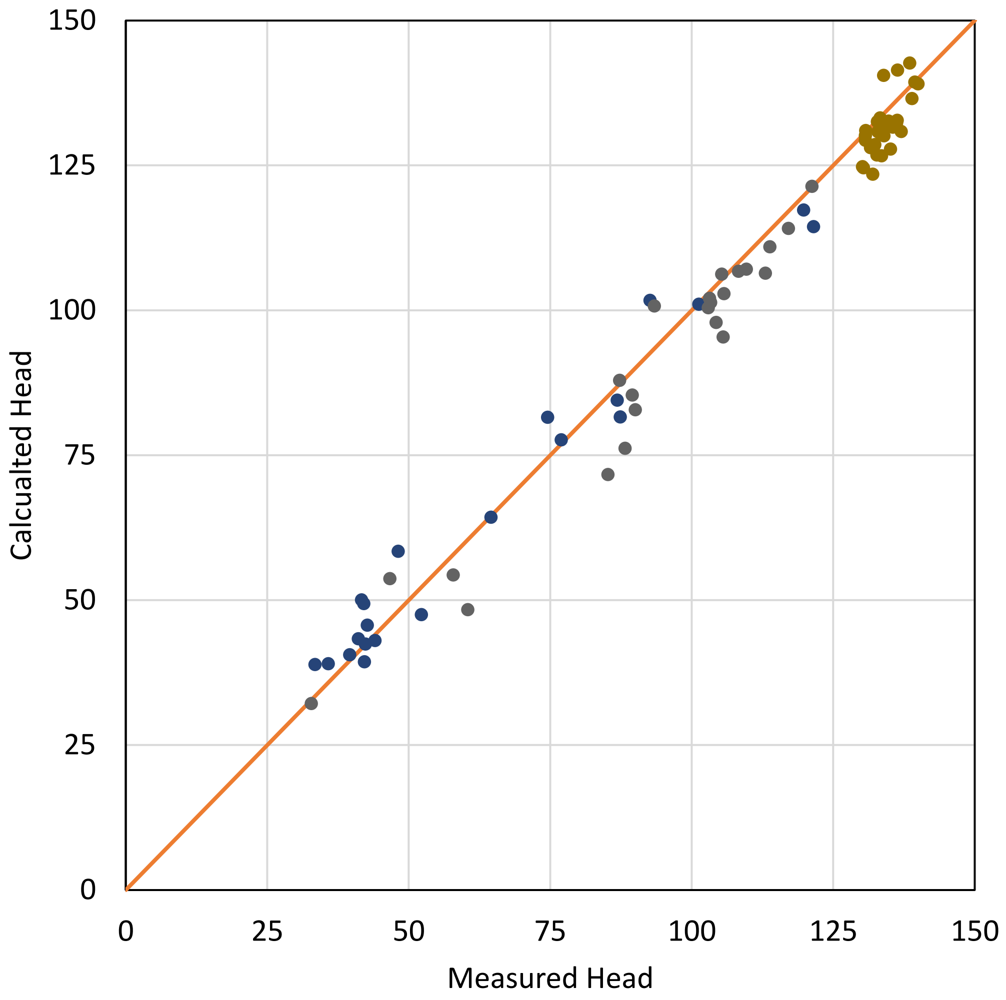
Figure

B.03



Calibration Results	
Correlation Coefficient	0.98
Flow Mass Balance	-0.78%
Normalized RMS	23.9% (Perched zone) 7.1% (Surficial Aquifer) 5.8% (Black Creek)
Maximum Residual	6.57 ft(Perched zone) 7.32 ft (Surficial Aquifer) 10.27 ft (Black Creek)
Minimum Residual	-8.52 ft(Perched zone) -13.54 ft (Surficial Aquifer) -0.007ft (Black Creek)
Residual Mean	-0.66 (ft)
Absolute Residual Mean	2.94 (ft)
Root Mean Square	4.34 ft(Perched zone) 6.24 ft (Surficial Aquifer) 5.08 ft (Black Creek)

Legend

● Black Creek Aquifer ● Surficial Aquifer ● Perched Zone

Flow Model Calibration Results

Chemours Fayetteville Works, North Carolina

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B.04

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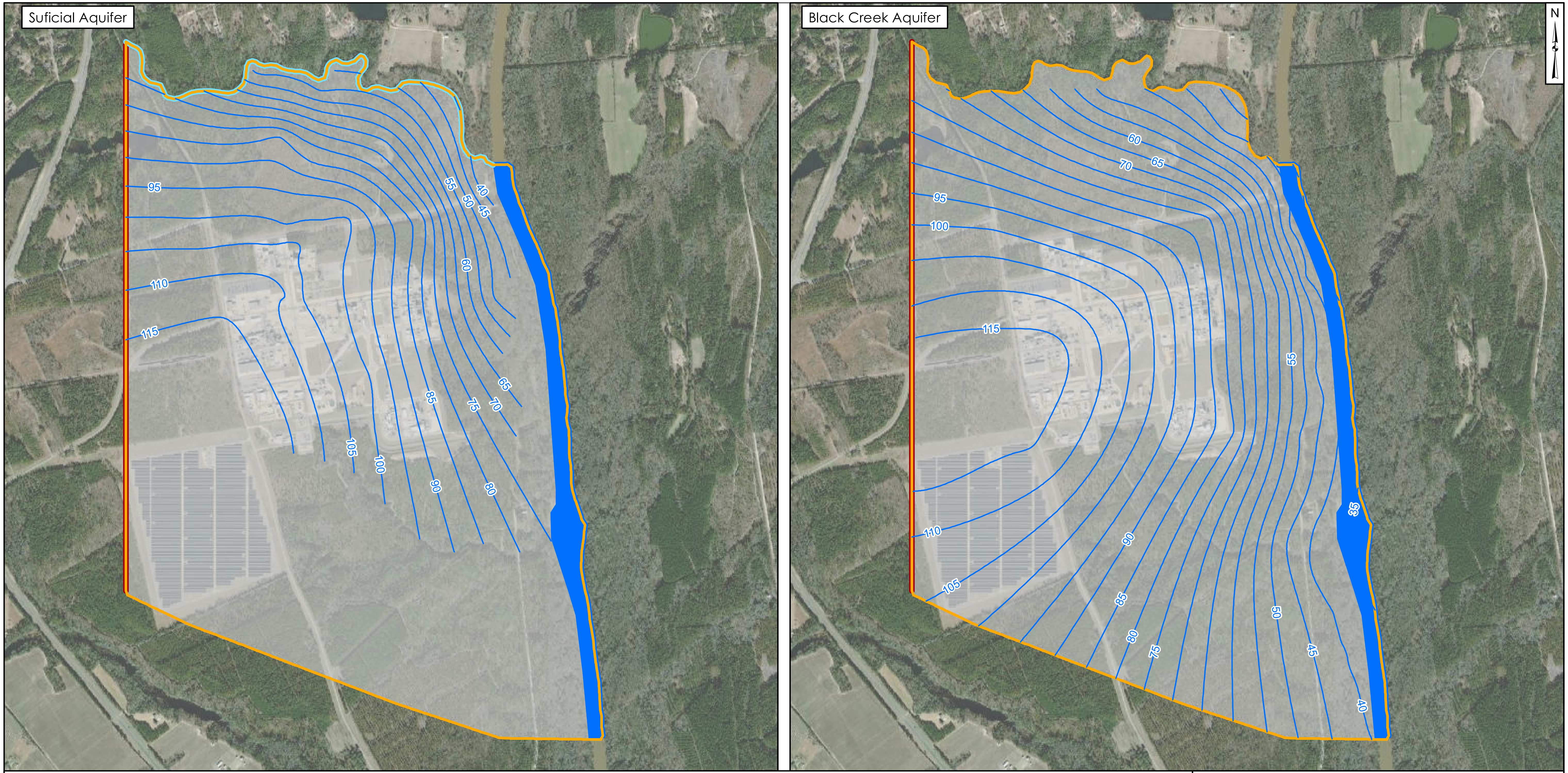

Legend

- — Simulated Equipotentials (feet NAVD 88)
- ▬ Constant Head Boundary
- ▬ Constant Head River Boundary (Willis Creek)
- ▬ Transient Head River Boundary (Cape Fear)
- ▨ Recharge Area
- □ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Flow Model Simulated Equipotentials - Base Model

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B.05

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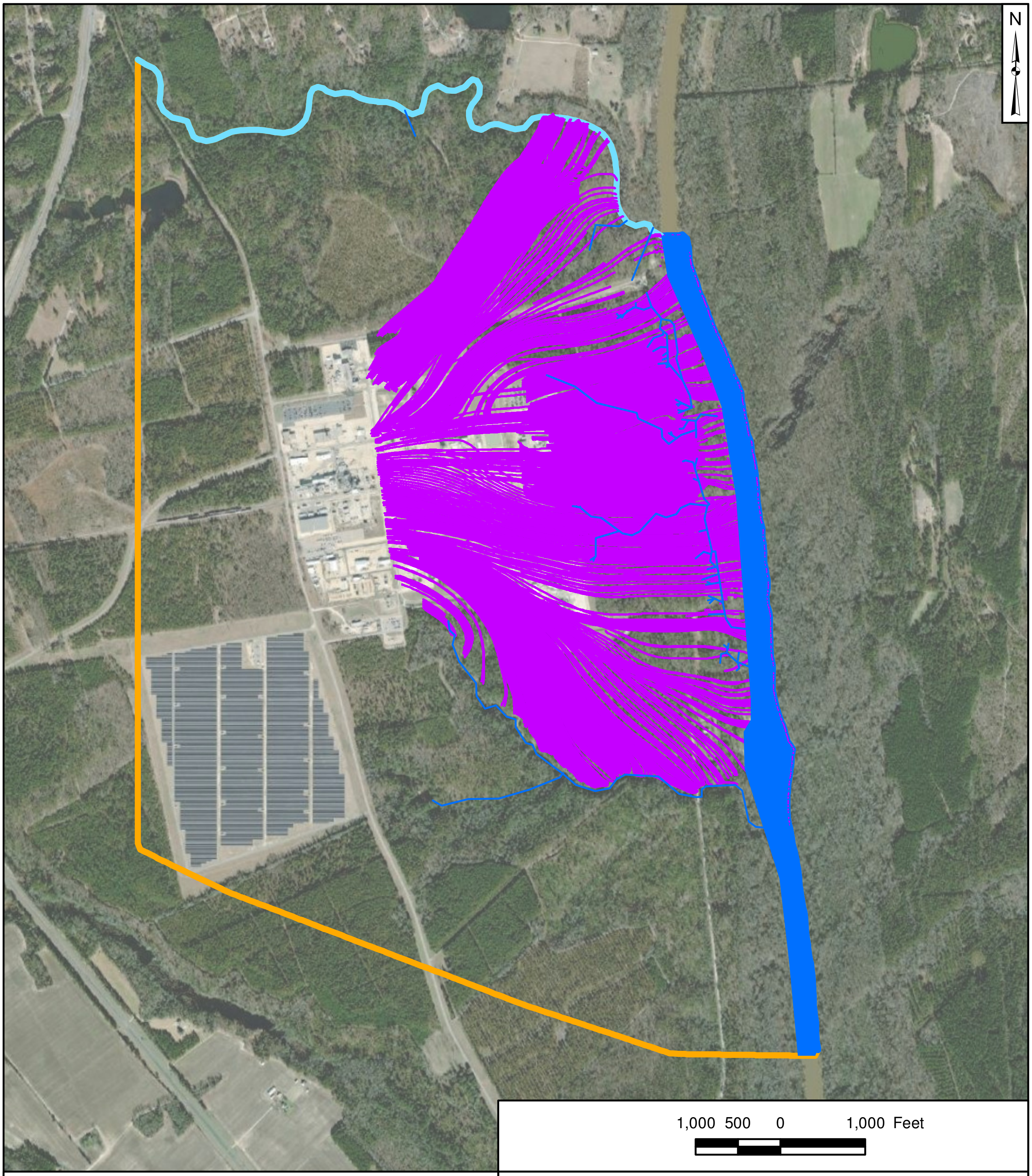

Legend

— 5 year Particle Tracks - No Remedy

— River Boundary (Willis Creek)

— River Boundary (Cape Fear)

▭ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 1 - Particle Tracking from Plant Area Ambient Conditions

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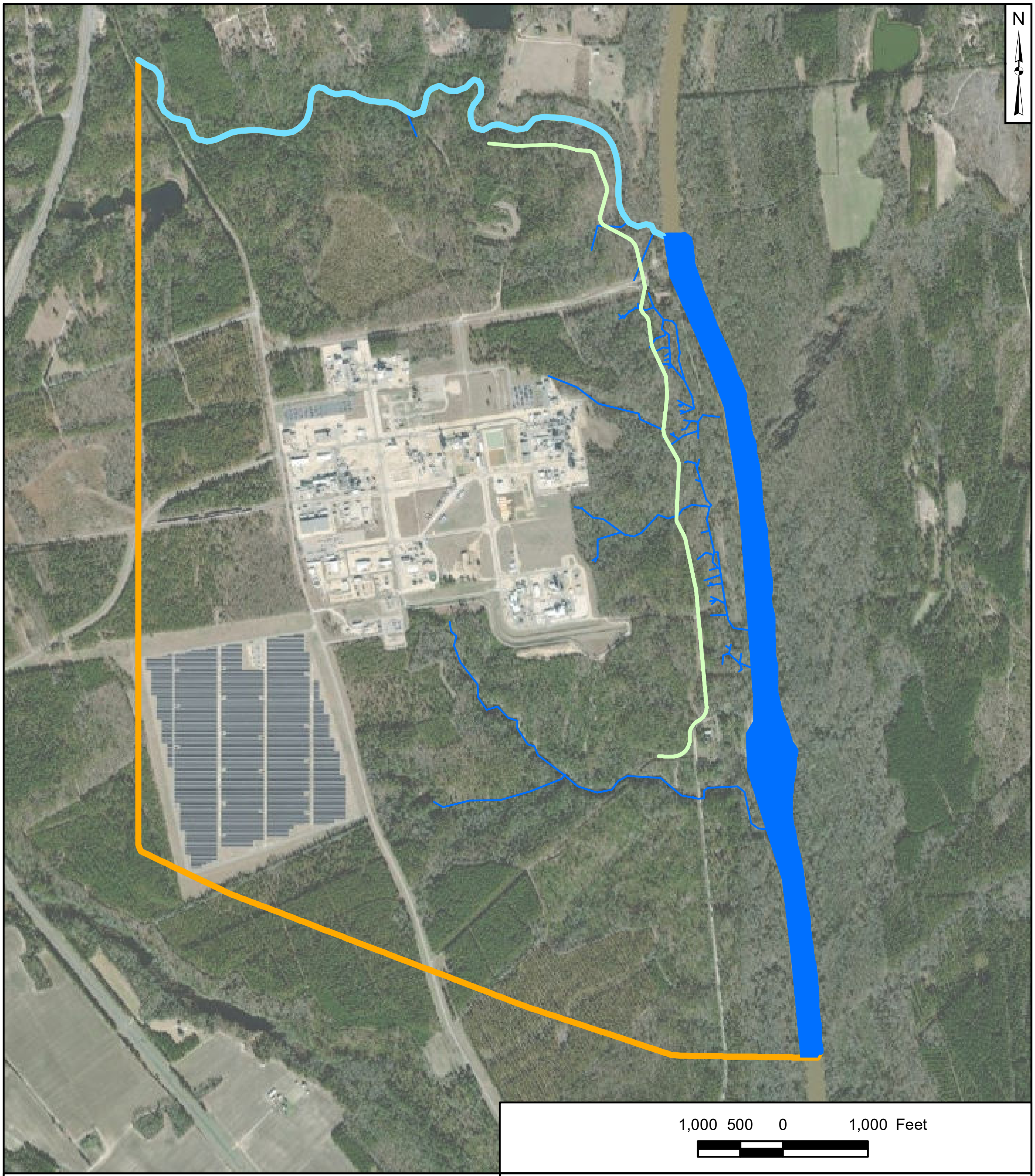
Figure

B.06



Legend

- Barrier Wall
- River Boundary (Willis Creek)
- River Boundary (Cape Fear)
- Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 2 – Vertical Barrier Remedial Design

Chemours Fayetteville Works, North Carolina

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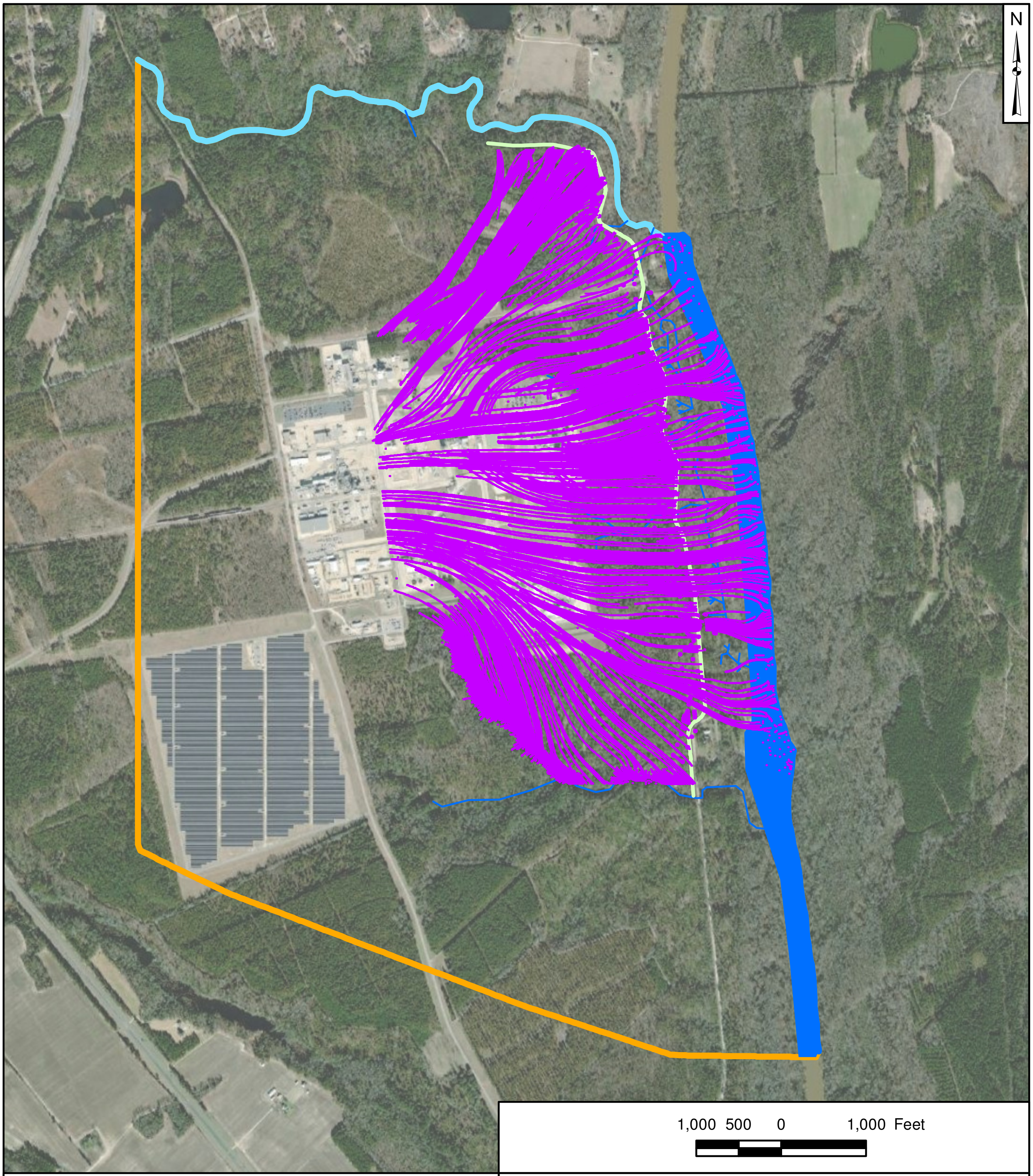
Figure
B.07



Legend

- 5 year Particle Tracks
- Barrier Wall
- River Boundary (Willis Creek)
- River Boundary (Cape Fear)
- Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 2 - Particle Tracking from Plant Area - Vertical Barrier

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
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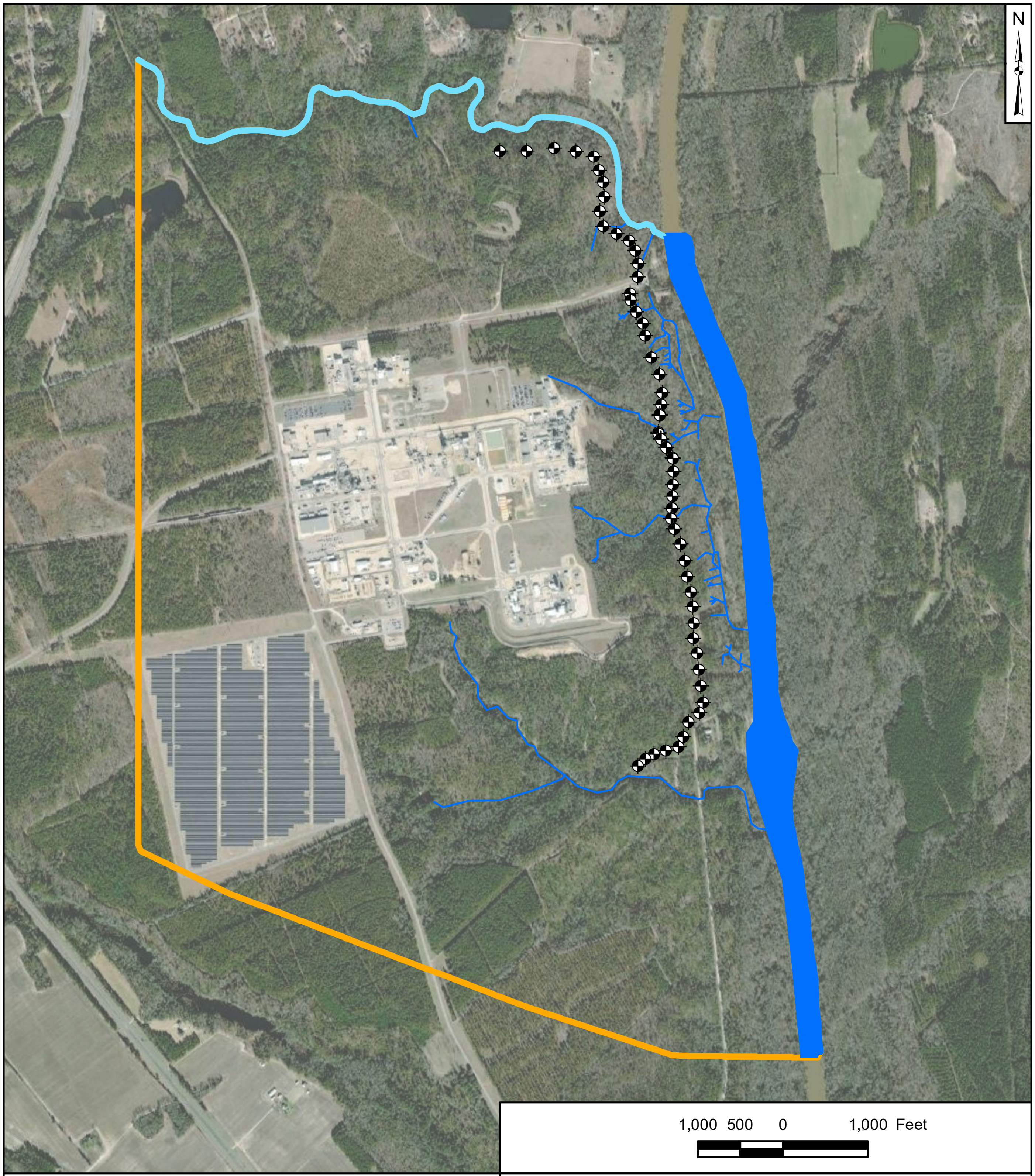
Figure
B.08



Legend

⊕ Extraction Well Location

▬ River Boundary (Willis Creek)

▬ River Boundary (Cape Fear)

☐ Model Boundary

Notes

1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 3 – Hydraulic Barrier Remedial Design

Chemours Fayetteville Works, North Carolina

Geosyntec
consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Figure

B.09

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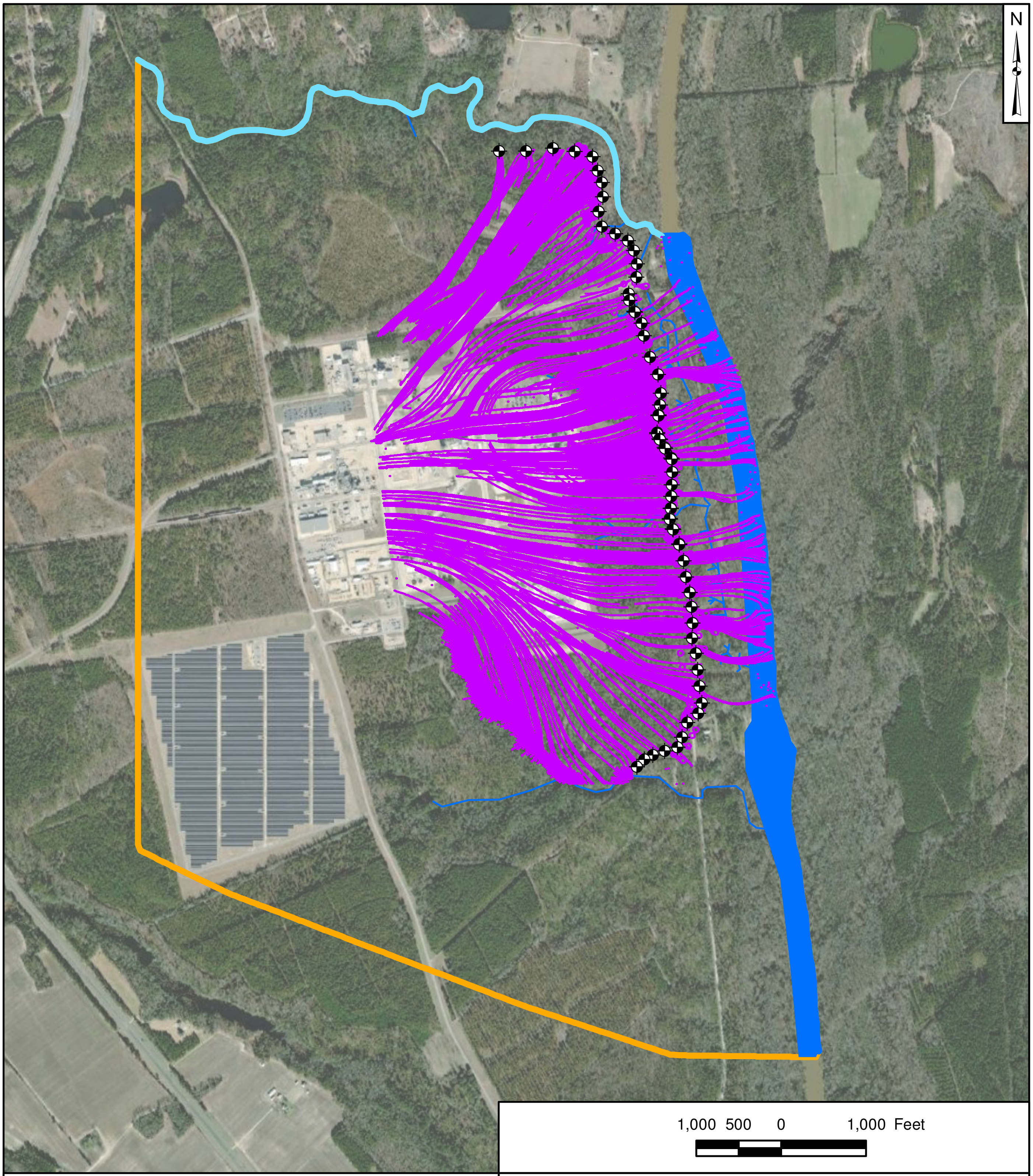
August 2021



Legend

▬ River Boundary (Willis Creek)

▬ River Boundary (Cape Fear)

▭ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 3 - Particle Tracking from Plant Area – Hydraulic Barrier

Chemours Fayetteville Works, North Carolina

Geosyntec
consultants

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NC License No.: C 3500 and C 295

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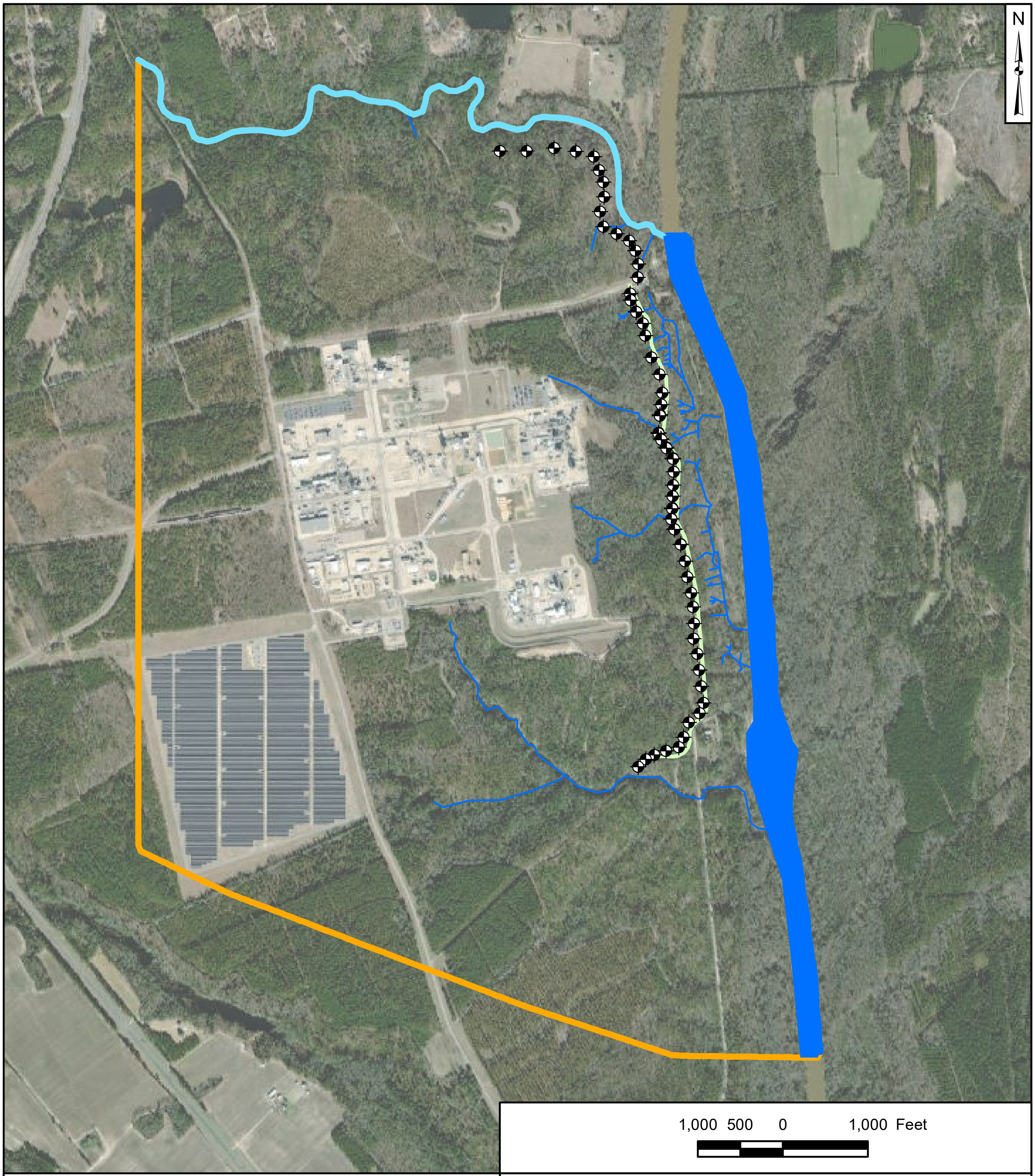
August 2021

Figure

B.10



Legend

- ⊕ Extraction Well Location
- ▬ Barrier Wall
- ▬ River Boundary (Willis Creek)
- ▬ River Boundary (Cape Fear)
- ▭ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 4 – Vertical and Hydraulic Remedial Design

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

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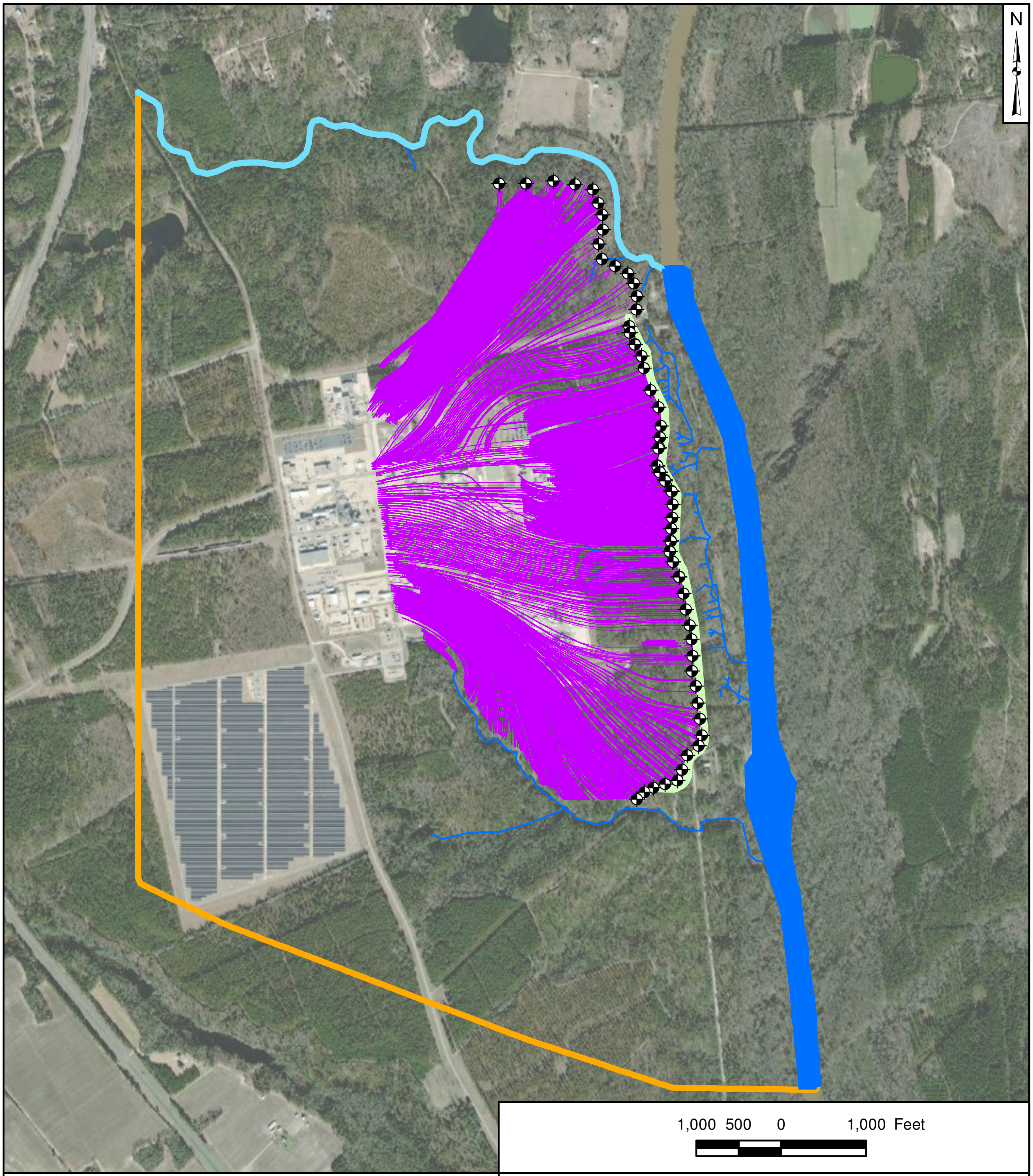
Figure

B.11



Legend

⊕ Extraction Well Location

🟩 Barrier Wall

— 5 year Particle Tracks

▬ River Boundary (Willis Creek)

▬ River Boundary (Cape Fear)

☐ Model Boundary

Notes
1. Basemap source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Scenario 4 - Particle Tracking from Plant Area – Vertical and Hydraulic Barrier

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

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Figure

B.12

Geosyntec Consultants of NC, P.C.
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GEOServices, LLC, Geotechnical and Materials Engineers

Appendix C
Barrier Wall Design Report

GEOS

GEOServices, LLC, Geotechnical and Materials Engineers

Barrier Wall 60% Design Submittal
Chemours Fayetteville Works

Prepared for

The Chemours Company FC, LLC
22828 NC Highway 87
Fayetteville, NC 28306

Prepared by

GEOServices, LLC
5559 North Lee Highway
Cleveland, TN 37312

TR0795A

August 2021

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Seepage Models and Results

Slope Stability Models and Results

Barrier Wall Alignment Retaining Wall 60% Conceptual Design Plans (Sheets RW-0.1, RW-1, RW-2, RW-2.1, RW-3.0, RW-4.0, RW-5.0, RW-6.0, RW-7.0, RW-8.0)

Retaining Wall Calculations

List of Abbreviations

cm/s	centimeters per second
COA	Consent Order Addendum
CU	Consolidated undrained
FHWA	Federal Highway Administration
FOS	Factor of Safety
ft	feet
ft bgs	feet below existing grade
ft/s	feet per second
GWTP	groundwater treatment plant
HFPO-DA	hexafluoropropylene oxide dimer acid
k2/k1	horizontal to vertical hydraulic conductivities
MSEW	Mechanically Stabilized Earth Wall
MSL	Mean Sea Level
NCDEQ	North Carolina Department of Environmental Quality
PDI	Pre-Design Investigation
PFAS	per- and polyfluoroalkyl substances
PFMOAA	perfluoro-1-methoxyacetic acid
PMPA	perfluoro-2-methoxypropanoic acid
SPT	standard penetration tests
SCPTU	seismic piezocone penetration tests
USCS	United Soil Classification System

1. Introduction and Objectives

GEOServices, LLC (GEOS) has prepared for The Chemours Company, FC, LLC (Chemours) this 60% Engineering Design Report for the Barrier Wall System planned to be installed at the Chemours Fayetteville Works facility in Bladen County, North Carolina. This report has been prepared pursuant to the Consent Order Paragraph 12 Addendum (COA) Paragraph 3 (North Carolina Department of Environmental Quality [NCDEQ], 2019) which requires a 60% design report for the Barrier Wall and Groundwater Extraction and Treatment System be submitted by August 15, 2021 to NCDEQ for approval. This report describes the basis of design for the Barrier Wall and presents a 60% level of design for the Barrier Wall System and its constituent components.

The COA outlines that Chemours shall proceed with the design and the installation of a barrier wall and groundwater extraction and treatment system to reduce per- and polyfluoroalkyl substances (PFAS) loading from groundwater flow from under the Facility to the Cape Fear River and Willis Creek. Similarly, the COA also outlines the objectives for a long-term seep remedy. The primary objective of the long-term seep remedy is to reduce the total annual mass loading of PFAS (as measured by the indicator parameters hexafluoropropylene oxide dimer acid [HFPO-DA], perfluoro-2-methoxypropanoic acid [PMPA] and perfluoro-1-methoxyacetic acid [PFMOAA]) to the Cape Fear River from Seeps A through D.

The remedy objectives outlined in the COA results in a remedy design with three components:

- The groundwater interception remedy
- The Seeps A and B ex-situ capture remedy
- The groundwater treatment plant

The groundwater interception remedy contains three key elements: (i) an underground barrier wall to create a vertical low permeability barrier to reduce the transmission of groundwater, (ii) a groundwater extraction system consisting of extraction wells in the Surficial and Black Creek aquifers, and (iii) a groundwater conveyance system to convey that groundwater to the treatment system (see Figure 1). The seeps ex-situ capture remedy design consists of two capture locations where the seep flow intersects the barrier wall alignment at Seep A and Seep B. The design uses impoundment and pumping systems along with equalization basins to accommodate dry weather flows and stormwater flows from rainfall events up to 0.5 inches over 24 hours. Last, the captured water is then conveyed to the groundwater treatment plant (GWTP) which is being designed to treat continuous maximum flow rates up to 1,500 gallons per minute (gpm) of water and to remove 99% of indicator parameters.

The COA requires Chemours to proceed with the design and installation of a barrier wall and groundwater extraction and treatment system to reduce PFAS loading from groundwater flow from under the Facility to the Cape Fear River and Willis Creek. The details and discussion of the groundwater extraction and conveyance design are presented in Appendix D of the 60% design document.

The barrier wall design concepts presented are expected to remain consistent between this report and the constructed remedy. However, some elements will be refined in the COA required 90% design submittal. Prior to the 90% design submittal Chemours will be selecting a barrier wall installation contractor. Potential contractors at this stage have different access requirements for barrier wall installation, and therefore selection of this contractor will enable the completion of many of the final remedy details including the barrier wall roadway, barrier wall alignment, and positioning of groundwater extraction wells and conveyance system in the 90% design submittal. The design is subject to change with new information or constraints uncovered after the submittal of this report.

2. Barrier Wall Location and alignment

The barrier wall will extend from the intake structure access road north of the Fayetteville Works to the location of Old Outfall 002 on the south side of the property. Locations of these described features are shown on the site map in Figure 1. The wall will be west of the Cape Fear River and approximately parallel to the river course. The alignment of the proposed barrier wall is determined based on topographic constraints and iterative design with the groundwater model (Appendix B) that considers the physical barrier and extraction system in combination. A preliminary alignment roughly following the EL 72 feet (ft) contour between the plant and the Cape Fear River was cleared for geotechnical investigation due to ease of access as the area is a natural bench. This elevation was also chosen as it is located above the 100-year flood elevation.

After preliminary investigation (discussed in subsequent sections) and consultation with potential barrier wall vendors, the alignment has been revised to the current draft alignment (see Figure 2 and attached plans). The revised alignment has been analyzed in the groundwater model to optimize the number of extraction wells. The alignment of the barrier wall roadway will be finalized in the 90% design submittal based on selected barrier wall vendor requirements and design iterations with the groundwater extraction and conveyance design components.

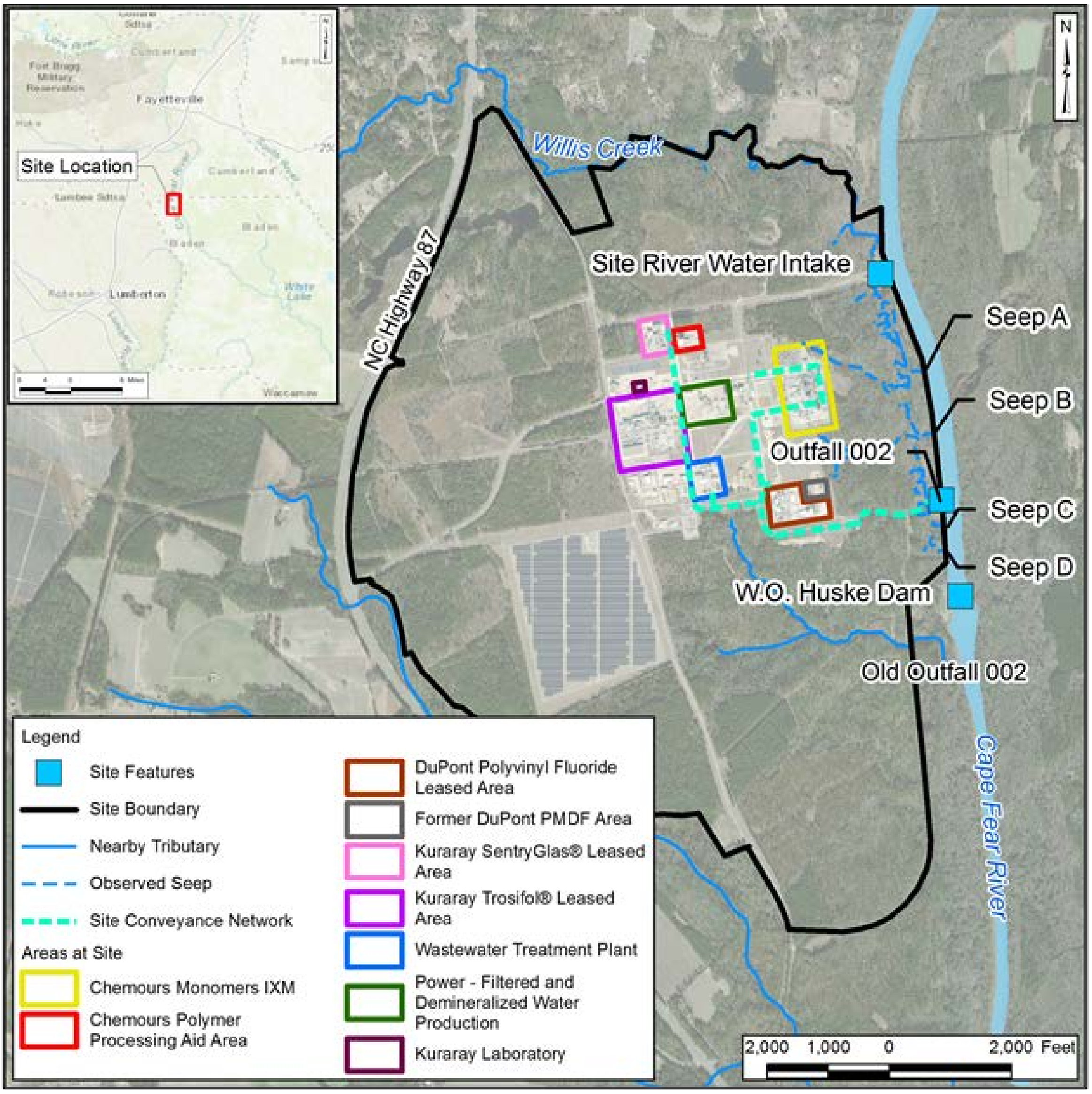


Figure 1: Site Location Features Used For Location Description

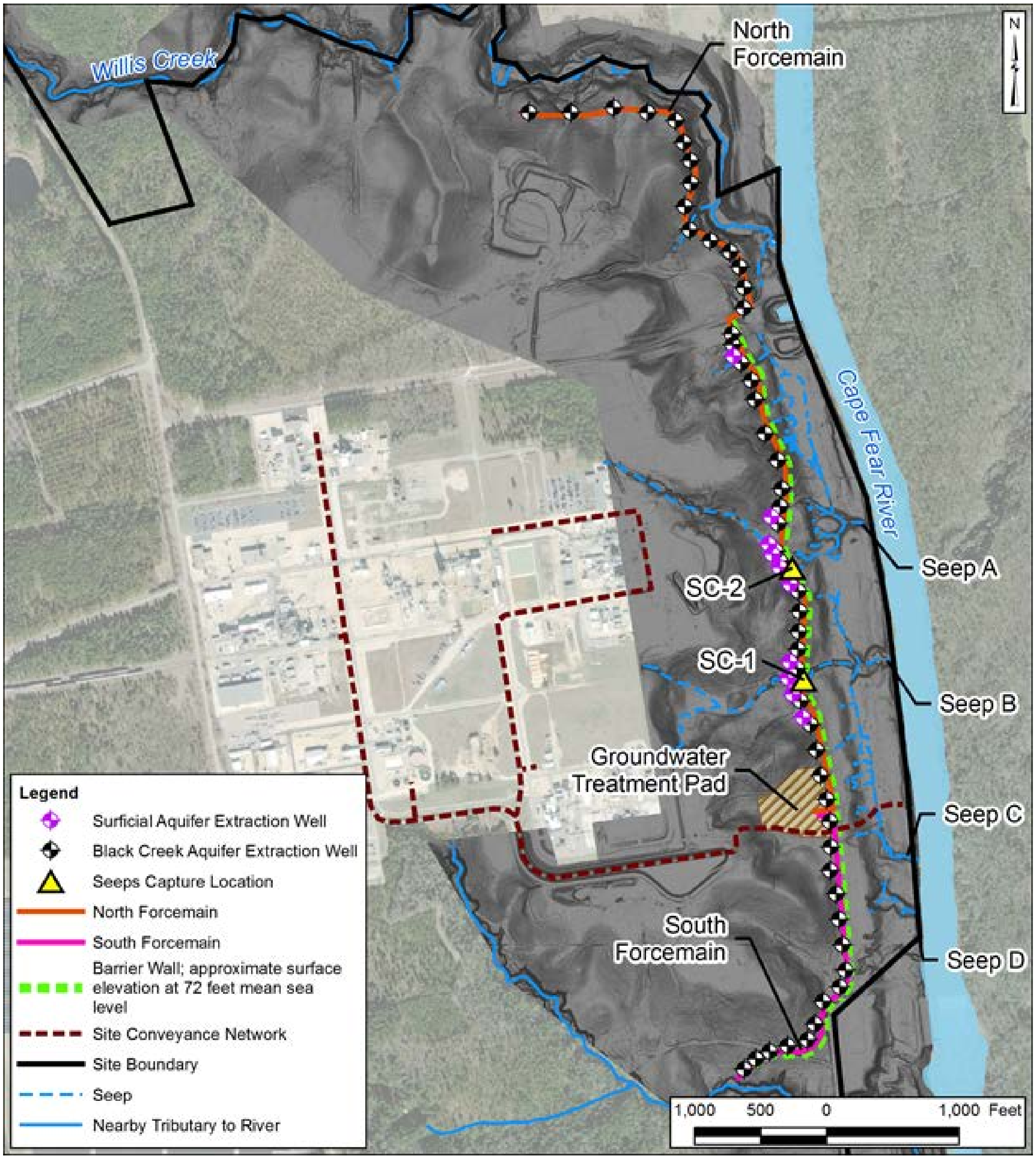


Figure 2: Remedy Layout Overview Including Barrier Wall Alignment

3. Geotechnical information

The geotechnical basis of the barrier wall system was developed using information collected at the site and observations during interim seep capture construction. Geotechnical information has been collected and analyzed to characterize the expected soil conditions in the location of the proposed groundwater interception system.

3.1 Exploratory Borings and Soundings

The subsurface conditions along the proposed barrier wall alignment were explored with a series of integrated electronic seismic piezocone penetration tests (SCPTU), traditional mud rotary borings (standard penetration test [SPT] borings), and rotary sonic soil borings. The mud rotary borings and cone soundings were alternated and spaced at increments of 250 ft along the proposed alignment to generate adequate coverage. This resulted in a total of nineteen cone soundings and nineteen traditional mud rotary borings completed in 2020. To resolve several identified data gaps, seven additional mud rotary borings, and five rotary sonic soil borings were advanced in March 2021 and logged by GEOS personnel in the field. Individual logs for the SPT borings, the SCPTU soundings, and the rotary sonic soil borings are presented in the GEOS Geotechnical report and addendum included as attachments to the PDI report in Appendix A of this report. All current exploration locations are shown on the 60% barrier wall design plans attached to this Appendix.

3.1.1 Standard Penetration Testing

Two phases of geotechnical borings were advanced, the first phase occurred from October to November 2020, and the second phase occurred in March 2021. A total of 26 (19 in 2020, 7 in 2021) geotechnical borings advanced using open hole methods with NWJ (2- 5/8 inch diameter) drill rods. The drill crew worked in general accordance with ASTM D 6151 (HSA Drilling) and ASTM D783 (Direct Rotary with Water-Based Drilling Fluid). The soil cuttings and drilling fluid were collected and placed in drums. The borings were then backfilled with grout. Detailed test boring records are presented in the full GEOServices geotechnical report and addendum (Appendix D).

SPT blow counts were measured using the split-spoon standard penetration test procedure (ASTM D 1586). In split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth and provide an indication of the relative density of granular materials and strength of cohesive materials. Soil collected by the sampler during the SPT are used for material property tests. Less disturbed samples for hydraulic conductivity and strength testing were collected using thin-walled tube sampling test procedure (ASTM D 1587).

3.1.2 Cone Penetration Testing

An additional nineteen locations were explored using an integrated electronic seismic cone penetration test probe (piezocone) during the first phase of exploration between October and November 2020. The piezocone dimensions and the operating procedure were in accordance with ASTM D 5778. Since the SCPTU is a direct push technology, it allows data to be obtained continuously (approximately every 2 inches). A computer connected to the cone records tip resistance, sleeve friction, and dynamic pore pressure via instruments in the cone. Additionally, when the cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, water is injected into a saturated porous material to generate excess pore pressures, then without advancing the cone, the pressure is then allowed to dissipate and pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file. Pore pressure dissipation testing was performed in each of the nineteen SCPTU sounding locations. The pore pressure dissipation results are presented in the appendices of the GEOS report in Appendix D of this report.

3.1.3 Rotary Sonic Soil Borings

In April 2021, a total of five geotechnical borings were advanced using sonic drilling methods along the preliminary barrier wall alignment. The drill crew worked in general accordance with ASTM D 6914 (Sonic Drilling for Site Characterization). Sonic drilling is a method in which the drill string is advanced, and the borehole is simultaneously cased by rotation and oscillation of the drill bit to collect a relatively continuous and undisturbed sample of the subsurface material. The sonic drilling method was selected for the supplementary excavation because a continuous sample of the layered strata is valuable for barrier wall mix design and identification of the presence of gravels and other non-soil materials identified in isolated borings during the preliminary exploration. The borings were backfilled with grout upon completion of each location. Detailed test boring records are presented in the addendum to the GEOS geotechnical report (attached to Appendix A)

The PDI and subsequent 2021 soil investigation were primarily focused on soil layers that will be encountered by barrier wall construction, varying between 70 feet to 80 feet mean sea level (MSL). The investigations were performed from a cleared temporary roadway that approximately followed the EL 72ft MSL contour. For geotechnical purposes, this information is sufficient for geotechnical modeling of the barrier wall. However, none of the PDI geotechnical borings were performed above the proposed roadway elevation due to site constraints and the preliminary nature of the cleared alignment. An additional sonic drilling, in addition to those listed above, was performed during the Addendum investigation with the specific intention of characterizing layers above the roadway elevation and acquiring samples for laboratory testing for geotechnical parameters for use in slope stability calculations. The upslope boring encountered alluvial deposits (similar to all other collected borings) for the full penetration/boring depth. The sonic boring was extended to 60 feet below existing grade (ft bgs) near the top of the existing slope. Layers to be used for preliminary slope stability analyses were determined based on manual and visual classification (ASTM D2487) and laboratory tests. One boring is not sufficient for the design of slopes along the entire barrier wall alignment, but the information collected, and preliminary analyses, are consistent with the design methodology that will be used for the 90% design. Additional borings will be collected for slope stability analysis when the roadway alignment is finalized (after selecting wall installation vendor).

3.2 Geotechnical Laboratory Testing

Laboratory tests were performed as part of both the PDI Geotechnical Report and Addendum investigations. Results of laboratory testing are included in the PDI report (Appendix A) and on boring logs in the GEOS PDI Geotechnical Report. Moisture content determinations (ASTM D2216), Atterberg Limits (ASTM D4318) and particle size analyses (ASTM D6913 and ASTM D1140) were performed on bulk samples to assist in the United Soil Classification System (USCS) classification of the sampled soils in accordance with ASTM D2487.

Additional geotechnical laboratory testing was performed on trimmed intact samples to identify relevant design parameters for the barrier wall system. Hydraulic conductivity testing of various layers was determined using falling head permeability methods (ASTM D5084). Results of this testing can be found in the PDI Geotechnical Report. Consolidated undrained (CU) triaxial testing (ASTM D4767) was performed on specimens trimmed from 4-inch diameter intact sonic drilling sleeves. Triaxial strength testing is used in this context to evaluate the shear strength conditions of the underlying clayey soil. The strength of sandy soil layers in the slope above the roadway elevation was determined using the Direct Shear Test method (ASMD3080).

Results of all laboratory testing can be found in the PDI Geotechnical Report attached to the PDI Report in Appendix A.

3.3 Development of Barrier Wall Design Cross Sections

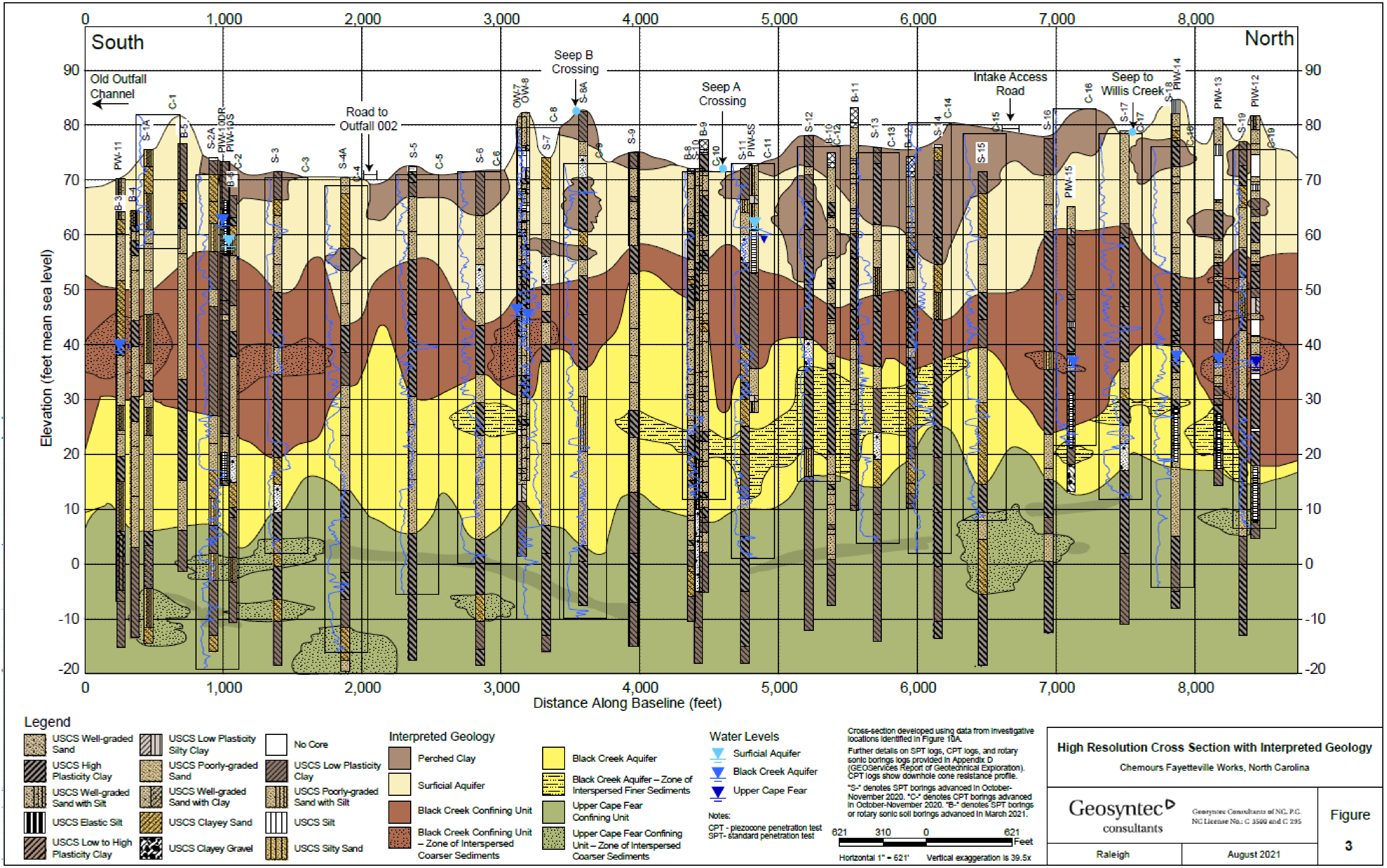
Borings and SCPTU soundings collected by GEOS and well log information collected by Geosyntec (for testing described in Appendix B) were used to develop a cross-section of the expected soil conditions along the preliminary barrier wall alignment. The developed cross section (Figure 3), plotted by Geosyntec, represents a view perpendicular to the centerline alignment of the barrier wall. The soil layers shown in Figure 3 were classified using overall site hydraulic modeling nomenclature and definitions of local geologic units including: Perched Clay, Surficial Aquifer, Black Creek Confining Unit, Black Creek Aquifer and Upper Cape Fear Confining Unit.

It is important to note that the soil identification nomenclature of the geotechnical boring logs prepared by GEOS in the PDI Geotechnical Report do not directly match the geologic nomenclature of the Geosyntec well logs because the explorations were performed for different reasons. Geotechnical boring log soil classification follows standard geotechnical engineering practice (ASTM D2487) of identifying soils with USCS nomenclature to assist in assessing the geotechnical engineering properties of the soils. This is an important distinction because the groundwater interception design requires both styles of classifications to describe and evaluate various aspects of the overall remedy system.

All soils sampled in the PDI investigation were deposited by water and are therefore classified as alluvial deposits in typical geotechnical engineering nomenclature. At the subject site, the alluvial deposits can then be divided into two sub-classifications: fine and coarse grained. Fine-grained deposits consist of silts and clays while coarse-grained deposits consist primarily of sands. Transition zones between fine- and coarse-grained soil layers are typical in alluvial deposits and exist at this site.

Design 2-D cross-sections perpendicular to the barrier wall alignment are required for seepage and slope stability analyses Seepage modeling cross sections are most impacted by the hydraulic engineering properties of soil layers existing from the top of the barrier wall to the confining unit at depth. Slope stability cross-sections require layering and soil property information above and below the roadway bench that will be graded for the installation of the barrier wall. At the subject site the soils nearest the slope surface will tend to control slope stability due to the sandy soil profiles.

The geologic unit nomenclature and, where appropriate, layer elevations presented in Figure 3 were used when assigning soil layer names in cross-sections below the roadway elevation to remain consistent with the layering used in the hydraulic model in Appendix B. USCS nomenclature was used for elevations above the roadway based on the additional slope boring and engineering judgement. The geotechnical engineering properties (unit weights, shear strength, and seepage parameters) assigned to all layers for geotechnical modeling were primarily based on laboratory tests results presented in the PDI Geotechnical Report but also include some engineering judgement and correlation to field measurements collected during exploration. The layers and their geotechnical properties for both seepage and slope stability analyses are discussed in subsequent sections.



Notes:
CPT - piezocone penetration test
SPT- standard penetration test

Cross-section developed using data from investigative locations identified in Figure 10A.

Further details on SPT logs, CPT logs, and rotary sonic borings logs provided in Appendix D (GEOServices Report of Geotechnical Exploration). CPT logs show downhole cone resistance profile.

"S-" denotes SPT borings advanced in October-November 2020. "C-" denotes CPT borings advanced in October-November 2020. "B-" denotes SPT borings or rotary sonic soil borings advanced in March 2021.

Figure 3 - Barrier Wall Soil Cross Section

4. 60% Barrier Wall Design

The proposed barrier wall will enable more efficient control of groundwater flow from under the Chemours facility by the extraction wells. Therefore, groundwater analysis is required to determine the physical properties of the wall required to achieve the intended system performance. Physical requirements of the barrier wall (discussed in detail in subsequent sections) are summarized as:

- Minimum wall thickness of 0.5meter (m)
- Maximum hydraulic conductivity of $1\text{x}10^{-6}$ centimeters per second (cm/s) for the barrier wall post-mixing
- Minimum compressive strength of 50psi
- Minimum embedment of 5 feet into the Upper Cape Fear Confining layer

Beyond determining the wall properties, the barrier wall system design process also considers necessary modifications of existing site conditions to accommodate barrier wall installation infrastructure. Site modification considerations are especially impactful at this site as the proposed barrier wall and the roadway are located on a large soil slope between the active plant and the river. The size and condition of the slope requires consideration of existing and planned topography in the design of the barrier wall system. In some areas, regrading of the natural slopes is possible while other areas will require retaining walls to achieve maintainable slopes above and below the roadway. Thus, in addition to the evaluation of the effectiveness of the barrier wall as part of the groundwater interception system, additional slope stability and retaining wall analyses are required to evaluate grading changes resulting from the new construction.

4.1 Barrier Wall Material, Width, and Material Properties

The PDI geotechnical report presents analysis and comparison of potential barrier wall installation methods. Based on the conclusions of the PDI Geotechnical Report, the barrier wall design considers one-pass wall methods (Keller TRD or Dewind One Pass) that continually mixes soil with binder along the entire wall height to minimize joints in the barrier wall. After consultation with barrier wall contractors, it was determined that 0.5m thickness is achievable by both considered one-pass technologies so preliminary barrier wall analyses consider a 0.5m thick wall extending into the Upper Cape Fear Clay that underlies the Black Creek Aquifer in the subsurface model shown in Figure 3.

The hydraulic conductivity of the barrier wall is dependent on the proprietary contractor method of mixing and mix design parameters but both methods utilize a combination of bentonite and cement to bind with in-situ soils. Based on soil information collected from the PDI, and after consulting with potential barrier wall contractors, a design compressive strength of 50psi and a hydraulic conductivity value of $1.0\text{x}10^{-6}$ cm/s are assigned to the barrier wall for seepage and groundwater modeling analyses. A bench testing program will be completed after contractor selection to confirm the design hydraulic conductivity and compressive strength values for the barrier wall. Seepage and groundwater modeling revisions will be necessary if the value measured in bench mixing trials is significantly different from 1.0×10^{-6} cm/s. The hydraulic conductivity value used in modeling scenarios is considered a maximum allowable value and will be evaluated during construction as part of a quality monitoring program.

4.2 Barrier Wall Embedment (Seepage Modeling)

The PDI results demonstrate that the Black Creek Aquifer is underlain by the Upper Cape Fear Confining Unit, a stiff clay layer of low permeability. Stiff clay is an ideal key-in layer to impede water flow under the wall. The elevation of the Upper Cape Fear Confining unit varies across the site. Elevations observed in each boring along the alignment are presented in Table 1.

The wall will extend into the stiff clays of the Upper Cape Fear Confining Unit. Key-in (or embedment) depth into a low permeability layer is determined considering the targeted performance criteria of the system and consideration of existing soil conditions. The subject site contains defined aquifers (Surficial and Black Creek) transporting PFAS containing water that is specifically targeted for interception, collection, and treatment. Therefore, that water needs to be contained in the aquifer long enough for the extraction system to collect the required volume.

The depth of barrier wall embedment required for this system is dependent on hydraulic interaction between the soil layers and the barrier wall. Primarily, the depth of embedment is determined based on the depth required to limit the hydraulic gradient (change in hydraulic head over a distance) at the bottom of the wall to drive the primary flow of the system into the wall instead of providing a preferential flow path under the wall. Soil-borne water interaction with the barrier wall requires a seepage analysis to determine the parameters used to evaluate embedment depth.

Table 1 - Elevation of Confining Layer at Each Boring

Boring Number	Northing	Easting	Elevation at Top of Confining Layer (ft)
B-1	394058.1353	2052259.3690	4.3
B-2	394257.1810	2052239.7265	-2.0
B-3	394356.6976	2052229.9053	4.3
B-4	394456.2141	2052220.0840	6.3
B-5	394804.5095	2052185.7098	3.3
B-6	395145.3787	2052374.4750	-5.1
B-7	395310.8989	2052361.5701	4.8
B-8	398085.9123	2052065.4609	-4.1
B-9	398155.3424	2051934.6273	8.2
B-10	399039.3653	2051907.7781	9.7
B-11	399231.4305	2051829.8464	10.4
B-12	399610.2113	2051709.9043	22.3
S-1A	394555.7181	2052210.2628	4.5
S-2A	395017.6623	2052276.9758	-3.0
S-3	395476.2209	2052340.4083	-0.5
S-4A	395962.0230	2052349.9385	13.5
S-5	396446.5351	2052343.2112	6.0
S-6	396900.2816	2052172.1302	4.0
S-7	397343.2830	2051993.1524	9.0
S-8A	397474.6952	2051762.8147	4.0
S-9	397670.4359	2052074.8044	6.5
S-10	398126.6934	2052003.8872	-5.5
S-11	398453.1470	2051931.4787	10.0
S-12	398914.4355	2051914.6132	15.5
S-13	399382.5730	2051759.5980	11.5
S-14	399785.1325	2051587.1342	25.0
S-15	400089.4998	2051687.6356	-5.5
S-16	400546.3983	2051554.8299	2.0
S-17	400792.9535	2051160.3674	16.5
S-18	401160.4833	2051194.3123	5.5
S-19	401637.1153	2051085.5536	6.0

4.2.1 Barrier Wall Seepage Modeling Scenarios

Two types of seepage analysis are considered in the design of geotechnical structures: transient and steady state. Transient systems do not have constant boundary conditions and the seepage conditions are therefore time dependent. Steady state systems develop long-term boundary conditions that are independent of time. The hydraulic barrier system is analyzed as both types of system to evaluate different performance parameters and time increments are of interest. Transient conditions are critical for partcile migration analysis of the groundwater model system, but the transient conditions are dependent on hydraulic variables that are outside the geotechnical scope and can only be analyzed in the hydraulic model of the site that includes sources and well modeling (details in Appendix B). The steady state case considered in the geotechnical analysis of the barrier wall is based on long term normal operating conditions determined from the full-site transient hydraulic modeling. From a geotechnical design perspective, the critical performance case for the barrier wall occurs when the largest head difference between upslope (west) and downslope (east) develops in a steady state. The largest total head difference develops the maximum hydraulic gradients at interface layers, which dictates the embedment depth required for the barrier wall to minimize underflow and allow the groundwater extraction system to perform as intended. Hyrdaulic control and particle migration are considered in the hydraulic model in Appendix B.

Geotechnical seepage for the barrier wall design was computed using the finite element method in the commercially available two dimensional (2D) geotechnical finite element software RS2 from Rocscience. Preliminary seepage modeling designed to evaluate embedment depth of the wall into the Upper Cape Fear Confining unit is described in subsequent sections with modeling inputs and results attached to this Appendix.

Five seepage models were created and evaluated for the 60% design submittal. One cross-section (topography, soil layering, and hydraulic condition) is considered in each model. Four models represent seep locations (Seeps A through D) and one model represents an area south of Seep D. The locations of these models were chosen as points of interest in the overall hydraulic model for the site.

4.2.2 Seepage Model Input Properties

For steady state seepage analysis, identification of soil layering, water elevation and subsequent pressure (total head), and layer hydraulic conductivity is required at each location. Soil hydraulic conductivity testing was performed on clay and sand specimens collected and documented in the PDI Geotechnical Report. Hydraulic conductivities for each major geologic unit (Table 2) were utilized in the analyses.

Table 2 - Hydraulic Conductivity for Geologic Units Used in Seepage Models

Material Name	Porosity	Hydraulic conductivity (cm/s)	k2/k1
Surficial Aquifer	0.40	$1x10^{-2}$	0.01
Black Creek Confining Unit	0.40	$2x10^{-6}$	0.01
Black Creek Aquifer	0.38	$1x10^{-2}$	0.01
Black Creek Silty Sand	0.52	$1x10^{-1}$	0.01
Upper Cape Fear Clay	0.35	$3x10^{-7}$	0.01

Due to the difficulty in reliably measuring field porosity and the anisotropy ratio of the horizontal to vertical hydraulic conductivities (k2/k1) in each layer, estimates of the anisotropy ratio values as shown in Table 2 were assigned to each layer. This anisotropy ratio accounts for any layering discontinuities or preferential flow paths that can develop in alluvial soils.

Layer boundary elevations were selected at each modeled cross section based on the site cross section presented in Figure 3. Layer boundaries are modeled as constant elevation perpendicular to the site cross section. This is a simplification as the layer boundaries vary in elevation; however, the purpose of this modeling is to evaluate the embedment depth of the barrier wall at discrete locations. Layer heterogeneity is best considered as part of the three-dimensional site hydraulic study.

In addition to the hydraulic conductivities of the material layers, external hydraulic boundary conditions are required to create a seepage flow condition for analysis. The boundary conditions in the model were applied as total heads based on output information from the hydraulic modeling (Appendix B). The total heads presented in Table 3 include baseline water level and the effects of the barrier wall and extraction wells on total head for the west side and east side of the wall (upstream and downstream). Baseline and differential total heads were modeled for cross-sections at each of the four Seep locations (Seeps A through D) and an additional location south of Seep D. Upstream total head in the models was computed by adding the average upstream water level increase in Table 3 to the baseline water level. The downstream total head was computed by subtracting the largest decrease in the water level from the baseline water level. The maximum difference between upstream (west) and downstream (east) is considered the worst-case seepage scenario as it creates the maximum head difference across the wall section resulting in maximum hydraulic gradients which are used to determine wall embedment.

Table 3 – Baseline Total Heads and 90% Pumping Scenario Water Level Change

Area	Baseline Water Elevation (ft MSL)	Average Upstream (West-Side) Wall Water Level Increase (ft)	Range Downstream (East-Side) Wall Water Level Decrease (ft)	Maximum Head Difference Considered in Model (FT)
Seep A	45	1.73	3.2 – 5.3	46.73ft-39.7ft=7.03ft
Seep B	50	2.16	3.1 – 5.1	52.16ft-44.9ft=7.26ft
Seep C	50	2.88	3.7 – 4.9	52.88ft-45.1ft=7.78ft
Seep D	60	3.42	3.3 – 4.7	63.42ft-55.3ft=8.12ft
South of Seep D	60	4.39	2.3 – 3.9	64.39ft-56.10ft=8.29ft

4.2.3 Seepage Modeling Results

Two primary outputs of the seepage models are of interest: the flow net conditions to confirm hydraulic behavior; and, hydraulic gradient contours to determine if the barrier wall embedment is sufficient to limit gradients below the barrier wall below a critical hydraulic gradient. The critical gradient represents the hydraulic gradient condition at which soil particles can become unstable and begin to move.

An example seepage model cross section located at Seep A is shown in Figure 4. At this location, the Black Creek Aquifer (shown in yellow) is thickest (from EL 40FT to about EL 10FT) of the locations modeled in this document. The layout of the model is viewed from south to north on the plan so the upstream (west) side of the wall is on the left of the model. The total head boundary conditions shown are directly from Table 3 and the layer elevations are from Figure 3.

The layout in Figure 4 represents the inputs for the seepage model with the finite element mesh shown over the barrier wall. All material inputs are included in the results attached to the Appendix. The post-processed outputs of the example model are the flow net (equipotential and flow lines) in Figure 5, and the hydraulic gradient contours in Figure 6. The scale on the total head contours in Figure 5 is relative to the original boundary conditions to illustrate the effect of the barrier wall on total head and flow.

The equipotential lines in Figure 5 confirm that the barrier wall is concentrating the flow through the aquifer zone. The water in the Black Creek Aquifer layer with a hydraulic conductivity of 1×10^{-2} cm/s prefers to continue the flow path into the barrier wall (hydraulic conductivity of 1×10^{-6} cm/s) than into the confining unit clay (hydraulic conductivity of 1×10^{-7} cm/s or lower). The gradient results confirm this behavior with the contour of hydraulic gradients showing maximum values at the interface between the aquifer and the Upper Cape Fear Confining Unit nearest the barrier wall.

The important takeaway from the hydraulic gradient results in Figure 6 is that the zone around the bottom of the wall (embedded five feet into the Upper Cape Fear Confining Unit) is nearly zero. This indicates the wall is sufficiently embedded to maintain material stability and minimize flow under the barrier wall, as intended. The scale on hydraulic gradient in Figure 6 is from 0 to 1.0 as the critical hydraulic gradient is around 1.0 for most soils. There are zones of hydraulic gradient exceeding 1.0 located at the interface between the sands and clays illustrating the high contrast in hydraulic conductivity. However, as long as the barrier wall is properly embedded to limit the hydraulic gradient at the toe area, these interface soils are confined by the system. The model in Figure 6 indicates that 5 feet of embedment into the Upper Cape Fear Confining Unit is sufficient to limit the hydraulic gradients of the system.

Preliminary seepage modeling results for the remaining four cases are attached to this Appendix. An embedment of five feet into the Upper Cape Fear Confining Unit was confirmed to meet performance expectations using the layering listed in Table 3; however, real layer boundaries are not typically as abrupt as those used in the numerical models. Alluvial soils typically transition from one soil type to another over a few feet such as when a sand becomes clayey as it transitions to a clay layer. Therefore, a parametric study was required to evaluate the effect of transitioning hydraulic conductivity in soils in the top two feet of the Upper Cape Fear Confining Unit. This is important because the wall embedment is designed to limit exit gradients which are heavily influenced by head loss across soil boundaries.

A preliminary parametric study was conducted by assigning varied hydraulic conductivities, two orders of magnitude larger (9.84×10^{-7} feet per second (ft/s) in model input represents 3×10^{-5} cm/s) and four orders of magnitude higher (9.84×10^{-5} ft/s in model input represents 3×10^{-3} cm/s), to the soil over the top 2 feet of the Upper Cape Fear Confining Unit. These conditions represent a potential transition zone where the clay may have a higher sand content which would increase the hydraulic conductivity essentially lowering the interface between the aquifer and the confining layer. Parametric studies were conducted for the soil profile at Seep A because the overlying sand layer, Black Creek Aquifer, was thickest at this section, hence any adverse effects would be accentuated at this location. The results of the parametric study, shown in

Figure 7 and Figure 8 preliminarily confirm an embedment depth of five feet (including 2 feet of transition material in the parametric study) is sufficient to manage exit gradients below critical levels providing resistance to material movement from fine grained layers at the bottom of the barrier wall.

Additional model inputs, cross sections, and outputs will be analyzed and submitted in the 90% design document. Design geometry for each seepage scenario in that submittal will be based on the 90% design alignment grading and geotechnical information collected in the area of each cross-section location.

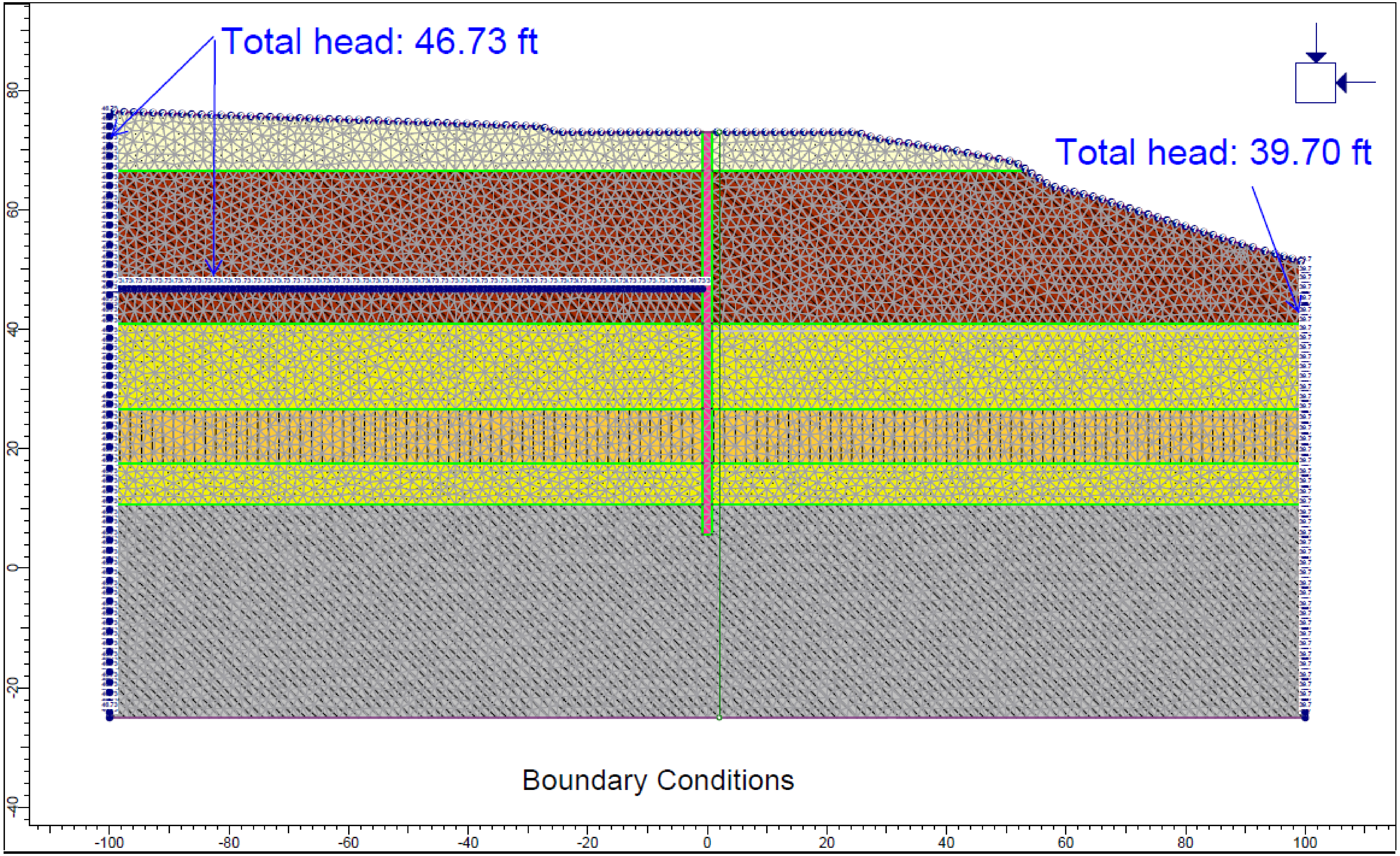


Figure 4 - Example Seepage Model Geometry for Seep A Cross-section

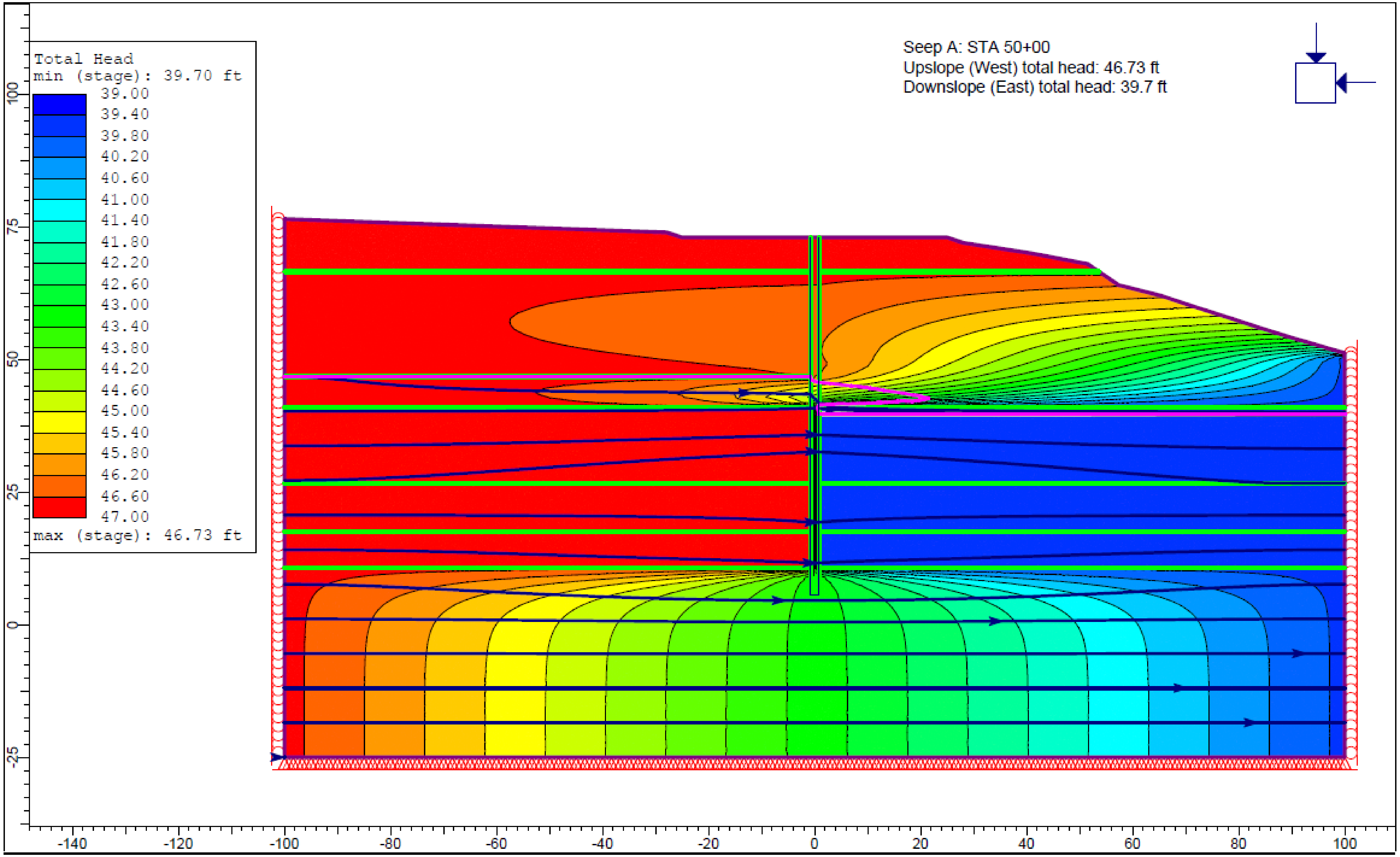


Figure 5 - Total Head Contours (equipotential lines) with Flow Lines for Seep A Cross Section

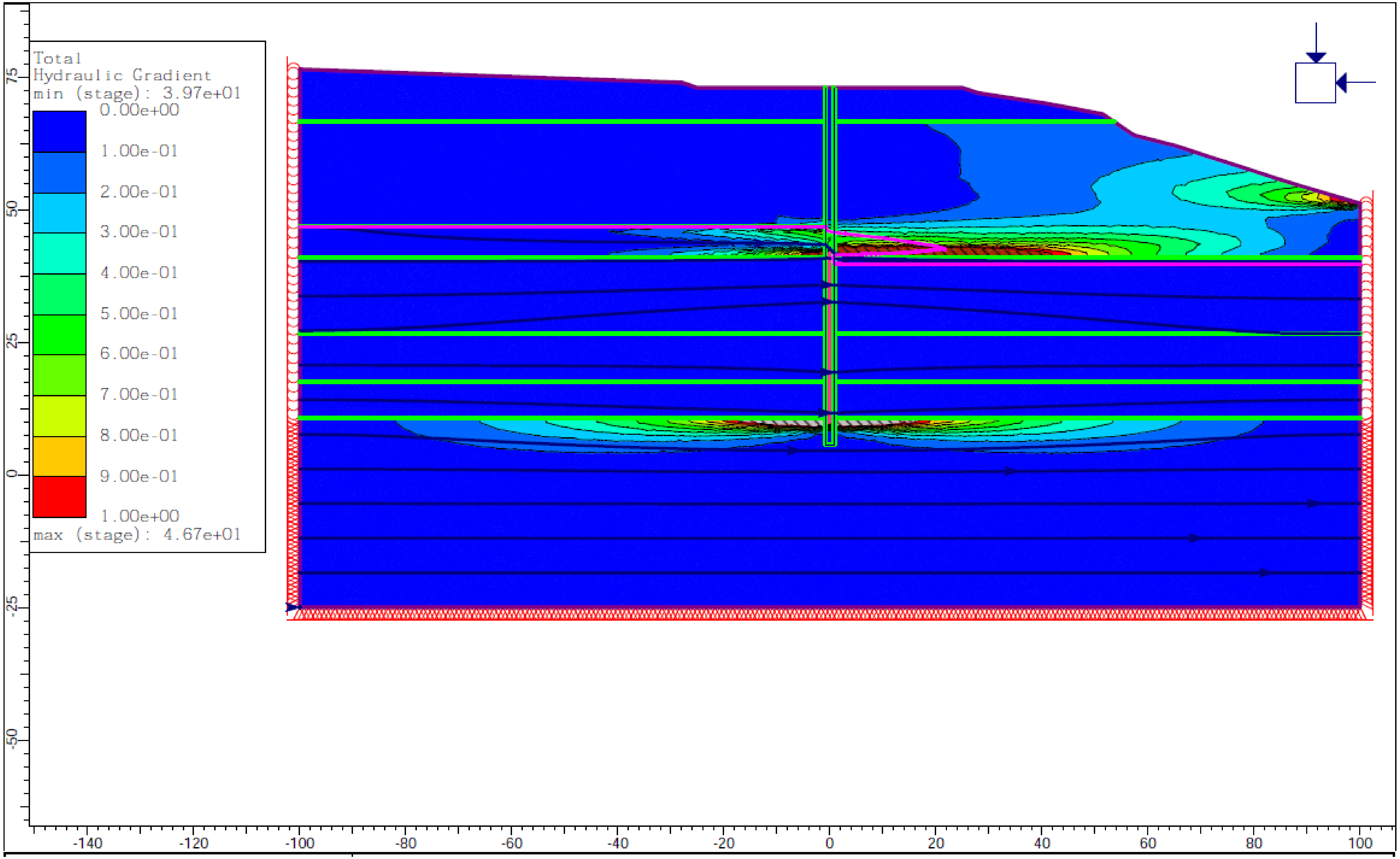


Figure 6 - Hydraulic Gradient Contours for Seep A Cross-Section

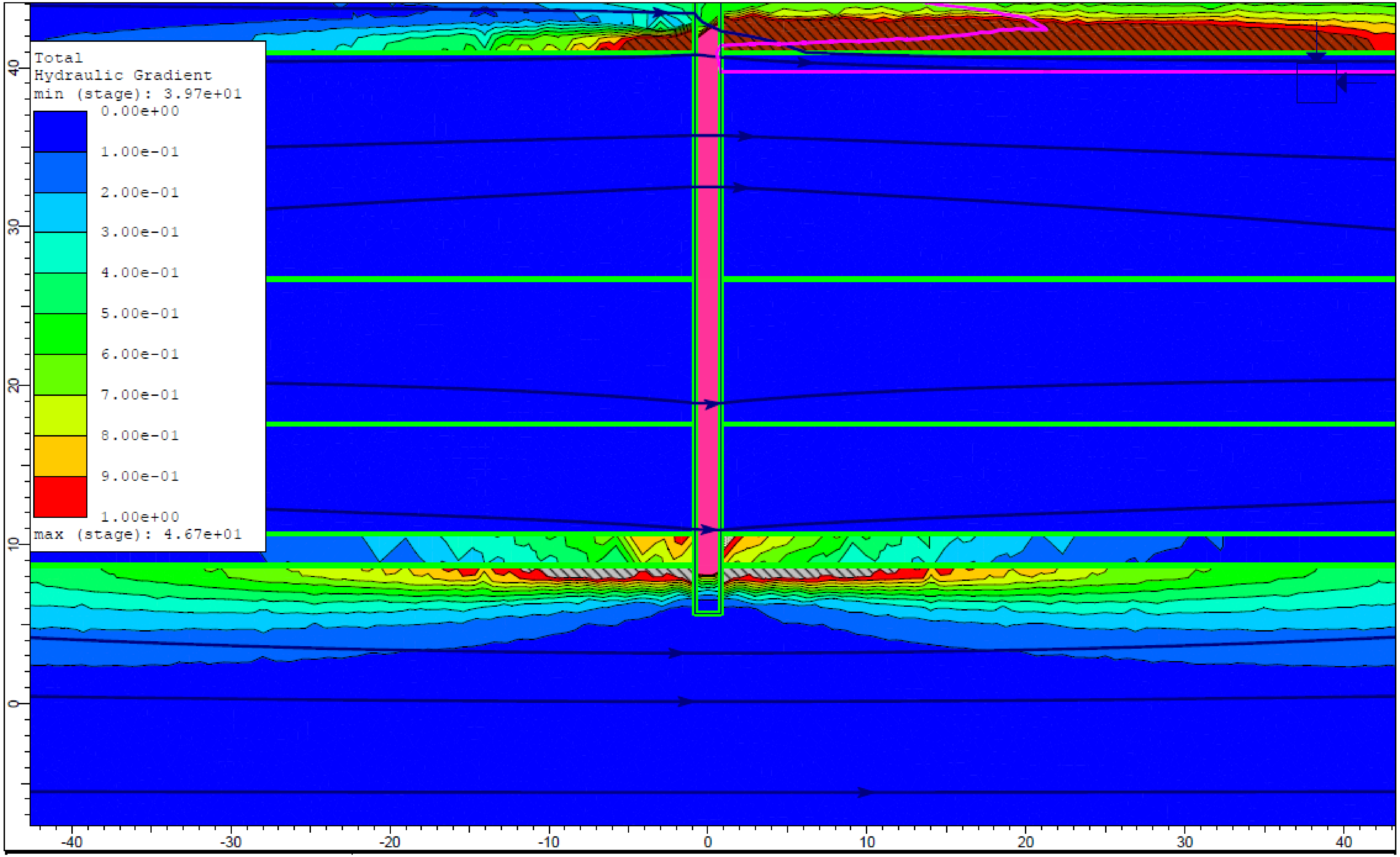


Figure 7 – Hydraulic Gradient for Parametric Study Case Seep A with 2ft Transition Zone of Higher Hydraulic Conductivity (2 orders of magnitude) in Upper Cape Fear Unit

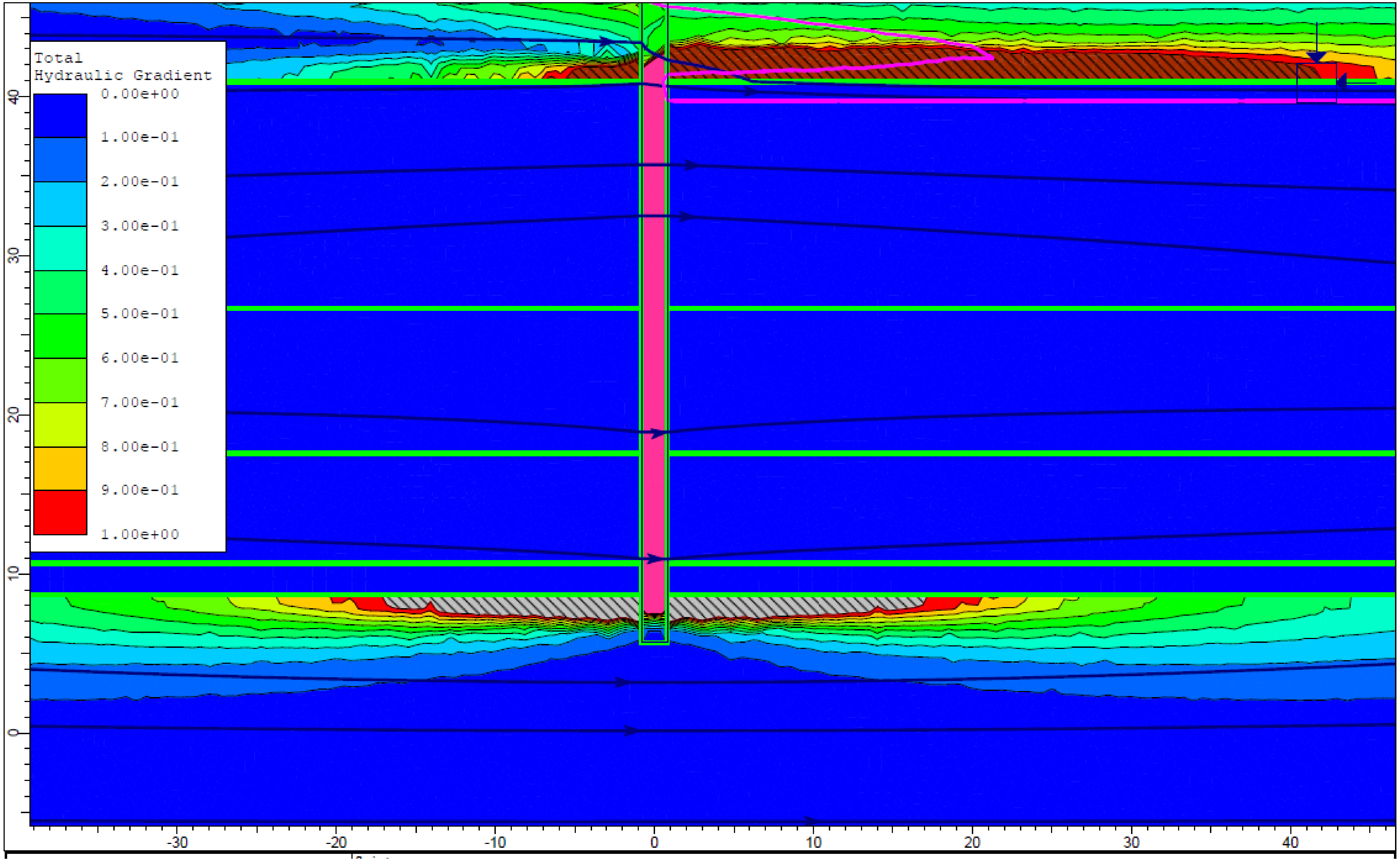


Figure 8 – Hydraulic Gradient for Parametric Study Seep A 2ft Layer of Higher Hydraulic Conductivity (4 orders of magnitude) in Upper Cape Fear Unit

4.3 Barrier Wall Roadway Analysis

The construction of the barrier wall will require access roadway to facilitate the movement of equipment and materials necessary for construction and for long-term maintenance of the extraction well system. Stability analyses for potential access road cross-sections before barrier wall construction was performed in the PDI Geotechnical Report (attached to Appendix A). One of the recommendations of the PDI analysis was grading of all slopes to 3H:1V. Design of the roadway alignment has proceeded with this recommendation in areas where space/permit constraints allow for slope grading. However, some sections along the alignment shown in the 60% design barrier wall plan set cannot be graded to 3H:1V within the topographic and permitted constraints of the property. Subsequent design calculations indicate that steep sections of the alignment will require retaining walls to intercept natural grades and prevent additional permitting and clearing. Retaining wall systems and slope grading have been preliminarily evaluated for stability during installation of the barrier wall. As mentioned previously, the selection of the wall contractor could impact the geometry of the roadway including but not limited to the centerline. As such, the location, height, and reinforcement of retaining walls are subject to change.

4.3.1 Retaining Wall Design Considerations

The grading of the barrier wall road alignment shown in the attached plans is based on the PDI Geotechnical Report slope stability analysis indicating that 3H:1V slopes should be used to maintain serviceability of the roadway during hydraulic barrier system installation and operation. The existing soil slopes are inclined at nearly 3H:1V making new grading difficult to match up with existing grade within the limits of the roadway construction area. To counteract this, mechanically stabilized earth walls (MSEW) will be installed above and/or below the road to assist in grading and reduce on-slope grading operations. Preliminary plans and calculations for retaining walls along the proposed alignment are attached to this Appendix.

For preliminary design, downslope walls were limited in height because the reinforcement in the retained zone typical of MSEW construction is not compatible with installation of the barrier wall using one-pass methods. These walls are designed as gravity (no reinforcement) retaining walls with face drainage. Upslope walls are taller than six feet in areas where it is possible to use geogrid reinforcement in the retained soil zone. The preliminary design includes use of on-site soils as backfill to reduce off-hauling. Native soils along the alignment of retaining walls will be sampled and tested for grain-size distribution to determine applicability as fill per industry standards for MSEW.

For preliminary design, cross sections based on preliminary grading and existing surveyed contours were developed and analyzed using computer analysis software Redi-Rock Wall+ by Redi-Rock International and Fine Software. The software was used to evaluate internal, external, and global stability of all MSEW using calculations based on design concepts from Federal Highway Administration (FHWA) guidance (Berg, et al., 2009). Global stability analysis within the retaining wall calculations evaluates surfaces through the geogrid (if used) and surfaces immediately behind the retained sections. Global analysis of the slopes above and below the retaining walls was performed separately once the design criteria of the retaining walls were satisfied. Retaining wall minimum factors of safety used for appropriate limit states are summarized in Table 4.

Table 4 – Factors of Safety for Retaining Wall Design

Limit States External Sliding	**Minimum Factor of Safety**
External Overturning	2.0
External Bearing Capacity	3.0
Internal Sliding Along Geogrid	1.5
Geogrid Tensile Strength	1.5
Geogrid Pullout	1.5
Geogrid/Block Connection Strength	1.5

Preliminary design plans and calculations for all retaining walls are attached to this Appendix. Wall heights vary based on grading and location relative to the barrier wall access road. The 90% design will provide backfill material requirements, reinforcement, and drainage details based on available materials and site-specific design constraints that arise after barrier wall contractor selection.

4.3.2 Slope Stability Analysis

Once the retaining walls were inserted into the grading, six representative cross-sections for preliminary slope stability analysis were identified by visual analysis of elevation contours along the alignment. The following slope conditions were considered:

- Section supported by tallest retaining wall
- Section with large cut and fill with no retaining walls
- Section with largest quantity of fill below the roadway
- Section with retaining wall supported upslope with large fill on downslope side of road
- Section with steepest natural downslope below roadway

Slope analysis was performed using Slide2 (Rocscience version 9.010) limit equilibrium slope modeling software for efficient evaluation of potential failure surfaces. Spencer’s complete equilibrium method (Spencer, 1967) is used to evaluate global stability Factor of Safety (FOS). When appropriate, a groundwater table is included based on the hydraulic conditions reported by the site groundwater modeling (Table 3). When the section of interest is located at considerable distance from the seeps, the water level was assumed to be located in the surficial aquifer. Additionally, an assumed roadway surcharge of 500 pounds per square foot (psf) was included to account for the equipment loading during barrier wall construction. Once the equipment type and barrier wall installation methodology are selected the surcharge value and extents will be verified and slope stability analyses will be revised.

It is common engineering practice is to evaluate slopes for both short term and long-term stability. Short term, or undrained, analysis evaluates the slope immediately after construction when excess pore pressures have been generated but have not yet dissipated. Long term, or drained, analysis attempts to evaluate the slope over a considerably longer time frame (especially in clay layers) when pore pressure changes from construction activity have dissipated (positive for fill slopes and negative for cut slopes). The alignment currently has cuts and fills planned with and without retaining walls. All sections consider both long-term and short-term analyses. Models and results for all analyzed sections are included in the attachments.

4.3.2.1 Slope Stability Parameter Selection

Eight different soil materials are considered in the soil profile for slope stability analyses. These materials consist of the following: 1) Light Brown Sand, 2) Dark Gray Clay, 3) Light Gray Sand, 4) Perched Clay, 5) Surficial Aquifer, 6) Black Creek Confining Unit, 7) Black Creek Aquifer, and 8) Upper Cape Fear Confining Unit. Geologic unit analysis was not available on the upper soil layers collected in the sonic boring above the roadway so these upper soil layers are denominated by geotechnical classification (ASTM D2488) while the layers at and below the roadway are denominated using geologic classification to be consistent with the cross-section profile in Figure 3. In addition to these native soil layers, roadways and compacted fills were represented by Roadway Material and Compacted Fill layers with properties based on experience in materials testing. For the purposes of these analyses, the retaining wall block units are assigned infinite strength to analyze the stability of the slopes above and below the roadway without surfaces exiting the face of the retaining wall. Such a failure mechanism would be considered internal to the retaining wall and internal and external stability of the wall sections are considered explicitly in the retaining wall design.

For clayey layers, total stress (undrained) strength parameters were used for short term stability analysis and effective stress (drained) strength parameters were used for long term stability analysis. Sandy layers were assumed to be freely draining which significantly decreases excess pore pressure generation during construction activities. Therefore, the analyses consider effective stress strength parameters in sands for both short term and long-term stability analyses.

Unit weights and shear strength parameters utilized in the analyses were based primarily on existing soil borings and laboratory testing detailed in the PDI Geotechnical Report. These parameters were then adjusted to account for changes in soil consistency identified by SPT N-values as well as available SCPTU data. In some instances, adjustments considered published soil strength parameter standards. The material parameters used for stability analysis of the proposed roadway are summarized in Table 5.

Table 5 – Slope Stability Modeling Parameters

Layer Name	**Unit Weight (pcf)**	**Total Stress (Short-term) Strength Parameters**	**Effective Stress (Long-term) Strength Parameters**	
		Undrained Shear Strength (psf)	**Cohesion (psf)**	**Friction Angle (degrees)**
Light Brown Sand	110	-	75	32
Dark Gray Clay	120	1300	200	25
Light Gray Sand	115	-	50	32
Perched Clay	110	1100	200	24
Surficial Aquifer	115	-	75	32
Black Creek Confining Unit	120	900 - 2000	125	26
Black Creek Aquifer	120	-	0	33
Upper Cape Fear Confining Unit	120	2500	200	26
Compacted Fill	135	-	0	35
Roadway Material	145	-	0	45

Upper soil layers were assigned constant strength over the entire thickness of the layers. However, due to the variation in the depth of the Black Creek Confining Unit at different sections, depth dependent shear strength is assigned with a minimum strength of 900 psf, increasing at 30 psf per foot of the layer, and a maximum strength of 2000 psf.

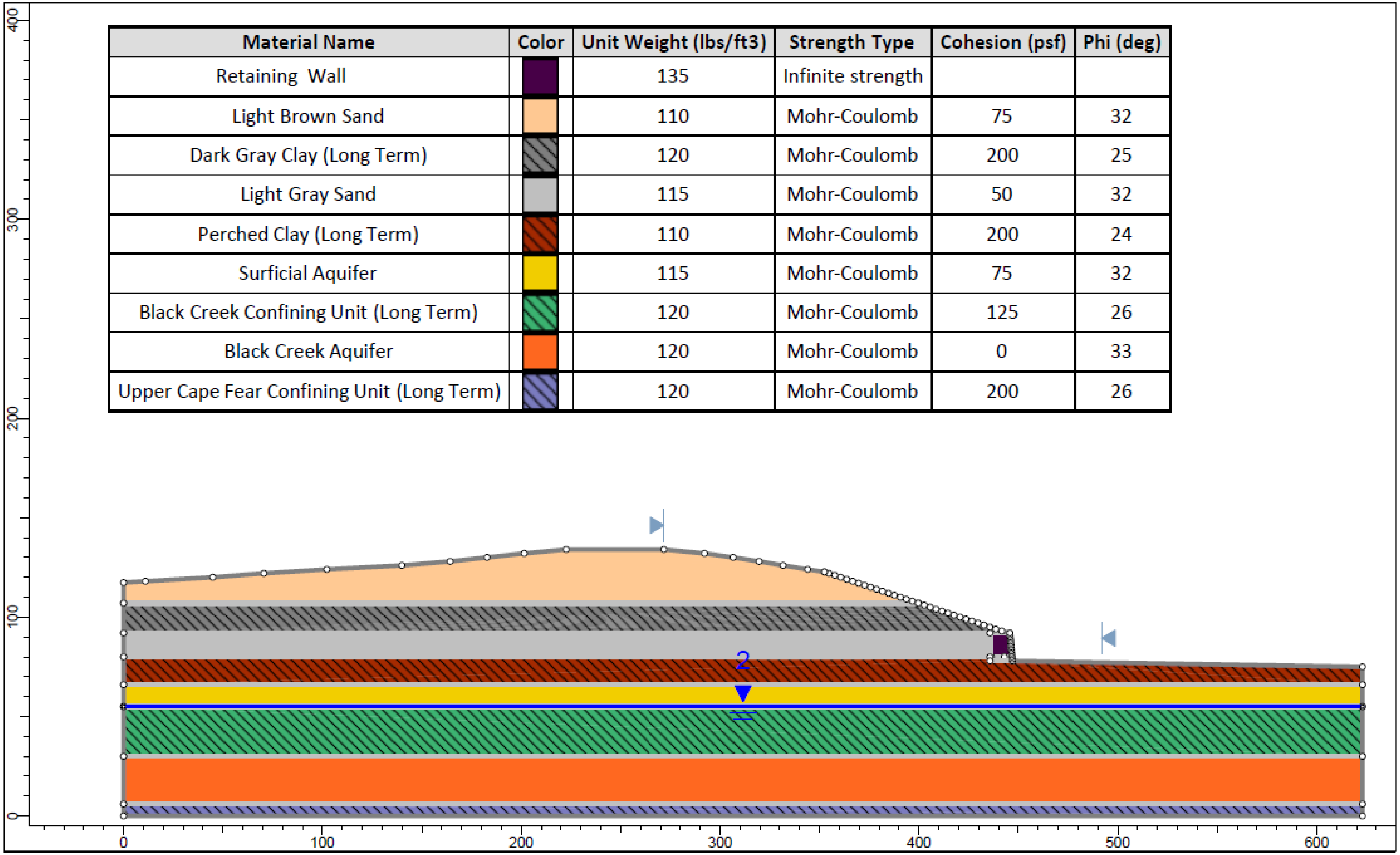
4.3.2.2 Slope Stability Analysis Results

The output of interest from slope stability analysis is the FOS observed on the critical surface. Critical surface is defined as the slope search surface reporting the lowest FOS. For permanent slopes, the critical surface FOS is compared to the target FOS of 1.5.

An example slope stability analysis is shown in Figures 9 - 11. Model geometry and material inputs are shown in Figure 9. The result of a short-term analysis with undrained soil strength parameters for clays and drained soil strength parameters for sands is shown as Figure 10. Long term analysis with drained soil strength parameters for all soils in the same model is shown as Figure 11. The FOS of both analyses is greater than or equal to the target FOS of 1.5 demonstrating the proposed grading is adequate for slope stability.

Results of all slope stability analyses are attached to this Appendix. The analysis confirms the PDI Geotechnical Recommendation of grading slopes to 3H:1V is adequate to provide a factor-of-safety of at least 1.5. Additional sections will be evaluated and reported on in the 90% design submittal after the alignment is finalized.

The sandy nature of the surficial soils observed in interim seep capture construction will require careful compaction during construction, erosion control protocols, and maintenance of slopes post-construction to control surficial sloughing. Erosion from surface water during significant rain events is also a concern that will be addressed in slope construction and maintenance recommendations in the 90% design submittal.



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Retaining Wall	🟪	135	Infinite strength		
Light Brown Sand	🟫	110	Mohr-Coulomb	75	32
Dark Gray Clay (Long Term)	▨	120	Mohr-Coulomb	200	25
Light Gray Sand	⬜	115	Mohr-Coulomb	50	32
Perched Clay (Long Term)	🟥	110	Mohr-Coulomb	200	24
Surficial Aquifer	🟨	115	Mohr-Coulomb	75	32
Black Creek Confining Unit (Long Term)	🟩	120	Mohr-Coulomb	125	26
Black Creek Aquifer	🟧	120	Mohr-Coulomb	0	33
Upper Cape Fear Confining Unit (Long Term)	🟦	120	Mohr-Coulomb	200	26

Figure 9 - Example Slope Stability Model with Parameters

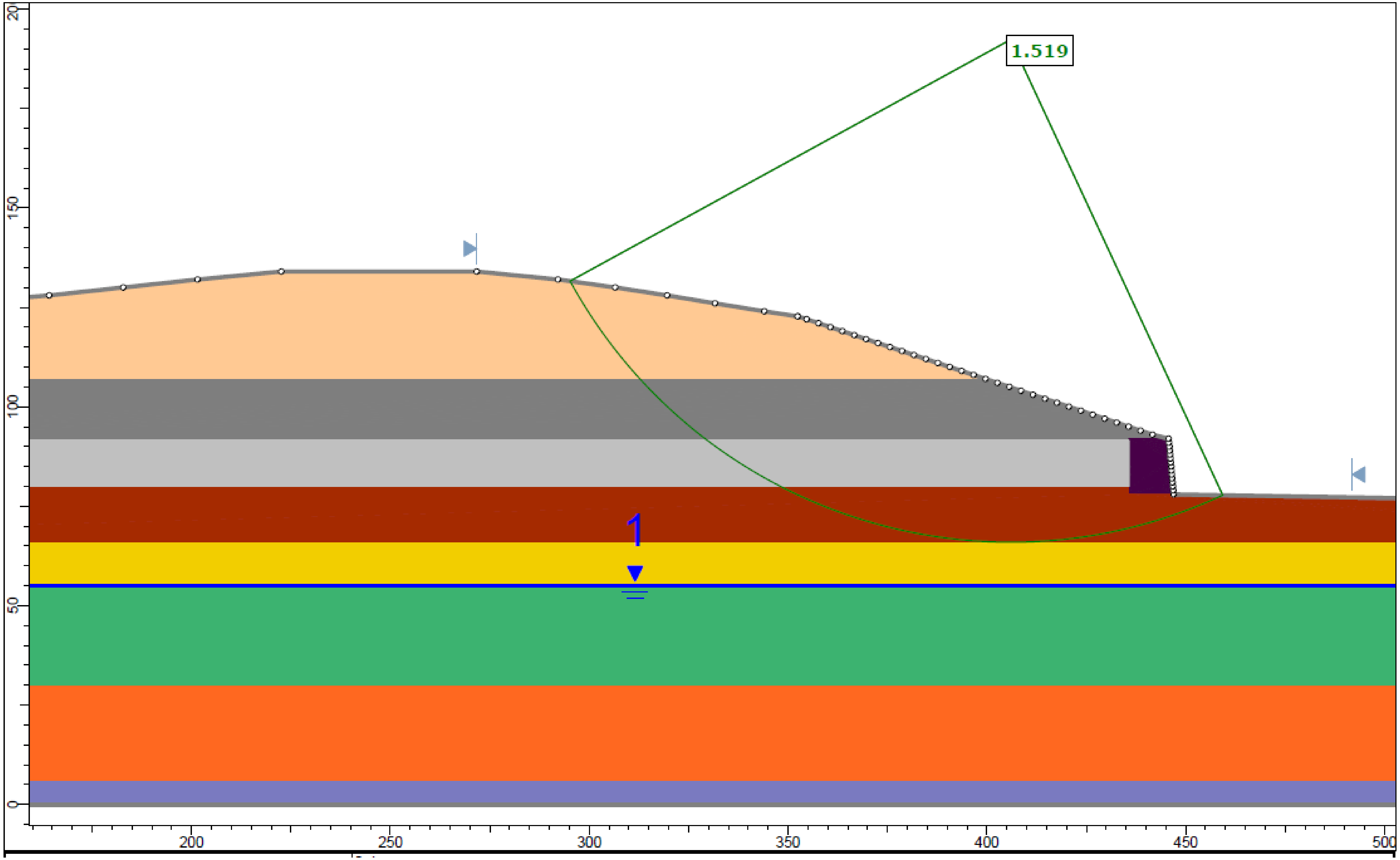


Figure 10 - Short-Term Slope Analysis of Example Case

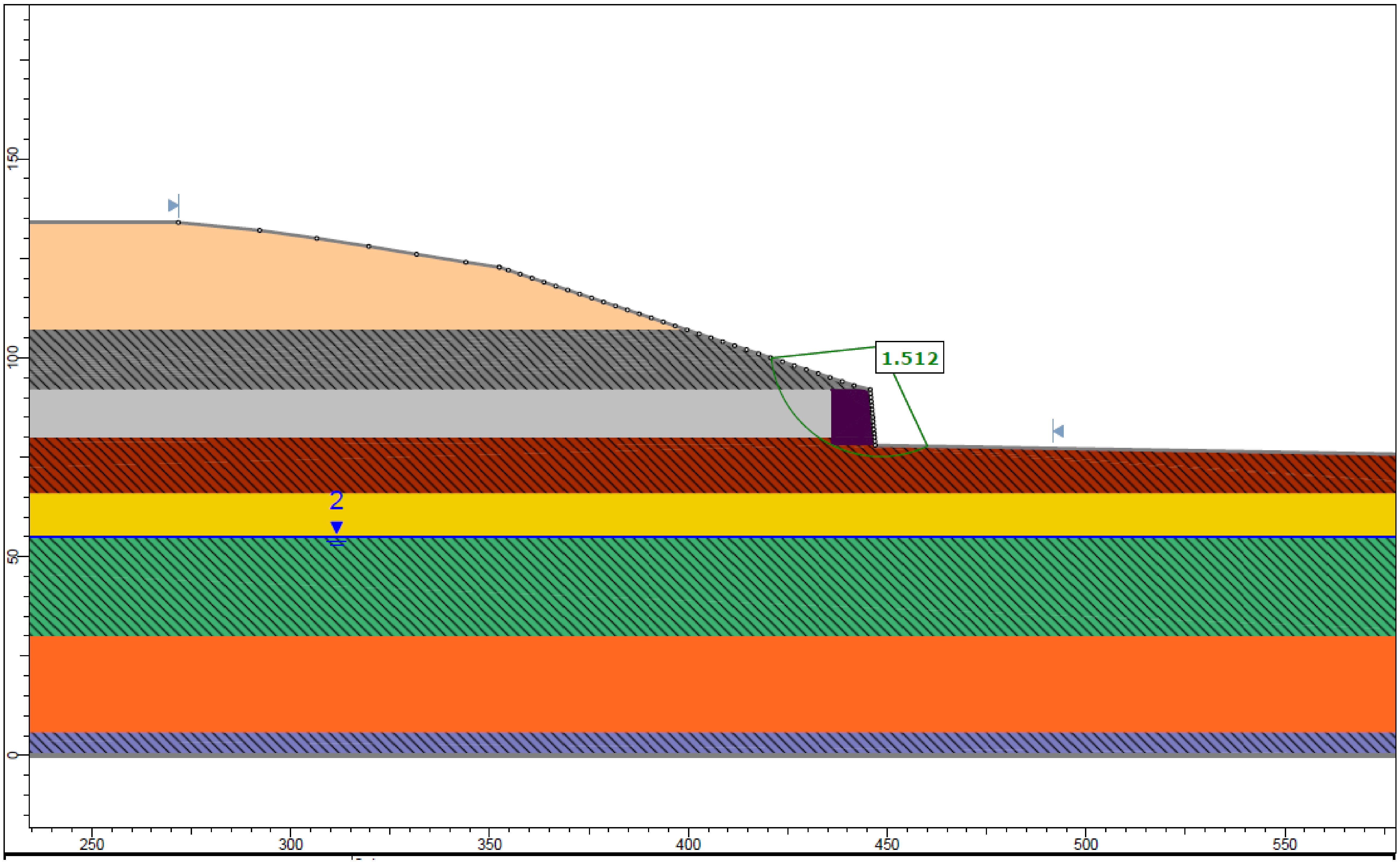


Figure 11 - Long-Term Slope Analysis of Example Case

5. Summary And Closing

The barrier wall system is part of the groundwater interception system design to address the objectives of Paragraph 3(b)(i) and (ii) in the COA. Geotechnical and well drilling exploration of the site was utilized to develop a geologic cross-section of the area used in site groundwater and seepage models. Geotechnical laboratory testing (summarized in the PDI Geotechnical Report) is utilized in design parameters for both seepage modeling of the barrier wall and stability analyses of the roadway slopes and retaining walls.

Seepage modeling indicates that a 0.5m thick barrier wall with a hydraulic conductivity of $1x10^{-6}$ cm/s requires a minimum embedment of 5 feet into the Upper Caper Fear Confining Unit to reduce seepage and facilitate well collection of PFAS loaded water on the upslope side of the barrier wall. Preliminary inputs, cross sections, and outputs of seepage models are attached. Additional models and refinement of current models will be provided as part of the 90% design submittal once contractor specific details of the alignment are finalized.

Slope stability modeling of the barrier wall alignment indicates that final slopes of 3H:1V satisfy long term stability requirements but will require surface water management, and maintenance to reduce the effects of erosion and maintain access to the groundwater interception system once operational. Additionally, some areas will require MSEW retaining walls to achieve recommended grading within the project site limits. Refined slope analyses will be provided in the 90% design submittal after the alignment and grading is finalized (awaiting contractor selection).

The next step for the barrier wall design process is to select a barrier wall installation vendor to finalize the alignment and details of the barrier wall. Additional geotechnical assessment of the roadway alignment and the slopes above the roadway is planned before construction begins.

6. References

Berg, R.R., Christopher, B.R., and Samtani, N.C. (2009). Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, FHSA NHI-10-024 Volume 1 and NHI-10-025 Volume II, U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 306p (Vol I) and 380p (Vol II)

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Geosyntec, 2021a. Pre-Design Investigation Summary (Version 2). Chemours Fayetteville Works. June 29, 2021

NCDEQ, 2019. Addendum to Consent Order Paragraph 12. General Court of Justice Superior Court Division. State of North Carolina. County of Bladen. February 25, 2019.

Spencer, E. (1967). “A Method of Analysis of the Stability of Embankments Assuming Parallel Interslice Forces”. Geotechnique; 17(1), 11-26

Attachments

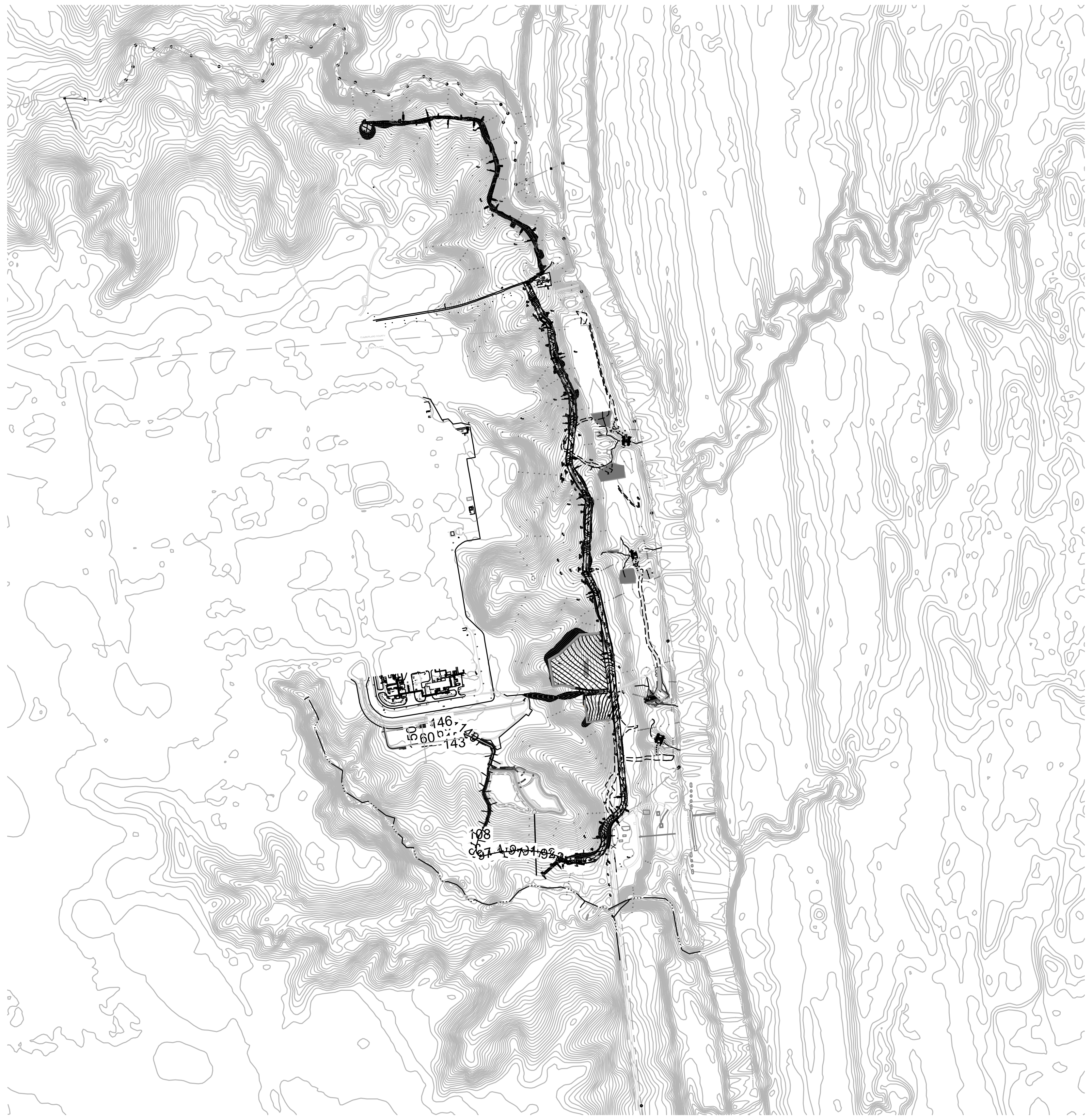
Barrier Wall 60% Design Plans

The Chemours Company

Fayetteville, North Carolina

Barrier Wall 60% Design Plans

July 28, 2021



DRAWING INDEX

GENERAL

G-1.0	COVER SHEET

BARRIER WALL

BW-0.1	SITE PLAN
BW-1.0	BARRIER WALL PLAN & PROFILE
BW-2.0	BARRIER WALL PLAN & PROFILE
BW-3.0	BARRIER WALL PLAN & PROFILE
BW-4.0	BARRIER WALL PLAN & PROFILE
BW-5.0	BARRIER WALL PLAN & PROFILE

GEOS
Geotechnical, Environmental and Materials Engineers

Barrier Wall 60% Design Plans
Cover Sheet

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design
Not for
Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: TJD	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
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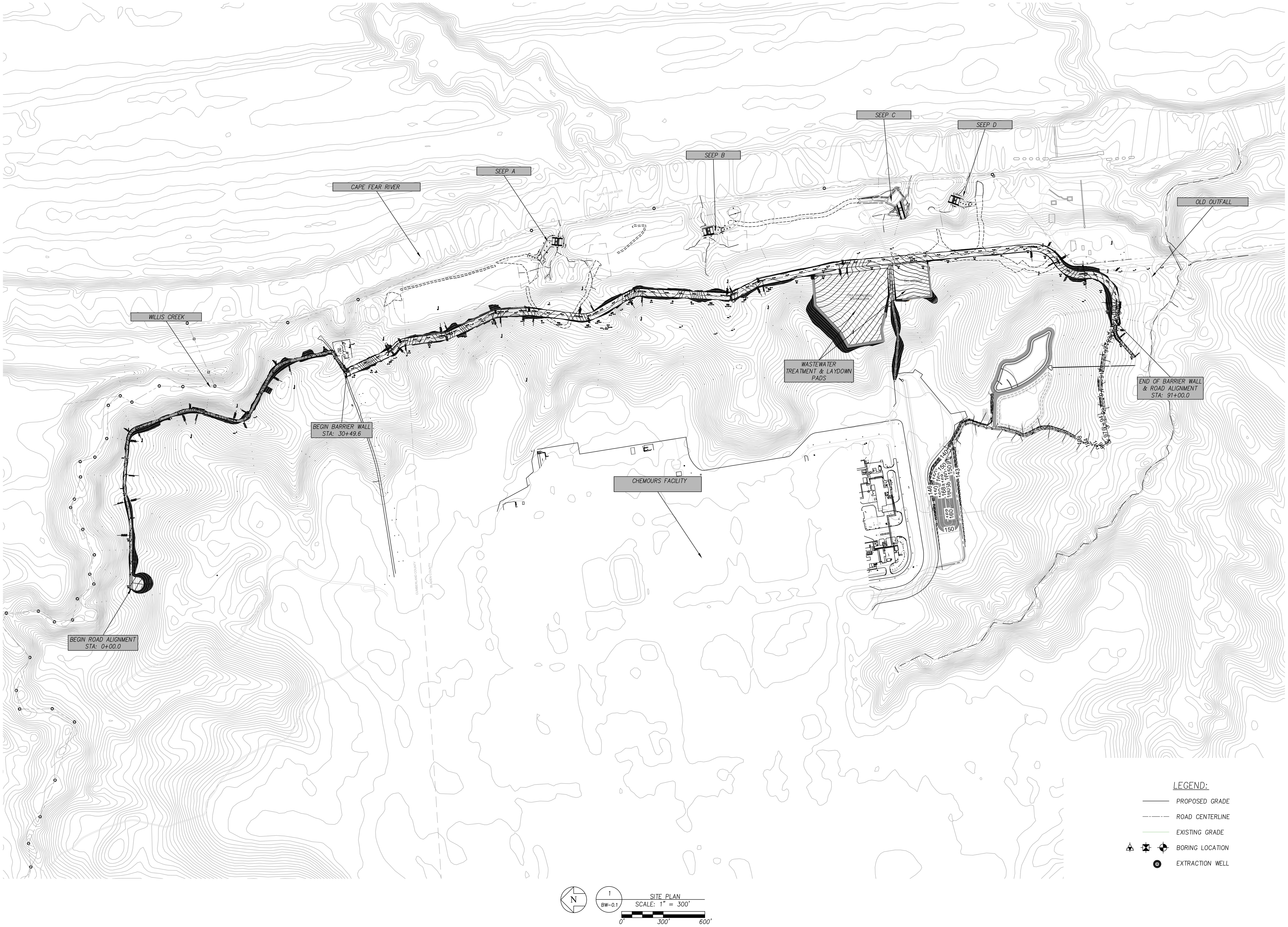
DRAWING: G-1.0

PROJECT NUMBER: 45-20803



LEGEND:

- PROPOSED GRADE
- ROAD CENTERLINE
- EXISTING GRADE
- BORING LOCATION
- EXTRACTION WELL

1 BW-0.1 SITE PLAN
SCALE: 1" = 300'

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Barrier Wall 60% Design Plans
Site Plan

Chemours Fayetteville Works
Fayetteville, North Carolina

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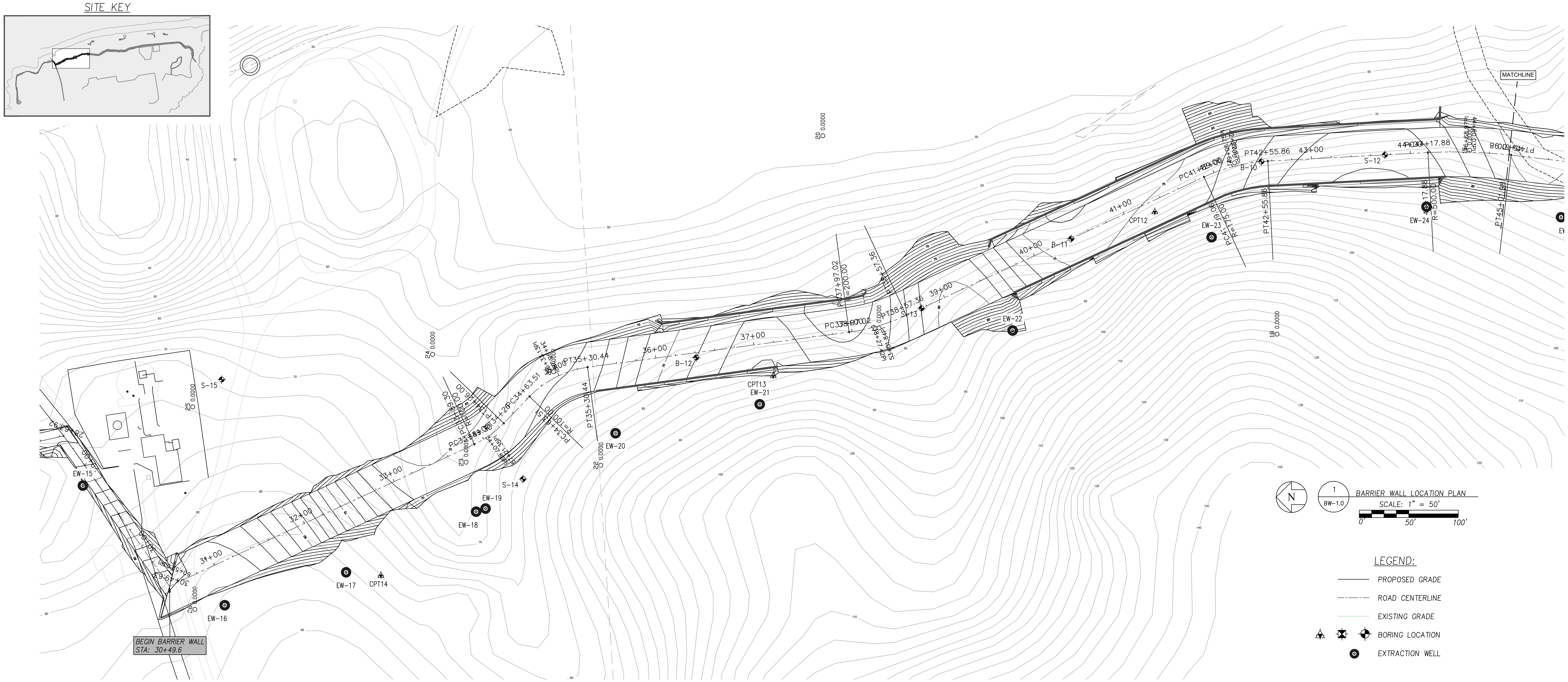
BW-0.1

PROJECT NUMBER:
45-20803



BARRIER WALL LOCATION PLAN

SCALE: 1" = 50'

0' 50' 100'

1 / BW-1.0

LEGEND:

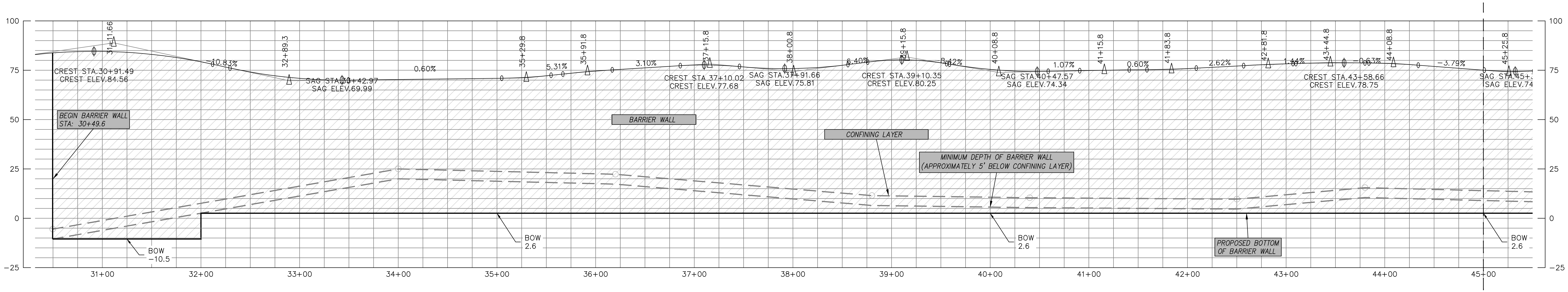
PROPOSED GRADE

ROAD CENTERLINE

EXISTING GRADE

BORING LOCATION

EXTRACTION WELL



NOTE:
CONTRACTOR TO PROVIDE BARRIER WALL WITH MINIMUM THICKNESS OF 0.5M AND A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1X10E-6 CM/S.

BARRIER WALL PROFILE

SCALE: NTS

2 / BW-1.0

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Barrier Wall 60% Design Plans
Barrier Wall Plan & Profile

Chemours Fayetteville Works
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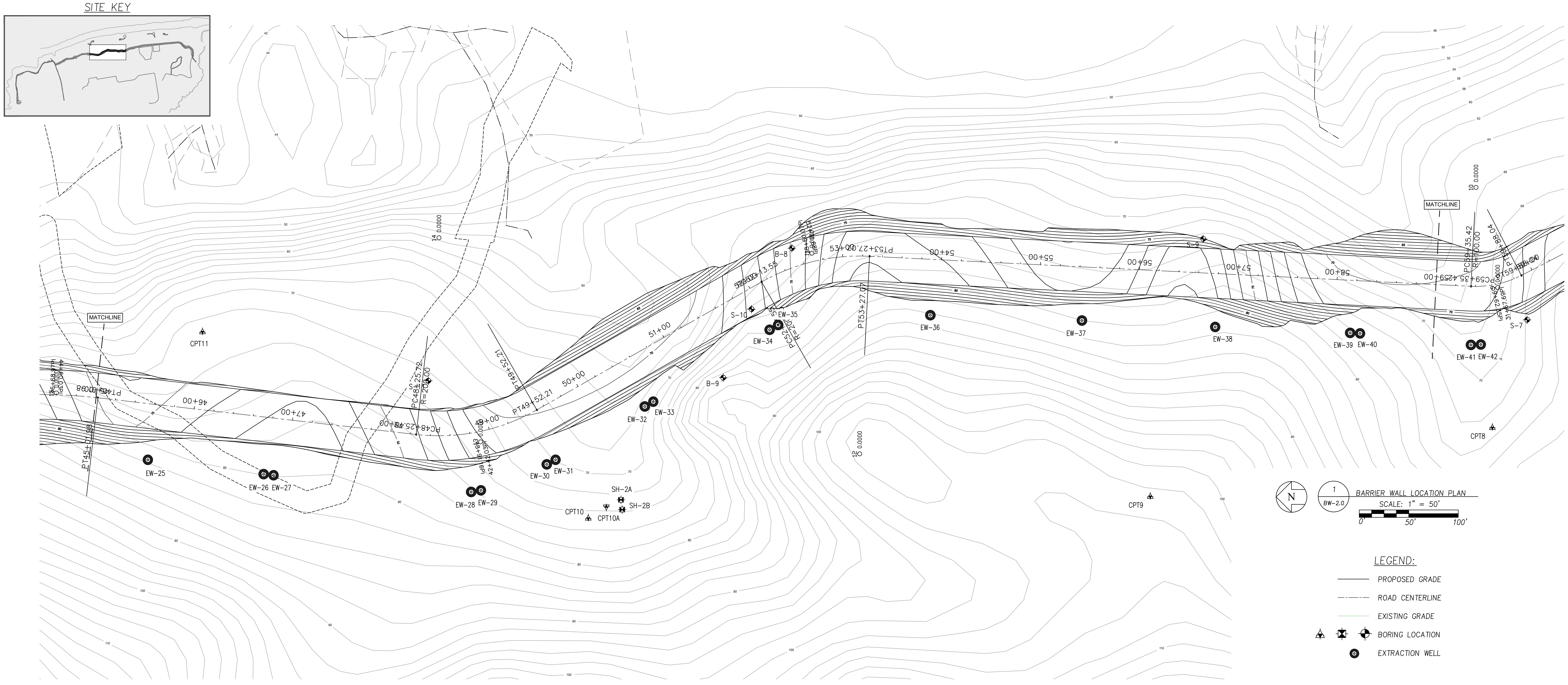
DRAWING:
BW-1.0

PROJECT NUMBER:
45-20803

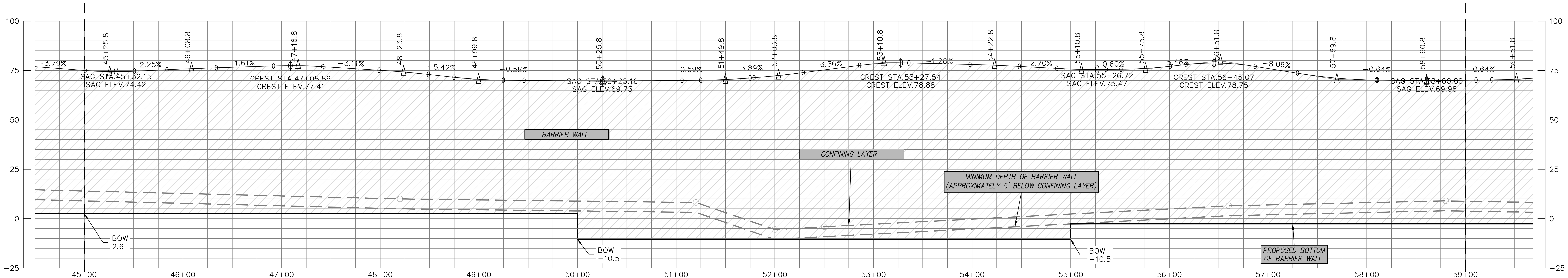
SITE KEY



1 BW-2.0 BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

LEGEND:

───	PROPOSED GRADE
─·─	ROAD CENTERLINE
───	EXISTING GRADE
▲ ✖ ✚	BORING LOCATION
●	EXTRACTION WELL



NOTE:
CONTRACTOR TO PROVIDE BARRIER WALL WITH MINIMUM THICKNESS OF 0.5M AND A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1X10E-6 CM/S.

2 BW-2.0 BARRIER WALL PROFILE
SCALE: NTS

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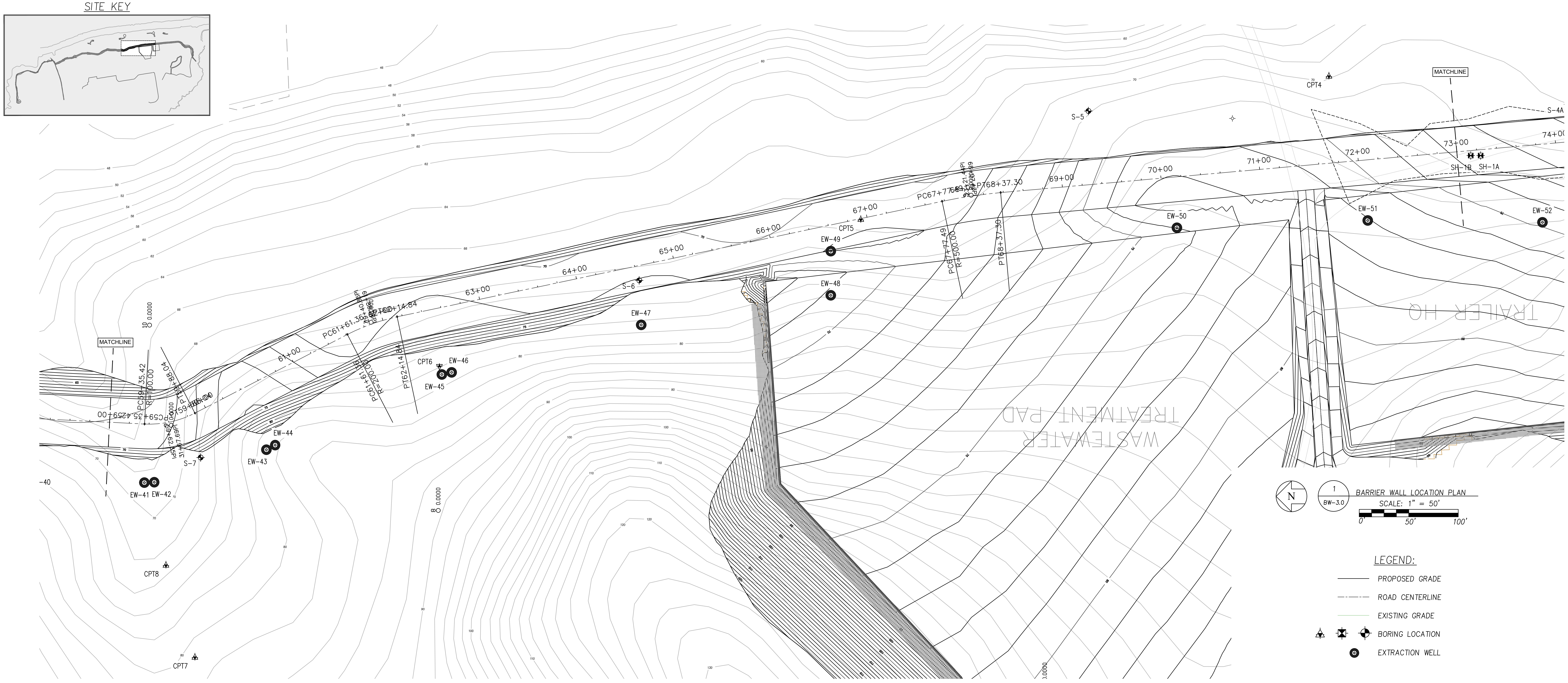
DRAWING:
BW-2.0

PROJECT NUMBER:
45-20803



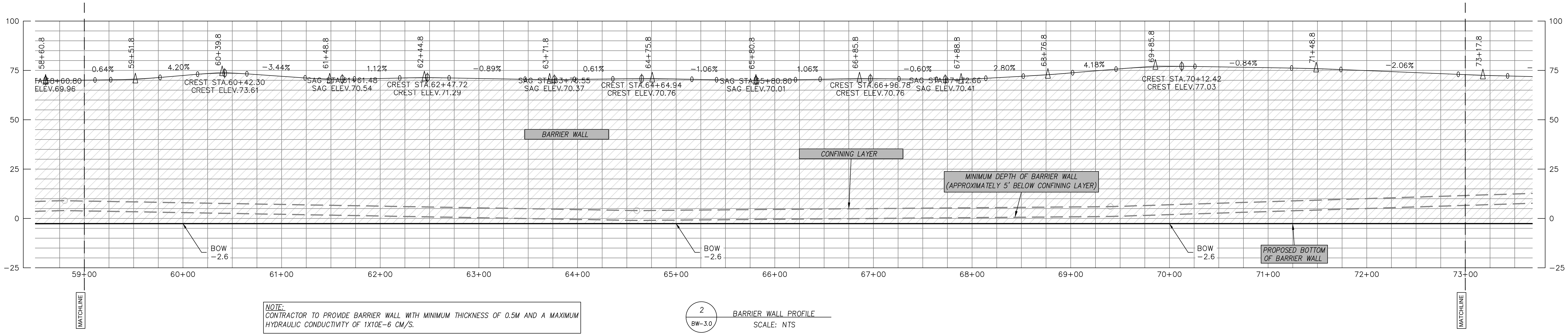
1 BW-3.0 BARRIER WALL LOCATION PLAN

SCALE: 1" = 50'

0' 50' 100'

LEGEND:

- PROPOSED GRADE
- ROAD CENTERLINE
- EXISTING GRADE
- BORING LOCATION
- EXTRACTION WELL



NOTE:
CONTRACTOR TO PROVIDE BARRIER WALL WITH MINIMUM THICKNESS OF 0.5M AND A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1X10E-6 CM/S.

2 BW-3.0 BARRIER WALL PROFILE

SCALE: NTS

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DATE: July 28, 2021	

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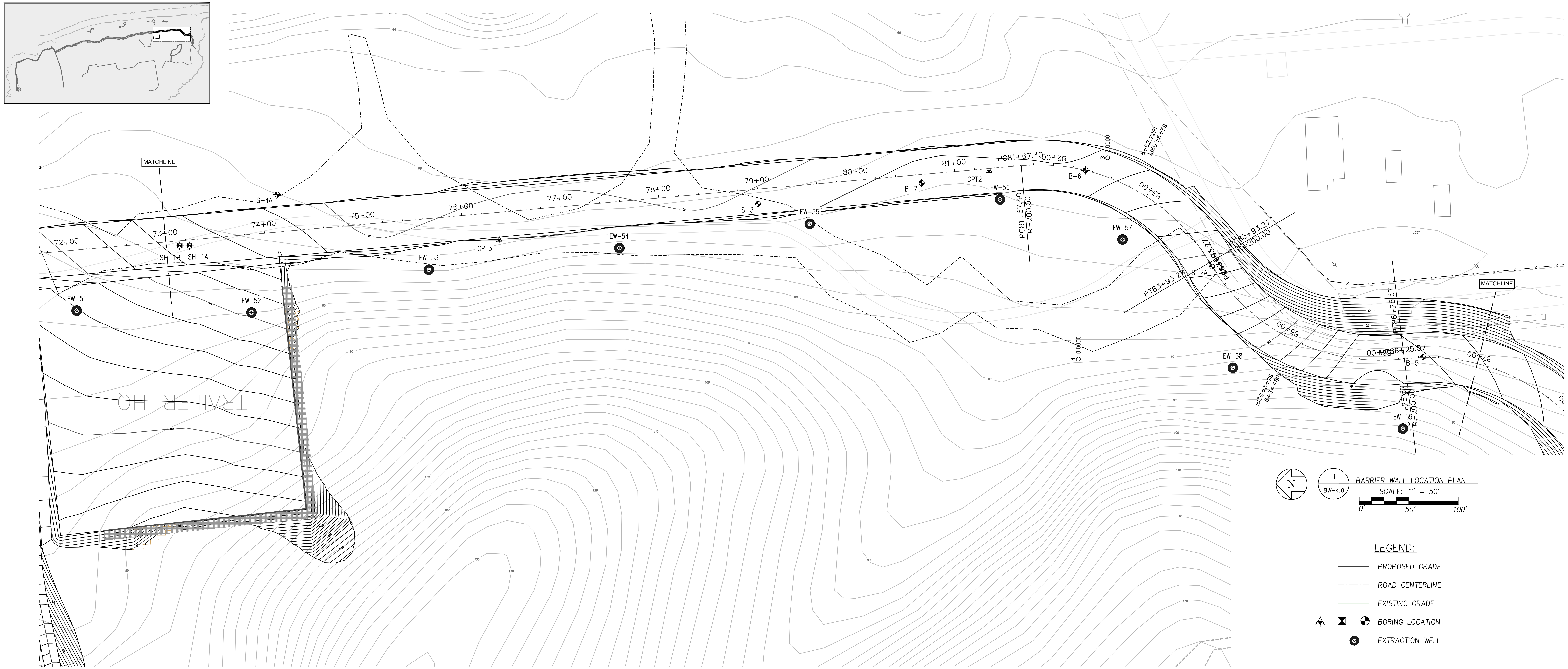
DRAWING:
BW-3.0

PROJECT NUMBER:
45-20803

SITE KEY

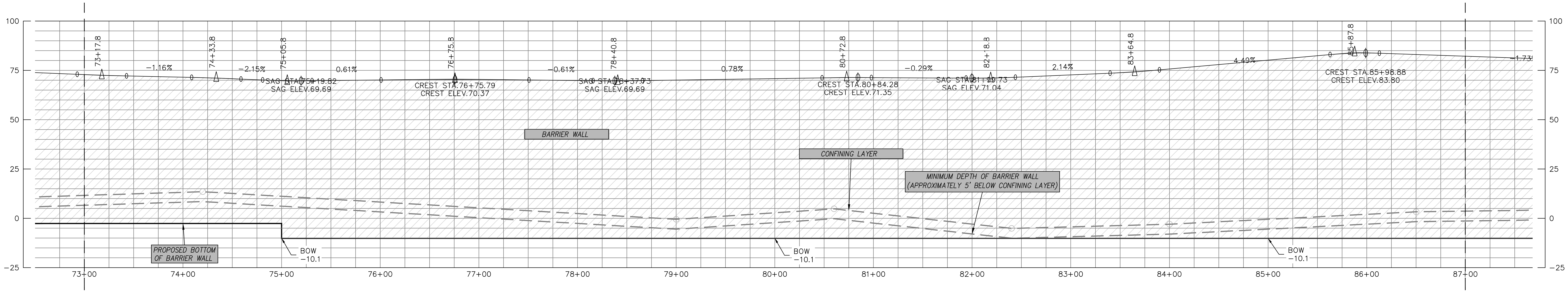


N

1
BW-4.0
BARRIER WALL LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

LEGEND:

PROPOSED GRADE
ROAD CENTERLINE
EXISTING GRADE
BORING LOCATION
EXTRACTION WELL



NOTE:
CONTRACTOR TO PROVIDE BARRIER WALL WITH MINIMUM THICKNESS OF 0.5M AND A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1X10E-6 CM/S.

2
BW-4.0
BARRIER WALL PROFILE
SCALE: NTS

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DATE:
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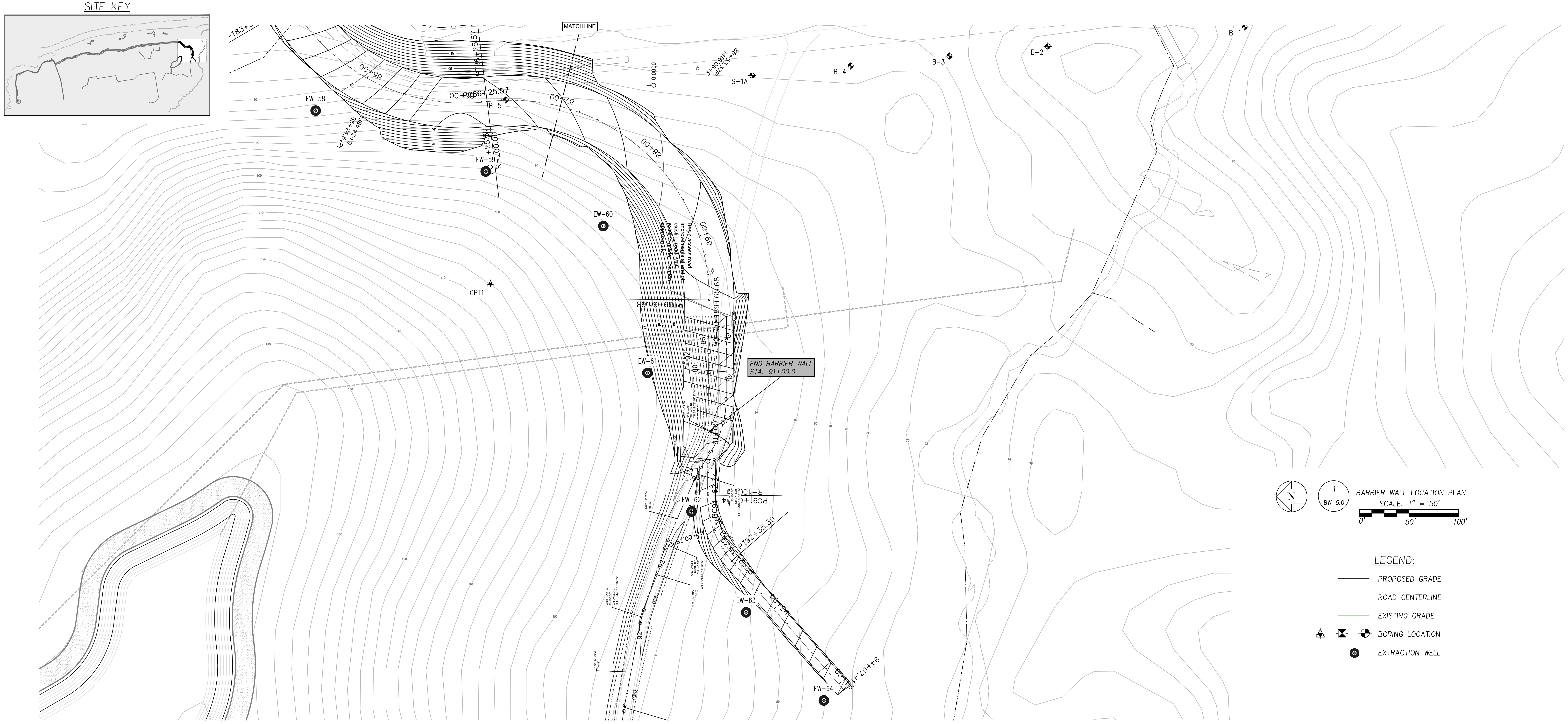
DRAWING:
BW-4.0

PROJECT NUMBER:
45-20803



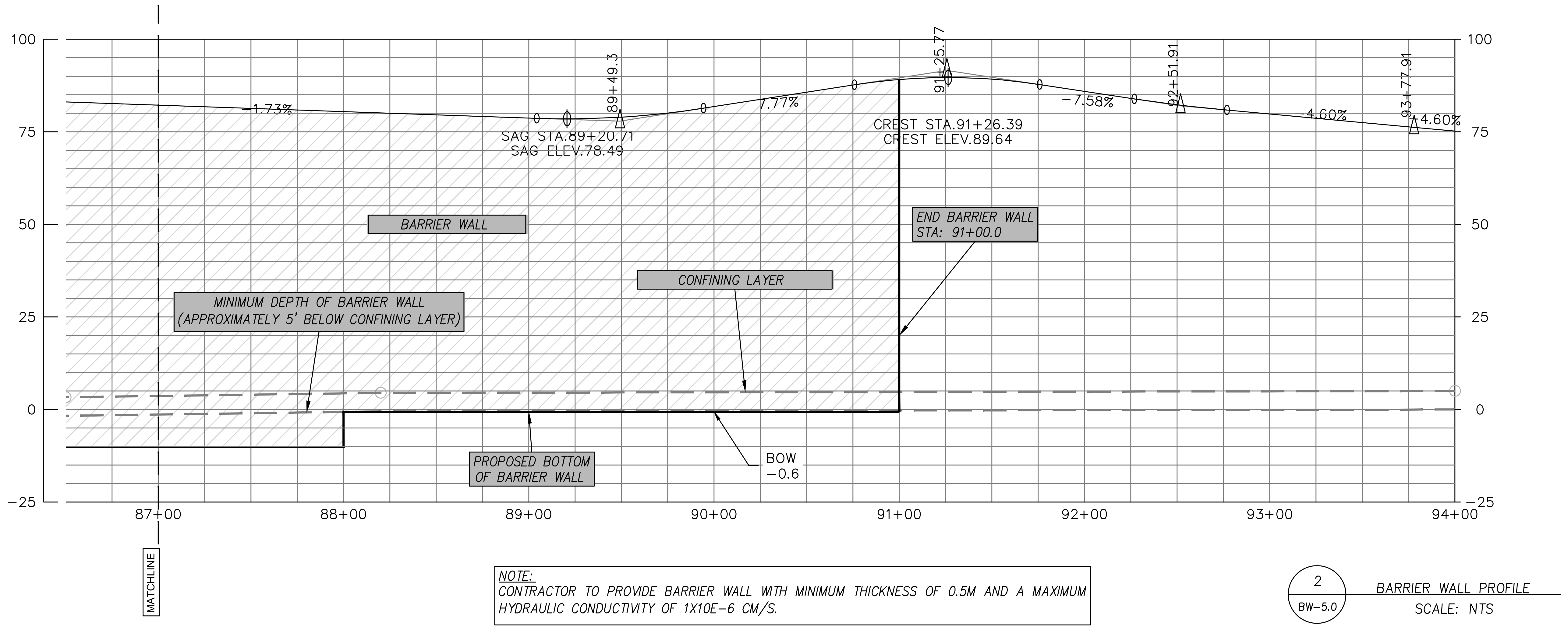
1 / BW-5.0 BARRIER WALL LOCATION PLAN

SCALE: 1" = 50'

0' 50' 100'

LEGEND:

———	PROPOSED GRADE
—·—·—	ROAD CENTERLINE
———	EXISTING GRADE
▲ ⊠ ⊕	BORING LOCATION
●	EXTRACTION WELL



NOTE:
CONTRACTOR TO PROVIDE BARRIER WALL WITH MINIMUM THICKNESS OF 0.5M AND A MAXIMUM HYDRAULIC CONDUCTIVITY OF 1X10E−6 CM/S.

2 / BW-5.0 BARRIER WALL PROFILE

SCALE: NTS

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No.	Date	Description	By:
1			
2			
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4			
5			
6			

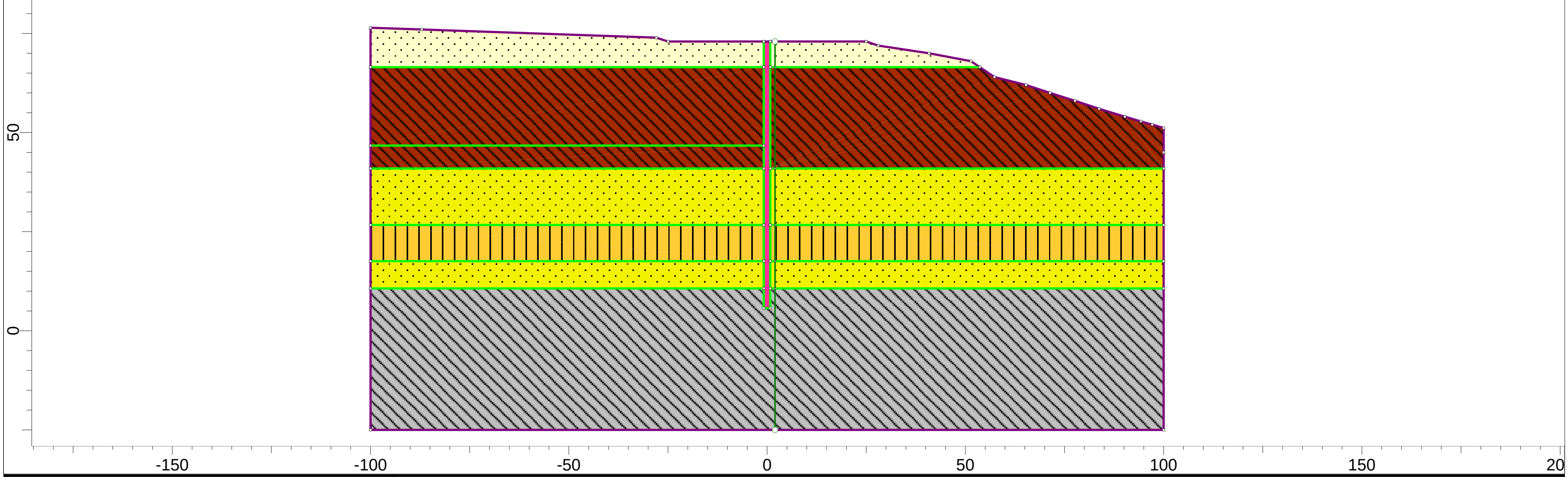
DRAWING:
BW-5.0

PROJECT NUMBER:
45-20803

Attachments

Seepage Models and Results

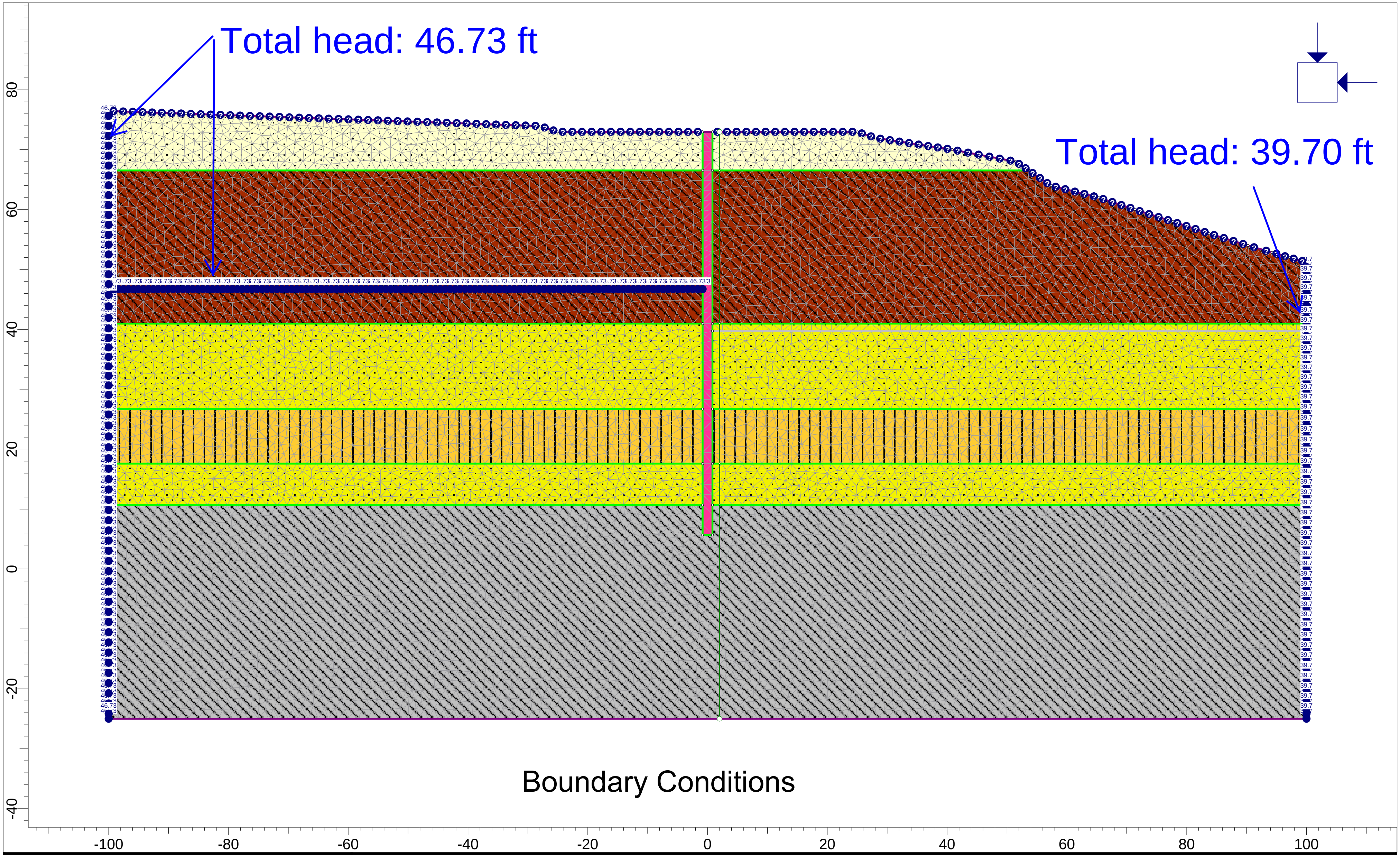
Material Name	Material Color	Unit Weight (lbs/ft3)	Use Unsaturated Parameters	Material Behaviour	Porosity Value	Ks (ft/s)	K2 / K1	K1 Definition	K1 Angle (degrees)	Soil Type
Surficial Aquifer Sand	░	115	No	Drained	0.4	0.000331	0.01	Angle	0	Sand
Black Creek Confining Unit Clay	▨	120	No	Drained	0.4	6.56e-08	0.01	Angle	0	Clay
Black Creek Aquifer Sand	░	115	No	Drained	0.38	0.000331	0.01	Angle	0	Sand
Black Creek Silty Sand	▥	120	No	Drained	0.52	0.00331	0.01	Angle	0	Sand
Upper Cape Fear Clay (light gray)	▨	130	No	Drained	0.35	9.84e-09	0.01	Angle	0	Clay
Wall	■	130	No	Drained	0.1	3.28e-08	1	Angle	0	General



GEOS
Geotechnical, Environmental and Materials Engineers

RS2 11.009

Project	45-20803 Barrier Wall
Analysis Description	Seepage Through 0.5m Barrier Wall
Drawn By	
Scale	1:450
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep A 50+00 0.5M thick wall E-8.fez



Total head: 46.73 ft

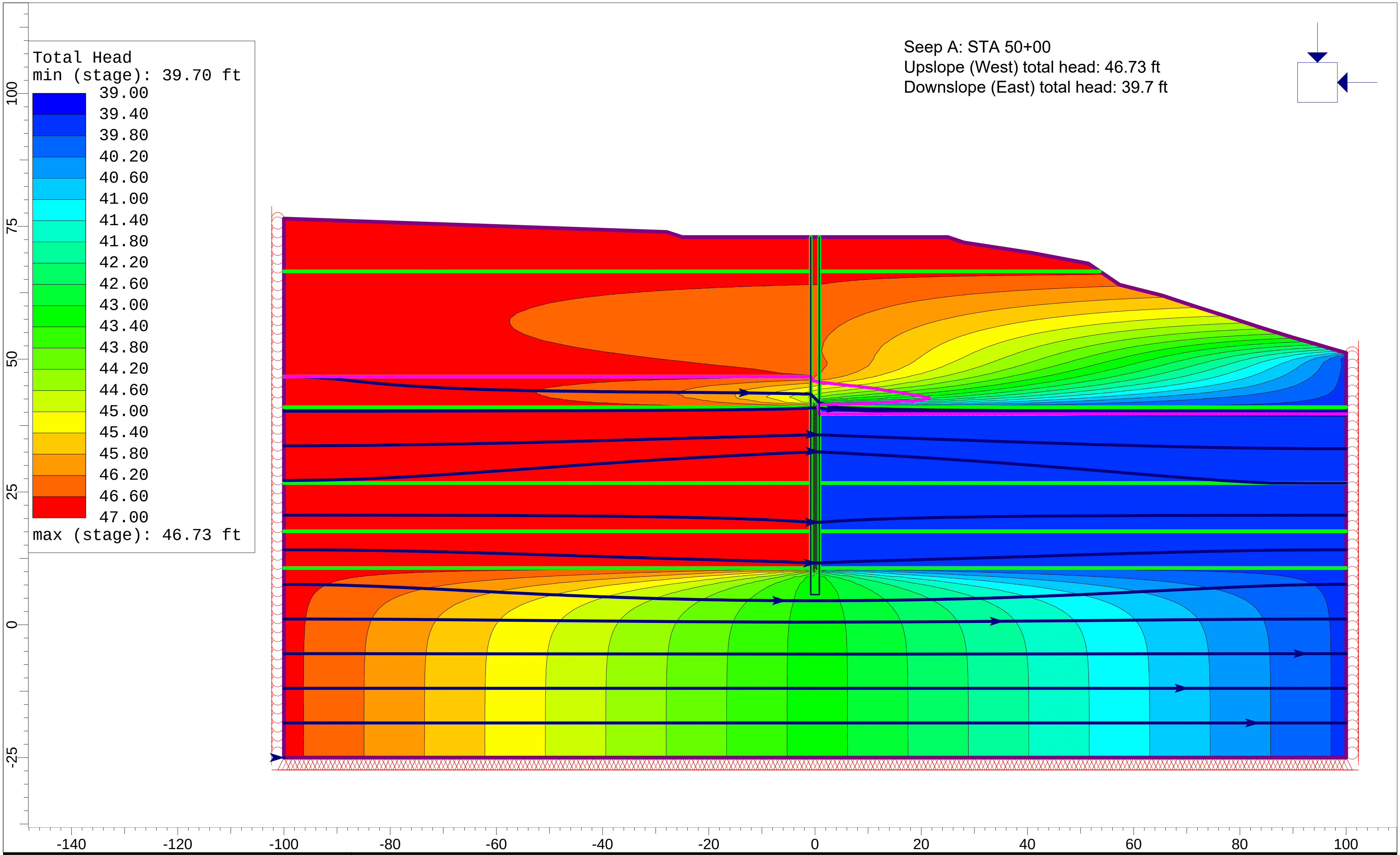
Total head: 39.70 ft

Boundary Conditions

Geotechnical, Environmental and Materials Engineers

RS2 11.010

Project	45-20803 Barrier Wall				
Analysis Description	Seep A: Seepage Through 0.5m Barrier Wall				
Drawn By		*Scale*	1:266	*Company*	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM			*File Name*	Seep A 50+00 0.5M thick wall E-82.fez

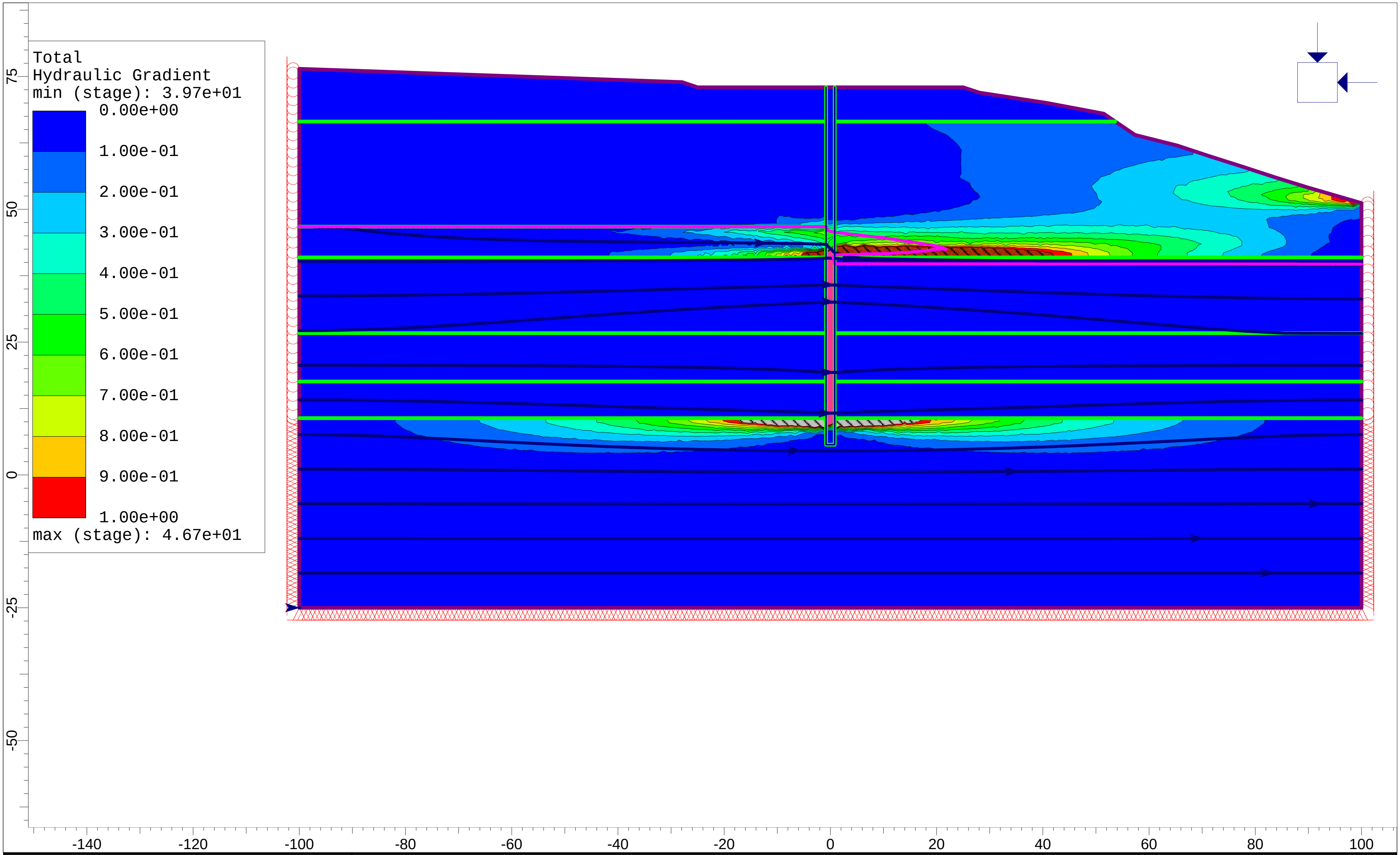


Seep A: STA 50+00
Upslope (West) total head: 46.73 ft
Downslope (East) total head: 39.7 ft

Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project	45-20803 Barrier Wall
Analysis Description	Seep A: Seepage Through 0.5m Barrier Wall
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep A 50+00 0.5M thick wall E-8.fez



Geotechnical, Environmental and Materials Engineers

INTERPRET 11.009

Project	45-20803 Barrier Wall
Analysis Description	Seep A: Seepage Through 0.5 m Barrier Wall
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep A 50+00 0.5M thick wall E-8.fez

rocscience

GEOS
Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Seep A 0.5m Thick Wall
Seepage Analysis
Date Created: 25-May-21, 9:09:32 AM
Software Version: 11.01

Table of Contents

Seep A 50+00 0.5M thick wall E-8.fez

RS2 Analysis Information

Project Summary

File Name:	Seep A 50+00 0.5M thick wall E-8.fez
Last saved with RS2 version:	11.01
Project Title:	45-20803 Barrier Wall
Analysis:	Seepage Through 0.5m Barrier Wall
Company:	GeoServices LLC

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations:	500
Tolerance:	0.001
Number of Load Steps:	Automatic
Convergence Type:	Comprehensive
Tensile Failure:	Reduces Shear Strength

Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	15247	30846
2. Pumping	15247	30846

Mesh Quality

1 of 15247 Elements (0.0 % of elements) are poor quality elements
1 of 15247 Elements (0.0 % of elements) are poor quality elements because of the side length ratio
1 of 15247 Elements (0.0 % of elements) are poor quality elements because of the minimum interior angle
0 of 15247 Elements (0.0 % of elements) are poor quality elements because of the maximum interior angle
0 of 15247 Elements (0.0 % of elements) are poor quality elements because they are inverted
Note: Elements can be of poor quality for more than one reason

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Silty Sand

Material Color	🟧
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	500000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	30 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.52
Ks	0.00331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	🟥
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

List of All Coordinates

External boundary

X	Y
100	-25
100	10.69
100	17.59
100	26.69
100	39.7
100	40.95
100	45
100	51.18
97.1513	52.0039
94.2607	52.84
90.2502	54
90.2367	54.0039
83.7772	56.0039
77.6695	58.0039
71.363	60.0039
65.3217	62.0039
57.3492	64.0039
53.6405	66.52
51.4532	68.0039
40.8533	70.0039
28.0437	71.9548
25	72.9694
0.82	72.9694
-0.82	72.9694
-25	72.9694
-27.9168	73.9417
-87.0888	76.0039
-100	76.4539
-100	66.52
-100	46.73
-100	40.95
-100	26.69
-100	17.59
-100	10.69
-100	-25

Stage boundary

X	Y
100	39.7
0.82	39.7

Material boundary

X	Y
-0.82	72.9694
-0.82	66.52
-0.82	46.73
-0.82	40.95
-0.82	26.69
-0.82	17.59
-0.82	10.69
-0.82	5.69
0.82	5.69
0.82	10.69
0.82	17.59
0.82	26.69
0.82	39.7
0.82	40.95
0.82	66.52
0.82	72.9694

Material boundary

X	Y
-100	66.52
-0.82	66.52

Material boundary

X	Y
0.82	66.52
53.6405	66.52

Material boundary

X	Y
-100	40.95
-0.82	40.95

Material boundary

X	Y
-100	26.69
-0.82	26.69

Material boundary

X	Y
-100	17.59
-0.82	17.59

Material boundary

X	Y
-100	10.69
-0.82	10.69

Material boundary

X	Y
0.82	40.95
100	40.95

Material boundary

X	Y
0.82	26.69
100	26.69

Material boundary

X	Y
0.82	17.59
100	17.59

Material boundary

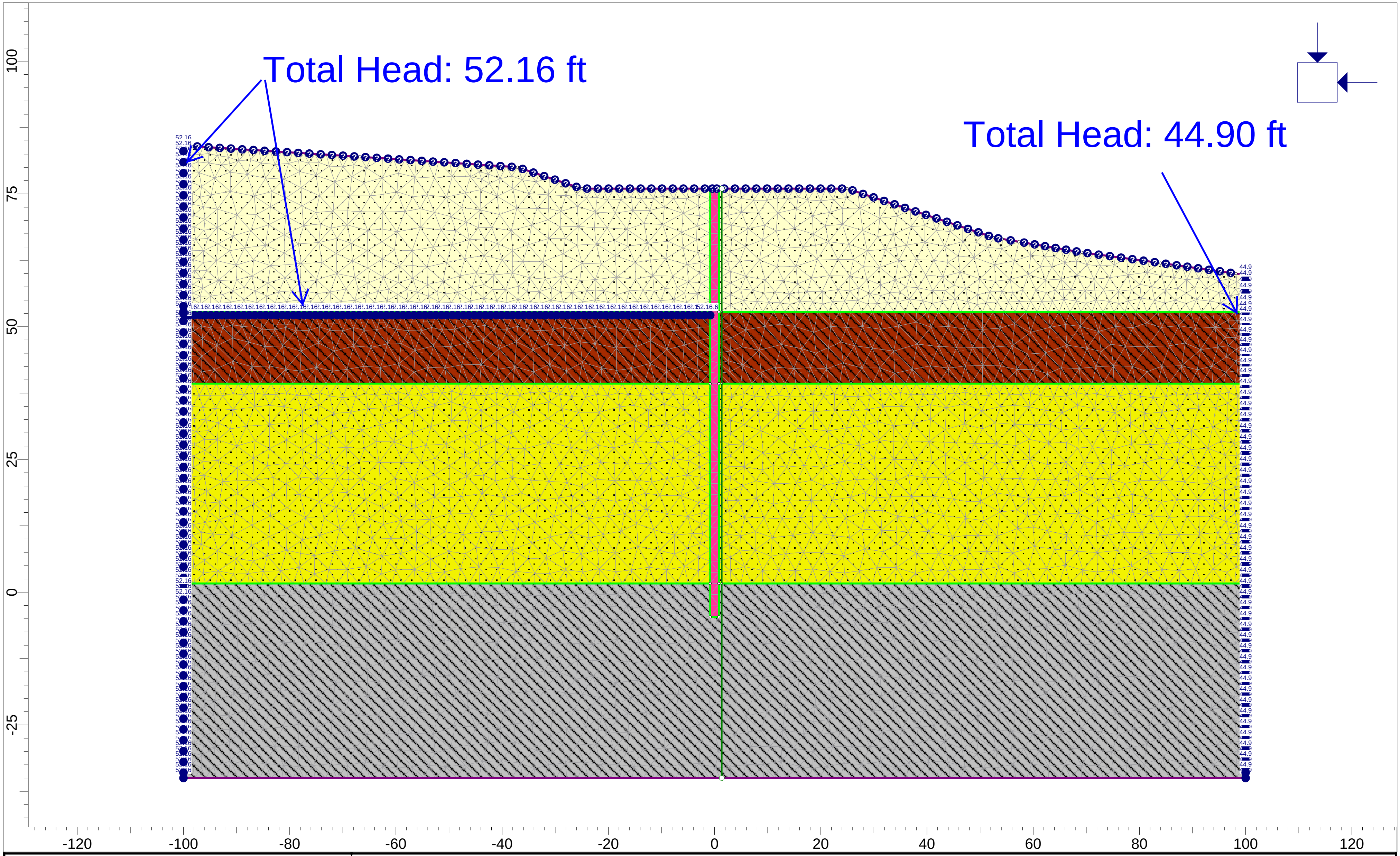
X	Y
0.82	10.69
100	10.69

Material boundary

X	Y
-100	46.73
-0.82	46.73

Discharge section

X	Y
2	72.9694
2	66.52
2	40.95
2	26.69
2	17.59
2	10.69
2	-25



Geotechnical, Environmental and Materials Engineers

RS2 11.010

Project
45-20803 Barrier Wall

Analysis Description
Seep B: Seepage Through 0.5m Barrier Wall

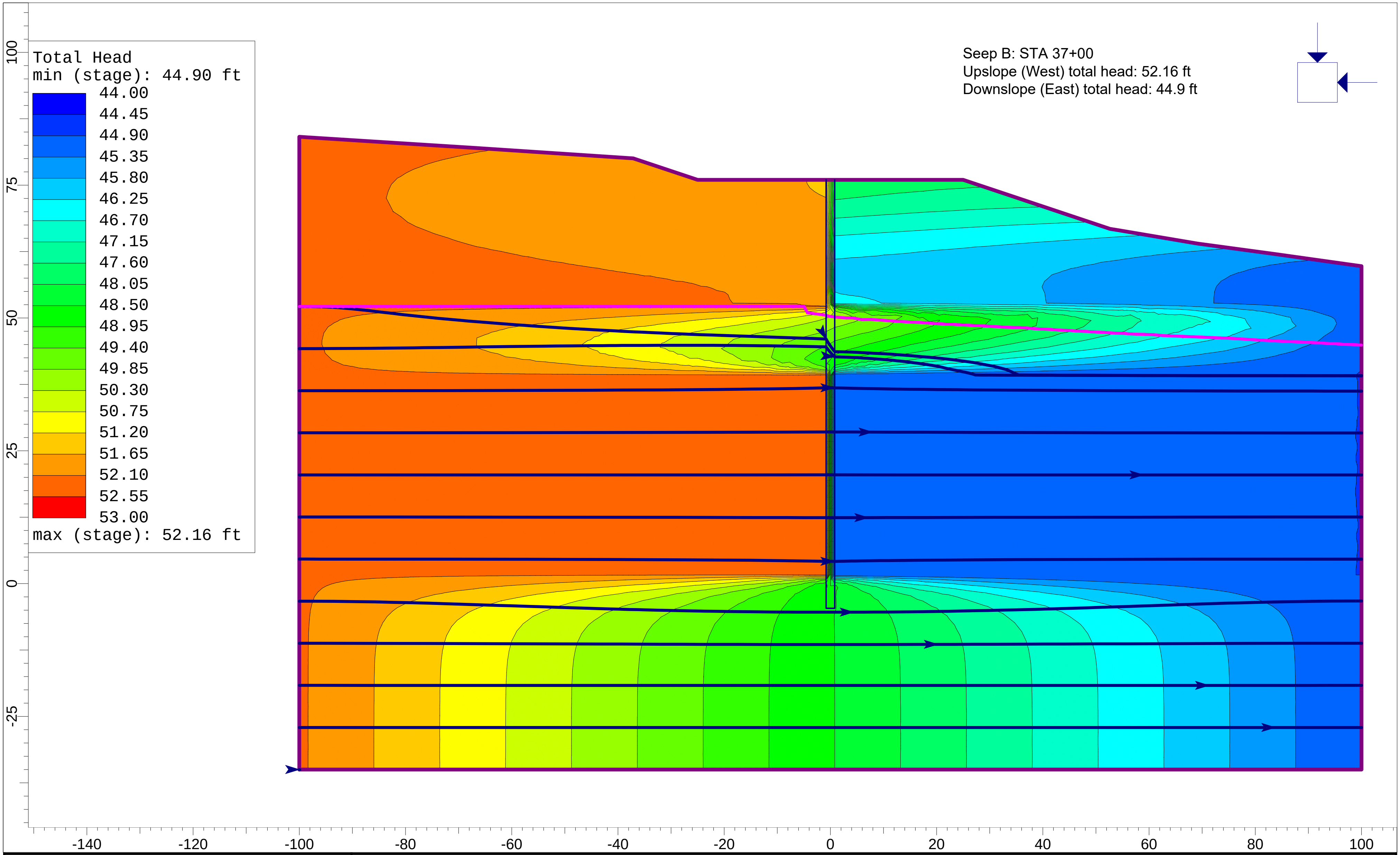
Drawn By

Scale
1:300

Company
GeoServices LLC

Date
24-Dec-20, 9:09:32 AM

File Name
Seep B 37+00 0.5M thick wall E-8.fez



Seep B: STA 37+00
Upslope (West) total head: 52.16 ft
Downslope (East) total head: 44.9 ft

GEOS
Geotechnical, Environmental and Materials Engineers
INTERPRET 11.010

Project 45-20803 Barrier Wall

Analysis Description Seep B: Seepage Through 0.5m Barrier Wall

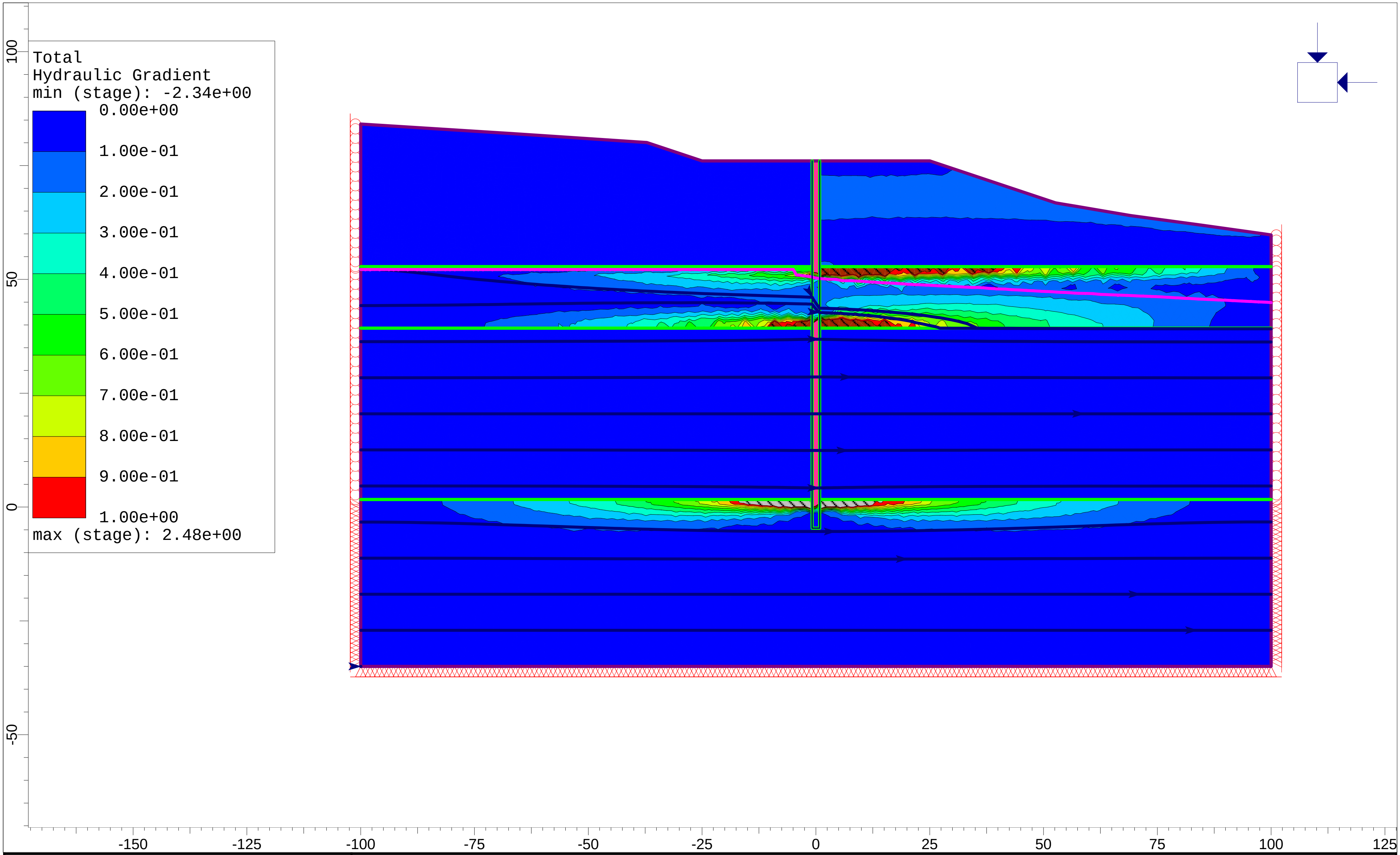
Drawn By

Scale 1:300

Company GeoServices LLC

Date 24-Dec-20, 9:09:32 AM

File Name Seep B 37+00 0.5M thick wall E-8.fez



Geotechnical, Environmental and Materials Engineers

Project	45-20803 Barrier Wall		
Analysis Description	Seep B: Seepage Through 0.5m Barrier Wall		
Drawn By	*Scale* 1:350	*Company*	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM	*File Name*	Seep B 37+00 0.5M thick wall E-8.fez

INTERPRET 11.009

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GEOS
Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Seep B, 0.5 m Thick Wall
Seepage Analysis
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

Seep B 37+00 0.5M thick wall E-8.fez

RS2 Analysis Information

Project Summary

File Name:	Seep B 37+00 0.5M thick wall E-8.fez
Last saved with RS2 version:	11.009
Project Title:	45-20803 Barrier Wall
Analysis:	Seep B: Seepage Through 0.5m Barrier Wall
Company:	GeoServices LLC

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations: 500
Tolerance: 0.001
Number of Load Steps: Automatic
Convergence Type: Comprehensive
Tensile Failure: Reduces Shear Strength
Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Field Stress

Field stress:	Gravity
Using actual ground surface	
Effective stress ratio (horizontal/vertical in-plane):	1
Effective stress ratio (horizontal/vertical out-of-plane):	1
Locked-in horizontal stress (in-plane):	0
Locked-in horizontal stress (out-of-plane):	0

Mesh

Mesh type:	Graded
Element type:	6 Noded triangles

Stage Name	# of Elements	# of Nodes
1. Initial condition	5746	11795
2. Pumping	5746	11795

Mesh Quality

2 of 5746 Elements (0.0 % of elements) are poor quality elements
2 of 5746 Elements (0.0 % of elements) are poor quality elements because of the side length ratio
2 of 5746 Elements (0.0 % of elements) are poor quality elements because of the minimum interior angle
0 of 5746 Elements (0.0 % of elements) are poor quality elements because of the maximum interior angle
0 of 5746 Elements (0.0 % of elements) are poor quality elements because they are inverted
Note: Elements can be of poor quality for more than one reason

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	20 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	50 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	■
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

List of All Coordinates

External boundary

X	Y
-100	-35
100	-35
100	1.65
100	39.27
100	52.8
100	52.84
100	59.75
98.1977	60.0027
83.9356	62.0027
69.1551	64.0027
57.298	66.0027
54.2087	66.52
52.6417	66.7824
25	76
0.82	76
0	76
-0.82	76
-25	76
-37.1327	80.0406
-66.7839	82.0027
-98.4462	84.0027
-100	84.1008
-100	52.84
-100	52.8
-100	52.16
-100	50
-100	39.27
-100	1.65

Material boundary

X	Y
-0.82	76
-0.82	52.8
-0.82	52.16
-0.82	39.27
-0.82	1.65
-0.82	-4.65
0.82	-4.65
0.82	1.65
0.82	39.27
0.82	52.8
0.82	76

Material boundary

X	Y
-100	52.8
-0.82	52.8

Material boundary

X	Y
-100	39.27
-0.82	39.27

Material boundary

X	Y
-100	1.65
-0.82	1.65

Material boundary

X	Y
0.82	52.8
100	52.8

Material boundary

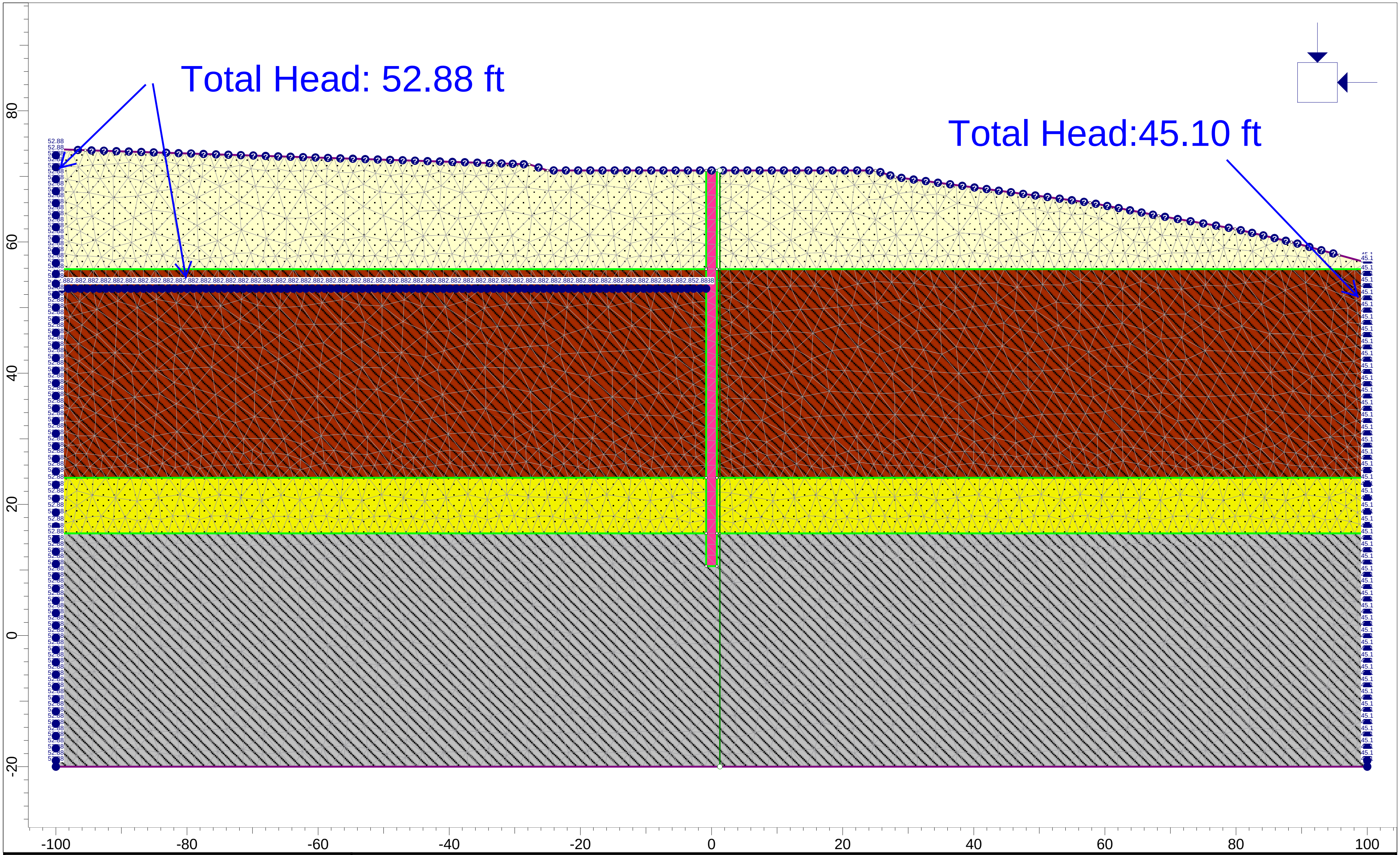
X	Y
0.82	39.27
100	39.27

Material boundary

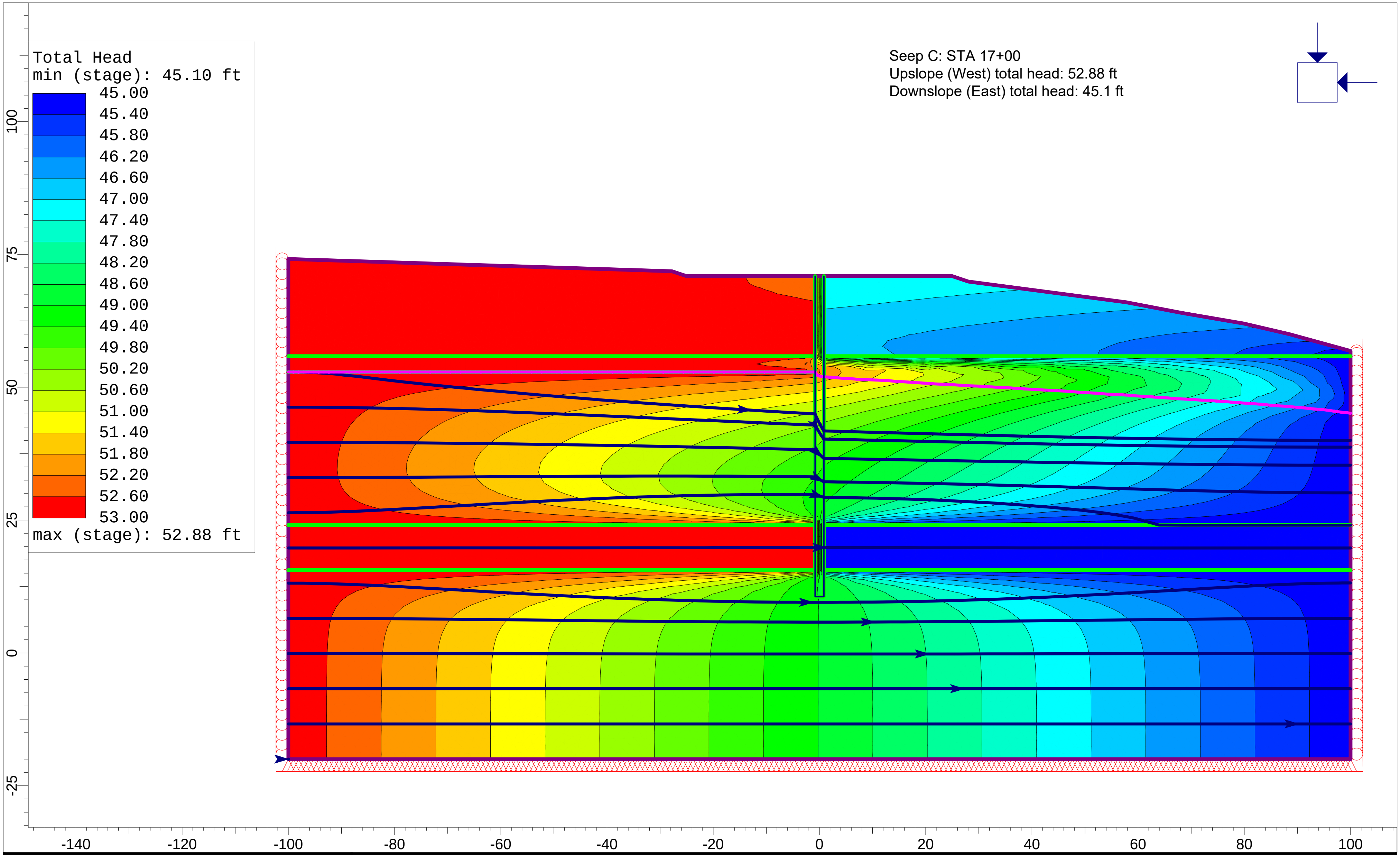
X	Y
0.82	1.65
100	1.65

Material boundary

X	Y
-100	52.16
-0.82	52.16



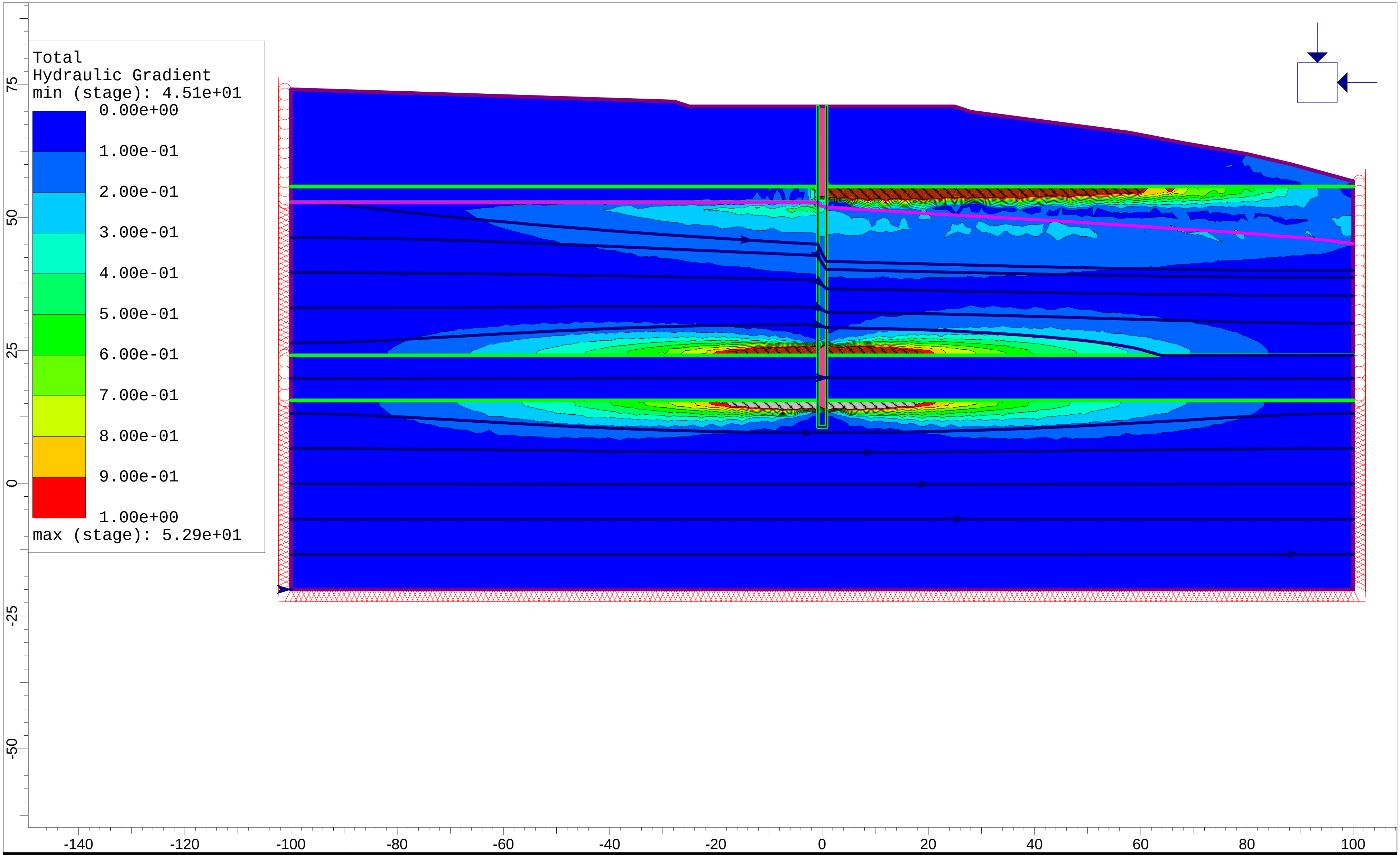
Project	45-20803 Barrier Wall
Analysis Description	Seep C: Seepage Through 0.5 m Barrier Wall
Drawn By	
Scale	1:243
Company	
Date	24-Dec-20, 9:09:32 AM
File Name	Seep C 17+00 0.5M thick wall E-8.fez



Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project	45-20803 Barrier Wall
Analysis Description	Seep C: Seepage Through 0.5 m Barrier Wall
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep C 17+00 0.5M thick wall E-8.fez



Geotechnical, Environmental and Materials Engineers

INTERPRET 11.009

Project	45-20803 Barrier Wall		
Analysis Description	Seep C: Seepage Through 0.5 m Barrier Wall		
Drawn By		*Scale* 1:300	*Company* GeoServices LLC
Date	24-Dec-20, 9:09:32 AM	*File Name*	Seep C 17+00 0.5M thick wall E-8.fez

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GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Seep C 0.5m Thick Wall
Seepage Analysis
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

Seep C 17+00 0.5M thick wall E-8.fez

RS2 Analysis Information

Project Summary

File Name:	Seep C 17+00 0.5M thick wall E-8.fez
Last saved with RS2 version:	11.009
Project Title:	Project1

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations: 500
Tolerance: 0.001
Number of Load Steps: Automatic
Convergence Type: Comprehensive
Tensile Failure: Reduces Shear Strength
Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	5121	10546
2. Pumping	5121	10546

Mesh Quality

All elements are of good quality

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	🟫
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	🟥
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

List of All Coordinates

External boundary

X	Y
-100	-20
100	-20
100	15.58
100	24.05
100	55.85
100	56.83
95.7399	57.9989
88.4508	59.9989
79.8595	61.9989
68.191	63.9989
57.7369	65.9989
28.0331	69.894
25	70.905
0.82	70.905
-0.82	70.905
-25	70.905
-27.7721	71.829
-32.8761	71.9989
-95.5141	73.9989
-100	74.1421
-100	55.85
-100	52.88
-100	24.05
-100	15.58

Material boundary

X	Y
-0.82	70.905
-0.82	56
-0.82	55.85
-0.82	52.88
-0.82	24.05
-0.82	15.58
-0.82	10.58
0.82	10.58
0.82	15.58
0.82	24.05
0.82	55.85
0.82	70.905

Material boundary

X	Y
-100	55.85
-0.82	55.85

Material boundary

X	Y
-100	24.05
-0.82	24.05

Material boundary

X	Y
-100	15.58
-0.82	15.58

Material boundary

X	Y
0.82	55.85
100	55.85

Material boundary

X	Y
0.82	24.05
100	24.05

Material boundary

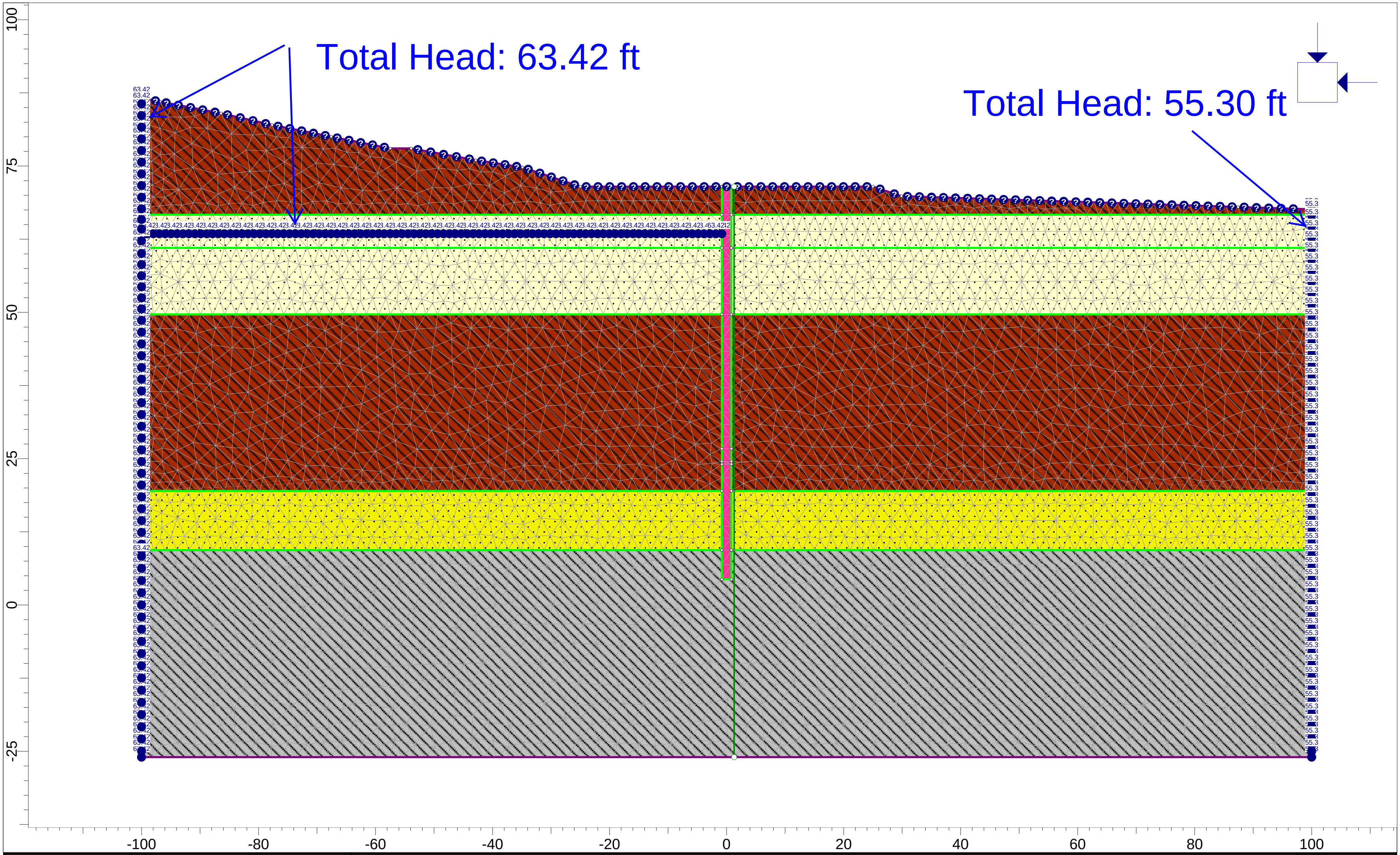
X	Y
0.82	15.58
100	15.58

Material boundary

X	Y
-100	52.88
-0.82	52.88

Discharge section

X	Y
1.27781	70.905
1.27781	55.85
1.27781	24.05
1.27781	15.58
1.27781	-20


Total Head: 63.42 ft

Total Head: 55.30 ft

Geotechnical, Environmental and Materials Engineers

RS2 11.010

Project: 45-20803 Barrier Wall

Analysis Description: Seep D: Seepage Through 0.5 m Barrier Wall

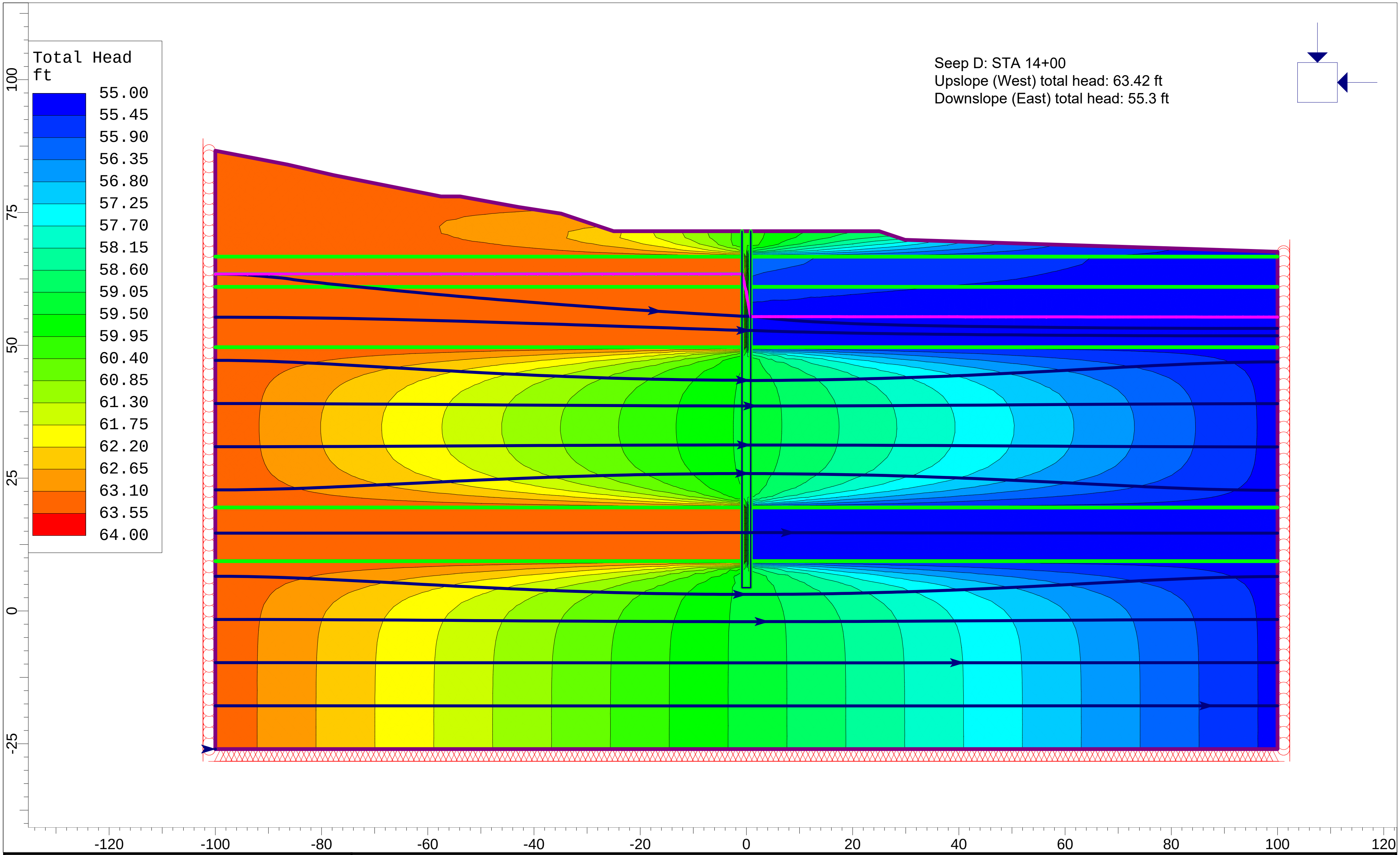
Drawn By:

Scale: 1:272

Company:

Date: 24-Dec-20, 9:09:32 AM

File Name: Seep D 14+00 0.5M thick wall E-8.fez

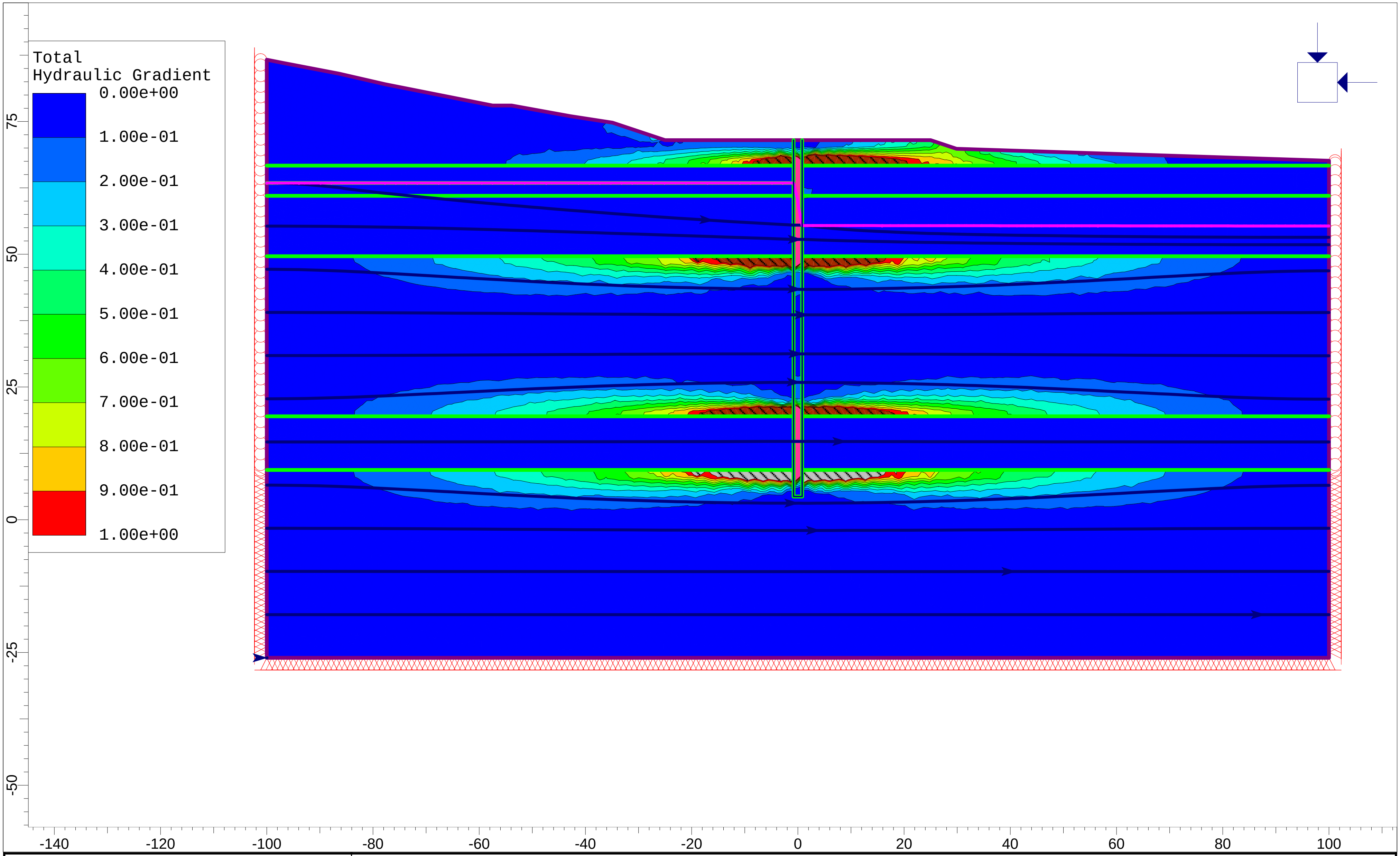


Seep D: STA 14+00
Upslope (West) total head: 63.42 ft
Downslope (East) total head: 55.3 ft

Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project	45-20803 Barrier Wall
Analysis Description	Seep D: Seepage Through 0.5 m Barrier Wall
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep D 14+00 0.5M thick wall E-8.fez



GEOS
Geotechnical, Environmental and Materials Engineers

INTERPRET 11.009

Project	45-20803 Barrier Wall
Analysis Description	Seep D: Seepage Through 0.5 m Barrier Wall
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	Seep D 14+00 0.5M thick wall E-8.fez

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GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Seep D 0.5m Thick Wall
Seepage Analysis
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

Seep D 14+00 0.5M thick wall E-8.fez

RS2 Analysis Information

Project Summary

File Name:	Seep D 14+00 0.5M thick wall E-8.fez
Last saved with RS2 version:	11.009
Project Title:	Project1

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations:	500
Tolerance:	0.001
Number of Load Steps:	Automatic
Convergence Type:	Comprehensive
Tensile Failure:	Reduces Shear Strength

Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	5674	11649
2. Pumping	5674	11649

Mesh Quality

All elements are of good quality

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	■
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

List of All Coordinates

External boundary

X	Y
-100	-26
100	-26
100	9.37
100	19.48
100	49.63
100	61
100	66.68
100	67.6
87.4135	68.0038
29.8805	69.8493
25	71.4761
0.82	71.4761
-0.82	71.4761
-25	71.4761
-34.898	74.7754
-42.8674	76.0038
-53.891	78.0038
-57.4854	78.0038
-67.5761	80.0038
-77.6827	82.0038
-86.4033	84.0038
-96.8327	86.0038
-100	86.6111
-100	66.68
-100	63.42
-100	61
-100	49.63
-100	19.48
-100	9.37

Material boundary

X	Y
-0.82	71.4761
-0.82	66.68
-0.82	63.42
-0.82	61
-0.82	49.63
-0.82	26.69
-0.82	24.5
-0.82	24.05
-0.82	19.48
-0.82	9.37
-0.82	4.37
0.82	4.37
0.82	9.37
0.82	19.48
0.82	24.05
0.82	24.5
0.82	26.69
0.82	49.63
0.82	61
0.82	66.68
0.82	71.4761

Material boundary

X	Y
-100	66.68
-0.82	66.68

Material boundary

X	Y
-100	49.63
-0.82	49.63

Material boundary

X	Y
-100	19.48
-0.82	19.48

Material boundary

X	Y
0.82	66.68
100	66.68

Material boundary

X	Y
0.82	49.63
100	49.63

Material boundary

X	Y
0.82	19.48
100	19.48

Material boundary

X	Y
-100	9.37
-0.82	9.37

Material boundary

X	Y
100	9.37
0.82	9.37

Material boundary

X	Y
-100	61
-0.82	61

Material boundary

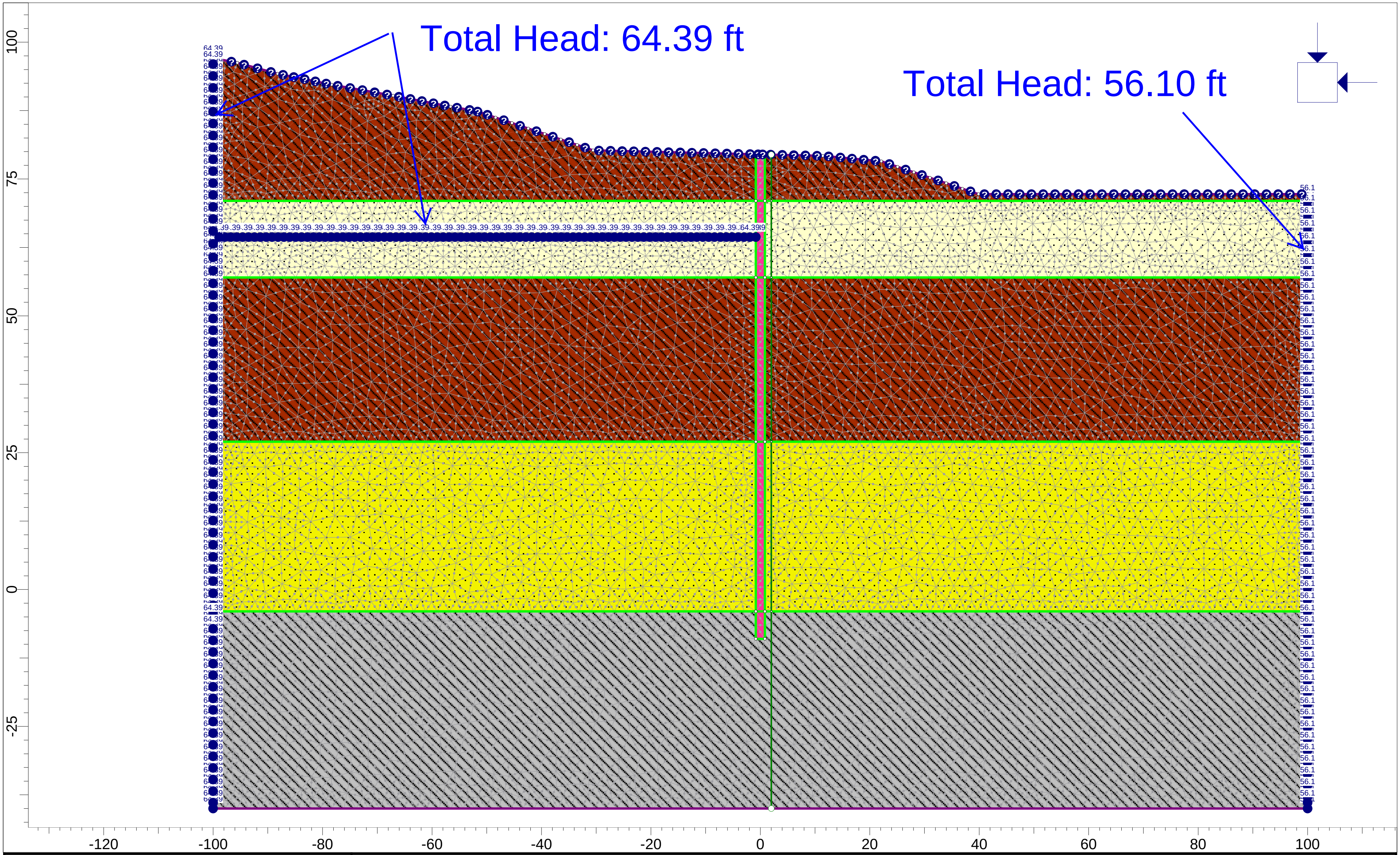
X	Y
100	61
0.82	61

Material boundary

X	Y
-100	63.42
-0.82	63.42

Discharge section

X	Y
1.27573	71.4761
1.27573	66.68
1.27573	61
1.27573	49.63
1.27573	19.48
1.27573	9.37
1.27573	-26



Total Head: 64.39 ft

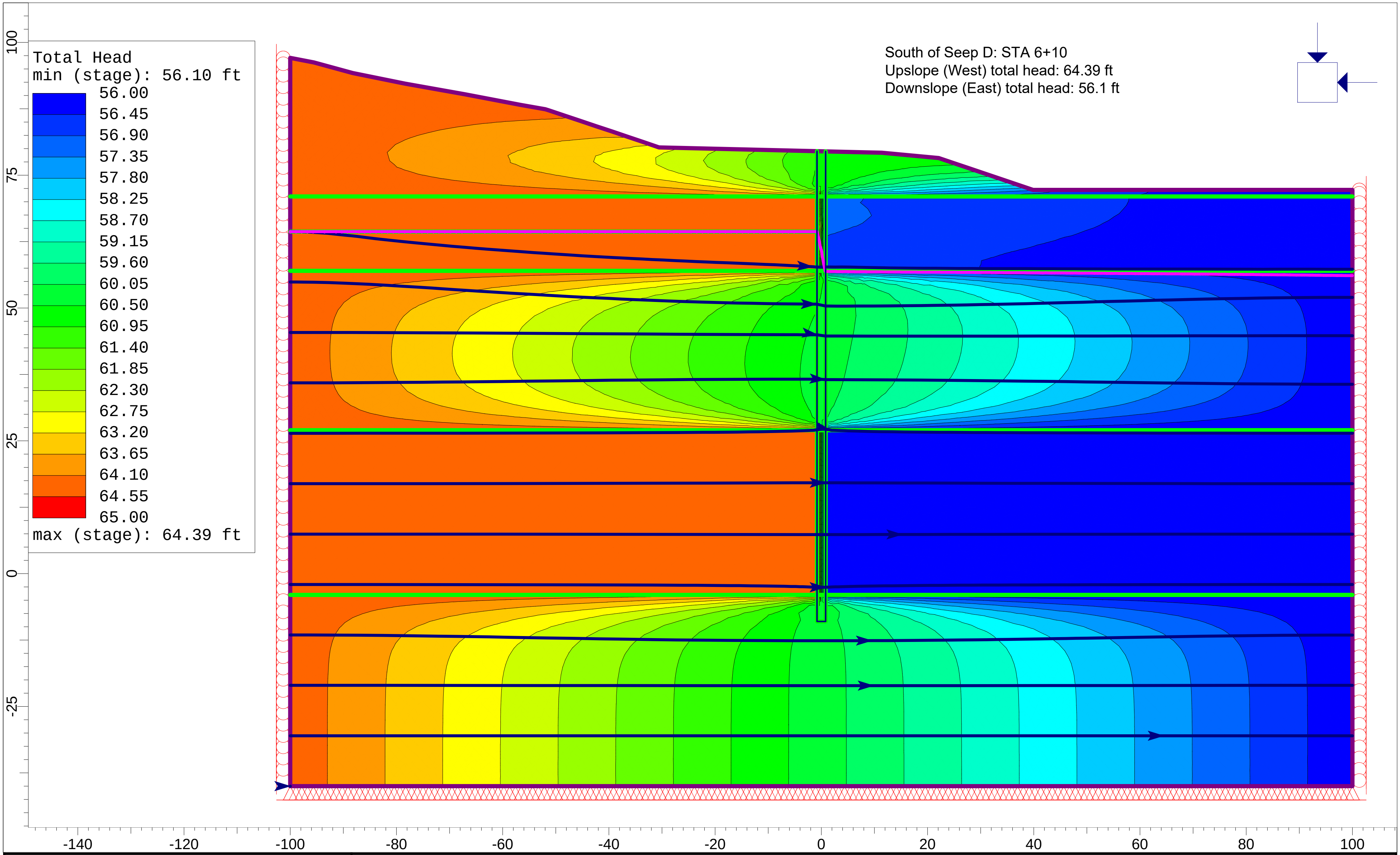
Total Head: 56.10 ft

Project	45-20803 Barrier Wall
Analysis Description	South of Seep D: Seepage Through 0.5 m Barrier Wall

Drawn By		*Scale* 1:291	*Company*
Date 24-Dec-20, 9:09:32 AM		*File Name* south_seep D 6+00 0.5M thick wall.fez	

Geotechnical, Environmental and Materials Engineers

RS2 11.010

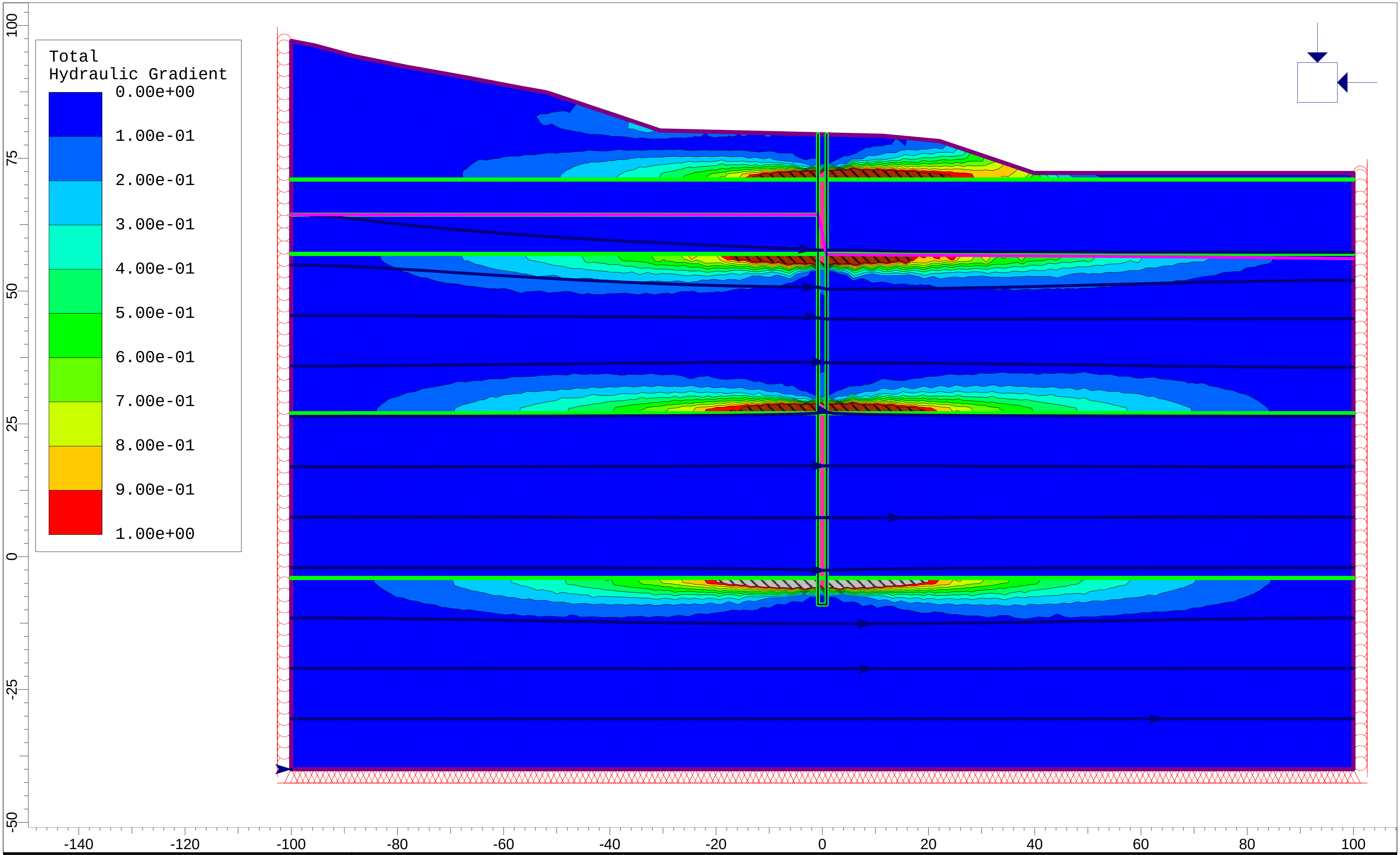


South of Seep D: STA 6+10
Upslope (West) total head: 64.39 ft
Downslope (East) total head: 56.1 ft

GEOS
Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project	45-20803 Barrier Wall		
Analysis Description	South of Seep D: Seepage Through 0.5 m Barrier Wall		
Drawn By		*Scale* 1:300	*Company* GeoServices LLC
Date	24-Dec-20, 9:09:32 AM	*File Name*	south_seep D 6+00 0.5M thick wall.fez



GEOS
Geotechnical, Environmental and Materials Engineers
INTERPRET 11.009

Project
45-20803 Barrier Wall

Analysis Description
South of Seep D: Seepage Through 0.5 m Barrier Wall

Drawn By

Scale
1:300

Company
GeoServices LLC

Date
24-Dec-20, 9:09:32 AM

File Name
south_seep D 6+00 0.5M thick wall.fez

rocscience

GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
South of Seep D
Seepage Analysis
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

south_seep D 6+00 0.5M thick wall.fez

RS2 Analysis Information

Project Summary

File Name:	south_seep D 6+00 0.5M thick wall.fez
Last saved with RS2 version:	11.009
Project Title:	Project1

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations: 500
Tolerance: 0.001
Number of Load Steps: Automatic
Convergence Type: Comprehensive
Tensile Failure: Reduces Shear Strength
Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	6975	14248
2. Pumping	6975	14248

Mesh Quality

All elements are of good quality

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	░
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	🟥
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

List of All Coordinates

External boundary

X	Y
-100	-40
100	-40
100	-4
100	27
100	57
100	71
100	72.23
39.88	72.23
36.92	73.23
33.96	74.23
31	75.23
28.04	76.23
25.07	77.23
22.1	78.23
11.4	79.23
0.82	79.4806
0	79.5
-0.82	79.5196
-30.57	80.23
-33.48	81.23
-36.45	82.23
-39.4	83.23
-42.43	84.23
-45.4	85.23
-48.39	86.23
-51.38	87.23
-51.97	87.42
-56.61	88.23
-67.1	90.23
-78.36	92.23
-88.22	94.23
-95.57	96.23
-100	97.08
-100	71
-100	64.39
-100	57
-100	27
-100	-4

Material boundary

X	Y
-100	71
-0.82	71
0.82	71
100	71

Material boundary

X	Y
-100	57
-0.82	57
0.82	57
100	57

Material boundary

X	Y
-100	27
-0.82	27
0.82	27
100	27

Material boundary

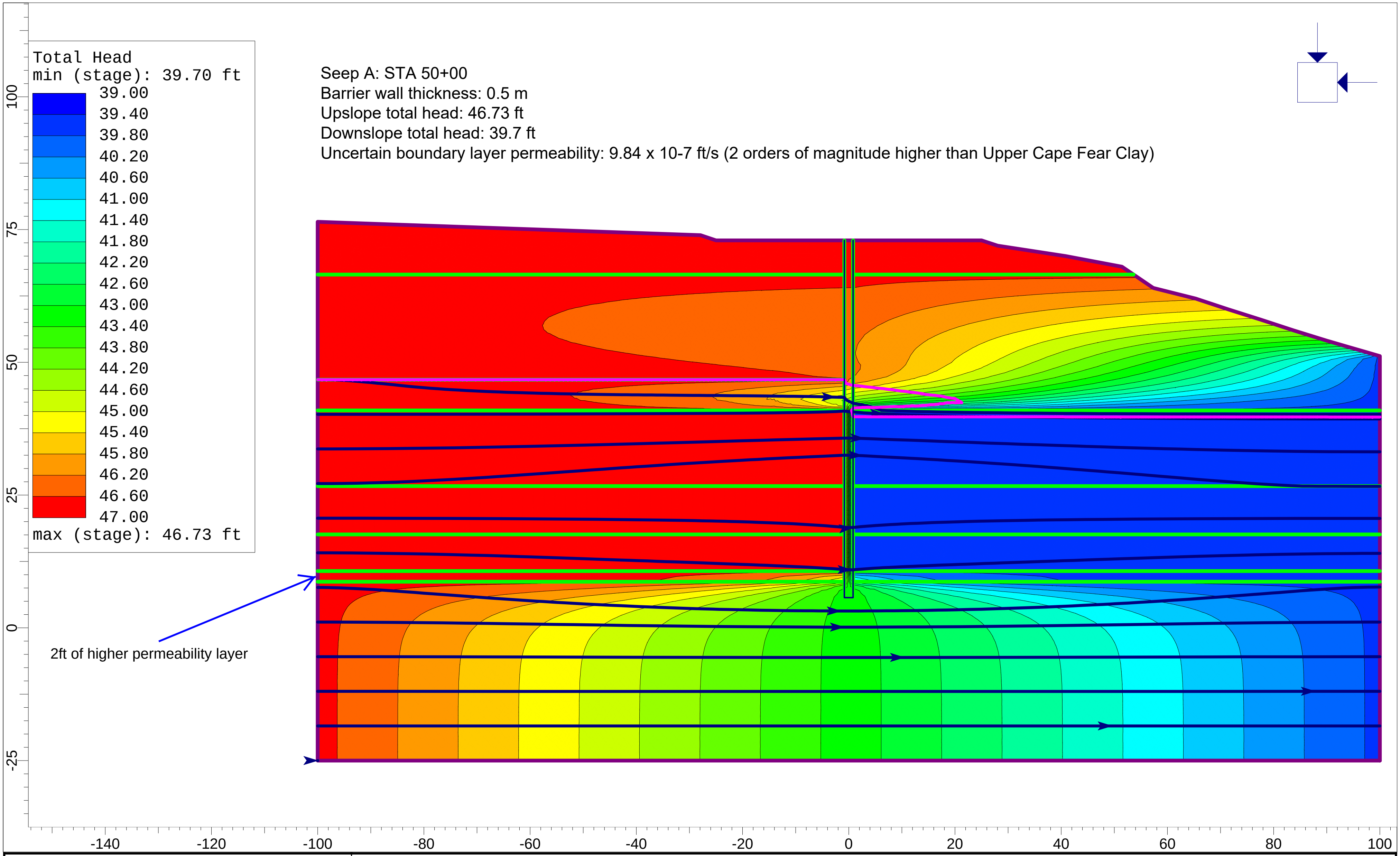
X	Y
-100	-4
-0.82	-4
0.82	-4
100	-4

Material boundary

X	Y
-0.82	79.5196
-0.82	71
-0.82	64.39
-0.82	57
-0.82	27
-0.82	-4
-0.82	-9
0.82	-9
0.82	-4
0.82	27
0.82	57
0.82	71
0.82	79.4806

Material boundary

X	Y
-100	64.39
-0.82	64.39



Seep A: STA 50+00
Barrier wall thickness: 0.5 m
Upslope total head: 46.73 ft
Downslope total head: 39.7 ft
Uncertain boundary layer permeability: 9.84 x 10-7 ft/s (2 orders of magnitude higher than Upper Cape Fear Clay)

2ft of higher permeability layer

GEOS
Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project 45-20803 Barrier Wall

Analysis Description Seep A: Seepage Through 0.5 m Barrier Wall, Higher Permeability 2ft Embedment Layer

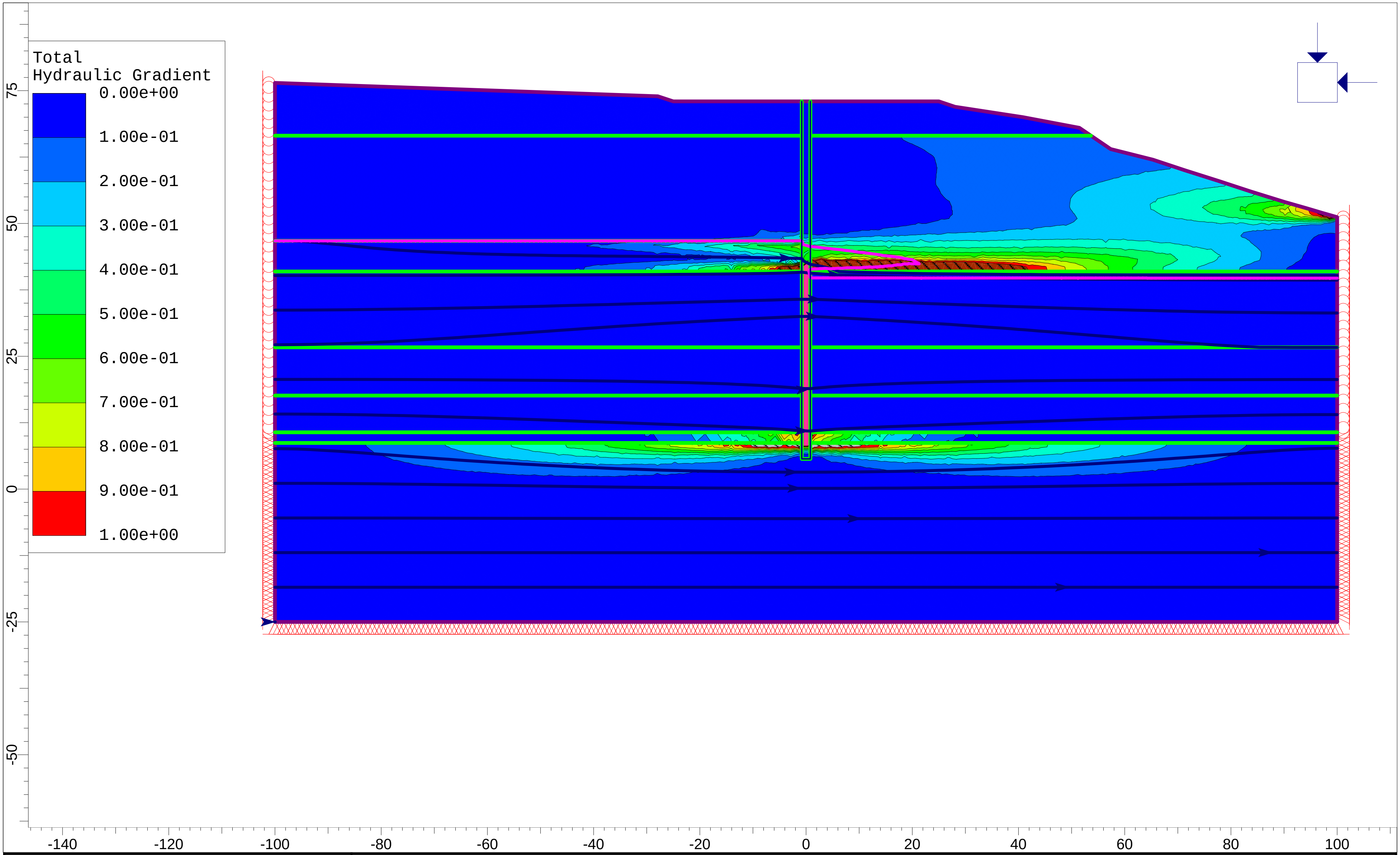
Drawn By

Scale 1:300

Company GeoServices LLC

Date 24-Dec-20, 9:09:32 AM

File Name seep-A_0p5m-wall_parameteric.fez



Geotechnical, Environmental and Materials Engineers

INTERPRET 11.009

Project	45-20803 Barrier Wall
Analysis Description	Seep A: Seepage Through 0.5m Barrier Wall, Higher Permeability 2ft Embedment Layer
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	seep-A_0p5m-wall_parameteric.fez

rocscience

GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall
Seep A 0.5m Thick Wall
Parametric Study, Two Orders of Magnitude Larger Transition Layer
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

seep-A_0p5m-wall_parameteric.fez

RS2 Analysis Information

Project Summary

File Name:	seep-A_0p5m-wall_parameteric.fez
Last saved with RS2 version:	11.009
Project Title:	45-20803 Barrier Wall
Analysis:	Seepage Through 0.5m Barrier Wall
Company:	GeoServices LLC

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations: 500
Tolerance: 0.001
Number of Load Steps: Automatic
Convergence Type: Comprehensive
Tensile Failure: Reduces Shear Strength
Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	15261	30874
2. Pumping	15261	30874

Mesh Quality

1 of 15261 Elements (0.0 % of elements) are poor quality elements
1 of 15261 Elements (0.0 % of elements) are poor quality elements because of the side length ratio
1 of 15261 Elements (0.0 % of elements) are poor quality elements because of the minimum interior angle
0 of 15261 Elements (0.0 % of elements) are poor quality elements because of the maximum interior angle
0 of 15261 Elements (0.0 % of elements) are poor quality elements because they are inverted
Note: Elements can be of poor quality for more than one reason

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Silty Sand

Material Color	🟧
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	500000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	30 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.52
Ks	0.00331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	■
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

Uncertain Boundary

Material Color	░
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-07 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

List of All Coordinates

External boundary

X	Y
100	-25
100	8.69
100	10.69
100	17.59
100	26.69
100	40.95
100	45
100	51.18
97.1513	52.0039
94.2607	52.84
90.2502	54
90.2367	54.0039
83.7772	56.0039
77.6695	58.0039
71.363	60.0039
65.3217	62.0039
57.3492	64.0039
53.6405	66.52
51.4532	68.0039
40.8533	70.0039
28.0437	71.9548
25	72.9694
0.82	72.9694
-0.82	72.9694
-25	72.9694
-27.9168	73.9417
-87.0888	76.0039
-100	76.4539
-100	66.52
-100	46.73
-100	40.95
-100	26.69
-100	17.59
-100	10.69
-100	8.69
-100	-25

Material boundary

X	Y
-0.82	72.9694
-0.82	66.52
-0.82	46.73
-0.82	40.95
-0.82	26.69
-0.82	17.59
-0.82	10.69
-0.82	8.69
-0.82	5.69
0.82	5.69
0.82	8.69
0.82	10.69
0.82	17.59
0.82	26.69
0.82	40.95
0.82	66.52
0.82	72.9694

Material boundary

X	Y
-100	66.52
-0.82	66.52

Material boundary

X	Y
0.82	66.52
53.6405	66.52

Material boundary

X	Y
-100	40.95
-0.82	40.95

Material boundary

X	Y
-100	26.69
-0.82	26.69

Material boundary

X	Y
-100	17.59
-0.82	17.59

Material boundary

X	Y
-100	10.69
-0.82	10.69

Material boundary

X	Y
0.82	40.95
100	40.95

Material boundary

X	Y
0.82	26.69
100	26.69

Material boundary

X	Y
0.82	17.59
100	17.59

Material boundary

X	Y
0.82	10.69
100	10.69

Material boundary

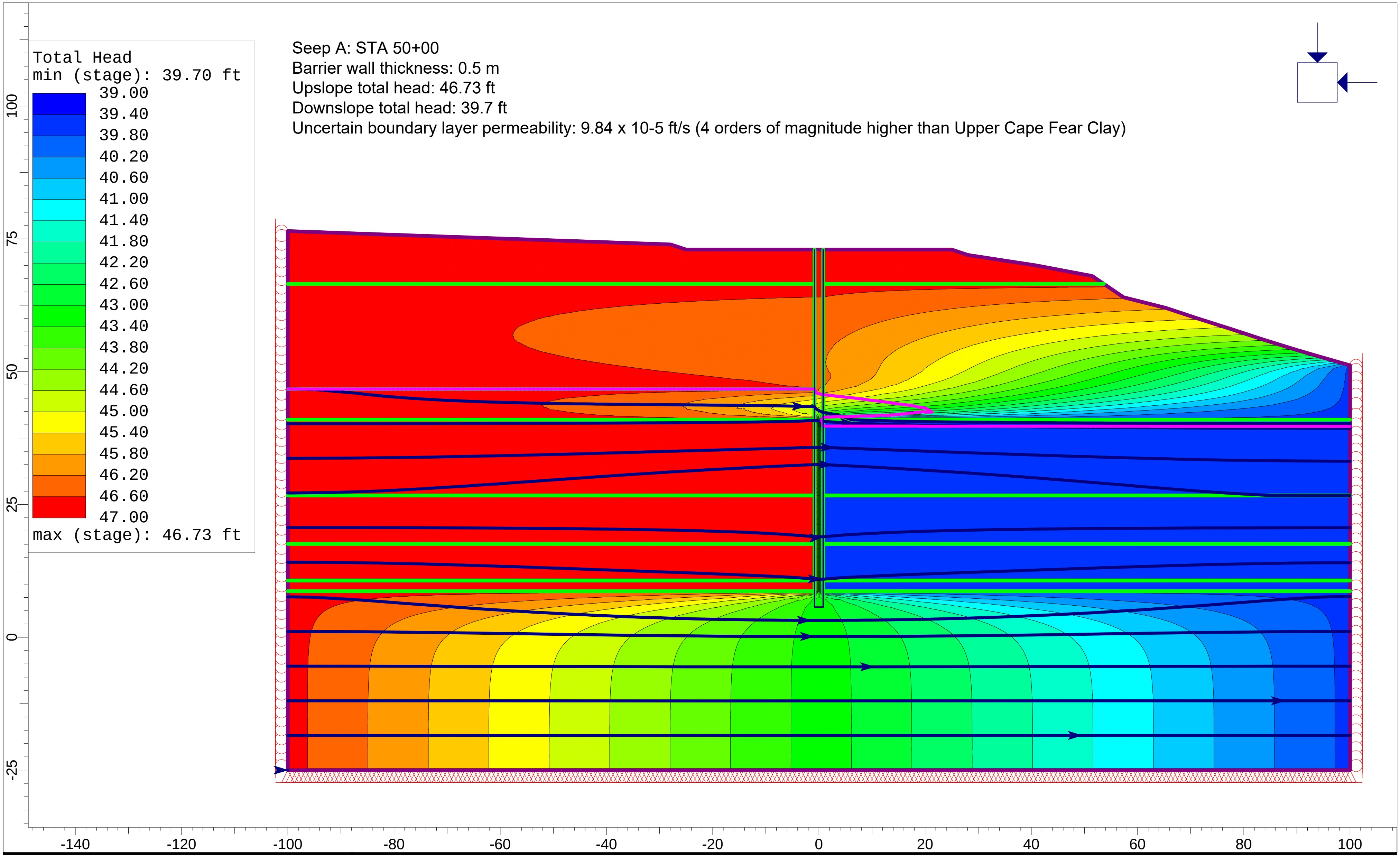
X	Y
-100	46.73
-0.82	46.73

Material boundary

X	Y
-100	8.69
-0.82	8.69

Material boundary

X	Y
100	8.69
0.82	8.69



Seep A: STA 50+00
Barrier wall thickness: 0.5 m
Upslope total head: 46.73 ft
Downslope total head: 39.7 ft
Uncertain boundary layer permeability: 9.84 x 10-5 ft/s (4 orders of magnitude higher than Upper Cape Fear Clay)

GEOS
Geotechnical, Environmental and Materials Engineers

INTERPRET 11.010

Project
45-20803 Barrier Wall

Analysis Description
Seep A: Seepage Through 0.5 m Barrier Wall, Higher Permeability 2ft Embendment Layer

Drawn By

Scale
1:300

Company
GeoServices LLC

Date
24-Dec-20, 9:09:32 AM

File Name
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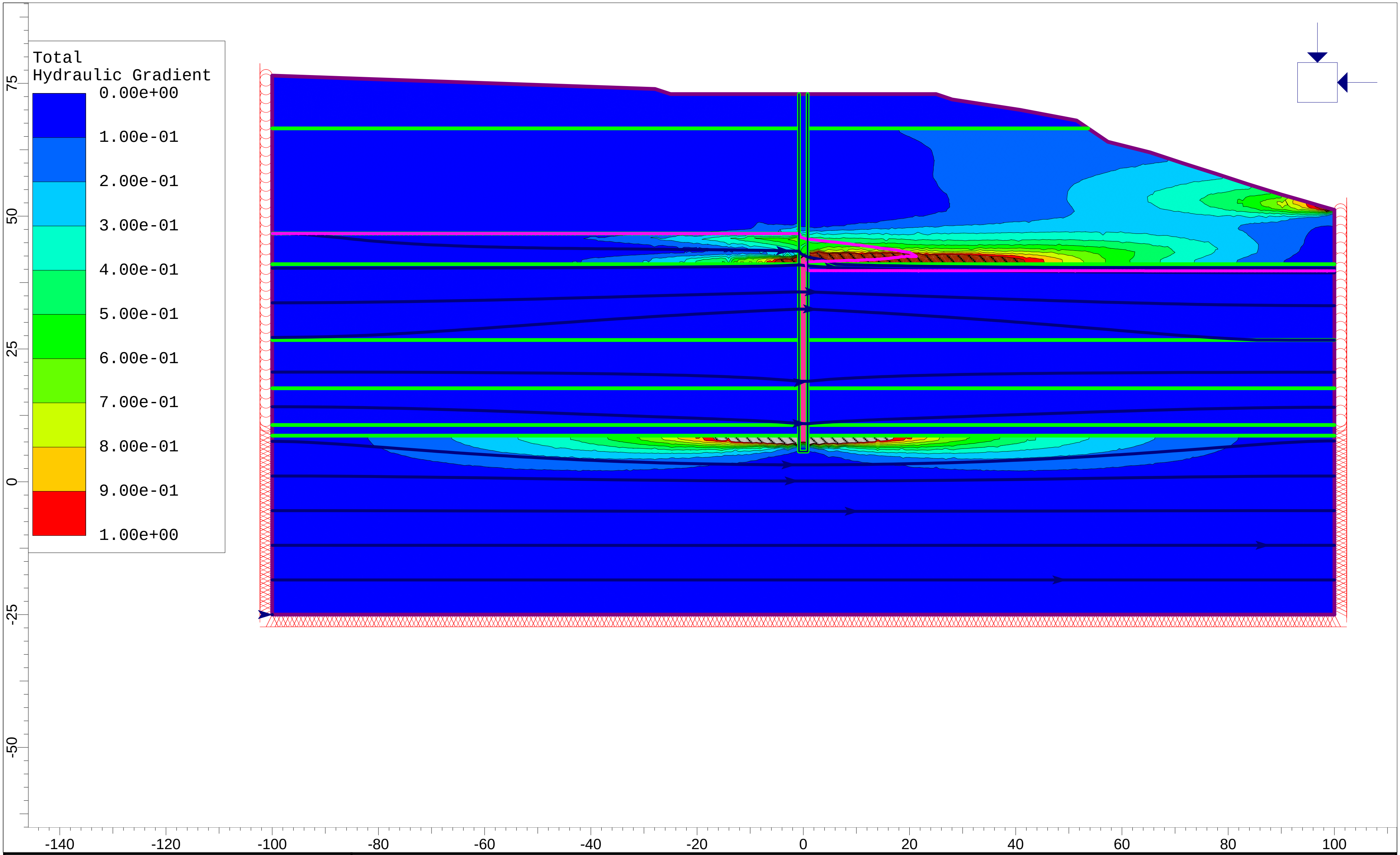


GEOS

Geotechnical, Environmental and Materials Engineers

INTERPRET 11.009

Project	45-20803 Barrier Wall
Analysis Description	Seep A: Seepage Through 0.5 m Barrier Wall, Higher Permeability 2ft Embendment Layer
Drawn By	
Scale	1:300
Company	GeoServices LLC
Date	24-Dec-20, 9:09:32 AM
File Name	seep-A_0p5m-wall_parameteric.fez

rocscience

GEOS
Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall
Seep A 0.5m Thick Wall
Parameteric Study, Four Orders of Magnitude Larger Transition Zone Permeability
Date Created: 24-Dec-20, 9:09:32 AM
Software Version: 11.009

Table of Contents

seep-A_0p5m-wall_parameteric.fez

RS2 Analysis Information

Project Summary

File Name:	seep-A_0p5m-wall_parameteric.fez
Last saved with RS2 version:	11.009
Project Title:	45-20803 Barrier Wall
Analysis:	Seepage Through 0.5m Barrier Wall
Company:	GeoServices LLC

General Settings

Number of Stages:	2
Analysis Type:	Plane Strain
Solver Type:	Gaussian Elimination
Units:	Imperial, stress as psf
Permeability Units:	feet/second
Time Units:	seconds

Analysis Options

Maximum Number of Iterations: 500
Tolerance: 0.001
Number of Load Steps: Automatic
Convergence Type: Comprehensive
Tensile Failure: Reduces Shear Strength
  Joint tension reduces joint stiffness by a factor of 0.01

Groundwater Analysis

Method:	Steady State
Pore Fluid Unit Weight:	62.4 lbs/ft3
Maximum Number of Iterations:	500
Tolerance:	0.001
Use Fluid Potential:	Yes
Use Improved Seepage:	No
Probability:	None

Mesh

Mesh type:	Graded	
Element type:	6 Noded triangles	
Stage Name	**# of Elements**	**# of Nodes**
1. Initial Conditions	15261	30874
2. Pumping	15261	30874

Mesh Quality

1 of 15261 Elements (0.0 % of elements) are poor quality elements
1 of 15261 Elements (0.0 % of elements) are poor quality elements because of the side length ratio
1 of 15261 Elements (0.0 % of elements) are poor quality elements because of the minimum interior angle
0 of 15261 Elements (0.0 % of elements) are poor quality elements because of the maximum interior angle
0 of 15261 Elements (0.0 % of elements) are poor quality elements because they are inverted
Note: Elements can be of poor quality for more than one reason

Poor quality elements defined as:

Side length ratio (maximum / minimum) > 30.00
Minimum interior angle < 2.0 degrees
Maximum interior angle > 175.0 degrees

Material Properties

Surficial Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	300000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Confining Unit Clay

Material Color	🟫
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	400000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	26 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.4
Ks	6.56e-08 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Black Creek Aquifer Sand

Material Color	🟨
Initial Element Loading	Field Stress and Body Force
Unit Weight	115 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	600000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	34 degrees
Peak Cohesion	0 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.38
Ks	0.000331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Black Creek Silty Sand

Material Color	🟧
Initial Element Loading	Field Stress and Body Force
Unit Weight	120 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	500000 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	30 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.52
Ks	0.00331 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Sand

Upper Cape Fear Clay (light gray)

Material Color	▨
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-09 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

Wall

Material Color	■
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	417709 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	0 degrees
Peak Cohesion	350 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.1
Ks	3.28e-08 ft/s
K2 / K1	1
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	General

Uncertain Boundary

Material Color	░
Initial Element Loading	Field Stress and Body Force
Unit Weight	130 lbs/ft3
Initial Water Condition	Interpolated
Elastic Type	Isotropic
Poisson's Ratio	0.3
Young's Modulus	1e+06 psf
Failure Criterion	Mohr-Coulomb
Material Type	Elastic
Peak Tensile Strength	0 psf
Peak Friction Angle	28 degrees
Peak Cohesion	100 psf
Use Unsaturated Parameters	No
Material Behaviour	Drained
Porosity Value	0.35
Ks	9.84e-05 ft/s
K2 / K1	0.01
K1 Definition	Angle
K1 Angle	0 degrees
Soil Type	Clay

List of All Coordinates

External boundary

X	Y
100	-25
100	8.69
100	10.69
100	17.59
100	26.69
100	40.95
100	45
100	51.18
97.1513	52.0039
94.2607	52.84
90.2502	54
90.2367	54.0039
83.7772	56.0039
77.6695	58.0039
71.363	60.0039
65.3217	62.0039
57.3492	64.0039
53.6405	66.52
51.4532	68.0039
40.8533	70.0039
28.0437	71.9548
25	72.9694
0.82	72.9694
-0.82	72.9694
-25	72.9694
-27.9168	73.9417
-87.0888	76.0039
-100	76.4539
-100	66.52
-100	46.73
-100	40.95
-100	26.69
-100	17.59
-100	10.69
-100	8.69
-100	-25

Material boundary

X	Y
-0.82	72.9694
-0.82	66.52
-0.82	46.73
-0.82	40.95
-0.82	26.69
-0.82	17.59
-0.82	10.69
-0.82	8.69
-0.82	5.69
0.82	5.69
0.82	8.69
0.82	10.69
0.82	17.59
0.82	26.69
0.82	40.95
0.82	66.52
0.82	72.9694

Material boundary

X	Y
-100	66.52
-0.82	66.52

Material boundary

X	Y
0.82	66.52
53.6405	66.52

Material boundary

X	Y
-100	40.95
-0.82	40.95

Material boundary

X	Y
-100	26.69
-0.82	26.69

Material boundary

X	Y
-100	17.59
-0.82	17.59

Material boundary

X	Y
-100	10.69
-0.82	10.69

Material boundary

X	Y
0.82	40.95
100	40.95

Material boundary

X	Y
0.82	26.69
100	26.69

Material boundary

X	Y
0.82	17.59
100	17.59

Material boundary

X	Y
0.82	10.69
100	10.69

Material boundary

X	Y
-100	46.73
-0.82	46.73

Material boundary

X	Y
-100	8.69
-0.82	8.69

Material boundary

X	Y
100	8.69
0.82	8.69

Attachments

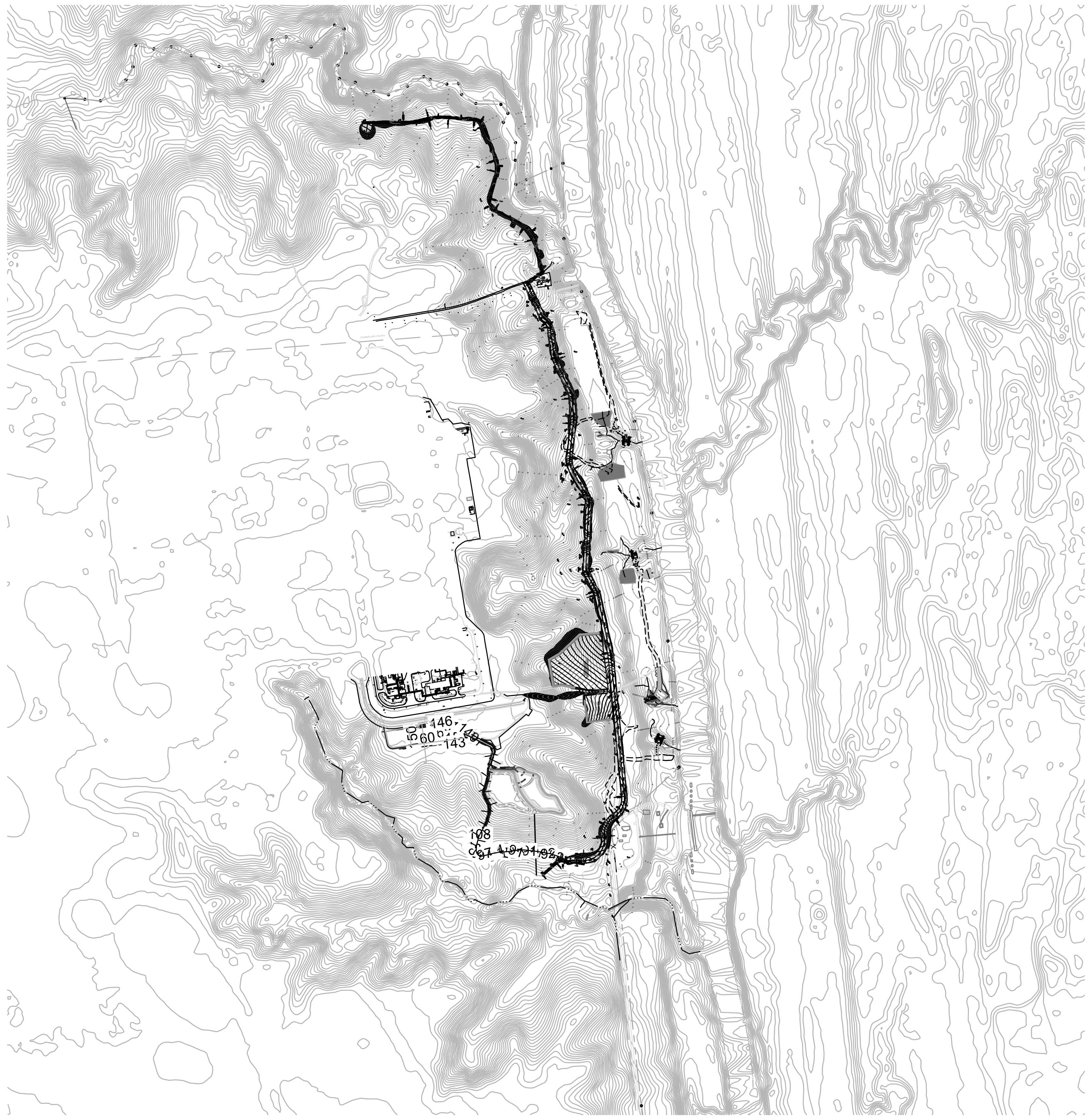
Retaining Wall Plans and Calculations

The Chemours Company

Fayetteville, North Carolina

Retaining Wall 60% Design Plans

July 28, 2021



DRAWING INDEX

GENERAL

G-1.0	COVER SHEET

BARRIER WALL

RW-0.1	RETAINING WALL SITE PLAN
RW-1.0	RETAINING WALL #1 PLAN & PROFILE
RW-2.0	RETAINING WALL #2 PLAN & PROFILE
RW-2.1	RETAINING WALL #2 PLAN & PROFILE
RW-3.0	RETAINING WALL #3 PLAN & PROFILE
RW-4.0	RETAINING WALL #4 PLAN & PROFILE
RW-5.0	RETAINING WALL #5 PLAN & PROFILE
RW-6.0	RETAINING WALL #6 PLAN & PROFILE
RW-7.0	RETAINING WALL #7 PLAN & PROFILE
RW-8.0	RETAINING WALL #8 PLAN & PROFILE

GEOS
Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Cover Sheet

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design
Not for
Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
1			
2			
3			
4			
5			
6			

DRAWING:
G-1.0

PROJECT NUMBER:
45-20803

RETAINING WALL LOCATION PLAN
SCALE: 1" = 200'

LEGEND:

—	PROPOSED GRADE
—·—	ROAD CENTERLINE
—	EXISTING GRADE
▲ ⊠ ◆	BORING LOCATION
◎	EXTRACTION WELL

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Retaining Wall 60% Design Plans
Retaining Wall Site Plan

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design
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Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
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No.	Date	Description	By:
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2			
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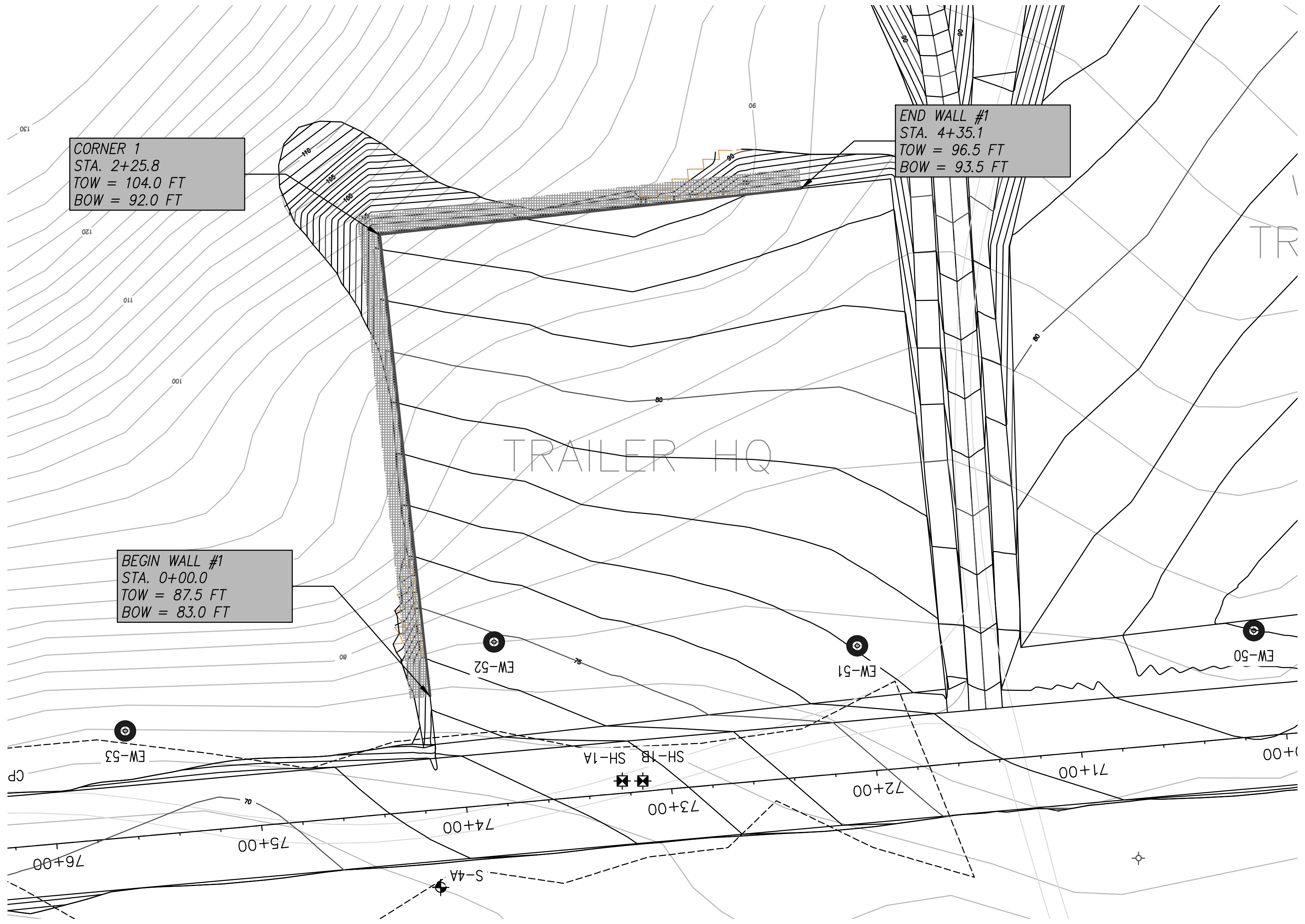
DRAWING:
RW-0.1

PROJECT NUMBER:
45-20803



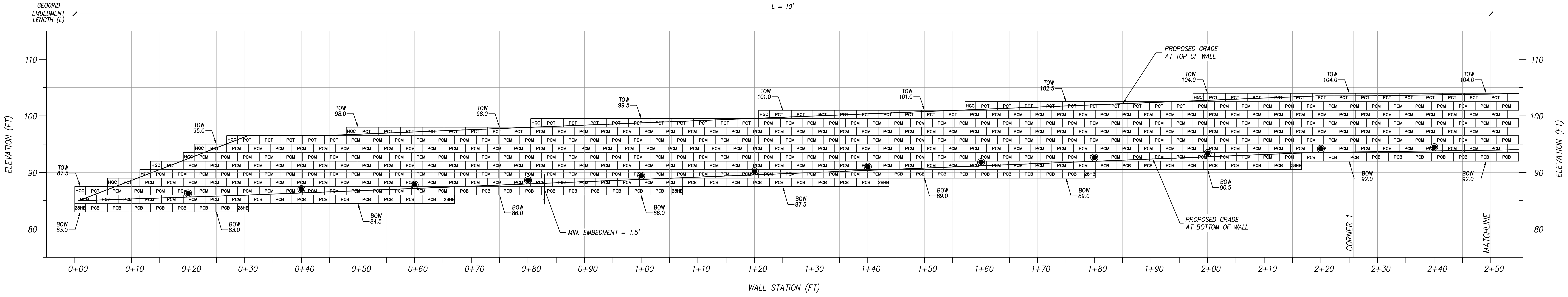
1 RW-1.0 RETAINING WALL #1 LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

ESTIMATED WALL #1 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	0	0.00	0.00
28"	Mid	5.75	0.00	0	0.00	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	0	0.00	0.00
41"	Bot	5.75	0.00	0	0.00	0.00
60"	Mid	5.75	0.00	0	0.00	0.00
60"	Bot	5.75	0.00	0	0.00	0.00
PC	Top	5.75	0.00	104	598.00	0.00
PC	Mid	5.75	0.00	684	3933.00	0.00
PC	Bot	5.75	0.00	109	626.75	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	19	54.63	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	9	25.88	0.00
41"	Half Mid	2.875	0.00	0	0.00	0.00
41"	Half Bot	2.875	0.00	0	0.00	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	0	0.00	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

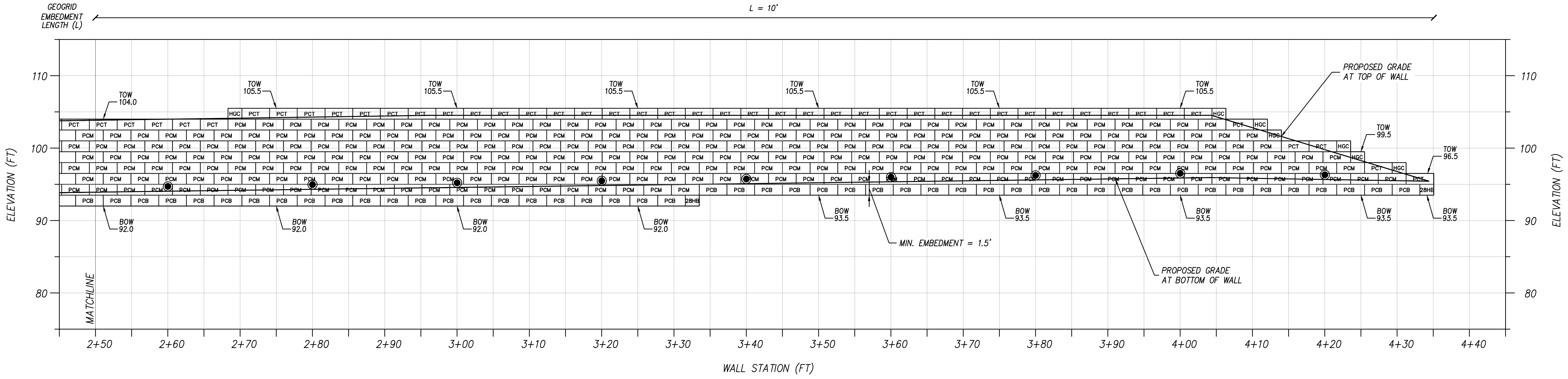
Summary of Quantities		
Total Face Area	5238.25	SF
Total Mirafi 8XT Area (12" Wide Strips)	2292.33	SY
Total Reinforced Fill Volume (Onsite Sands)	1552.07	CY
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	388.02	CY
Total Stone Volume	388.02	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the back of the reinforced zone and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.



2 RW-1.0 RETAINING WALL #1 PROFILE
SCALE: 1" = 10'
0' 10' 20'



3 RW-1.0 RETAINING WALL #1 PROFILE
SCALE: 1" = 10'
0' 10' 20'

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Retaining Wall 60% Design Plans
Retaining Wall #1 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design
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Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
1			
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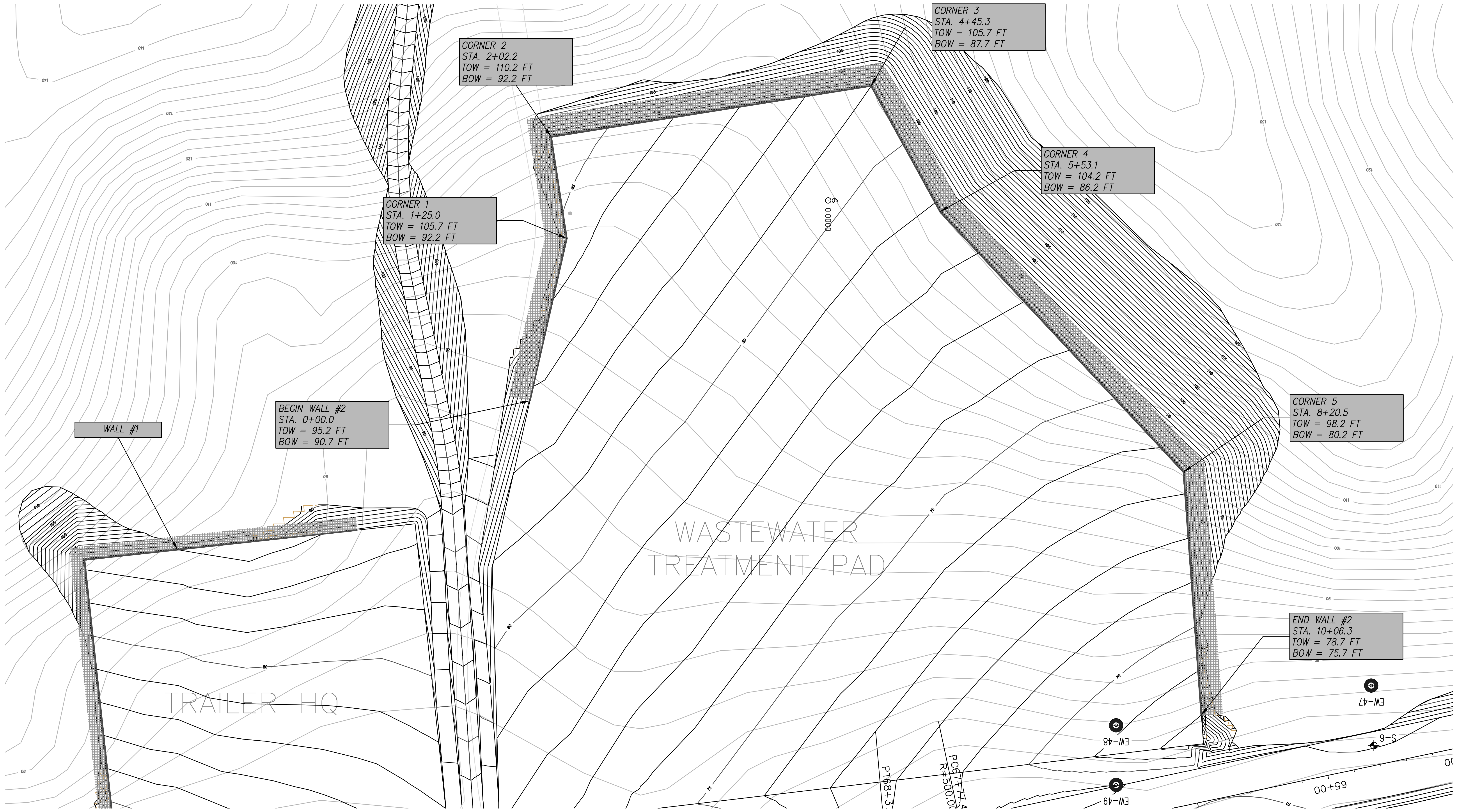
DRAWING:
RW-1.0

PROJECT NUMBER:
45-20803



1 RW-2.0 RETAINING WALL #2 LOCATION PLAN

SCALE: 1" = 50'

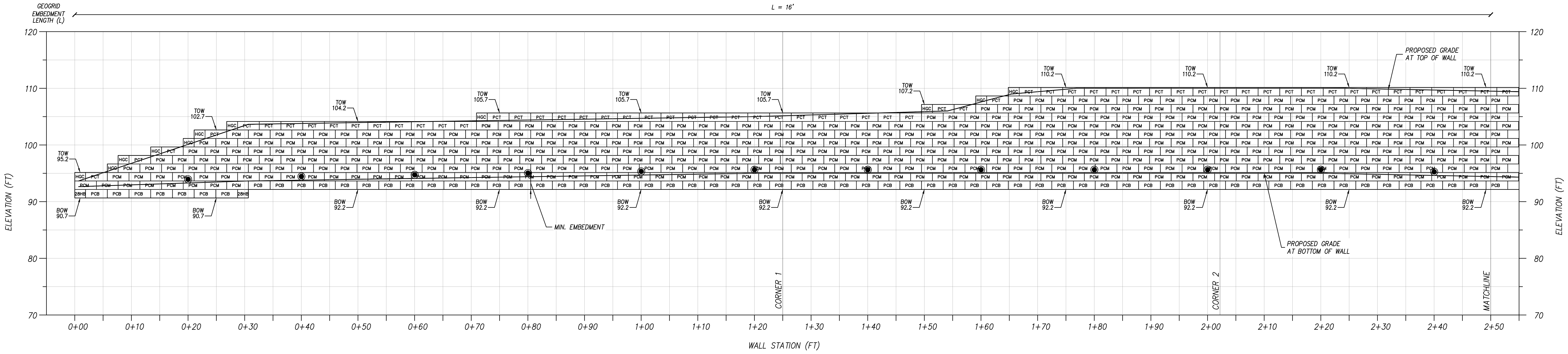
0' 50' 100'

ESTIMATED WALL #2 QUANTITIES						
Block Count		Face Area/Unit	Infill Volume/Unit	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type	(SF)	(CF)			
28"	Top	5.75	0.00	0	0.00	0.00
28"	Mid	5.75	0.00	0	0.00	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	0	0.00	0.00
41"	Bot	5.75	0.00	0	0.00	0.00
60"	Mid	5.75	0.00	0	0.00	0.00
60"	Bot	5.75	0.00	0	0.00	0.00
PC	Top	5.75	0.00	246	1414.50	0.00
PC	Mid	5.75	0.00	2396	13777.00	0.00
PC	Bot	5.75	0.00	256	1472.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	33	94.88	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	13	37.38	0.00
41"	Half Mid	2.875	0.00	0	0.00	0.00
41"	Half Bot	2.875	0.00	0	0.00	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	0	0.00	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	16795.75	SF
Total Mirafi 8XT Area (12" Wide Strips)	11270.00	SY
Total Reinforced Fill Volume (Onsite Sands)	8708.91	CY
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	1244.13	CY
Total Stone Volume	1244.13	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the back of the reinforced zone and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.



2 RW-2.0 RETAINING WALL #2 PROFILE

SCALE: 1" = 10'

0' 10' 20'

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Retaining Wall 60% Design Plans
Retaining Wall #2 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design
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DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
1			
2			
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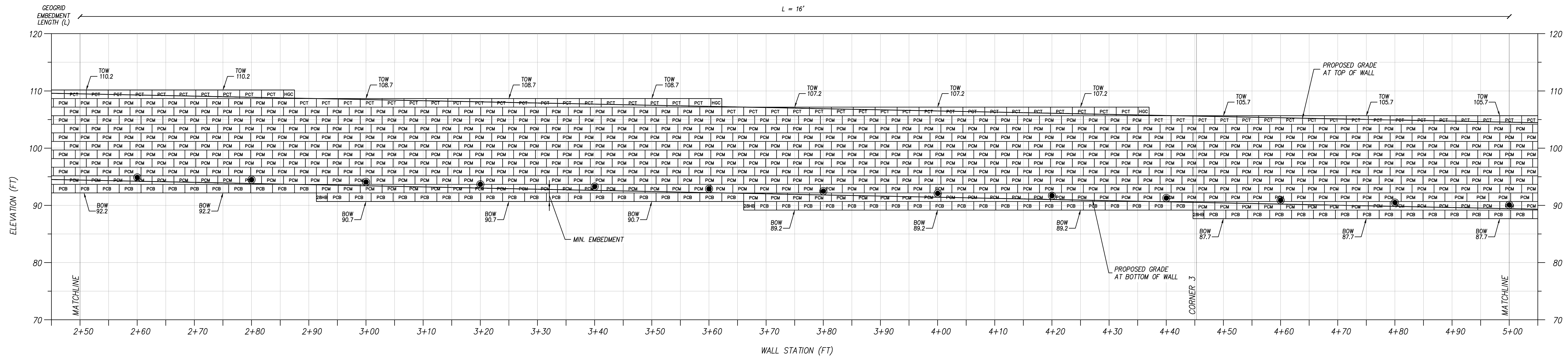
DRAWING:
RW-2.0

PROJECT NUMBER:
45-20803

1
RW-2.1
RETAINING WALL #2 PROFILE
SCALE: 1" = 10'
0' 10' 20'



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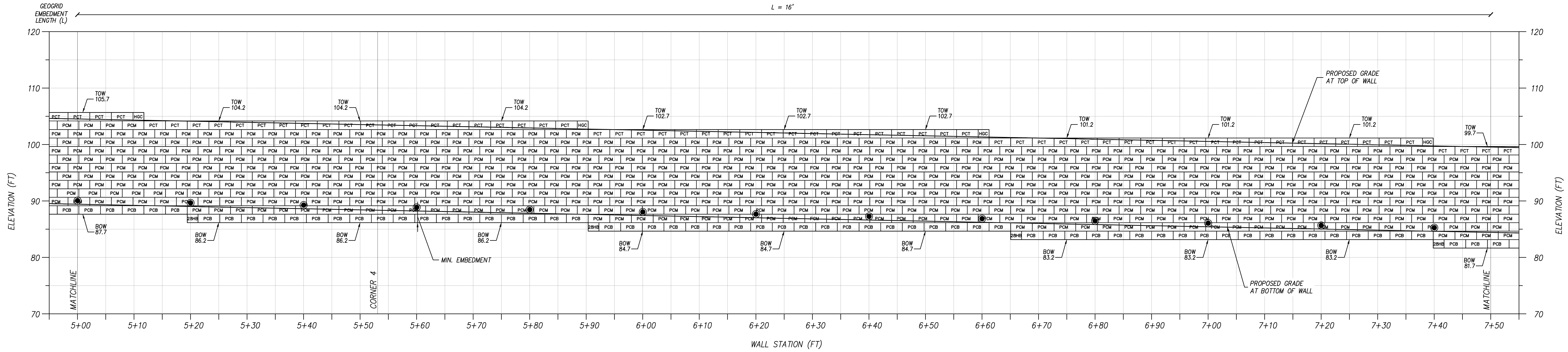
RW-2.1
RETAINING WALL #2 PROFILE
SCALE: 1" = 10'
0' 10' 20'



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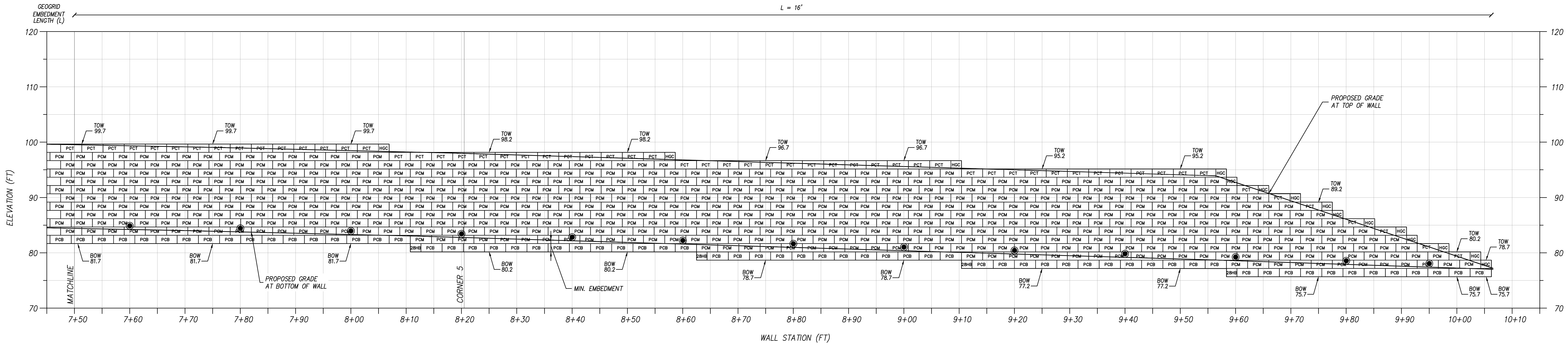
RW-2.1
RETAINING WALL #2 PROFILE
SCALE: 1" = 10'
0' 10' 20'



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Retaining Wall 60% Design Plans
Retaining Wall #2 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

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Not for
Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
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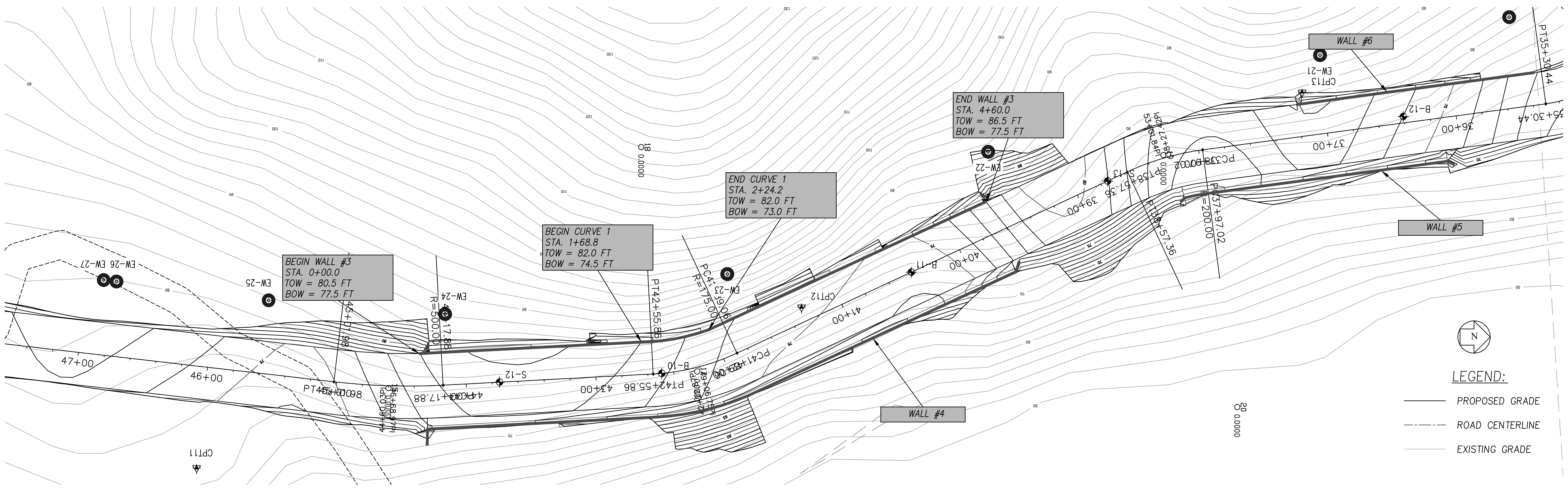
DRAWING:
RW-2.1

PROJECT NUMBER:
45-20803



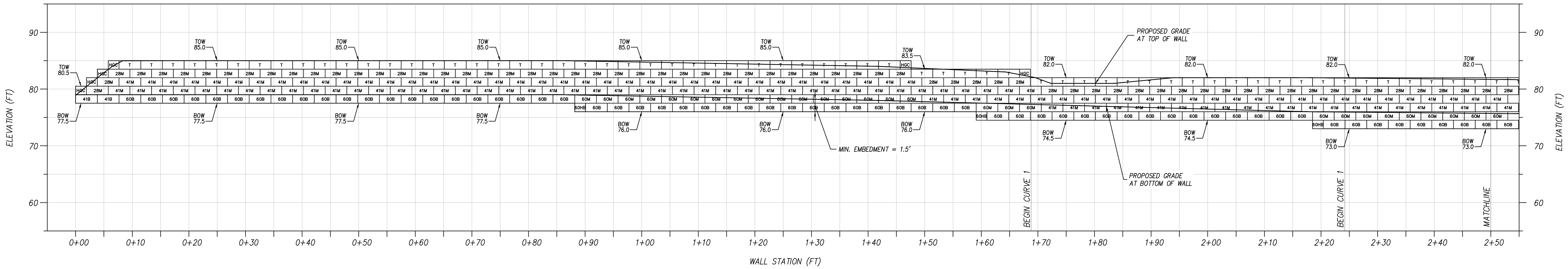
① RETAINING WALL #3 LOCATION PLAN
RW-3.0
SCALE: 1" = 50'
0' 50' 100'

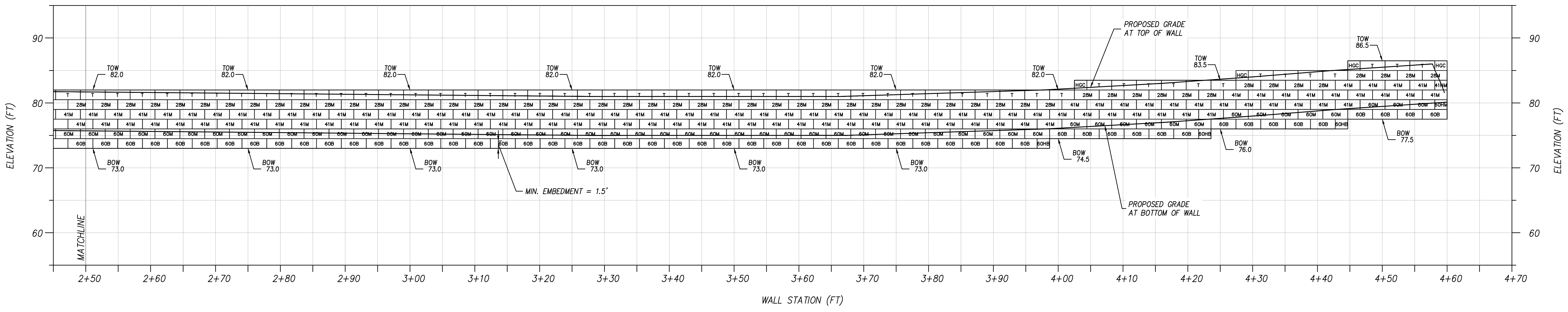
ESTIMATED WALL #3 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	115	661.25	0.00
28"	Mid	5.75	0.00	118	678.50	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	237	1362.75	0.00
41"	Bot	5.75	0.00	2	11.50	0.00
60"	Mid	5.75	0.00	80	460.00	0.00
60"	Bot	5.75	0.00	115	661.25	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	10	28.75	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	1	2.88	0.00
41"	Half Bot	2.875	0.00	0	0.00	0.00
60"	Half Mid	2.875	0.00	1	2.88	0.00
60"	Half Bot	2.875	0.00	6	17.25	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	3887.00	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	215.94	CY
Total Stone Volume	215.94	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.





② RETAINING WALL #3 PROFILE
RW-3.0
SCALE: 1" = 10'
0' 10' 20'

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Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Retaining Wall #3 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

60% Design Not for Construction

DRAWN BY: NSS
REVIEWED BY: TJD
DESIGNED BY: JEE
APPROVED BY:
SCALE: AS SHOWN
DATE: July 28, 2021

Revisions

No.	Date	Description	By:
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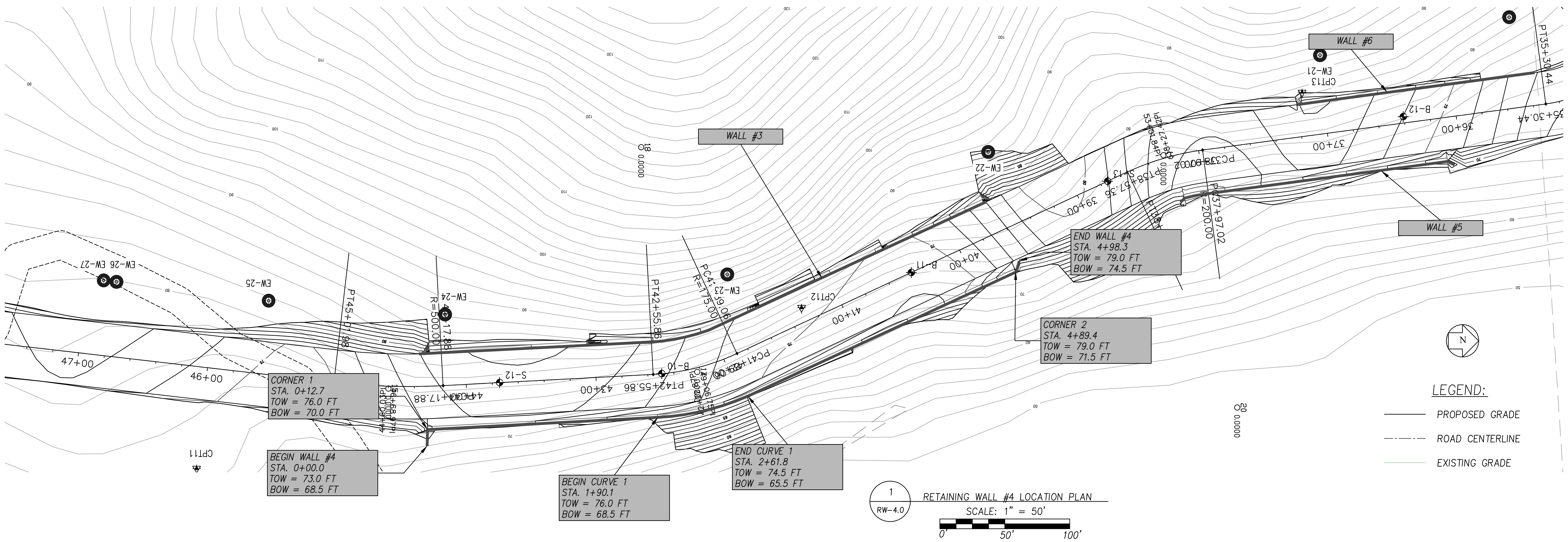
DRAWING: RW-3.0

PROJECT NUMBER: 45-20803



1 RW-4.0 RETAINING WALL #4 LOCATION PLAN

SCALE: 1" = 50'

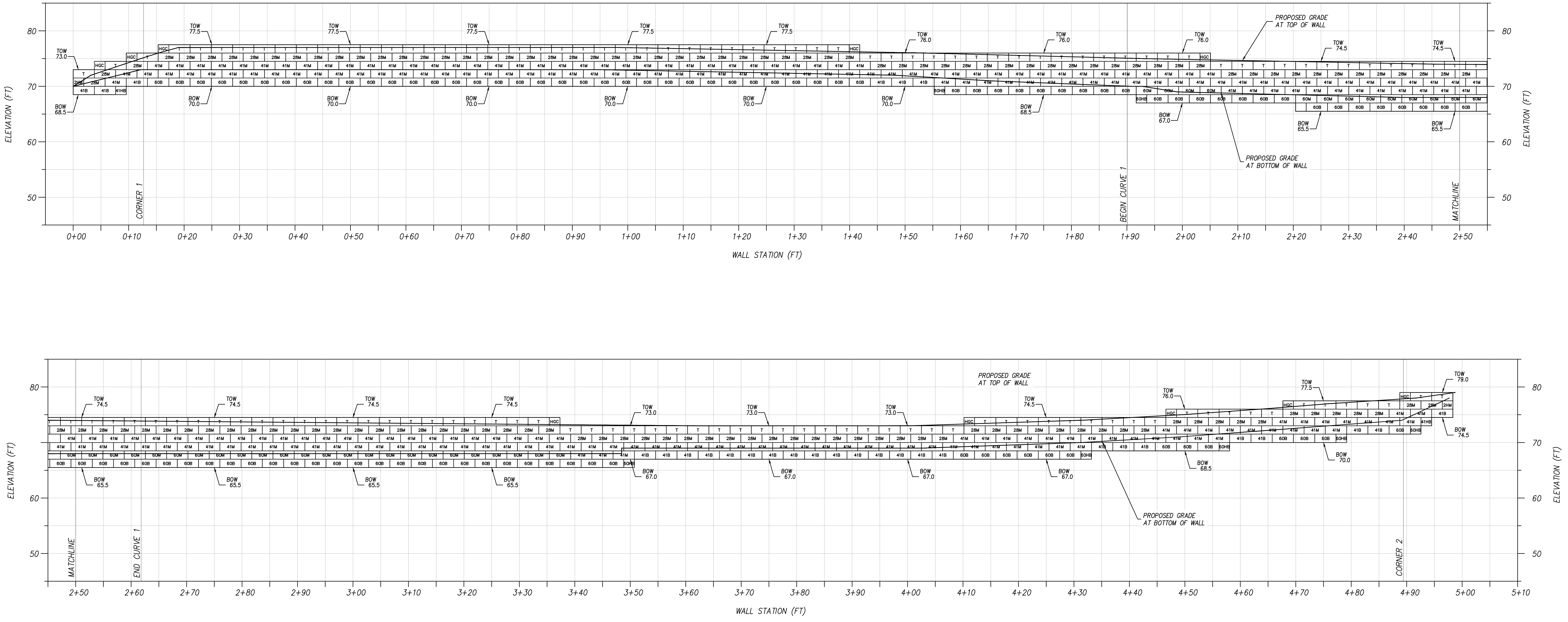
0' 50' 100'

ESTIMATED WALL #4 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	125	718.75	0.00
28"	Mid	5.75	0.00	125	718.75	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	228	1311.00	0.00
41"	Bot	5.75	0.00	29	166.75	0.00
60"	Mid	5.75	0.00	35	201.25	0.00
60"	Bot	5.75	0.00	96	552.00	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	10	28.75	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	2	5.75	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	0	0.00	0.00
41"	Half Bot	2.875	0.00	2	5.75	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	8	23.00	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	3731.75	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	207.32	CY
Total Stone Volume	207.32	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.



2 RW-4.0 RETAINING WALL #4 PROFILE

SCALE: 1" = 10'

0' 10' 20'

GEOS
Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Retaining Wall #4 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

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Construction

DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
1			
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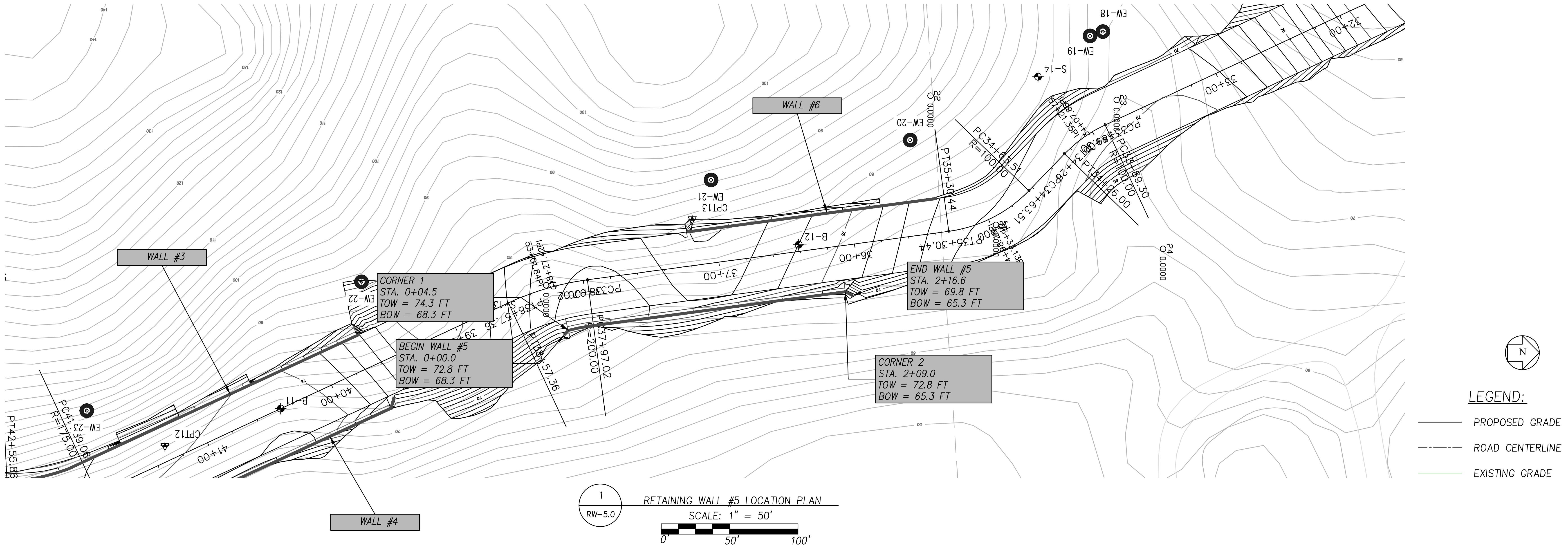
DRAWING:
RW-4.0

PROJECT NUMBER:
45-20803



1 RW-5.0 RETAINING WALL #5 LOCATION PLAN

SCALE: 1" = 50'

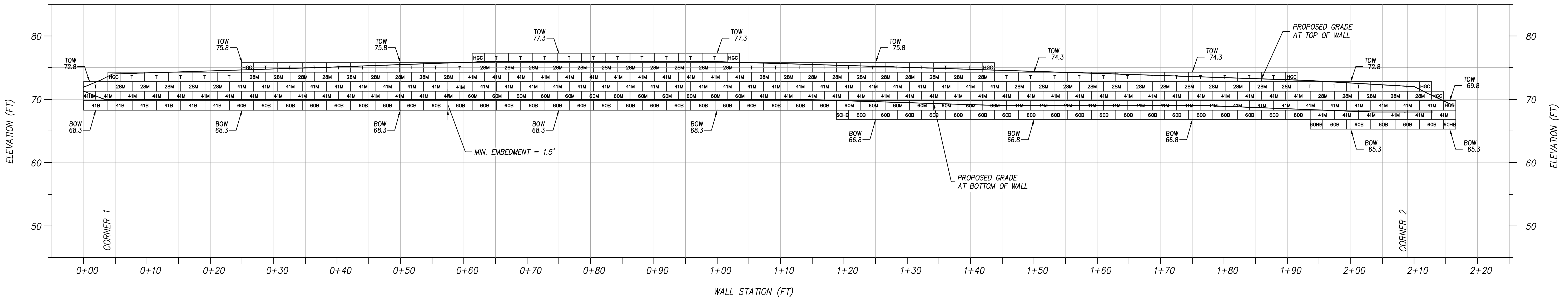
0' 50' 100'

ESTIMATED WALL #5 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	52	299.00	0.00
28"	Mid	5.75	0.00	52	299.00	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	106	609.50	0.00
41"	Bot	5.75	0.00	6	34.50	0.00
60"	Mid	5.75	0.00	19	109.25	0.00
60"	Bot	5.75	0.00	49	281.75	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	9	25.88	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	1	2.88	0.00
41"	Half Bot	2.875	0.00	0	0.00	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	3	8.63	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	1670.38	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	92.80	CY
Total Stone Volume	92.80	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.



2 RW-5.0 RETAINING WALL #5 PROFILE

SCALE: 1" = 10'

0' 10' 20'

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Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Retaining Wall #5 Plan & Profile

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Fayetteville, North Carolina

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DESIGNED BY: JEE	APPROVED BY:
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DATE: July 28, 2021	

Revisions

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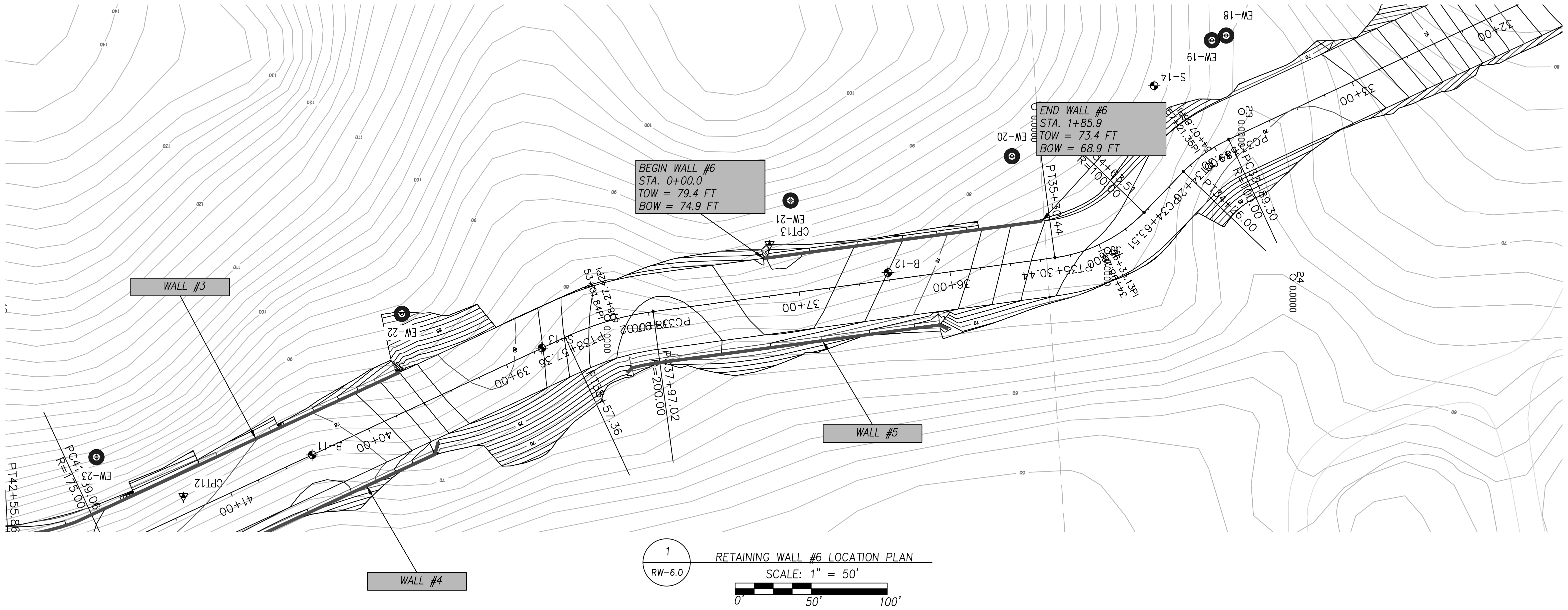
DRAWING:
RW-5.0

PROJECT NUMBER:
45-20803



1 RW-6.0 RETAINING WALL #6 LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

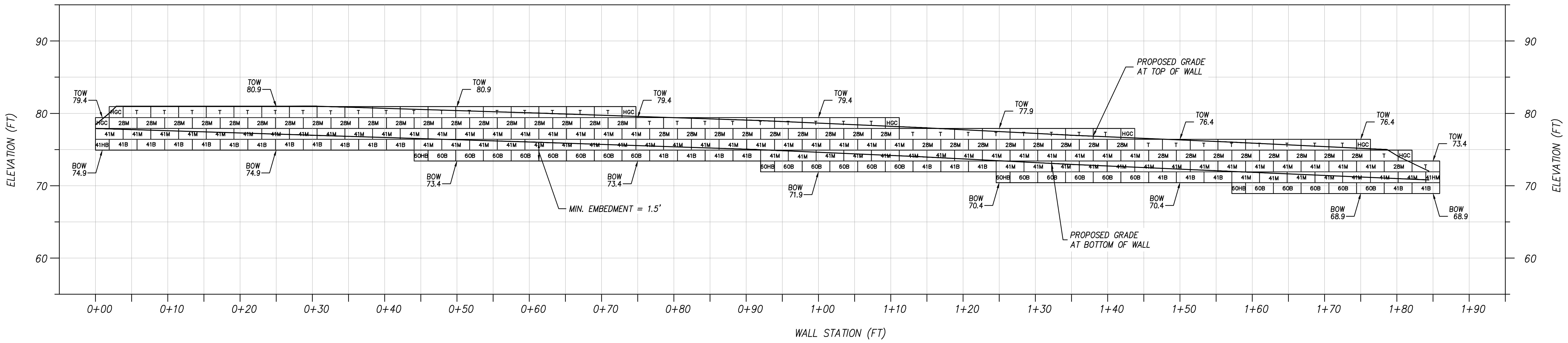
LEGEND:
PROPOSED GRADE
ROAD CENTERLINE
EXISTING GRADE

ESTIMATED WALL #6 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	45	258.75	0.00
28"	Mid	5.75	0.00	45	258.75	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	73	419.75	0.00
41"	Bot	5.75	0.00	23	132.25	0.00
60"	Mid	5.75	0.00	0	0.00	0.00
60"	Bot	5.75	0.00	23	132.25	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	7	20.13	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	1	2.88	0.00
41"	Half Bot	2.875	0.00	1	2.88	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	4	11.50	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	1239.13	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	68.84	CY
Total Stone Volume	68.84	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.



2 RW-6.0 RETAINING WALL #6 PROFILE
SCALE: 1" = 10'
0' 10' 20'

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Retaining Wall 60% Design Plans
Retaining Wall #6 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

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DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

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1			
2			
3			
4			
5			
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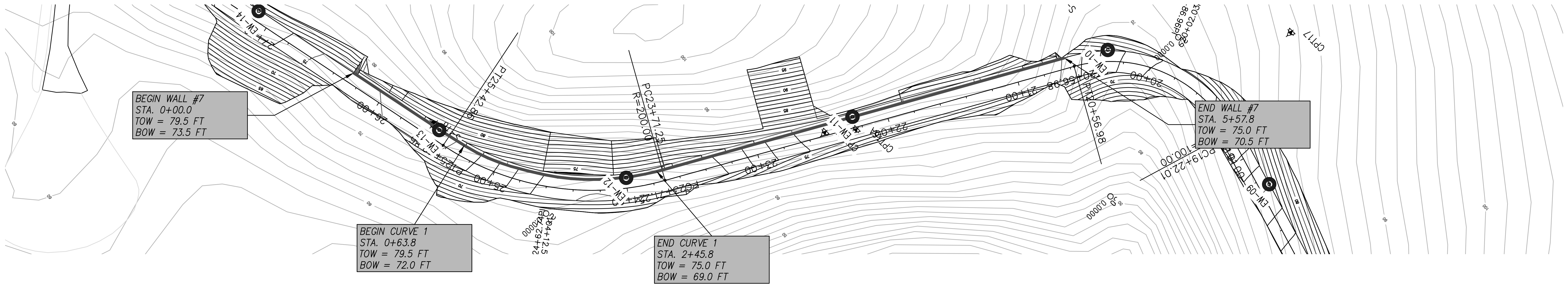
DRAWING:
RW-6.0

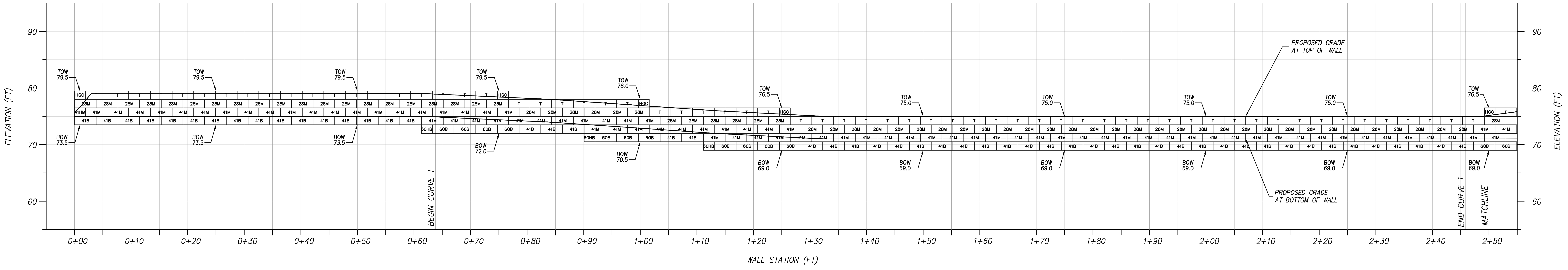
PROJECT NUMBER:
45-20803

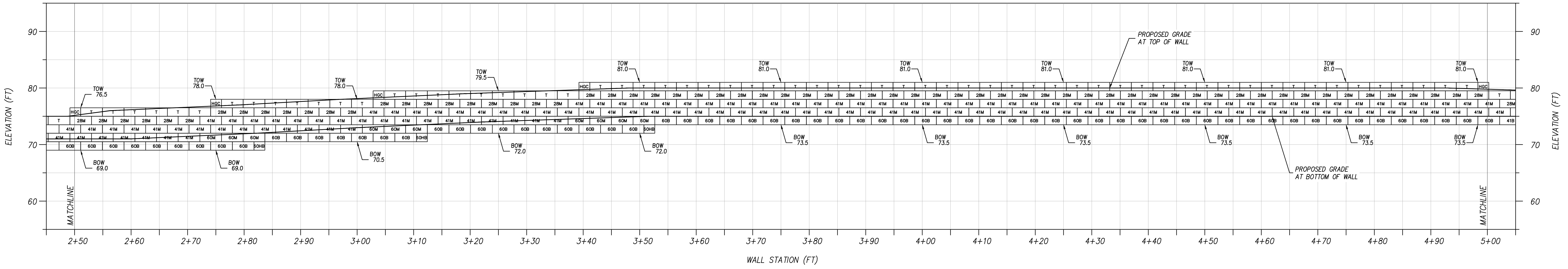
1
RW-7.0

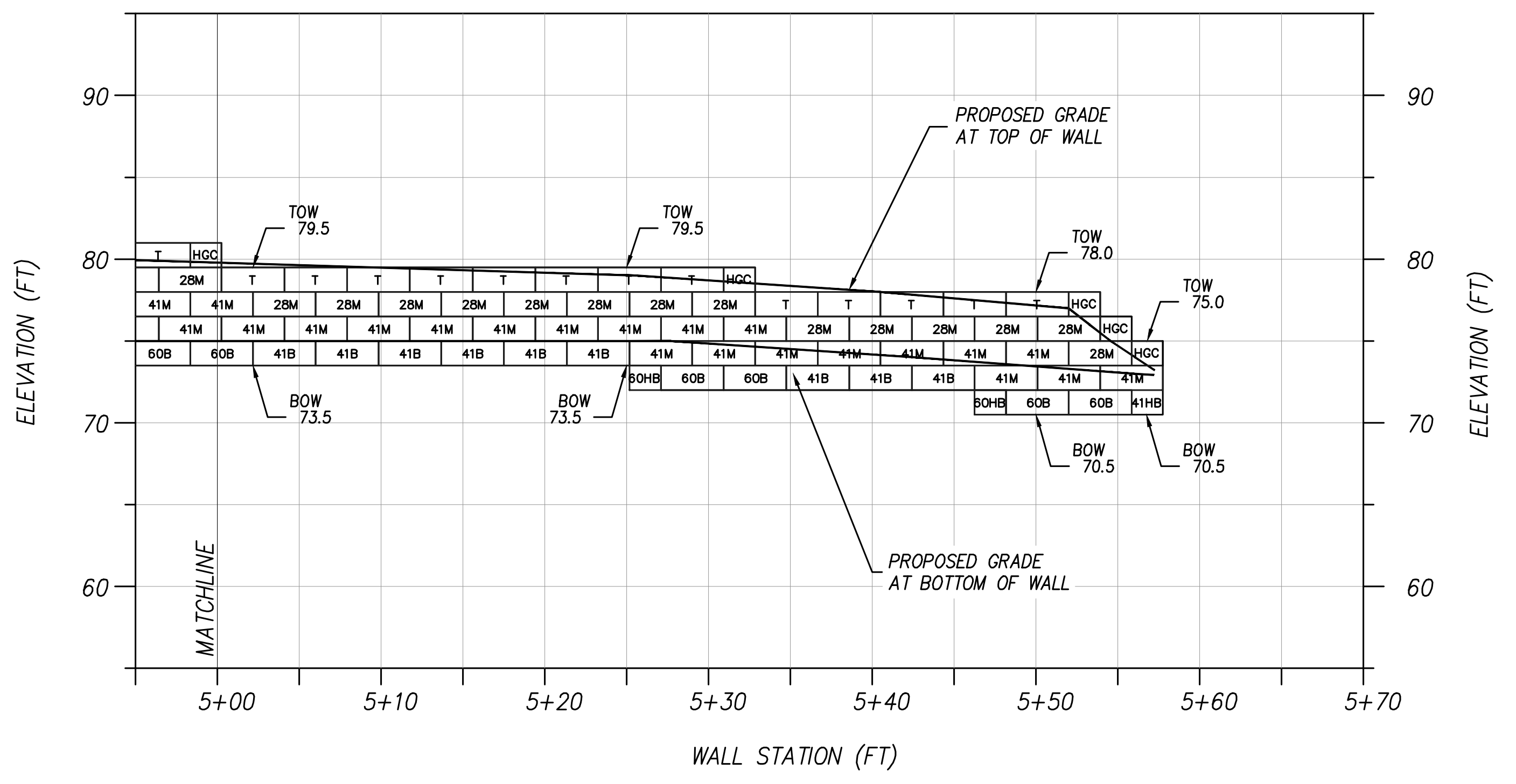
RETAINING WALL #7 LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'

LEGEND:
PROPOSED GRADE
ROAD CENTERLINE
EXISTING GRADE









2
RW-7.0

RETAINING WALL #7 PROFILE
SCALE: 1" = 10'
0' 10' 20'

ESTIMATED WALL #7 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	140	805.00	0.00
28"	Mid	5.75	0.00	141	810.75	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	228	1311.00	0.00
41"	Bot	5.75	0.00	61	350.75	0.00
60"	Mid	5.75	0.00	10	57.50	0.00
60"	Bot	5.75	0.00	80	460.00	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	13	37.38	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	1	2.88	0.00
41"	Half Bot	2.875	0.00	1	2.88	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	8	23.00	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	3861.13	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	214.51	CY
Total Stone Volume	214.51	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.

GEOS
Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Retaining Wall #7 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

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DRAWN BY: NSS	REVIEWED BY: TJD
DESIGNED BY: JEE	APPROVED BY:
SCALE: AS SHOWN	
DATE: July 28, 2021	

Revisions

No.	Date	Description	By:
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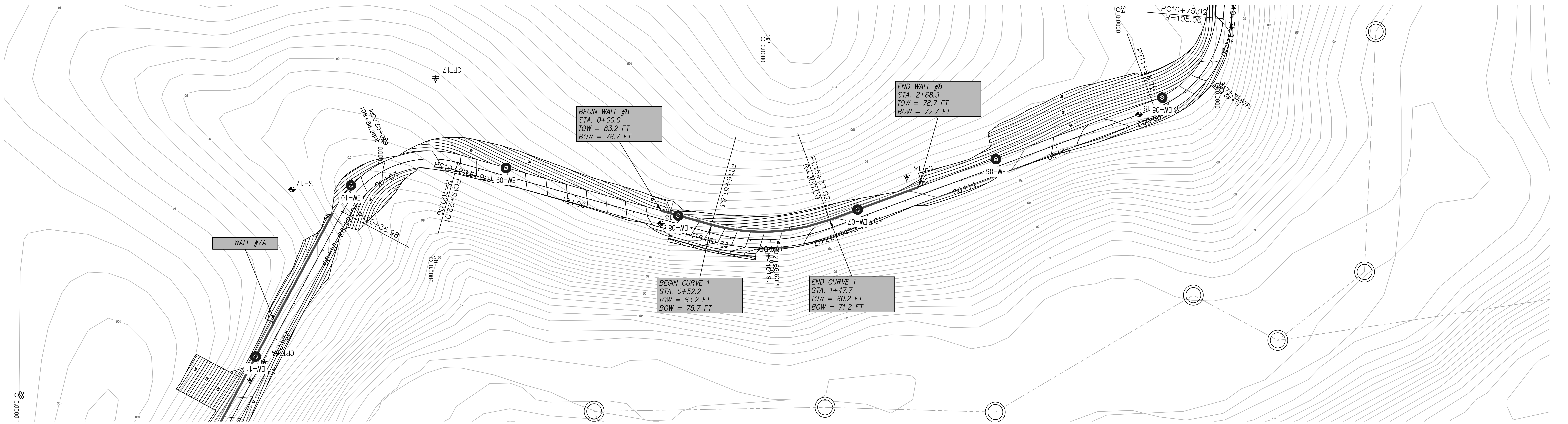
DRAWING:
RW-7.0

PROJECT NUMBER:
45-20803

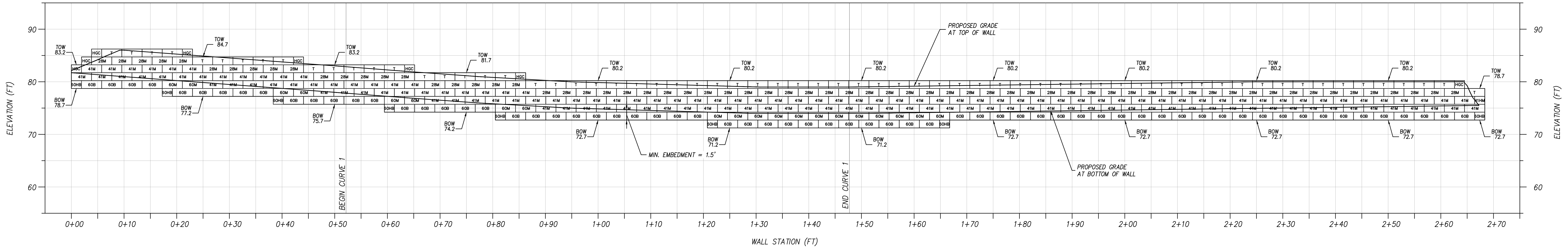


LEGEND:

———	PROPOSED GRADE
—··—··—	ROAD CENTERLINE
———	EXISTING GRADE

N

1
RW-8.0
RETAINING WALL #8 LOCATION PLAN
SCALE: 1" = 50'
0' 50' 100'



2
RW-8.0
RETAINING WALL #8 PROFILE
SCALE: 1" = 10'
0' 10' 20'

ESTIMATED WALL #8 QUANTITIES						
Block Count		Face Area/Unit (SF)	Infill Volume/Unit (CF)	Number of Units	Face Area (SF)	Infill Vol (CY)
Size	Type					
28"	Top	5.75	0.00	66	379.50	0.00
28"	Mid	5.75	0.00	66	379.50	0.00
28"	Bot	5.75	0.00	0	0.00	0.00
41"	Mid	5.75	0.00	139	799.25	0.00
41"	Bot	5.75	0.00	0	0.00	0.00
60"	Mid	5.75	0.00	20	115.00	0.00
60"	Bot	5.75	0.00	66	379.50	0.00
PC	Top	5.75	0.00	0	0.00	0.00
PC	Mid	5.75	0.00	0	0.00	0.00
PC	Bot	5.75	0.00	0	0.00	0.00
2-side	Cap	1.92	0.00	0	0.00	0.00
3-side	Cap	1.92	0.00	0	0.00	0.00
4-side	Cap	1.92	0.00	0	0.00	0.00
Corner	Half Gdn.	2.875	0.00	8	23.00	0.00
Corner	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Top	2.875	0.00	0	0.00	0.00
28"	Half Mid	2.875	0.00	0	0.00	0.00
28"	Half Bot	2.875	0.00	0	0.00	0.00
41"	Half Mid	2.875	0.00	1	2.88	0.00
41"	Half Bot	2.875	0.00	0	0.00	0.00
60"	Half Mid	2.875	0.00	0	0.00	0.00
60"	Half Bot	2.875	0.00	8	23.00	0.00
96"	XL	11.5	54.63	0	0.00	0.00
72"	XL	11.5	36.29	0	0.00	0.00
52"	XL	11.5	22.88	0	0.00	0.00

Summary of Quantities		
Total Face Area	2101.63	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	116.76	CY
Total Stone Volume	116.76	CY

Summary of Quantities		
Total Face Area	2101.63	SF
Total XL Infill Volume	0	CY
Total Drainage Stone Volume	116.76	CY
Total Stone Volume	116.76	CY

ASSUMPTIONS:

1. These quantities assume a neat excavation and do not account for the fill required between the drainage stone pocket and the temporary excavation. These quantities shall not be used for bidding without accounting for overages.

GEOS
Geotechnical, Environmental and Materials Engineers

Retaining Wall 60% Design Plans
Retaining Wall #8 Plan & Profile

Chemours Fayetteville Works
Fayetteville, North Carolina

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DRAWN BY: NSS	REVIEWED BY: TJD
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RW-8.0

PROJECT NUMBER:
45-20803

Geotechnical, Environmental and Materials Engineers

CHEMOURS

RETAINING WALL CALCULATIONS

WALL #1

Analysis of Redi Rock wall

Input data

Project

Task	:	Chemours Barrier Wall Retaining Walls
Part	:	Wall #1
Description	:	MSE
Author	:	GEOS
Date	:	4/9/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Top block 24 straight	18.00	24.00	108.00
2	Block 28 PC	18.00	28.00	120.00
3	Block 41 PC	18.00	40.50	120.00
4	Top block 28	18.00	28.00	120.00
5	Top block 41	18.00	40.50	120.00
6	Top block 24 straight garden	18.00	24.00	80.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Top block 24 straight	6061.00	11276.00	44.00
2	Block 28 PC	6061.00	11276.00	44.00
3	Block 41 PC	6061.00	11276.00	44.00
4	Top block 28	6061.00	11276.00	44.00
5	Top block 41	6061.00	11276.00	44.00
6	Top block 24 straight garden	6061.00	11276.00	44.00

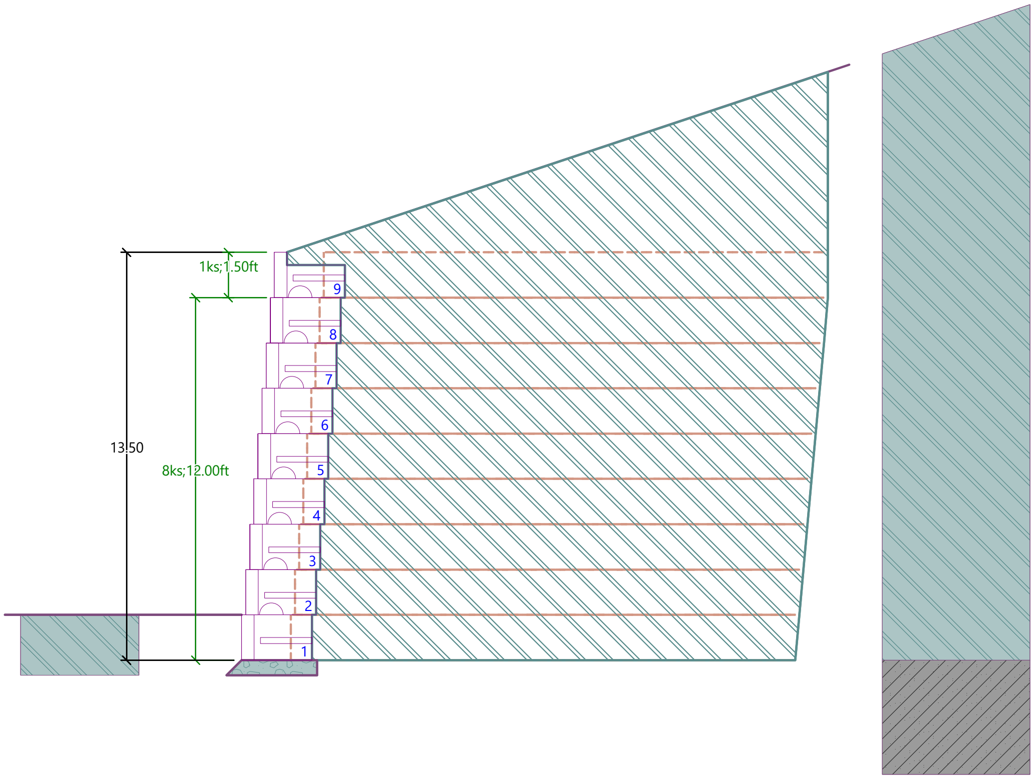
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
6	3.250

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	8	1.62
2	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	----------	7400.00	3393.87	3423.30

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7400.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.58	
Durability red. factor	RF_D	=	1.15	
Installation damage red. factor	RF_{ID}	=	1.20	
Long-term design strength	R_t	=	3393.87	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.67	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.67	
Scale correction factor	α	=	0.8	
Long-term strength reduction factor	CR_{cr}	=	0.532	
Calculation of long-term connection strength	R_{con}	=	3423.30	lbf/ft

Reinforcements

Input mode : 1 reinforcement type
Reinf. installation : in every row of blocks (50%)
Type of reinforcement : Miragrid 8XT
Top reinforcement : straight (25%)
Reinforcement geometry : identical length of reinforcements
Length of reinforcement l = 16.00 ft
Reinforced soil - Upper Sand

Reinforcements

No.	Consider	Name	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	16.00	
2	Yes	Miragrid 8XT	16.00	
3	Yes	Miragrid 8XT	16.00	
4	Yes	Miragrid 8XT	16.00	
5	Yes	Miragrid 8XT	16.00	
6	Yes	Miragrid 8XT	16.00	
7	Yes	Miragrid 8XT	16.00	
8	Yes	Miragrid 8XT	16.00	
9	Yes	Miragrid 8XT	16.00	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	13.50	0.00 .. 13.50	Upper Sand	▨
2	-	13.50 .. ∞	Upper Lean Clay	▨

Terrain profile

Terrain behind construction has the slope 1: 3.00 (slope angle is 18.43 °).

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Sand
Soil thickness in front of structure h = 2.00 ft

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-358.3	-0.50	0.0	2.33	1.000
Weight - reinforced soil	0.0	-8.49	31176.1	11.38	1.000
Active pressure	8600.7	-6.49	4573.1	19.42	1.000
Weight - wall	0.0	-6.58	3684.2	1.69	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability
Resisting moment M_{res} = 449833.1 lbfft/ft
Overturning moment M_{ovr} = 55640.9 lbfft/ft

Safety factor = 8.08 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 19237.32 lbf/ft
Active horizontal force H_{act} = 8242.36 lbf/ft

Safety factor = 2.33 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-80484.3	6041.69	-9633.06	0.000	2013.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-80484.3	6041.69	-9633.06

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 2013.9 psf
Bearing capacity of foundation soil R_d = 7500.0 psf

Safety factor = 3.72 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-6.58	3663.0	-0.64	1.000
FF resistance	-357.9	-0.50	0.0	-2.33	1.000
Active pressure	8726.9	-6.17	4243.0	16.00	1.000
Weight - reinforced soil	0.0	-8.26	29457.8	8.67	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 33700.80 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.92
Resistance along geo-reinforcement = 16440.71 lbf/ft
Wall resistance = 3073.58 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 19872.17 lbf/ft
Active horiz. force H_{act} = 8726.89 lbf/ft

Factor of safety = 2.28 > 1.50

Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-427.24	13.50	848.47	75.53	4311.45	14.86	855.83	74.88
2	Miragrid 8XT	-769.08	12.00	1696.94	67.98	7508.45	15.36	1711.65	67.40
3	Miragrid 8XT	-669.10	10.50	1696.94	59.14	6467.95	15.52	1711.65	58.64
4	Miragrid 8XT	-597.13	9.00	1696.94	52.78	5501.42	16.28	1711.65	52.33
5	Miragrid 8XT	-525.17	7.50	1696.94	46.42	4608.86	17.09	1711.65	46.02
6	Miragrid 8XT	-453.20	6.00	1696.94	40.06	3790.27	17.94	1711.65	39.72
7	Miragrid 8XT	-381.23	4.50	1696.94	33.70	3045.65	18.78	1711.65	33.41
8	Miragrid 8XT	-309.27	3.00	1696.94	27.34	2374.99	19.53	1711.65	27.10
9	Miragrid 8XT	-328.96	1.50	1696.94	29.08	1778.30	27.75	1711.65	28.83

Check for tensile strength (reinforcement No.1)

Tension strength R_t = 848.47 lbf/ft
Force in reinforcement F_x = 427.24 lbf/ft

Safety factor = 1.99 > 1.50

Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.9)

Pull out resistance T_p = 1778.30 lbf/ft
Force in reinforcement F_x = 328.96 lbf/ft

Safety factor = 5.41 > 1.50

Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)

Connection strength R_{con} = 855.83 lbf/ft
Force in reinforcement F_x = 427.24 lbf/ft

Safety factor = 2.00 > 1.50

Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

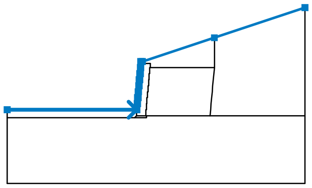
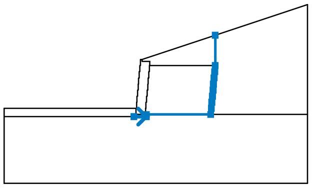
(input for current task)

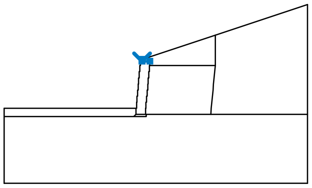
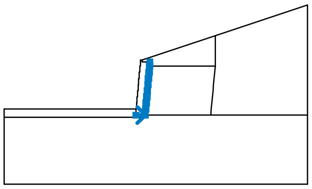
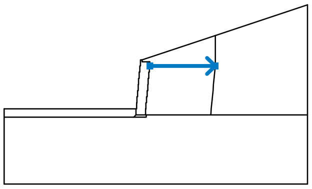
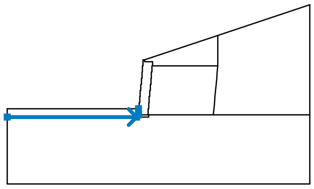
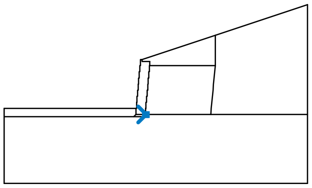
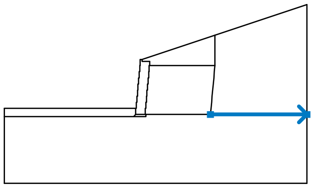
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-33.75	-12.00	-1.50	-12.00	-1.36	-12.00
		-1.36	-10.50	-1.23	-10.50	-1.23	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.96	-7.50
		-0.96	-6.00	-0.82	-6.00	-0.82	-4.50
		-0.69	-4.50	-0.69	-3.00	-0.55	-3.00
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	17.92	5.97	40.50	13.50
2		-2.00	-14.00	1.00	-14.00	1.00	-13.50
		16.83	-13.50	16.97	-12.00	17.10	-10.50
		17.24	-9.00	17.38	-7.50	17.51	-6.00
		17.65	-4.50	17.78	-3.00	17.92	-1.50
		17.92	5.97				

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.50	-13.50	0.83	-13.50	0.83	-12.00
		0.97	-12.00	0.97	-10.50	1.10	-10.50
		1.10	-9.00	1.24	-9.00	1.24	-7.50
		1.38	-7.50	1.38	-6.00	1.51	-6.00
		1.51	-4.50	1.65	-4.50	1.65	-3.00
		1.78	-3.00	1.78	-1.50	1.92	-1.50
		1.92	-0.42				
5		1.92	-1.50	17.92	-1.50		
6		-33.75	-14.00	-2.00	-14.00	-1.50	-13.50
		-1.50	-12.00				
7		0.83	-13.50	1.00	-13.50		
8		16.83	-13.50	40.50	-13.50		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

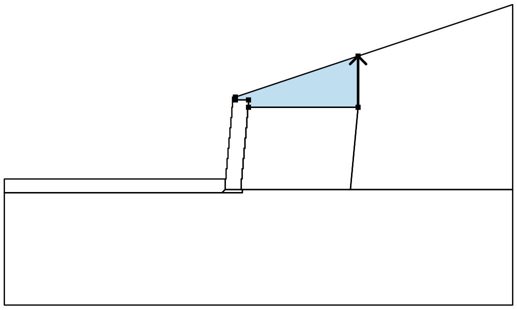
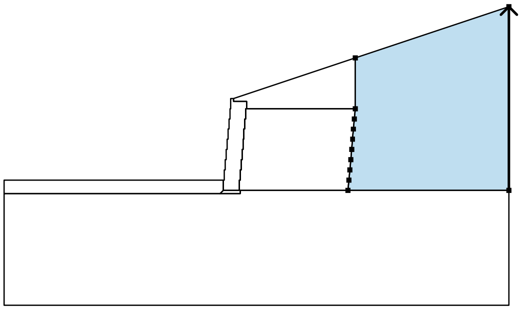
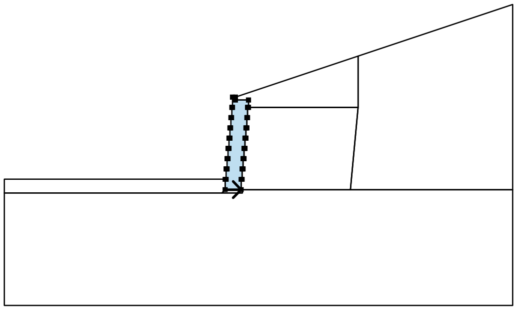
Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

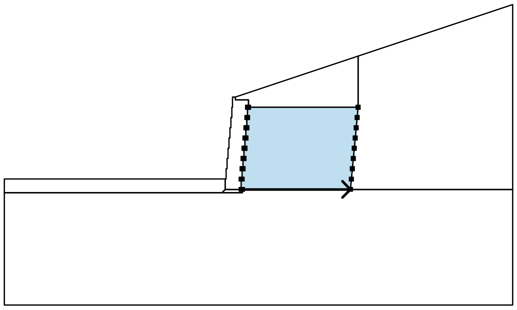
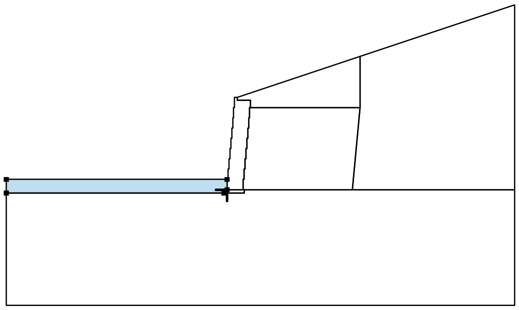
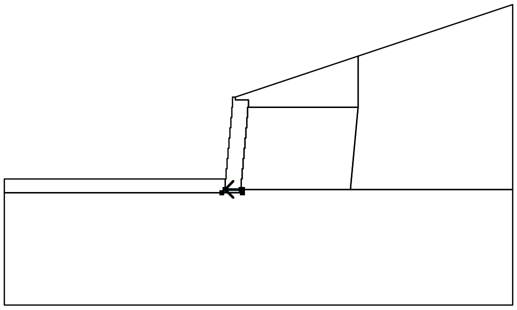
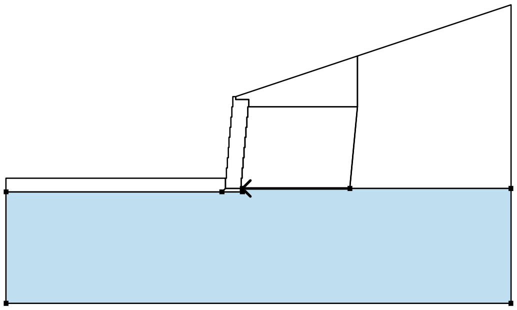
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		17.92	-1.50	17.92	5.97	Upper Sand
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		40.50	-13.50	40.50	13.50	Upper Sand
		17.92	5.97	17.92	-1.50	▨
		17.78	-3.00	17.65	-4.50	
		17.51	-6.00	17.38	-7.50	
		17.24	-9.00	17.10	-10.50	
		16.97	-12.00	16.83	-13.50	
3		-1.50	-13.50	0.83	-13.50	Material of structure
		0.83	-12.00	0.97	-12.00	🟥
		0.97	-10.50	1.10	-10.50	
		1.10	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.96	-6.00	
		-0.96	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.23	-9.00	
		-1.23	-10.50	-1.36	-10.50	
		-1.36	-12.00	-1.50	-12.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		1.00	-13.50	16.83	-13.50	Upper Sand
		16.97	-12.00	17.10	-10.50	▨
		17.24	-9.00	17.38	-7.50	
		17.51	-6.00	17.65	-4.50	
		17.78	-3.00	17.92	-1.50	
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.10	-9.00	
		1.10	-10.50	0.97	-10.50	
		0.97	-12.00	0.83	-12.00	
		0.83	-13.50			
5		-2.00	-14.00	-1.50	-13.50	Upper Sand
		-1.50	-12.00	-33.75	-12.00	▨
		-33.75	-14.00			
6		0.83	-13.50	-1.50	-13.50	#57 Stone
		-2.00	-14.00	1.00	-14.00	▨
		1.00	-13.50			
7		16.83	-13.50	1.00	-13.50	Upper Lean Clay
		1.00	-14.00	-2.00	-14.00	▨
		-33.75	-14.00	-33.75	-30.40	
		40.50	-30.40	40.50	-13.50	

Reinforcements

No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		reinf.
1	0.83	-13.50	16.83	-13.50	16.00	848.5	C = 0.67	Fixed
2	0.97	-12.00	16.97	-12.00	16.00	1696.9	C = 0.67	Fixed
3	1.10	-10.50	17.10	-10.50	16.00	1696.9	C = 0.67	Fixed
4	1.24	-9.00	17.24	-9.00	16.00	1696.9	C = 0.67	Fixed
5	1.38	-7.50	17.38	-7.50	16.00	1696.9	C = 0.67	Fixed
6	1.51	-6.00	17.51	-6.00	16.00	1696.9	C = 0.67	Fixed
7	1.65	-4.50	17.65	-4.50	16.00	1696.9	C = 0.67	Fixed
8	1.78	-3.00	17.78	-3.00	16.00	1696.9	C = 0.67	Fixed
9	1.92	-1.50	17.92	-1.50	16.00	1696.9	C = 0.67	Fixed

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-0.04	[ft]	Angles :	α_1 =	-23.93	[°]
	z =	26.37	[ft]		α_2 =	71.83	[°]
Radius :	R =	41.98	[ft]				
The slip surface after optimization.							

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	848.5
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 26425.6 lbf/ft
Sum of passive forces : F_p = 39072.7 lbf/ft

Sliding moment : M_a = 1109347.4 lbfft/ft
Resisting moment : M_p = 1640273.4 lbfft/ft
Factor of safety = 1.48 > 1.30
Slope stability ACCEPTABLE

WALL #2

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : Wall #2
Description : MSE
Author : GEOS
Date : 4/9/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Top block 24 straight	18.00	24.00	108.00
2	Block 28 PC	18.00	28.00	120.00
3	Block 41 PC	18.00	40.50	120.00
4	Top block 28	18.00	28.00	120.00
5	Top block 41	18.00	40.50	120.00
6	Top block 24 straight garden	18.00	24.00	80.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Top block 24 straight	6061.00	11276.00	44.00
2	Block 28 PC	6061.00	11276.00	44.00
3	Block 41 PC	6061.00	11276.00	44.00
4	Top block 28	6061.00	11276.00	44.00
5	Top block 41	6061.00	11276.00	44.00
6	Top block 24 straight garden	6061.00	11276.00	44.00

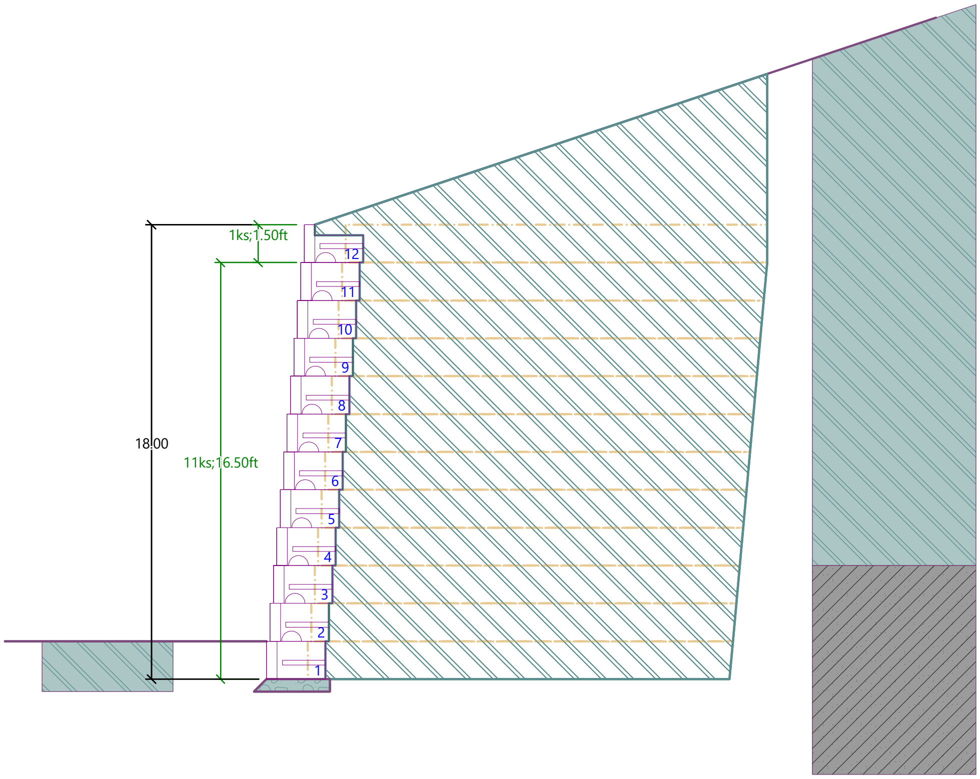
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
6	3.250

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	11	1.62
2	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
3	Miragrid 10XT	Miragrid 10XT	–·–·–·–·–·–·–	9500.00	4357.00	4287.39

3. Miragrid 10XT

Reinforcement details

Short-term char. strength T_{ult} = 9500.00 lbf/ft
Creep red. factor RF_{CR} = 1.58
Durability red. factor RF_D = 1.15
Installation damage red. factor RF_{ID} = 1.20
Long-term design strength R_t = 4357.00 lbf/ft
Coefficient of direct slip along reinforcement C_{ds} = 0.67
Coefficient of interaction of soil and geo-reinforcement C_i = 0.67
Scale correction factor α = 0.8
Long-term strength reduction factor CR_{cr} = 0.519
Calculation of long-term connection strength R_{con} = 4287.39 lbf/ft

Reinforcements

Input mode : 1 reinforcement type
Reinf. installation : in every row of blocks (50%)
Type of reinforcement : Miragrid 10XT
Top reinforcement : straight (25%)
Reinforcement geometry : identical length of reinforcements
Length of reinforcement l = 16.00 ft
Reinforced soil - Upper Sand

Reinforcements

No.	Consider	Name	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 10XT	16.00	
2	Yes	Miragrid 10XT	16.00	
3	Yes	Miragrid 10XT	16.00	
4	Yes	Miragrid 10XT	16.00	
5	Yes	Miragrid 10XT	16.00	
6	Yes	Miragrid 10XT	16.00	
7	Yes	Miragrid 10XT	16.00	
8	Yes	Miragrid 10XT	16.00	
9	Yes	Miragrid 10XT	16.00	
10	Yes	Miragrid 10XT	16.00	
11	Yes	Miragrid 10XT	16.00	
12	Yes	Miragrid 10XT	16.00	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	13.50	0.00 .. 13.50	Upper Sand	▨
2	-	13.50 .. ∞	Upper Lean Clay	▨

Terrain profile

Terrain behind construction has the slope 1: 3.00 (slope angle is 18.43 °).

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Sand
Soil thickness in front of structure h = 2.00 ft

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-358.3	-0.50	0.0	2.33	1.000
Weight - reinforced soil	0.0	-10.73	39491.2	11.52	1.000
Active pressure	13650.9	-7.72	6821.6	19.82	1.000
Weight - wall	0.0	-8.83	4944.2	1.89	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability
Resisting moment M_{res} = 599394.8 lbfft/ft
Overturning moment M_{ovr} = 105261.0 lbfft/ft

Safety factor = 5.69 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 25005.34 lbf/ft
Active horizontal force H_{act} = 13292.52 lbf/ft

Safety factor = 1.88 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-183736.3	8630.19	-16612.63	0.000	2876.7

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-183736.3	8630.19	-16612.63

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 2876.7 psf
Bearing capacity of foundation soil R_d = 9000.0 psf

Safety factor = 3.13 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-8.83	4922.6	-0.44	1.000
FF resistance	-357.9	-0.50	0.0	-2.33	1.000
Active pressure	13578.7	-7.52	6403.2	9.43	1.000
Weight - reinforced soil	0.0	-10.38	36778.1	8.68	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 43181.32 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.92
Resistance along geo-reinforcement = 17639.45 lbf/ft
Wall resistance = 4130.53 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 22127.85 lbf/ft
Active horiz. force H_{act} = 13578.72 lbf/ft

Factor of safety = 1.63 > 1.50

Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 10XT	-576.37	18.00	1089.25	79.37	5455.84	15.85	1071.85	80.66
2	Miragrid 10XT	-1057.17	16.50	2178.50	72.79	9674.15	16.39	2143.70	73.97
3	Miragrid 10XT	-947.00	15.00	2178.50	65.21	8510.57	16.69	2143.70	66.26
4	Miragrid 10XT	-875.03	13.50	2178.50	60.25	7420.96	17.69	2143.70	61.23
5	Miragrid 10XT	-803.07	12.00	2178.50	55.29	6405.33	18.81	2143.70	56.19
6	Miragrid 10XT	-731.10	10.50	2178.50	50.34	5463.65	20.07	2143.70	51.16
7	Miragrid 10XT	-659.13	9.00	2178.50	45.38	4595.95	21.51	2143.70	46.12
8	Miragrid 10XT	-587.17	7.50	2178.50	40.43	3802.21	23.16	2143.70	41.09
9	Miragrid 10XT	-515.20	6.00	2178.50	35.47	3082.44	25.07	2143.70	36.05
10	Miragrid 10XT	-443.23	4.50	2178.50	30.52	2436.64	27.29	2143.70	31.01
11	Miragrid 10XT	-371.27	3.00	2178.50	25.56	1864.81	29.86	2143.70	25.98
12	Miragrid 10XT	-421.96	1.50	2178.50	29.05	1366.94	46.30	2143.70	29.53

Check for tensile strength (reinforcement No.1)

Tension strength R_t = 1089.25 lbf/ft
Force in reinforcement F_x = 576.37 lbf/ft

Safety factor = 1.89 > 1.50

Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.12)

Pull out resistance T_p = 1366.94 lbf/ft
Force in reinforcement F_x = 421.96 lbf/ft

Safety factor = 3.24 > 1.50

Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)

Connection strength R_{con} = 1071.85 lbf/ft
Force in reinforcement F_x = 576.37 lbf/ft

Safety factor = 1.86 > 1.50

Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

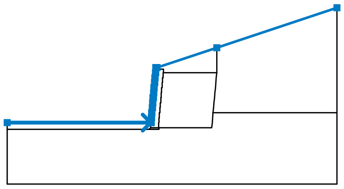
(input for current task)

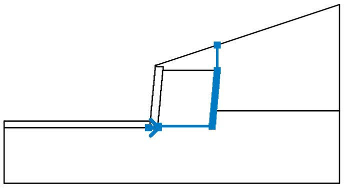
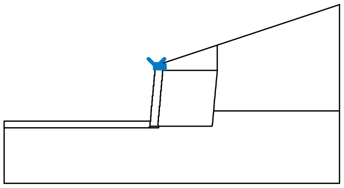
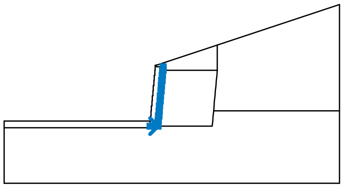
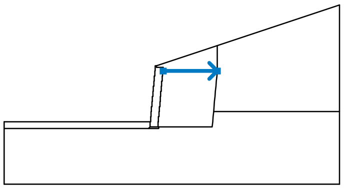
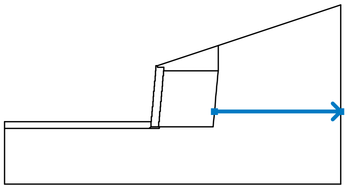
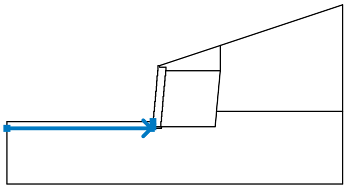
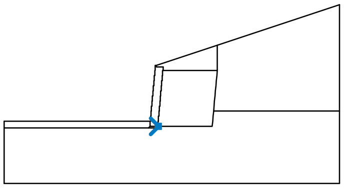
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-45.00	-16.50	-1.91	-16.50	-1.77	-16.50
		-1.77	-15.00	-1.64	-15.00	-1.64	-13.50
		-1.50	-13.50	-1.50	-12.00	-1.36	-12.00
		-1.36	-10.50	-1.23	-10.50	-1.23	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.96	-7.50
		-0.96	-6.00	-0.82	-6.00	-0.82	-4.50
		-0.69	-4.50	-0.69	-3.00	-0.55	-3.00
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	17.92	5.97	54.00	17.99

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
2		-2.41	-18.50	0.59	-18.50	0.59	-18.00
		16.43	-18.00	16.56	-16.50	16.70	-15.00
		16.83	-13.50	16.97	-12.00	17.10	-10.50
		17.24	-9.00	17.38	-7.50	17.51	-6.00
		17.65	-4.50	17.78	-3.00	17.92	-1.50
		17.92	5.97				
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.91	-18.00	0.43	-18.00	0.43	-16.50
		0.56	-16.50	0.56	-15.00	0.70	-15.00
		0.70	-13.50	0.83	-13.50	0.83	-12.00
		0.97	-12.00	0.97	-10.50	1.10	-10.50
		1.10	-9.00	1.24	-9.00	1.24	-7.50
		1.38	-7.50	1.38	-6.00	1.51	-6.00
		1.51	-4.50	1.65	-4.50	1.65	-3.00
		1.78	-3.00	1.78	-1.50	1.92	-1.50
		1.92	-0.42				
5		1.92	-1.50	17.92	-1.50		
6		16.83	-13.50	54.00	-13.50		
7		-45.00	-18.50	-2.41	-18.50	-1.91	-18.00
		-1.91	-16.50				
8		0.43	-18.00	0.59	-18.00		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

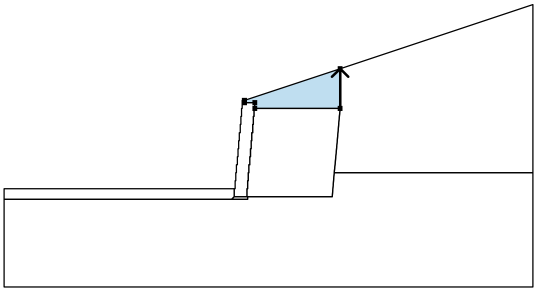
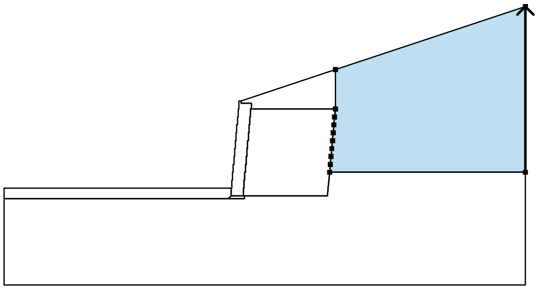
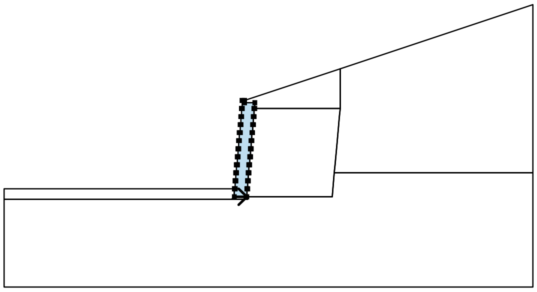
Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

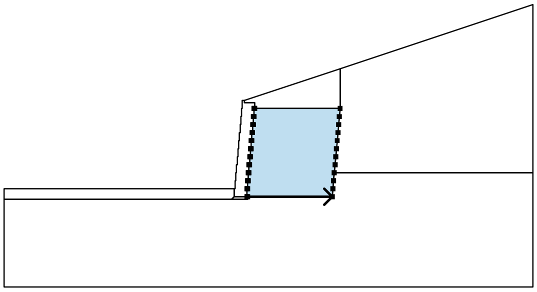
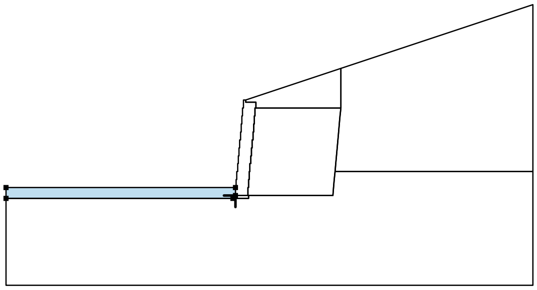
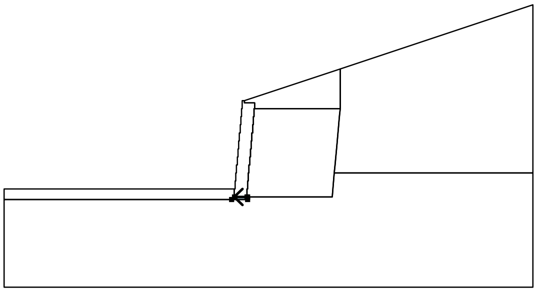
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

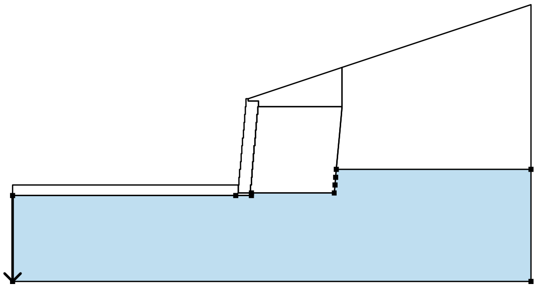
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		17.92	-1.50	17.92	5.97	Upper Sand
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		54.00	-13.50	54.00	17.99	Upper Sand
		17.92	5.97	17.92	-1.50	▨
		17.78	-3.00	17.65	-4.50	
		17.51	-6.00	17.38	-7.50	
		17.24	-9.00	17.10	-10.50	
		16.97	-12.00	16.83	-13.50	
3		-1.91	-18.00	0.43	-18.00	Material of structure
		0.43	-16.50	0.56	-16.50	▦
		0.56	-15.00	0.70	-15.00	
		0.70	-13.50	0.83	-13.50	
		0.83	-12.00	0.97	-12.00	
		0.97	-10.50	1.10	-10.50	
		1.10	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.96	-6.00	
		-0.96	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.23	-9.00	
		-1.23	-10.50	-1.36	-10.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
		-1.36	-12.00	-1.50	-12.00	
		-1.50	-13.50	-1.64	-13.50	
		-1.64	-15.00	-1.77	-15.00	
		-1.77	-16.50	-1.91	-16.50	
4		0.59	-18.00	16.43	-18.00	Upper Sand
		16.56	-16.50	16.70	-15.00	▨
		16.83	-13.50	16.97	-12.00	
		17.10	-10.50	17.24	-9.00	
		17.38	-7.50	17.51	-6.00	
		17.65	-4.50	17.78	-3.00	
		17.92	-1.50	1.92	-1.50	
		1.78	-1.50	1.78	-3.00	
		1.65	-3.00	1.65	-4.50	
		1.51	-4.50	1.51	-6.00	
		1.38	-6.00	1.38	-7.50	
		1.24	-7.50	1.24	-9.00	
		1.10	-9.00	1.10	-10.50	
		0.97	-10.50	0.97	-12.00	
		0.83	-12.00	0.83	-13.50	
		0.70	-13.50	0.70	-15.00	
		0.56	-15.00	0.56	-16.50	
		0.43	-16.50	0.43	-18.00	
5		-2.41	-18.50	-1.91	-18.00	Upper Sand
		-1.91	-16.50	-45.00	-16.50	▨
		-45.00	-18.50			
6		0.43	-18.00	-1.91	-18.00	#57 Stone
		-2.41	-18.50	0.59	-18.50	▨
		0.59	-18.00			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
7		-45.00	-18.50	-45.00	-34.90	Upper Lean Clay ▨
		54.00	-34.90	54.00	-13.50	
		16.83	-13.50	16.70	-15.00	
		16.56	-16.50	16.43	-18.00	
		0.59	-18.00	0.59	-18.50	
		-2.41	-18.50			

Reinforcements

No.	Point to the left x [ft]	Point to the left z [ft]	Point to the right x [ft]	Point to the right z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	0.43	-18.00	16.43	-18.00	16.00	1089.2	C = 0.67	Fixed
2	0.56	-16.50	16.56	-16.50	16.00	2178.5	C = 0.67	Fixed
3	0.70	-15.00	16.70	-15.00	16.00	2178.5	C = 0.67	Fixed
4	0.83	-13.50	16.83	-13.50	16.00	2178.5	C = 0.67	Fixed
5	0.97	-12.00	16.97	-12.00	16.00	2178.5	C = 0.67	Fixed
6	1.10	-10.50	17.10	-10.50	16.00	2178.5	C = 0.67	Fixed
7	1.24	-9.00	17.24	-9.00	16.00	2178.5	C = 0.67	Fixed
8	1.38	-7.50	17.38	-7.50	16.00	2178.5	C = 0.67	Fixed
9	1.51	-6.00	17.51	-6.00	16.00	2178.5	C = 0.67	Fixed
10	1.65	-4.50	17.65	-4.50	16.00	2178.5	C = 0.67	Fixed
11	1.78	-3.00	17.78	-3.00	16.00	2178.5	C = 0.67	Fixed
12	1.92	-1.50	17.92	-1.50	16.00	2178.5	C = 0.67	Fixed

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters								
Center :	x =	-2.73	[ft]	Angles :	α_1 =	-21.42	[°]
	z =	32.81	[ft]		α_2 =	71.27	[°]
Radius :	R =	52.97	[ft]				
The slip surface after optimization.							

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	1089.2
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0

Slope stability verification (Bishop)

Sum of active forces :	F_a =	41335.3	lbf/ft
Sum of passive forces :	F_p =	55339.9	lbf/ft
Sliding moment :	M_a =	2189531.6	lbfft/ft
Resisting moment :	M_p =	2931354.7	lbfft/ft

Factor of safety = 1.34 > 1.30

Slope stability ACCEPTABLE

WALL #3

MAX. WALL HEIGHT = 9.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H9
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

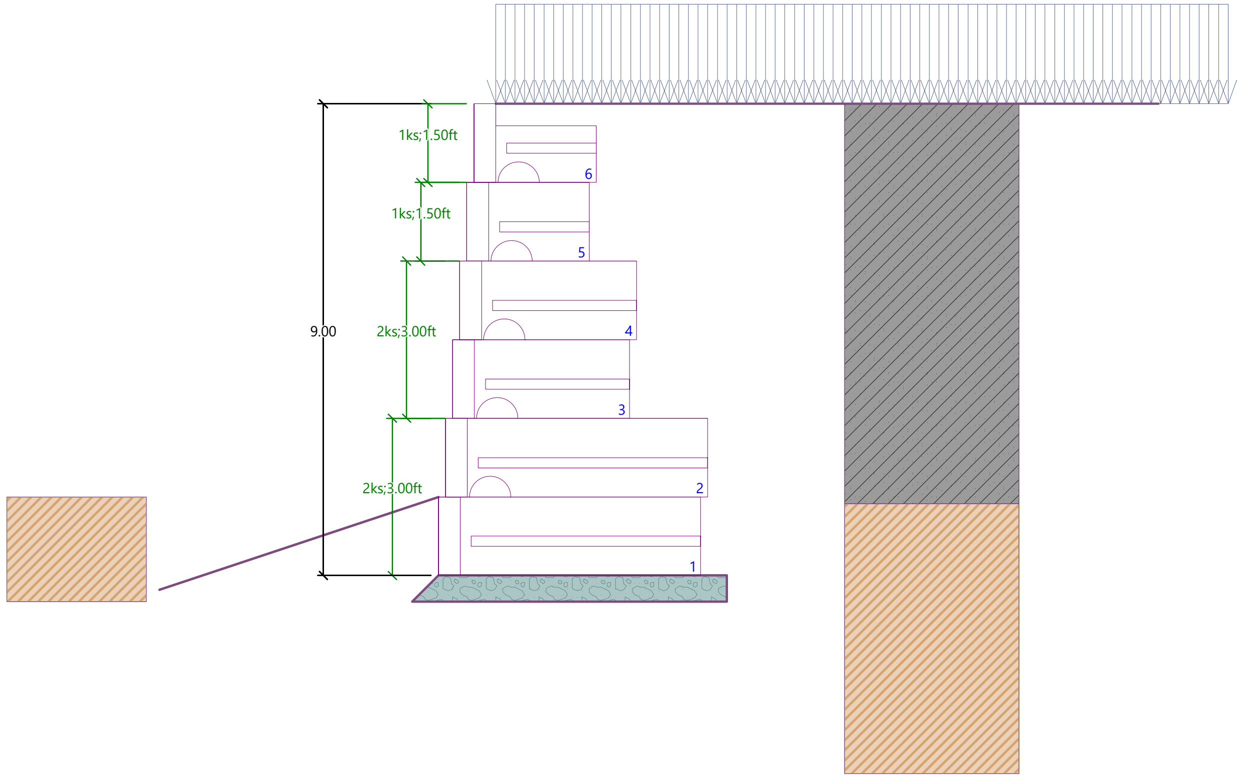
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	2	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Fat Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	4228.1	2.77	1.000
FF resistance	-1104.2	-0.85	-368.0	0.33	1.000
Weight - earth wedge	0.0	-0.75	23.3	5.68	1.000
Weight - earth wedge	0.0	-4.21	191.7	4.67	1.000
Weight - earth wedge	0.0	-6.91	66.6	3.71	1.000
Weight - earth wedge	0.0	-9.29	89.1	2.49	1.000
Active pressure	1350.5	-2.88	1368.3	5.21	1.000
Traffic/Construction Surcharge	798.9	-4.37	841.2	4.66	1.000
Traffic/Construction Surcharge	0.0	-9.50	411.5	2.42	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 25109.9 lbfft/ft
Overturning moment M_{ovr} = 6439.5 lbfft/ft

Safety factor = 3.90 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3886.86 lbf/ft
Active horizontal force H_{act} = 1045.10 lbf/ft

Safety factor = 3.72 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.56	3913.1	2.25	1.000
FF resistance	-429.5	-0.45	-143.1	0.00	1.000
Weight - earth wedge	0.0	-3.71	191.7	4.17	1.000
Weight - earth wedge	0.0	-6.41	66.6	3.21	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - earth wedge	0.0	-8.79	89.1	1.99	1.000
Active pressure	1117.3	-2.87	942.8	4.43	1.000
Traffic/Construction Surcharge	744.0	-4.16	727.3	3.98	1.000
Traffic/Construction Surcharge	0.0	-9.00	411.5	1.92	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 17843.7 lbfft/ft

Overturning moment M_{ovr} = 6112.9 lbfft/ft

Safety factor = 2.92 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 5201.54 lbf/ft

Active horizontal force H_{act} = 1431.68 lbf/ft

Safety factor = 3.63 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	1885.3	6851.89	1045.10	0.046	1257.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	1885.3	6851.89	1045.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.046

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1257.3 psf

Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 4.77 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

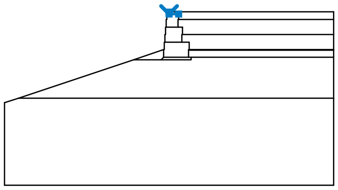
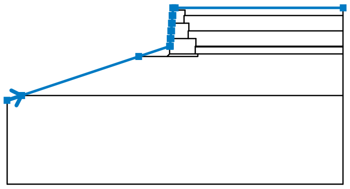
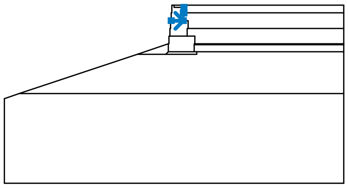
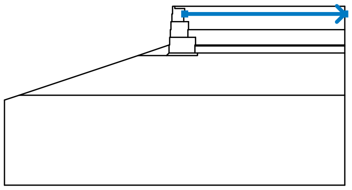
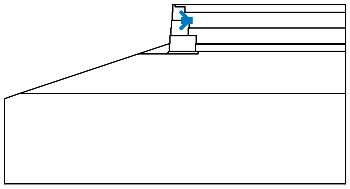
(input for current task)

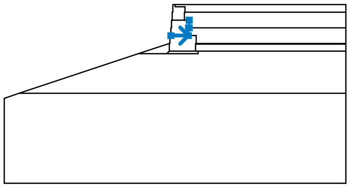
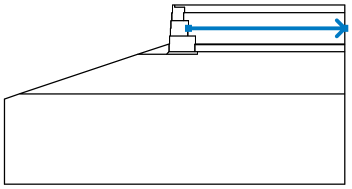
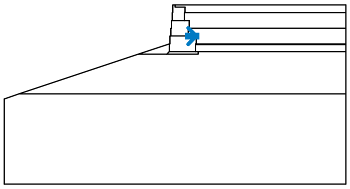
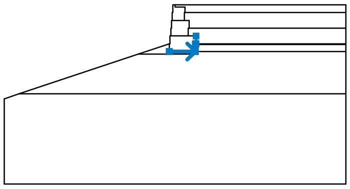
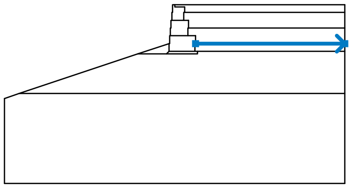
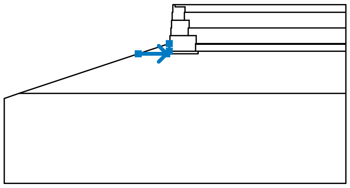
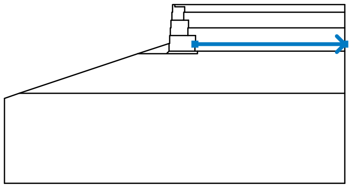
Stability analysis

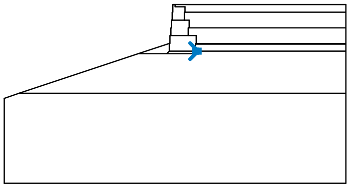
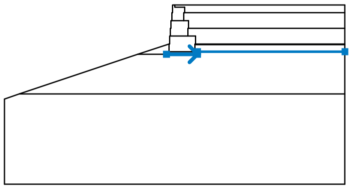
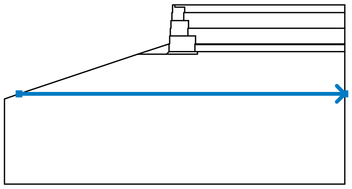
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-18.07	-29.98	-17.13	-7.09	-9.50
		-1.09	-7.50	-0.96	-7.50	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-1.09	-9.00	3.91	-9.00	3.91	-7.63
		3.91	-7.50	4.04	-7.50	4.04	-6.00
10		4.04	-7.50	32.80	-7.50		
11		-7.09	-9.50	-1.59	-9.50	-1.09	-9.00
		-1.09	-7.50				
12		3.91	-7.63	32.80	-7.63		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		3.91	-9.00	4.41	-9.00		
14		-1.59	-9.50	4.41	-9.50	4.41	-9.00
		32.80	-9.00				
15		-29.98	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φef [°]	cef [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γsat [pcf]	γs [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

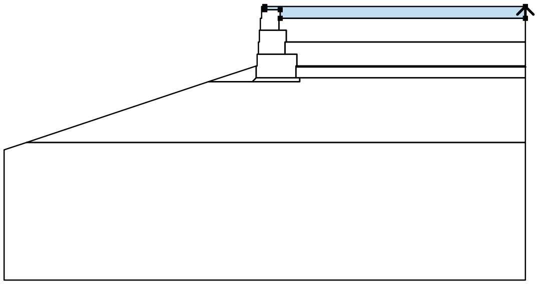
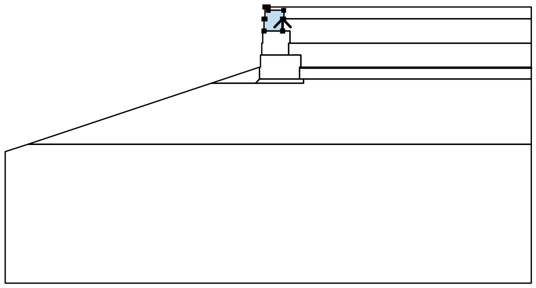
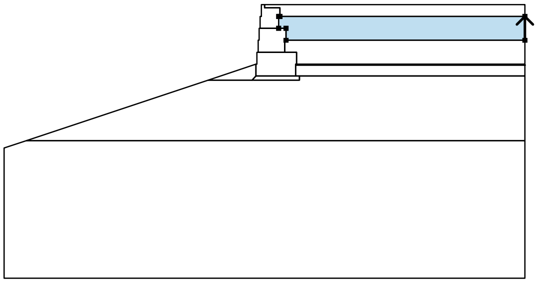
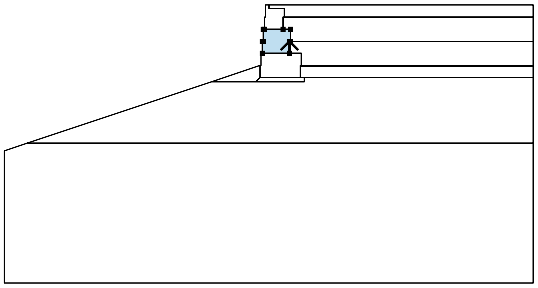
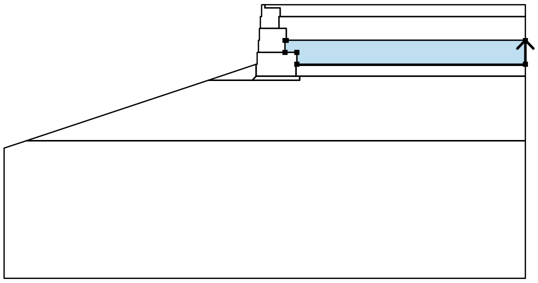
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

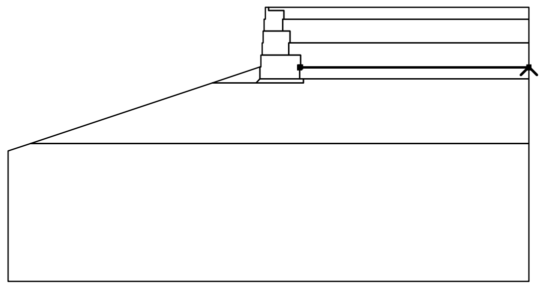
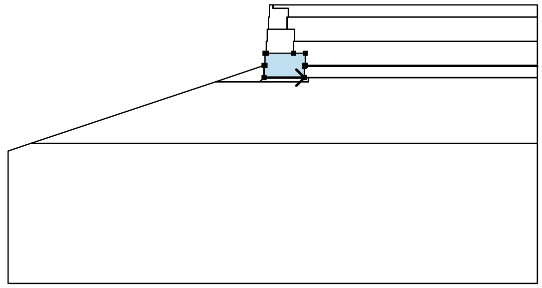
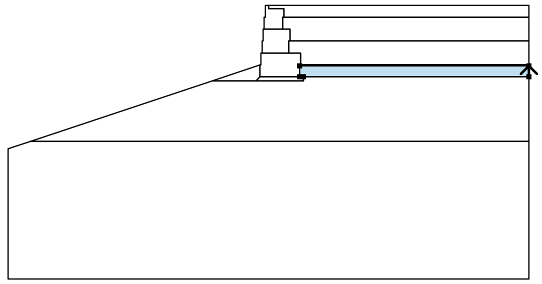
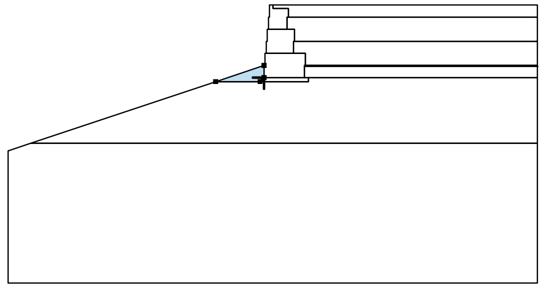
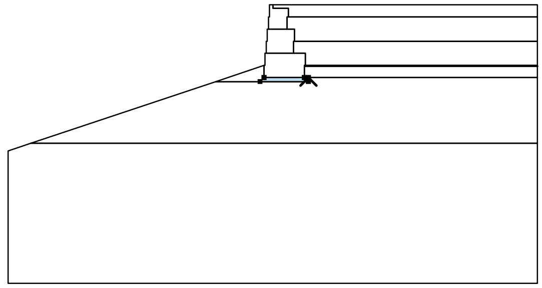
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

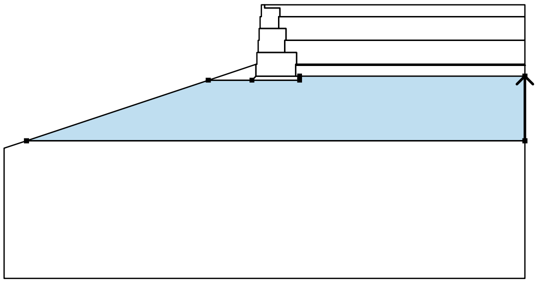
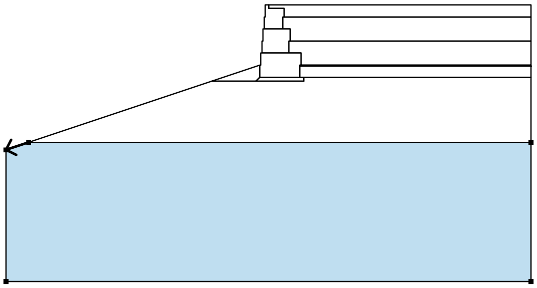
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.04	-7.50	3.91	-7.50	▨
		3.91	-7.63			
7		-1.09	-9.00	3.91	-9.00	Material of structure
		3.91	-7.63	3.91	-7.50	▦
		4.04	-7.50	4.04	-6.00	
		2.55	-6.00	-0.82	-6.00	
		-0.96	-6.00	-0.96	-7.50	
		-1.09	-7.50			
8		32.80	-9.00	32.80	-7.63	Upper Fat Clay
		3.91	-7.63	3.91	-9.00	▨
		4.41	-9.00			
9		-1.59	-9.50	-1.09	-9.00	Upper Fat Clay
		-1.09	-7.50	-7.09	-9.50	▨
10		4.41	-9.50	4.41	-9.00	#57 Stone
		3.91	-9.00	-1.09	-9.00	▩
		-1.59	-9.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		32.80	-17.13	32.80	-9.00	Upper Fat Clay
		4.41	-9.00	4.41	-9.50	▨
		-1.59	-9.50	-7.09	-9.50	
		-29.98	-17.13			
12		-29.98	-17.13	-32.80	-18.07	Upper Sand
		-32.80	-34.47	32.80	-34.47	▨
		32.80	-17.13			

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters								
Center :	x =	-21.44	[ft]	Angles :	α_1 =	-12.94	[°]
	z =	21.42	[ft]		α_2 =	57.32	[°]
Radius :	R =	39.67	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 12614.0 lbf/ft
Sum of passive forces : F_p = 17332.9 lbf/ft

Sliding moment : M_a = 500395.9 lbfft/ft
Resisting moment : M_p = 687595.3 lbfft/ft
Factor of safety = 1.37 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

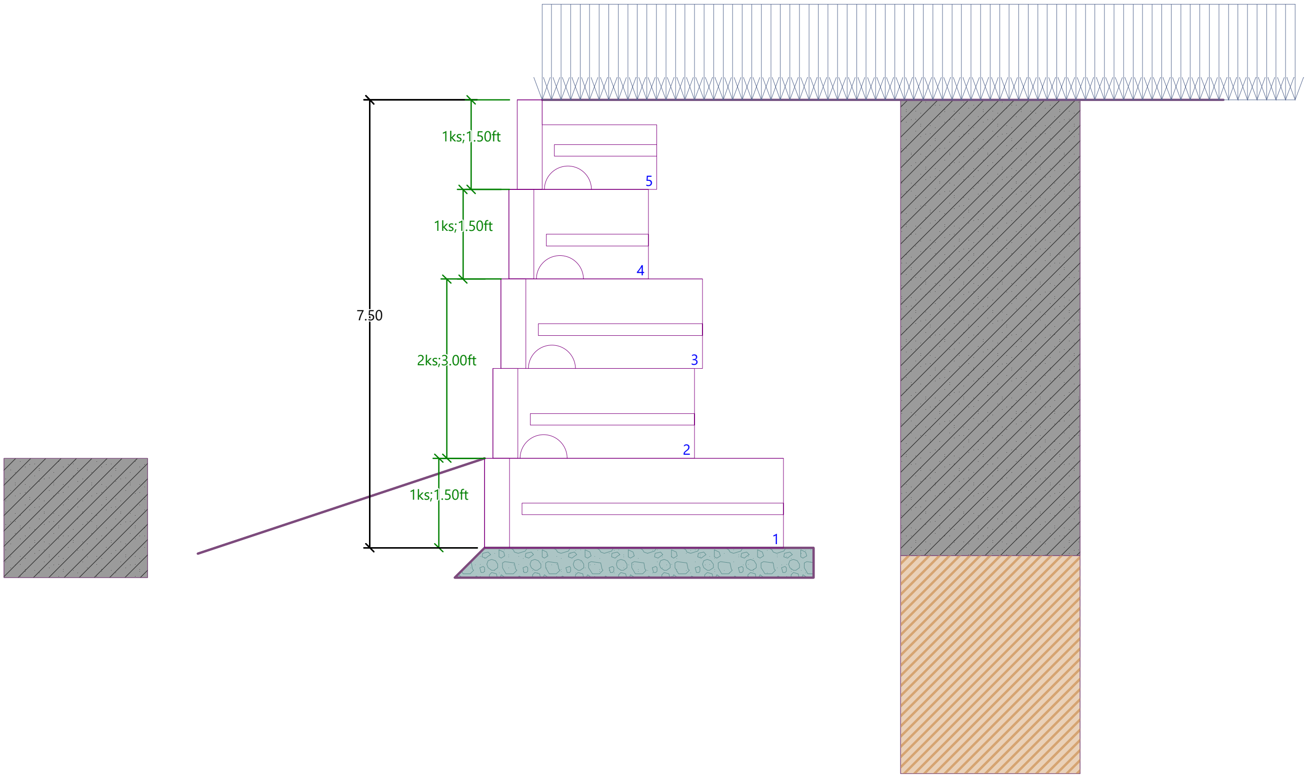
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | **Stage - analysis : 1 - 0**



Base

Geometry
Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material
Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability
Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

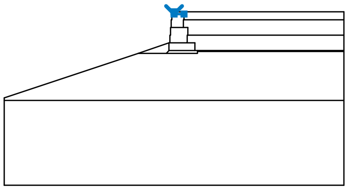
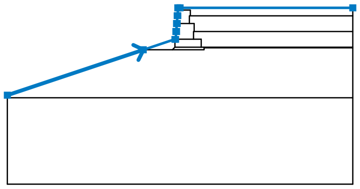
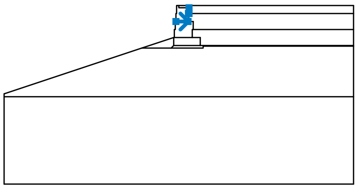
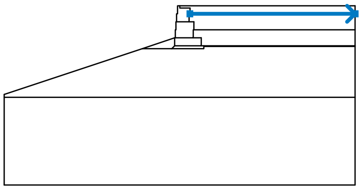
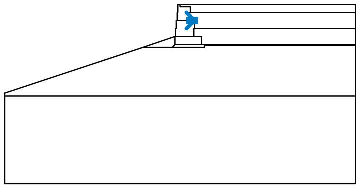
(input for current task)

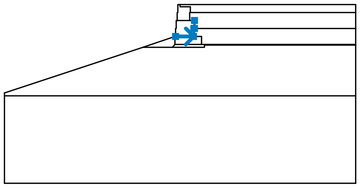
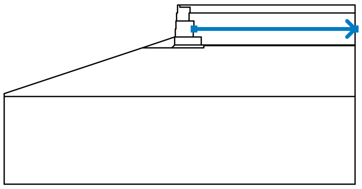
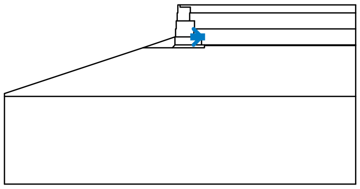
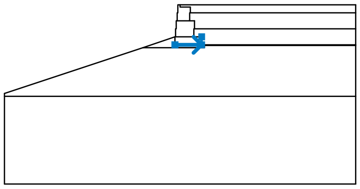
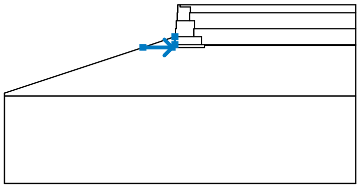
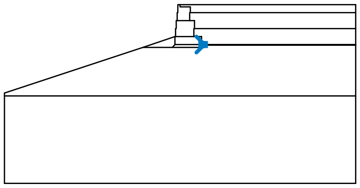
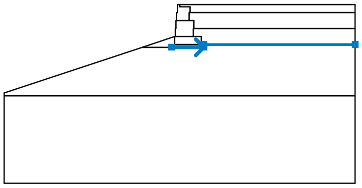
Stability analysis

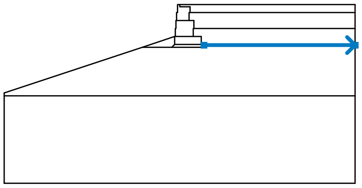
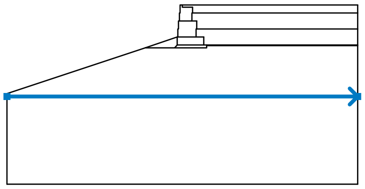
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

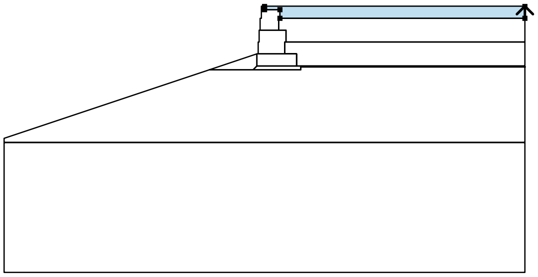
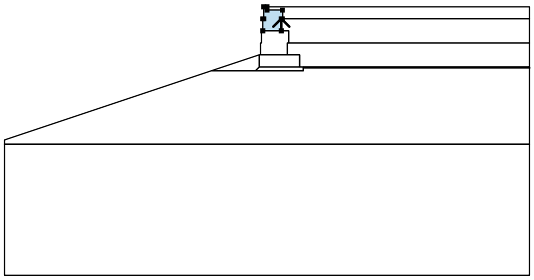
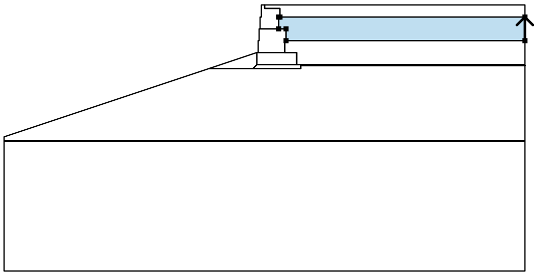
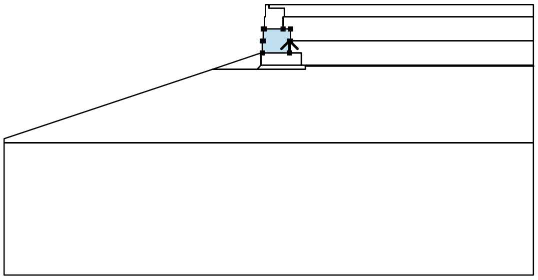
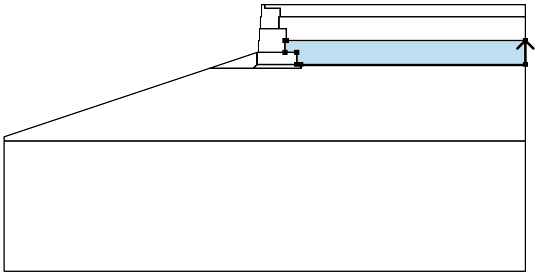
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

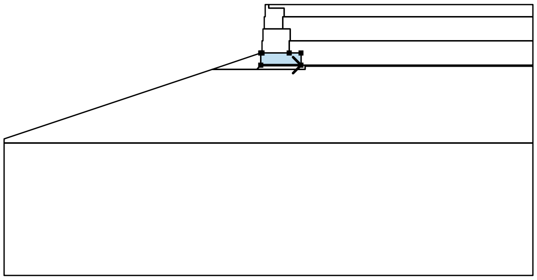
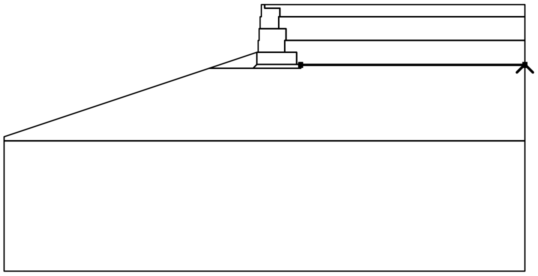
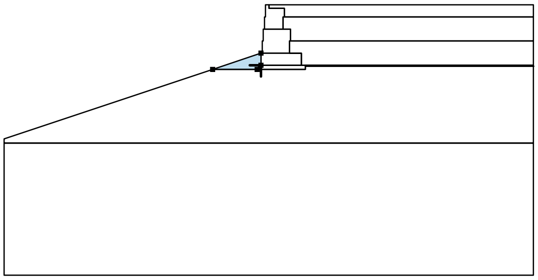
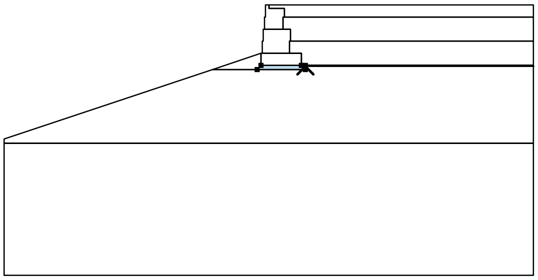
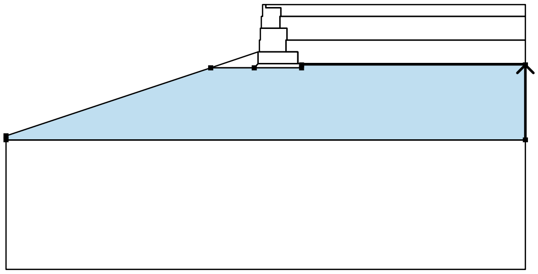
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

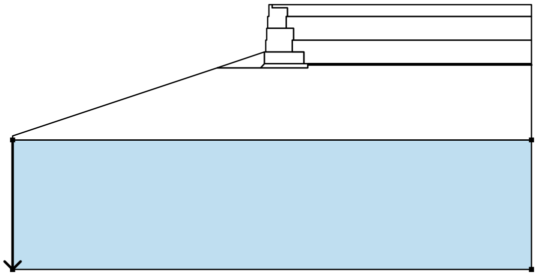
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	▦
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	▦
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure
		4.04	-6.00	2.55	-6.00	▦
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.54	-7.50	4.54	-7.63	▨
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay
		-0.96	-6.00	-6.96	-8.00	▨
9		4.54	-8.00	4.54	-7.63	#57 Stone
		4.54	-7.50	4.04	-7.50	▩
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		4.54	-7.63	4.54	-8.00	▨
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
11		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters								
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

Setbacks

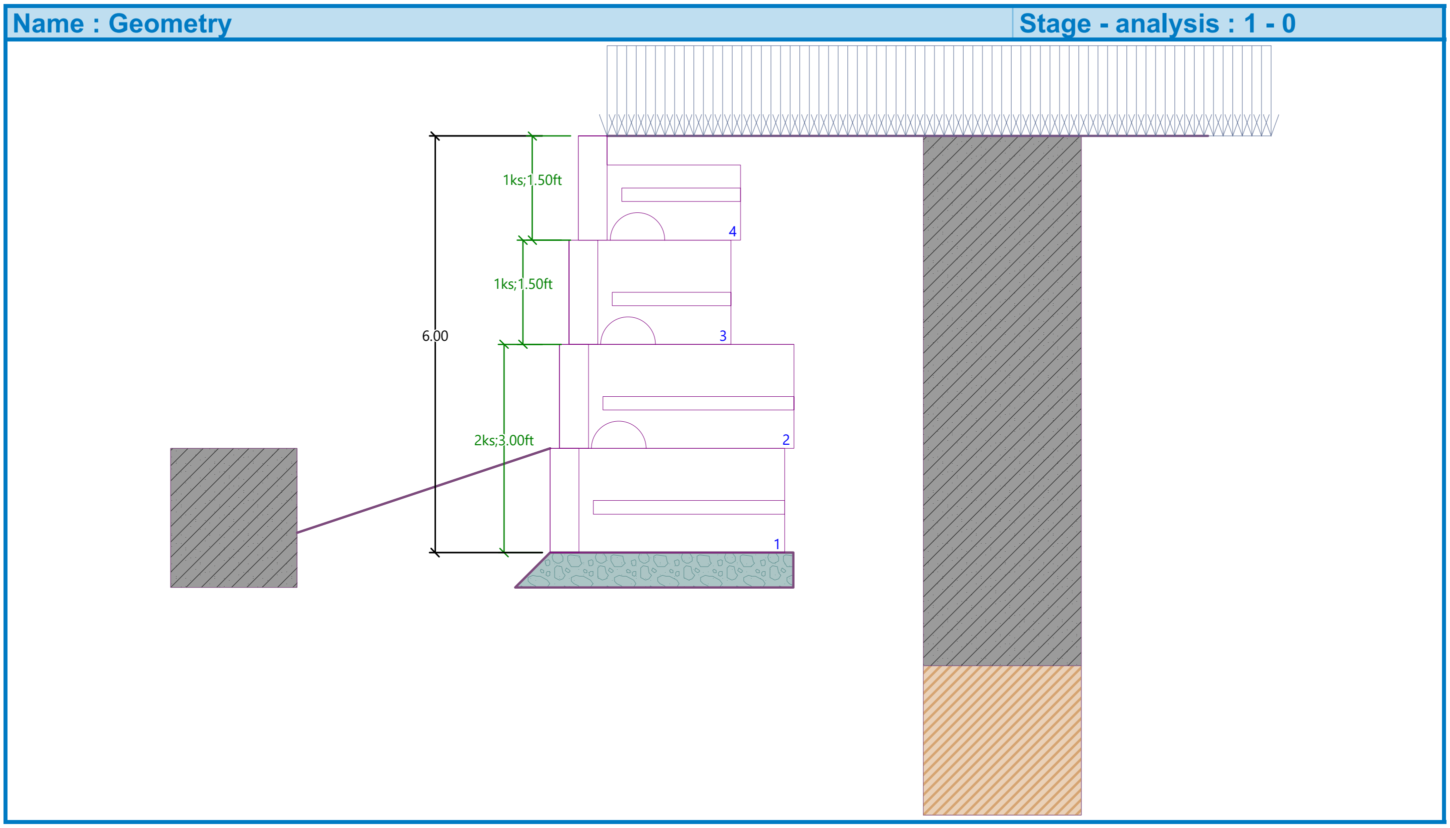
No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry

Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability
Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

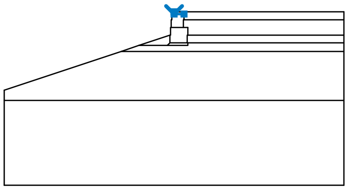
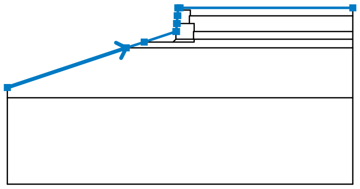
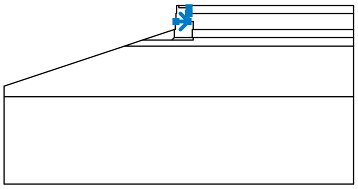
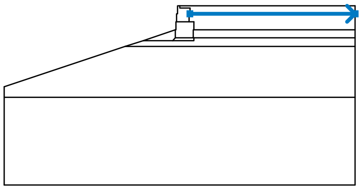
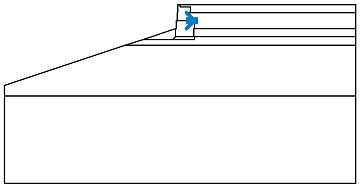
(input for current task)

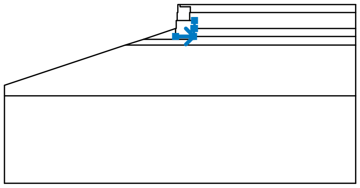
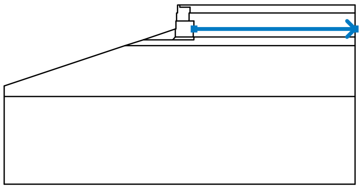
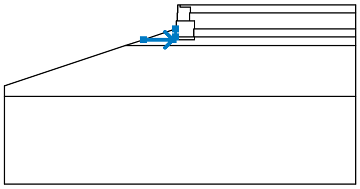
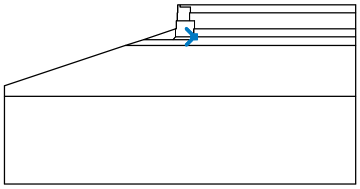
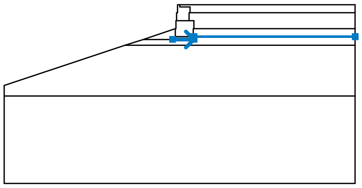
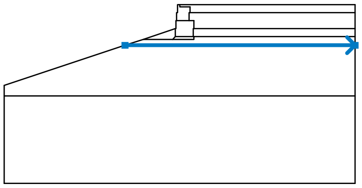
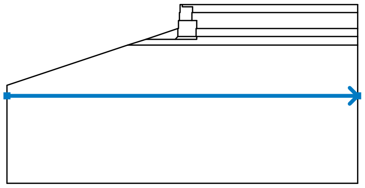
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		-6.82	-6.50	-1.32	-6.50	-0.82	-6.00
		-0.82	-4.50				
9		2.55	-6.00	2.68	-6.00		
10		-1.32	-6.50	2.68	-6.50	2.68	-6.00
		32.80	-6.00				
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

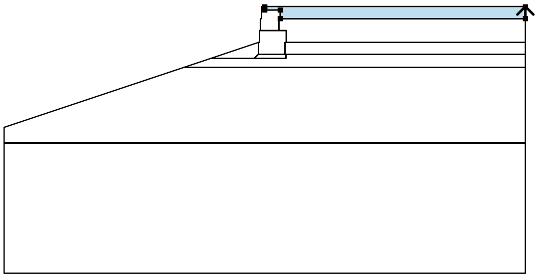
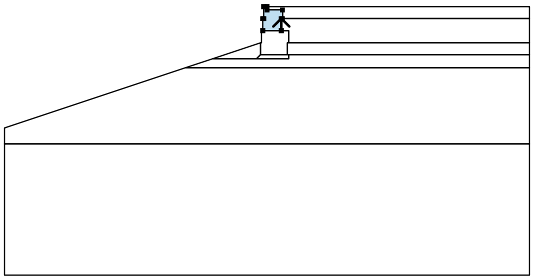
Upper Fat Clay

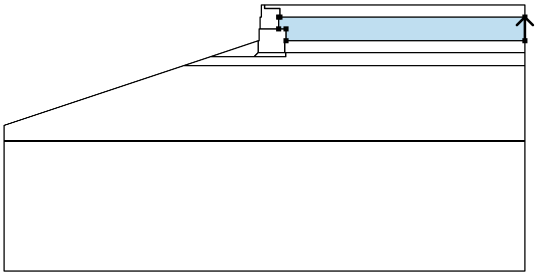
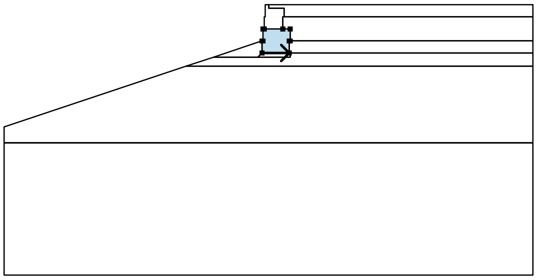
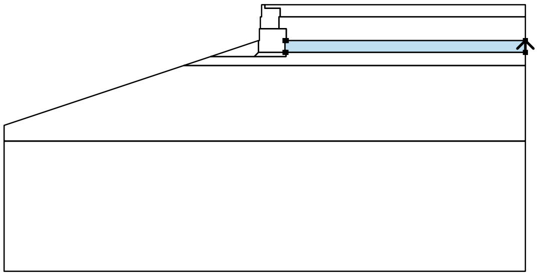
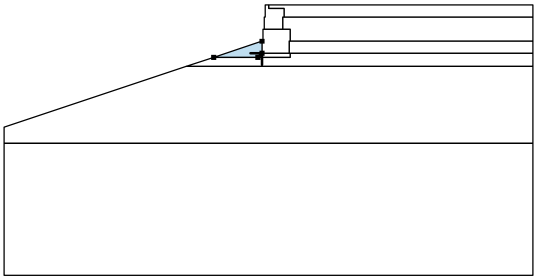
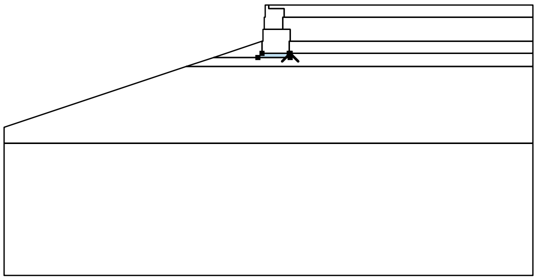
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

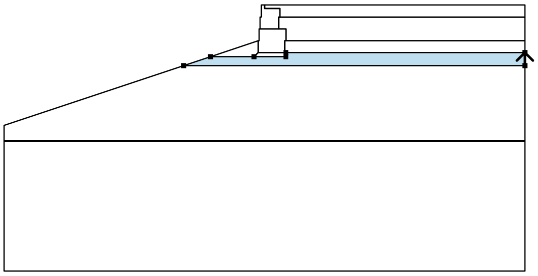
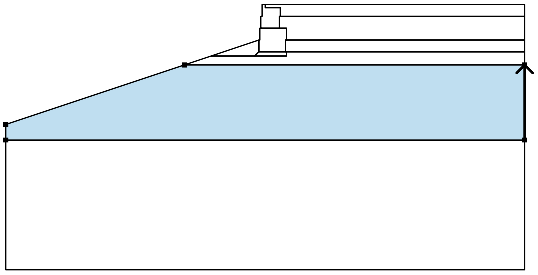
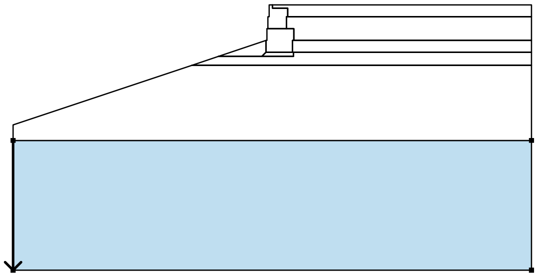
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure 🟥
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		-0.82	-6.00	2.55	-6.00	Material of structure 🟥
		2.55	-4.50	2.69	-4.50	
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
5		32.80	-6.00	32.80	-4.50	Upper Lean Clay ▨
		2.69	-4.50	2.55	-4.50	
		2.55	-6.00	2.68	-6.00	
6		-1.32	-6.50	-0.82	-6.00	Upper Lean Clay ▨
		-0.82	-4.50	-6.82	-6.50	
7		2.68	-6.50	2.68	-6.00	#57 Stone 🟦
		2.55	-6.00	-0.82	-6.00	
		-1.32	-6.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
8		32.80	-7.63	32.80	-6.00	Upper Lean Clay
		2.68	-6.00	2.68	-6.50	▨
		-1.32	-6.50	-6.82	-6.50	
		-10.21	-7.63			
9		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-10.21	-7.63	-32.80	-15.16	▨
		-32.80	-17.13			
10		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft
Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft
Resisting moment : M_p = 82044.5 lbfft/ft
Factor of safety = 1.56 > 1.30
Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

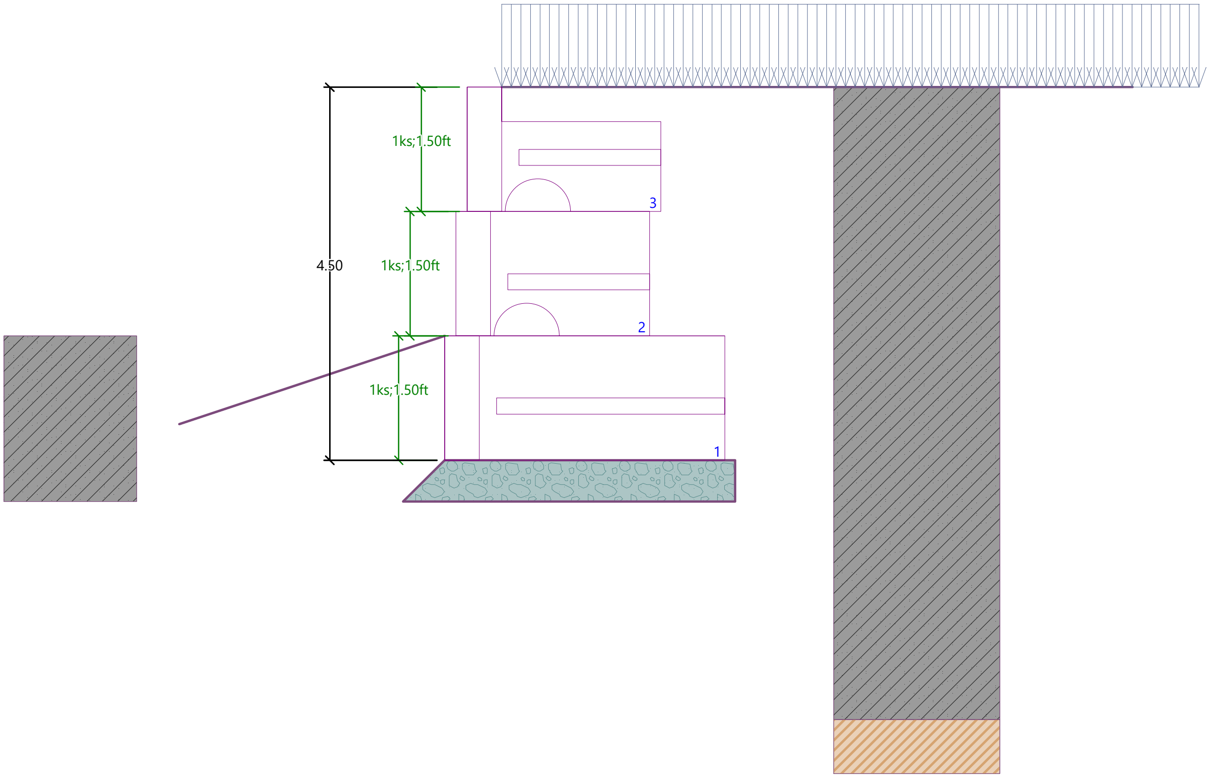
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [lbf/ft^2]	Mag.2 [lbf/ft^2]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
	new	change						
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

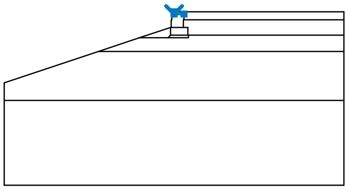
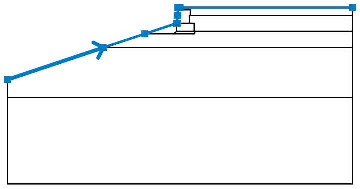
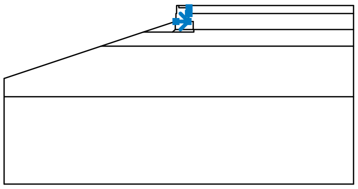
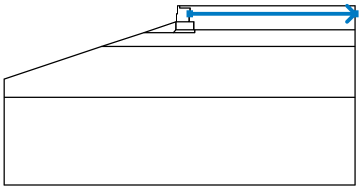
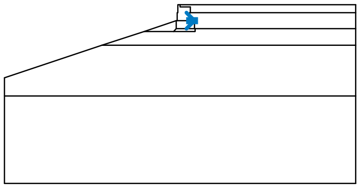
(input for current task)

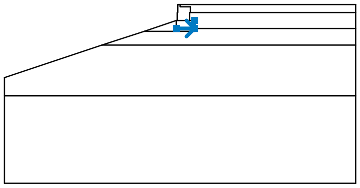
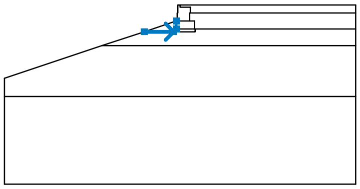
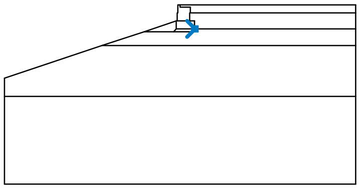
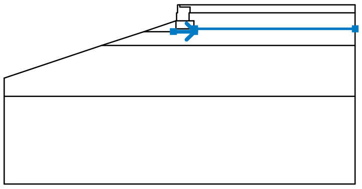
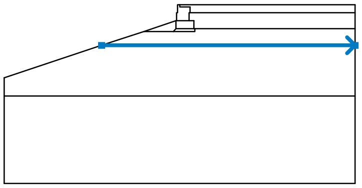
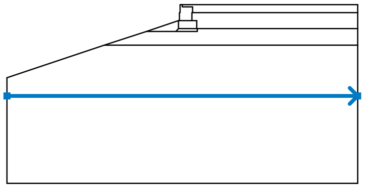
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

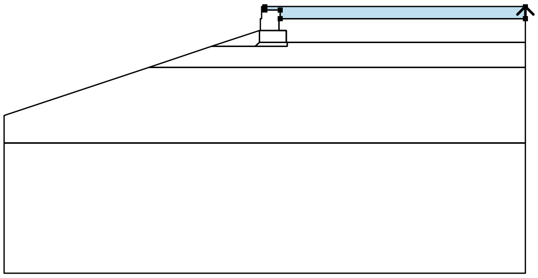
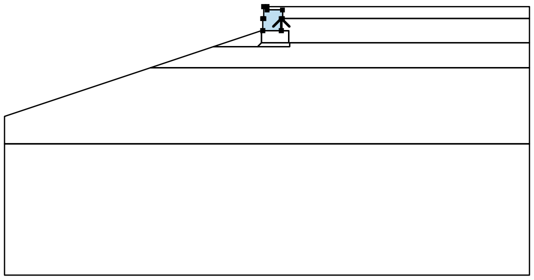
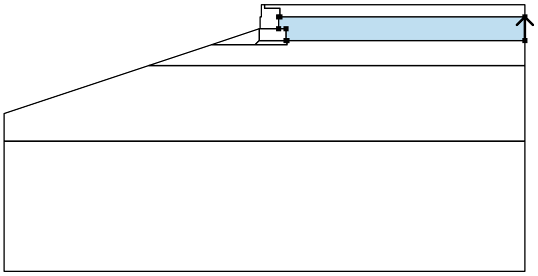
Upper Fat Clay

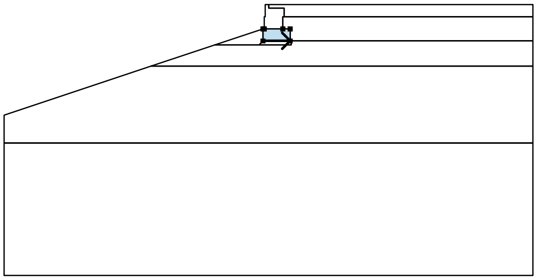
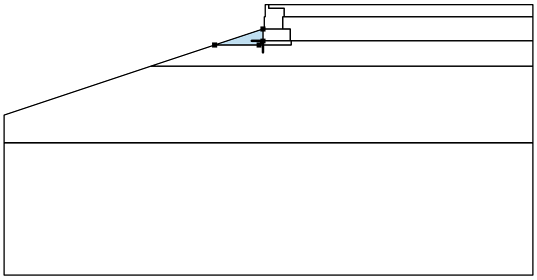
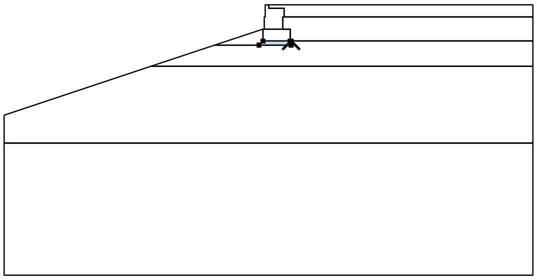
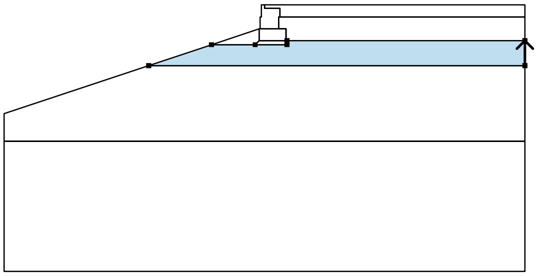
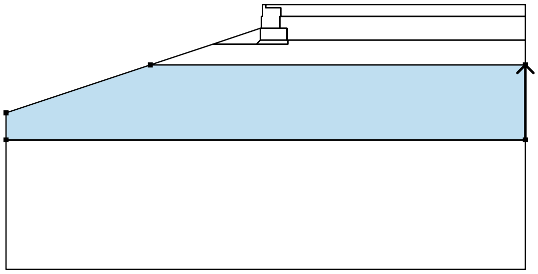
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

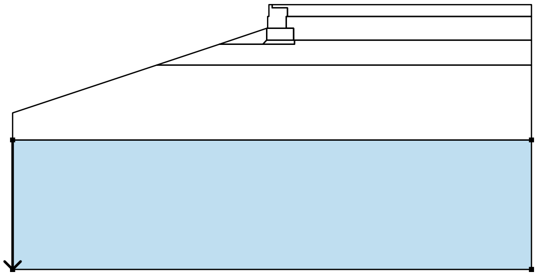
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69 2.69 -0.55	-4.50 -3.00 -3.00	2.69 1.78 -0.69	-4.50 -3.00 -3.00	Material of structure ▦
5		-1.19 -0.69	-5.00 -3.00	-0.69 -6.69	-4.50 -5.00	Upper Lean Clay ▨
6		2.81 2.69 -1.19	-5.00 -4.50 -5.00	2.81 -0.69	-4.50 -4.50	#57 Stone ▩
7		32.80 2.81 -1.19 -14.58	-7.63 -4.50 -5.00 -7.63	32.80 2.81 -6.69	-4.50 -5.00 -5.00	Upper Lean Clay ▨
8		32.80 -14.58 -32.80	-17.13 -7.63 -17.13	32.80 -32.80	-7.63 -13.70	Upper Fat Clay ▨

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
9		-32.80 32.80	-17.13 -33.53	-32.80 32.80	-33.53 -17.13	Upper Sand ▨

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q1, f, F, x	q2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

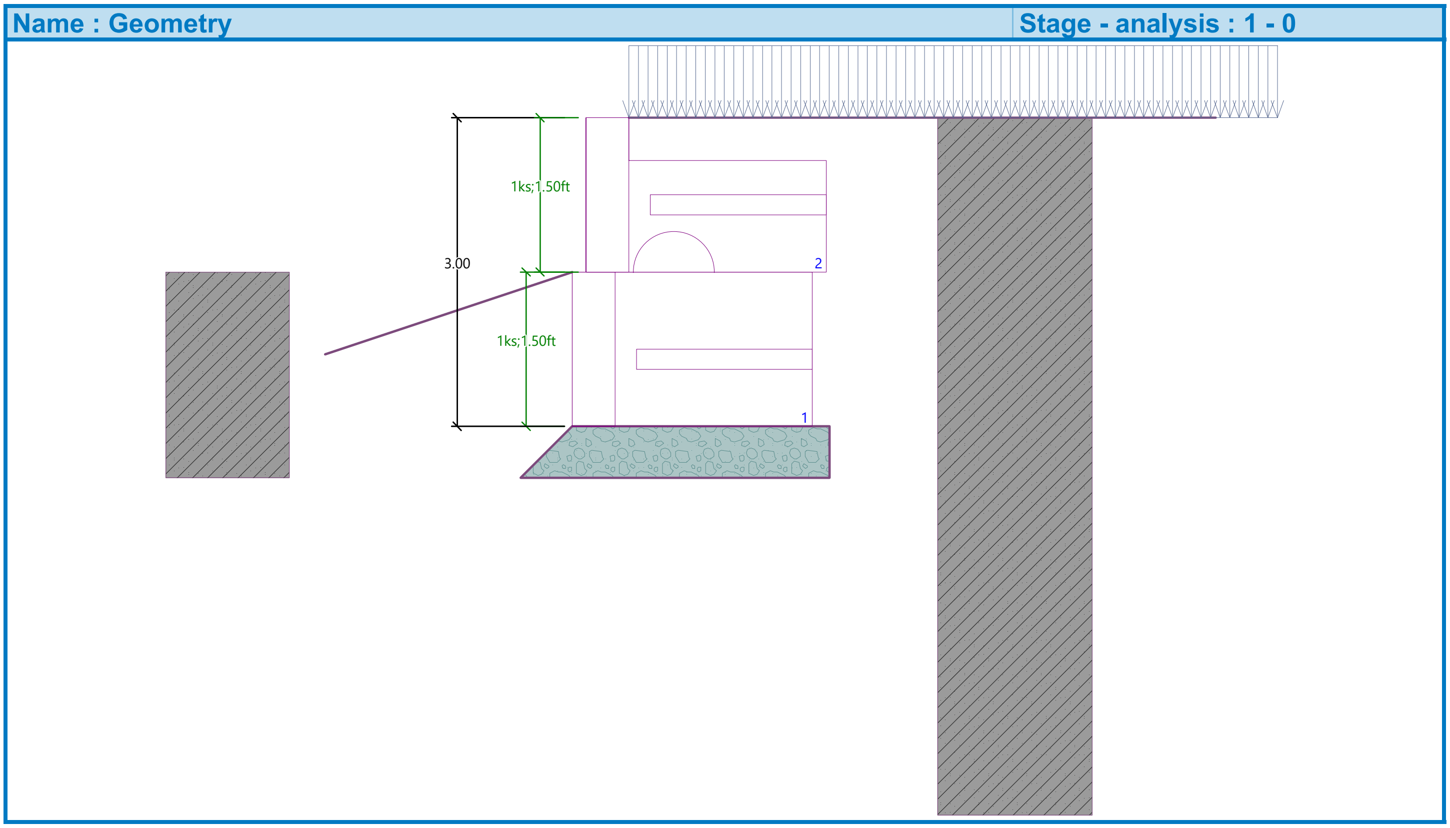
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft
Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft
Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

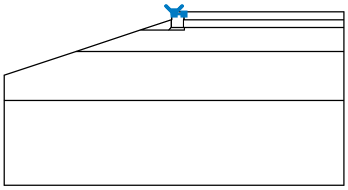
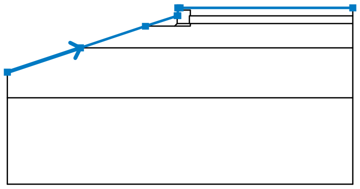
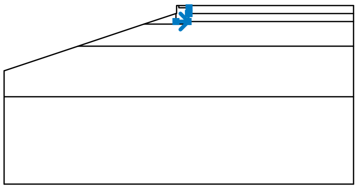
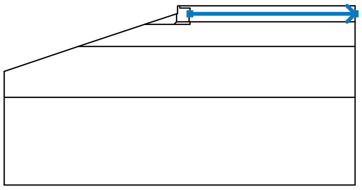
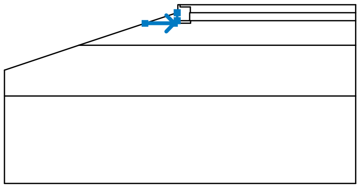
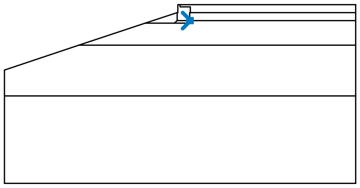
(input for current task)

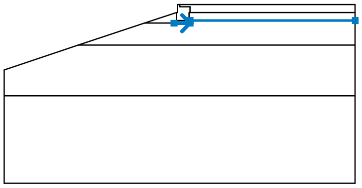
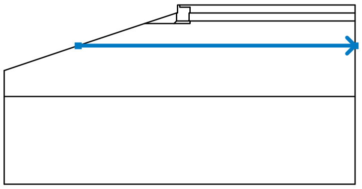
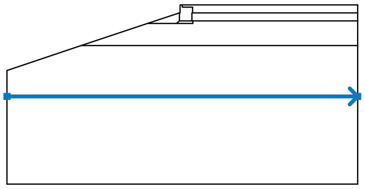
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_S =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft] x	z	x	z	x	z
7		-1.05 32.80	-3.50 -3.00	1.95	-3.50	1.95	-3.00
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

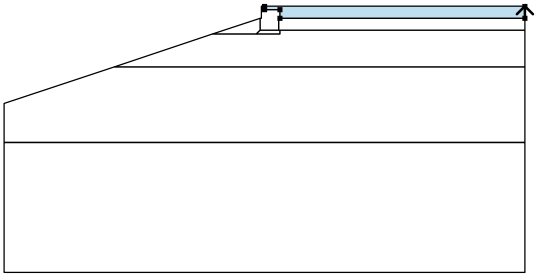
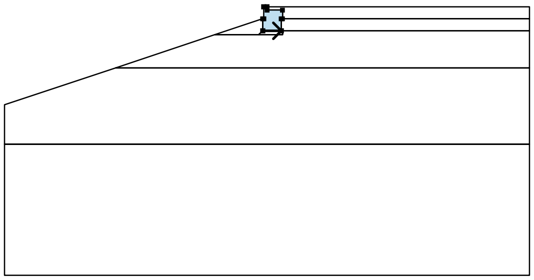
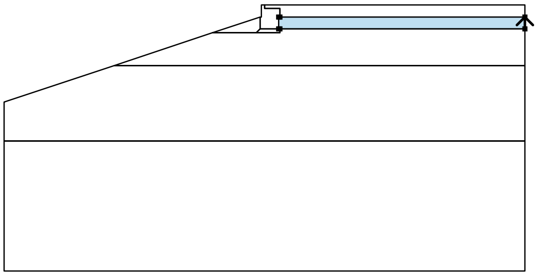
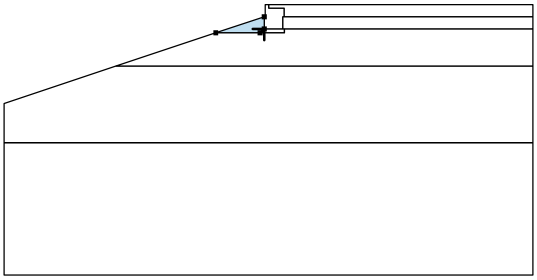
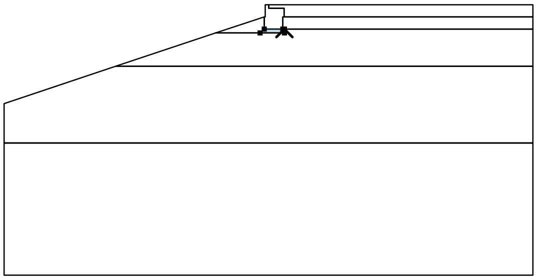
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

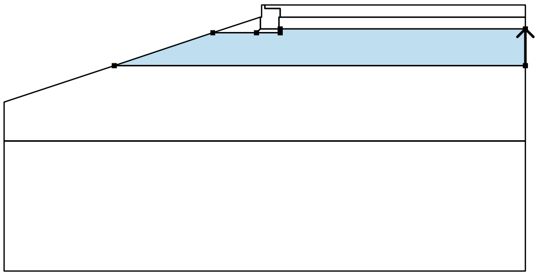
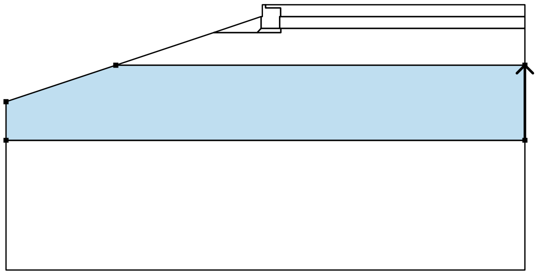
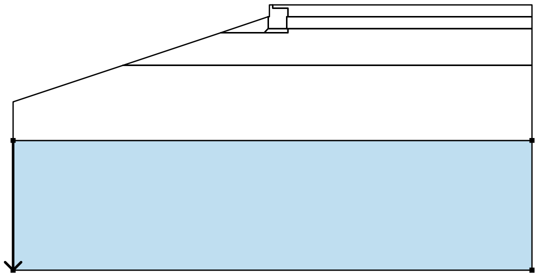
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure ▦
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay ▨
		-0.55	-1.50	-6.55	-3.50	
5		1.95	-3.50	1.95	-3.00	#57 Stone ▒
		1.78	-3.00	-0.55	-3.00	
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay
		1.95	-3.00	1.95	-3.50	▨
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-18.94	-7.63	-32.80	-12.25	▨
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft
Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft
Resisting moment : M_p = 131009.9 lbfft/ft
Factor of safety = 2.07 > 1.30

Slope stability ACCEPTABLE

WALL #4

MAX. WALL HEIGHT = 9.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task	:	Chemours Barrier Wall Retaining Walls
Part	:	H9
Description	:	Gravity
Author	:	GEOS
Date	:	2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

Setbacks

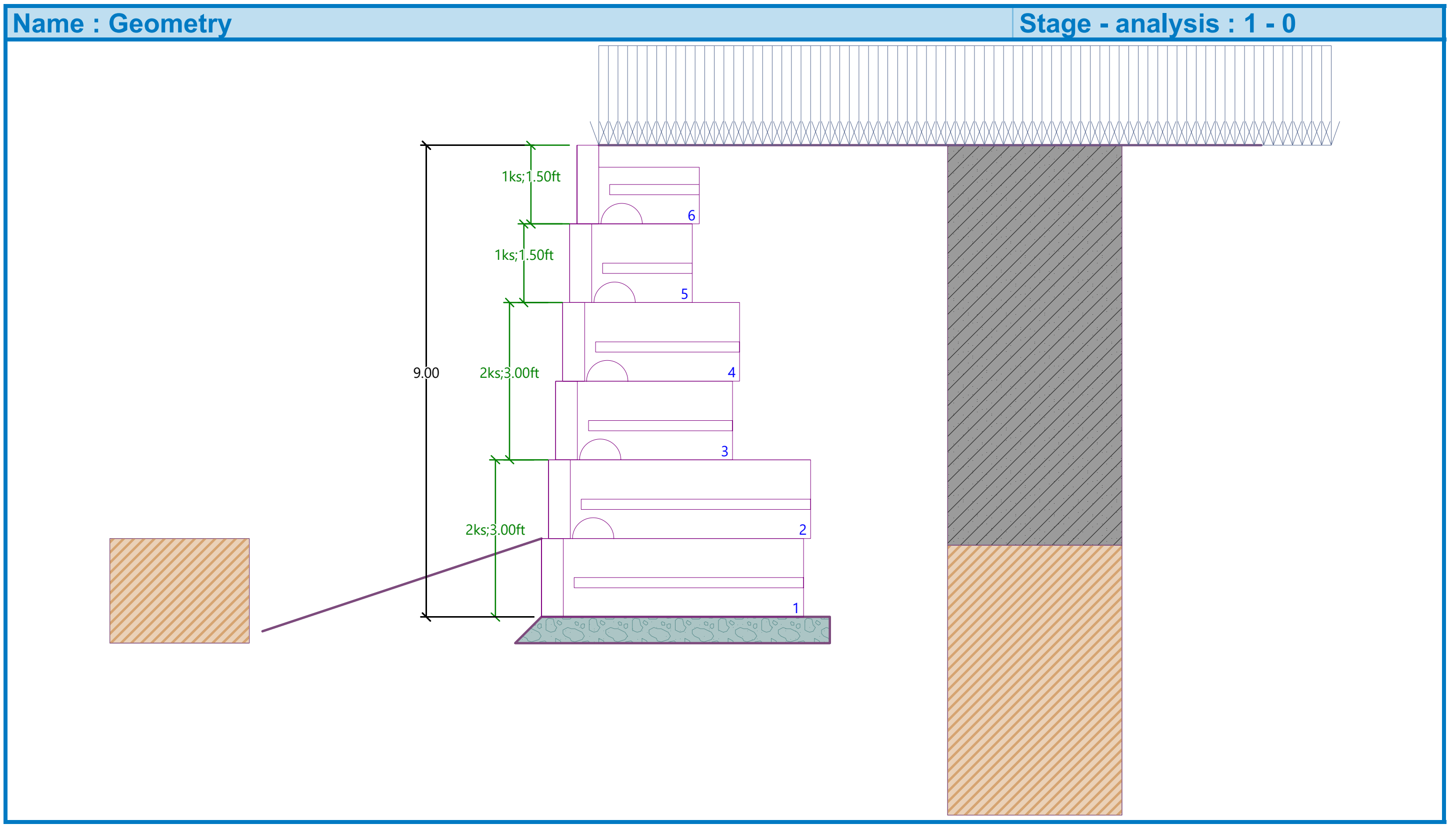
No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	2	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry

Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Fat Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	4228.1	2.77	1.000
FF resistance	-1104.2	-0.85	-368.0	0.33	1.000
Weight - earth wedge	0.0	-0.75	23.3	5.68	1.000
Weight - earth wedge	0.0	-4.21	191.7	4.67	1.000
Weight - earth wedge	0.0	-6.91	66.6	3.71	1.000
Weight - earth wedge	0.0	-9.29	89.1	2.49	1.000
Active pressure	1350.5	-2.88	1368.3	5.21	1.000
Traffic/Construction Surcharge	798.9	-4.37	841.2	4.66	1.000
Traffic/Construction Surcharge	0.0	-9.50	411.5	2.42	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 25109.9 lbfft/ft
Overturning moment M_{ovr} = 6439.5 lbfft/ft

Safety factor = 3.90 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3886.86 lbf/ft
Active horizontal force H_{act} = 1045.10 lbf/ft

Safety factor = 3.72 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.56	3913.1	2.25	1.000
FF resistance	-429.5	-0.45	-143.1	0.00	1.000
Weight - earth wedge	0.0	-3.71	191.7	4.17	1.000
Weight - earth wedge	0.0	-6.41	66.6	3.21	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - earth wedge	0.0	-8.79	89.1	1.99	1.000
Active pressure	1117.3	-2.87	942.8	4.43	1.000
Traffic/Construction Surcharge	744.0	-4.16	727.3	3.98	1.000
Traffic/Construction Surcharge	0.0	-9.00	411.5	1.92	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 17843.7 lbfft/ft
Overturning moment M_{ovr} = 6112.9 lbfft/ft

Safety factor = 2.92 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 5201.54 lbf/ft
Active horizontal force H_{act} = 1431.68 lbf/ft

Safety factor = 3.63 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	1885.3	6851.89	1045.10	0.046	1257.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	1885.3	6851.89	1045.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.046
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1257.3 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 4.77 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

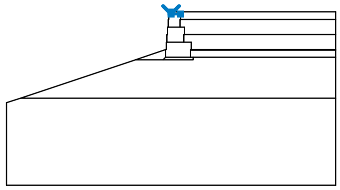
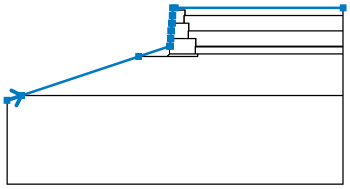
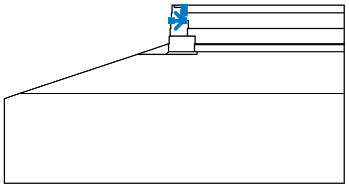
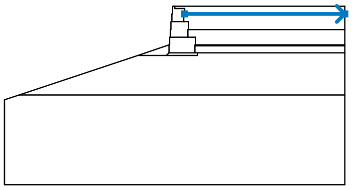
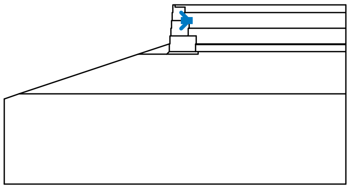
(input for current task)

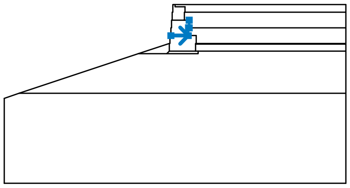
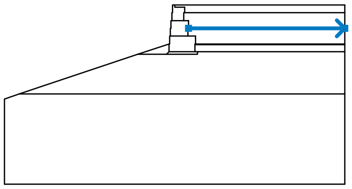
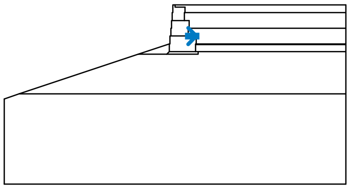
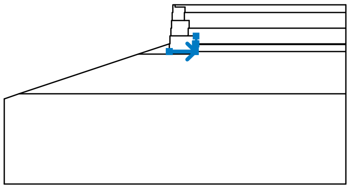
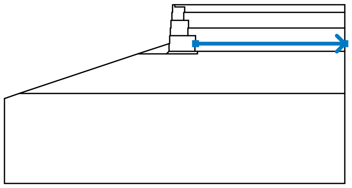
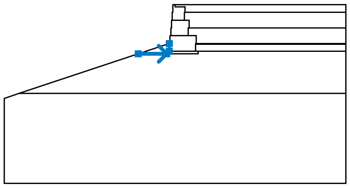
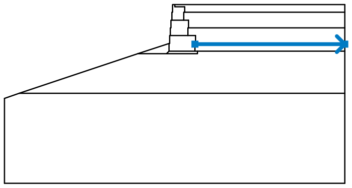
Stability analysis

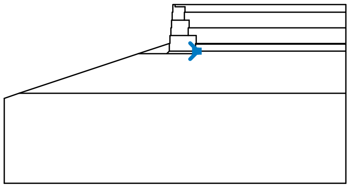
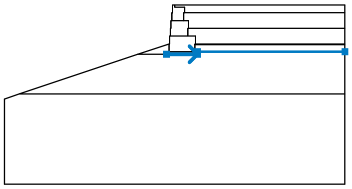
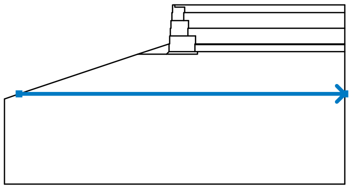
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-18.07	-29.98	-17.13	-7.09	-9.50
		-1.09	-7.50	-0.96	-7.50	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82 2.69	-6.00 -4.50	2.55 2.69	-6.00 -3.00	2.55	-4.50
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-1.09 3.91	-9.00 -7.50	3.91 4.04	-9.00 -7.50	3.91 4.04	-7.63 -6.00
10		4.04	-7.50	32.80	-7.50		
11		-7.09 -1.09	-9.50 -7.50	-1.59	-9.50	-1.09	-9.00
12		3.91	-7.63	32.80	-7.63		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		3.91	-9.00	4.41	-9.00		
14		-1.59	-9.50	4.41	-9.50	4.41	-9.00
		32.80	-9.00				
15		-29.98	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

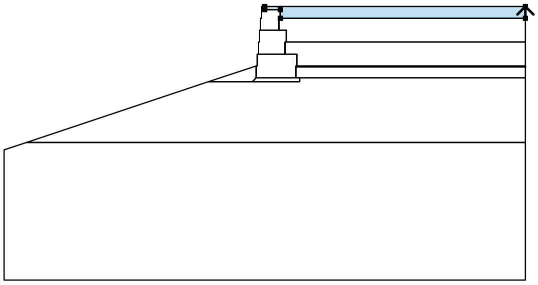
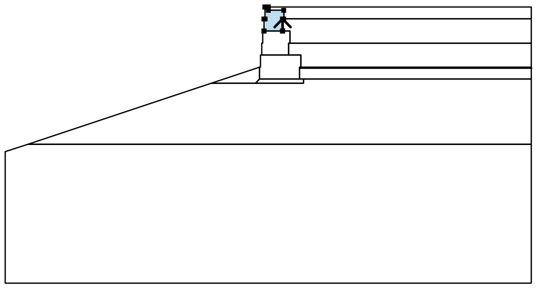
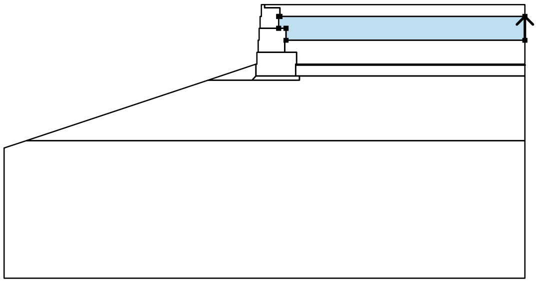
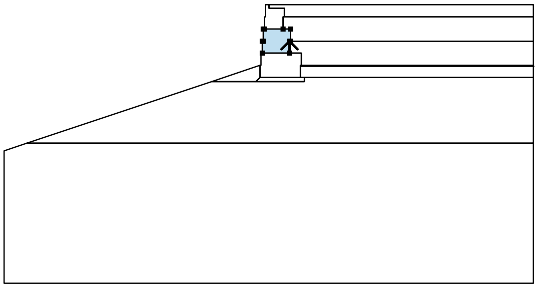
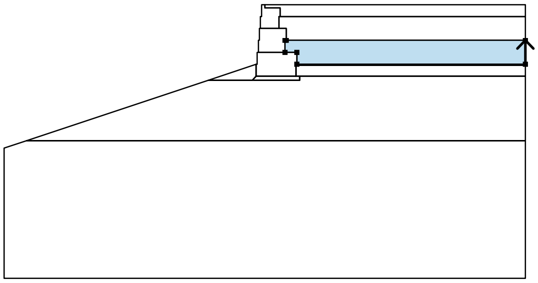
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

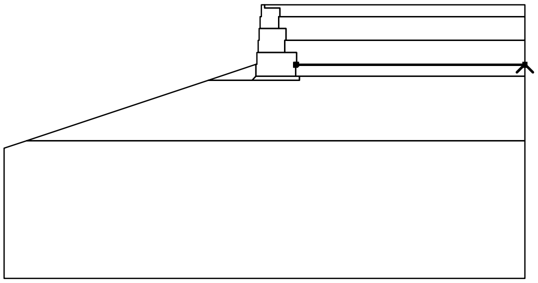
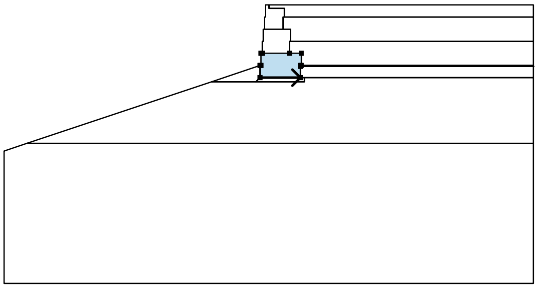
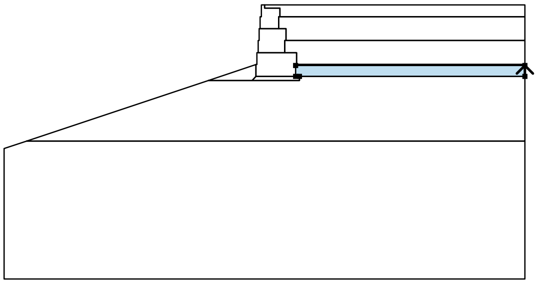
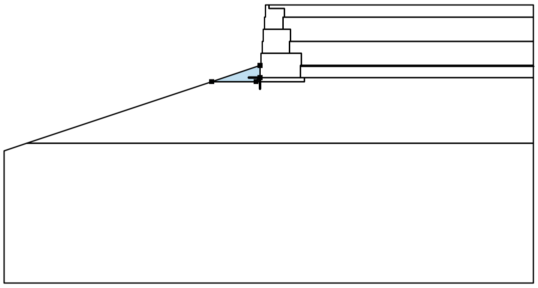
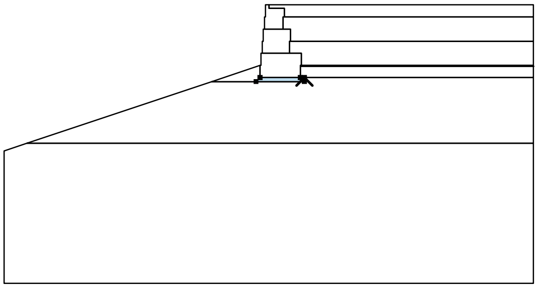
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

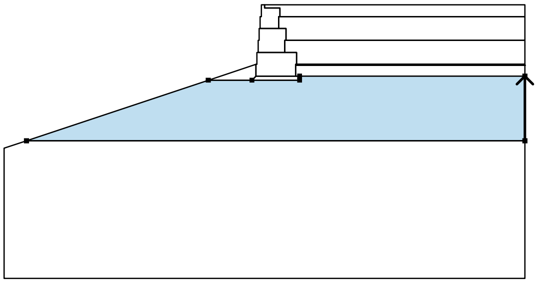
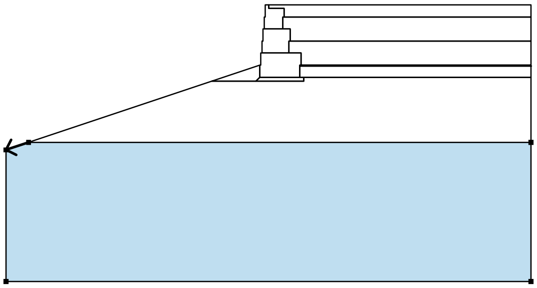
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.04	-7.50	3.91	-7.50	▨
		3.91	-7.63			
7		-1.09	-9.00	3.91	-9.00	Material of structure
		3.91	-7.63	3.91	-7.50	▦
		4.04	-7.50	4.04	-6.00	
		2.55	-6.00	-0.82	-6.00	
		-0.96	-6.00	-0.96	-7.50	
		-1.09	-7.50			
8		32.80	-9.00	32.80	-7.63	Upper Fat Clay
		3.91	-7.63	3.91	-9.00	▨
		4.41	-9.00			
9		-1.59	-9.50	-1.09	-9.00	Upper Fat Clay
		-1.09	-7.50	-7.09	-9.50	▨
10		4.41	-9.50	4.41	-9.00	#57 Stone
		3.91	-9.00	-1.09	-9.00	▩
		-1.59	-9.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		32.80	-17.13	32.80	-9.00	Upper Fat Clay
		4.41	-9.00	4.41	-9.50	▨
		-1.59	-9.50	-7.09	-9.50	
		-29.98	-17.13			
12		-29.98	-17.13	-32.80	-18.07	Upper Sand
		-32.80	-34.47	32.80	-34.47	▨
		32.80	-17.13			

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-21.44	[ft]	Angles :	α_1 =	-12.94	[°]
	z =	21.42	[ft]		α_2 =	57.32	[°]
Radius :	R =	39.67	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 12614.0 lbf/ft
Sum of passive forces : F_p = 17332.9 lbf/ft

Sliding moment : M_a = 500395.9 lbfft/ft
Resisting moment : M_p = 687595.3 lbfft/ft
Factor of safety = 1.37 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

Setbacks

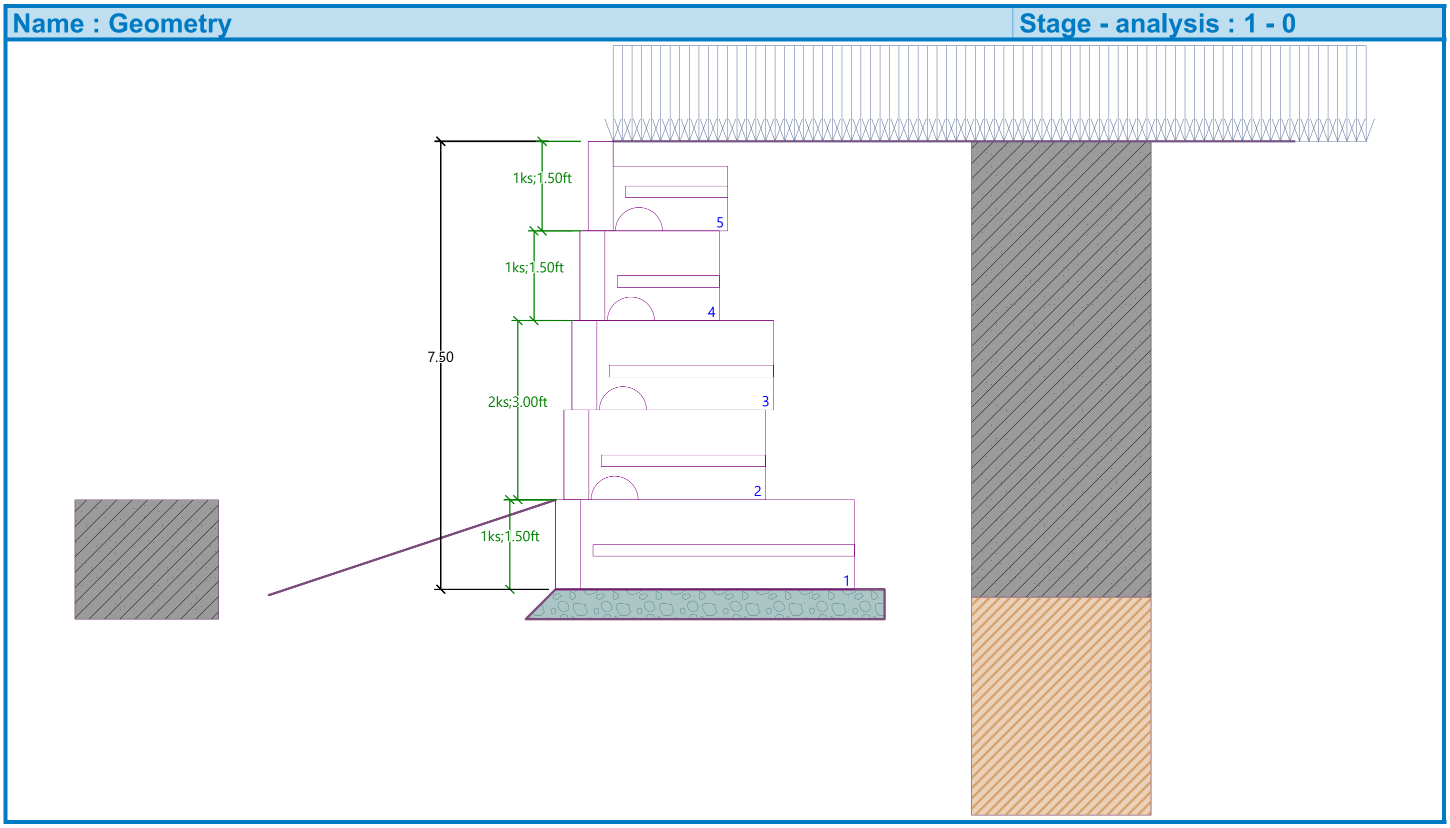
No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry

Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability
Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

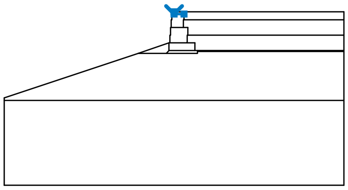
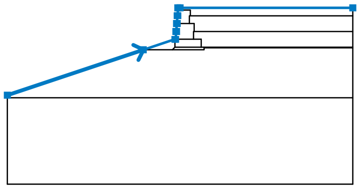
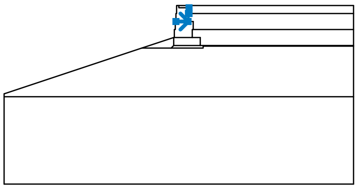
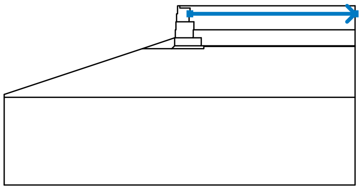
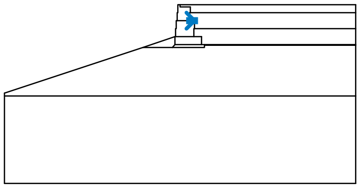
(input for current task)

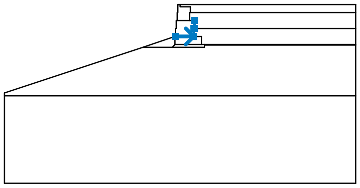
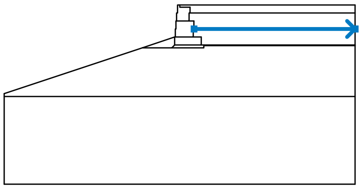
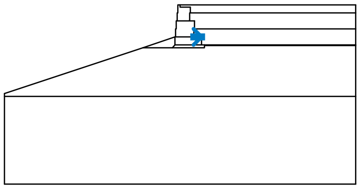
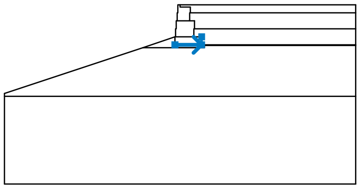
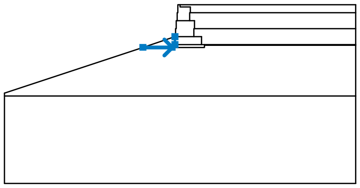
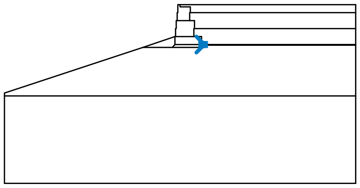
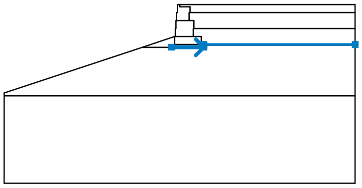
Stability analysis

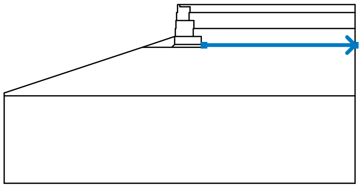
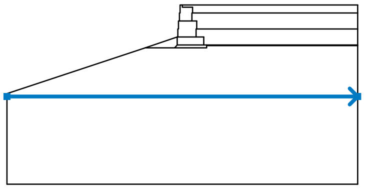
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

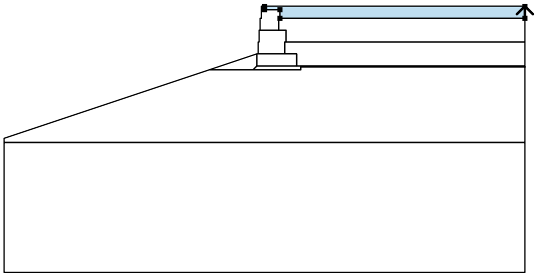
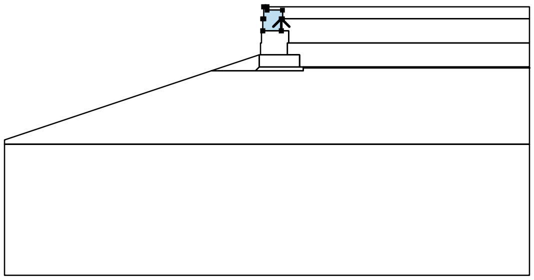
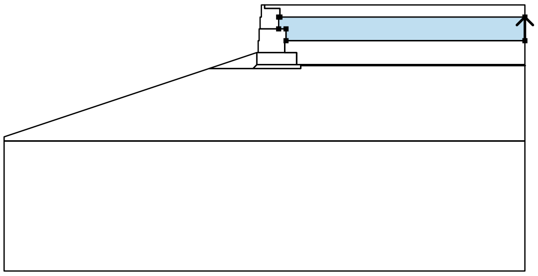
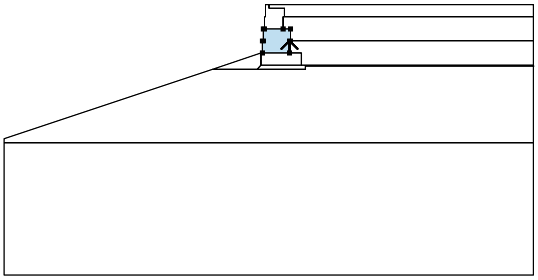
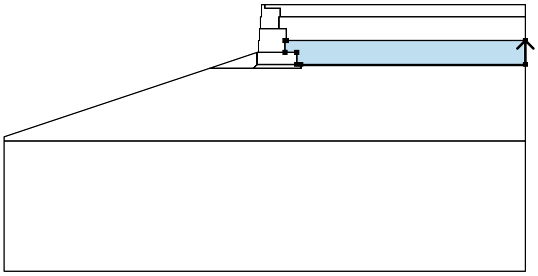
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

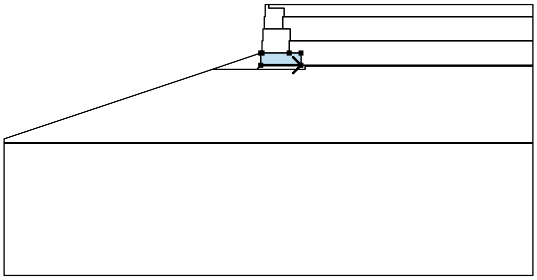
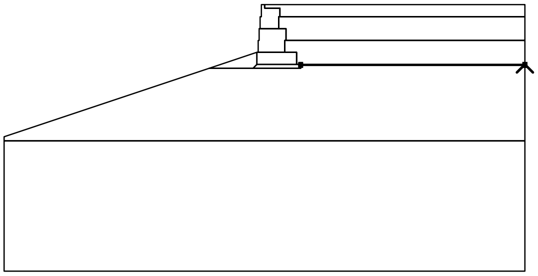
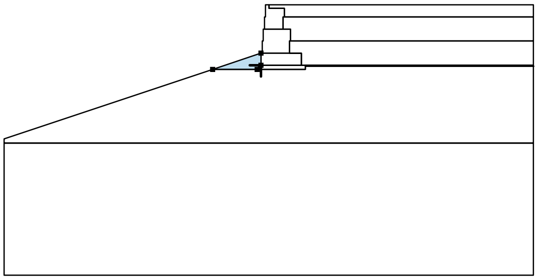
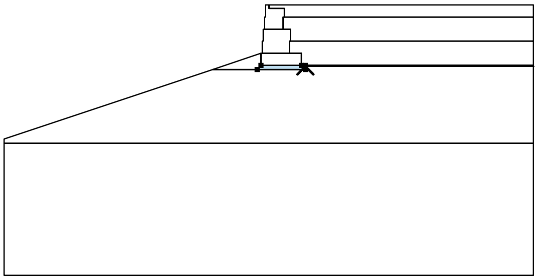
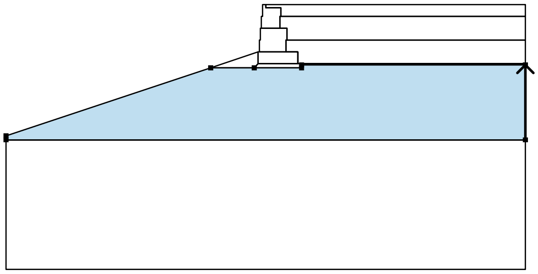
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

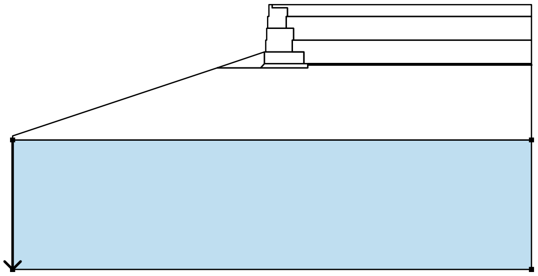
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure ▦
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure ▦
		2.69	-4.50	2.69	-3.00	
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay ▨
		2.69	-4.50	2.55	-4.50	
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure ▦
		4.04	-6.00	2.55	-6.00	
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay ▨
		4.54	-7.50	4.54	-7.63	
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay ▨
		-0.96	-6.00	-6.96	-8.00	
9		4.54	-8.00	4.54	-7.63	#57 Stone ▒
		4.54	-7.50	4.04	-7.50	
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		4.54	-7.63	4.54	-8.00	
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
11		-32.80 32.80	-17.13 -33.53	-32.80 32.80	-33.53 -17.13	Upper Sand ▨

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

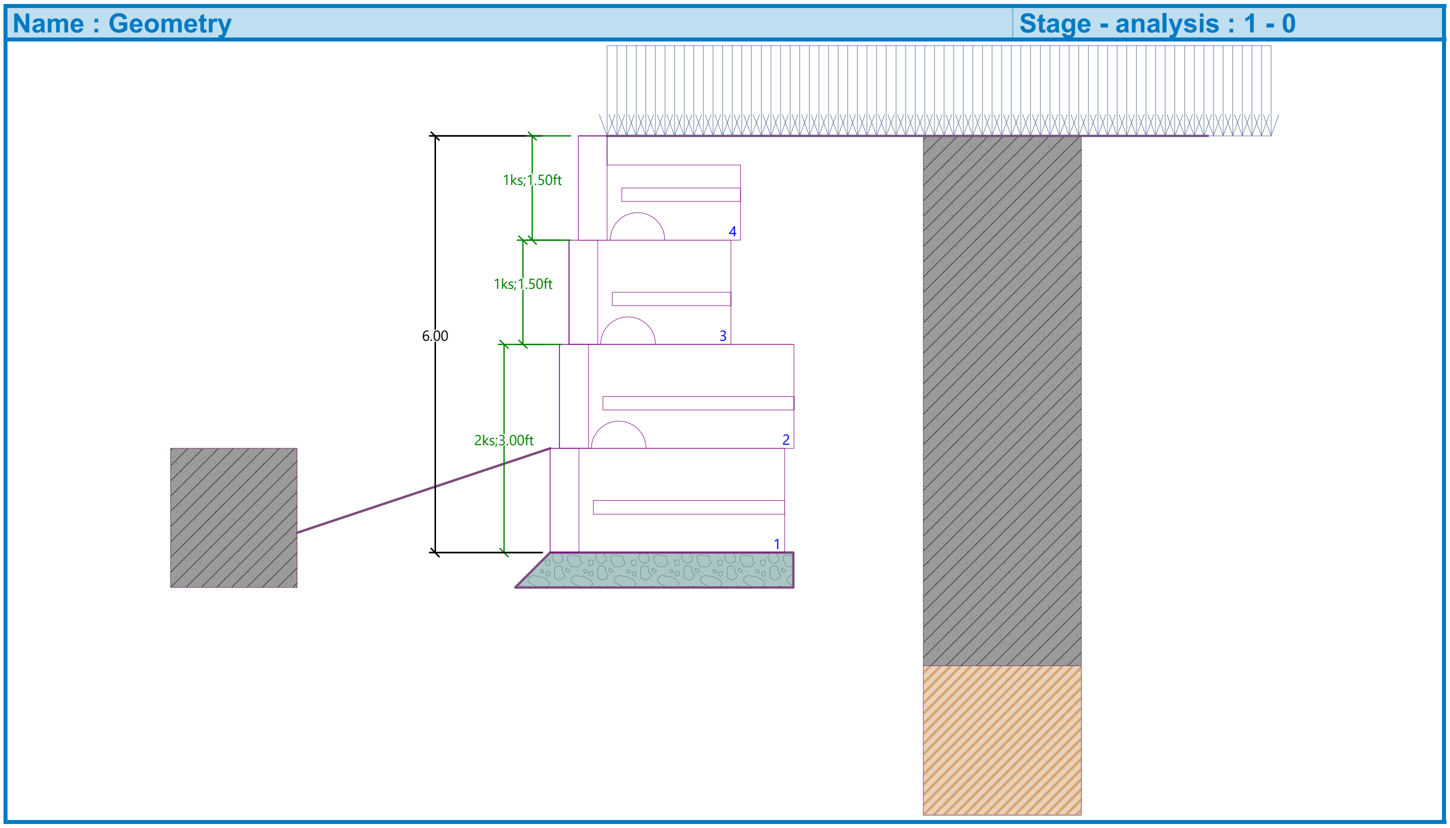
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

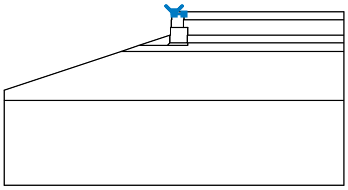
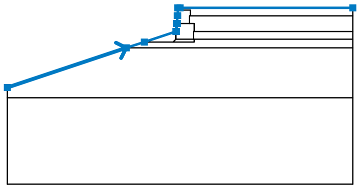
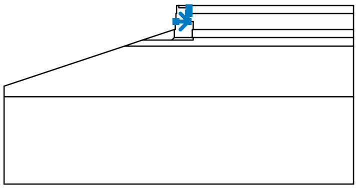
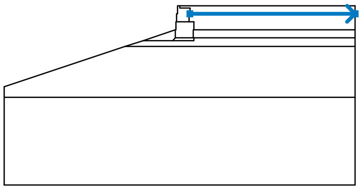
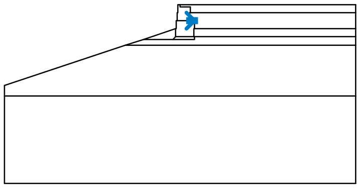
(input for current task)

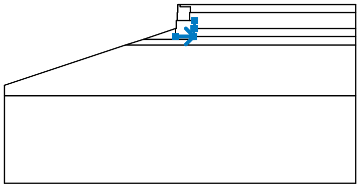
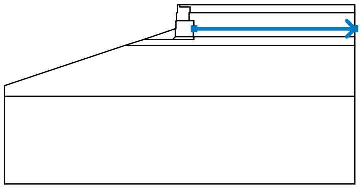
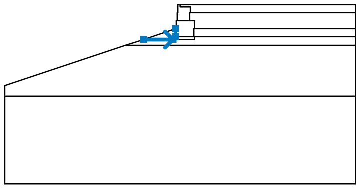
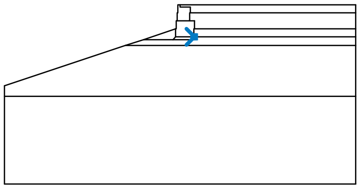
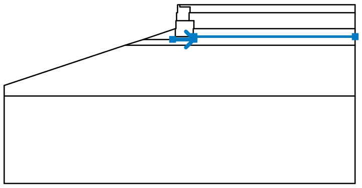
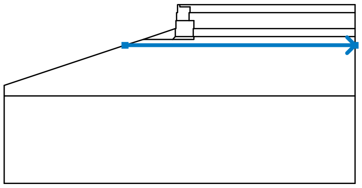
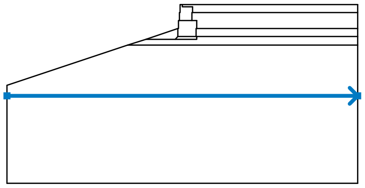
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		-6.82	-6.50	-1.32	-6.50	-0.82	-6.00
		-0.82	-4.50				
9		2.55	-6.00	2.68	-6.00		
10		-1.32	-6.50	2.68	-6.50	2.68	-6.00
		32.80	-6.00				
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight :	γ = 120.0 pcf
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 24.00 °
Cohesion of soil :	c_{ef} = 100.0 psf
Saturated unit weight :	γ_{sat} = 125.0 pcf

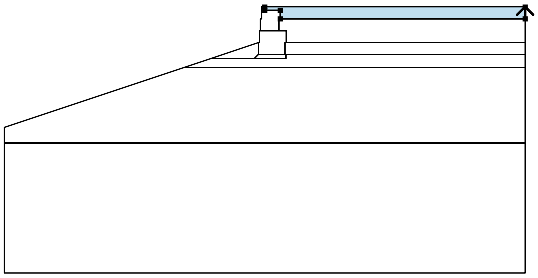
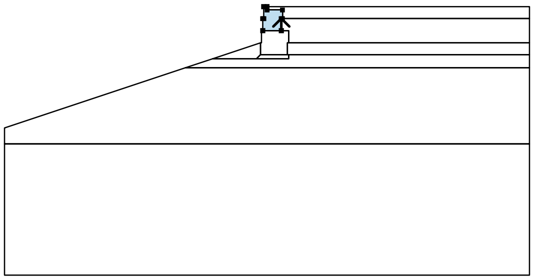
Upper Fat Clay

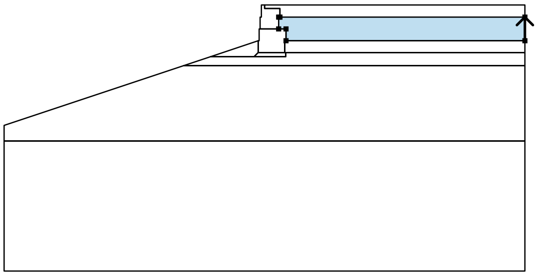
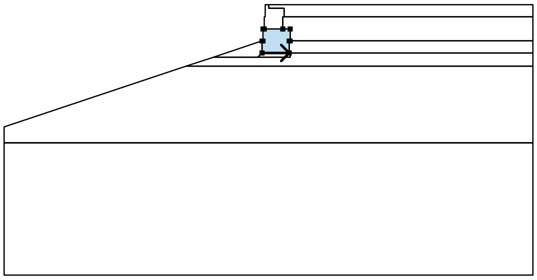
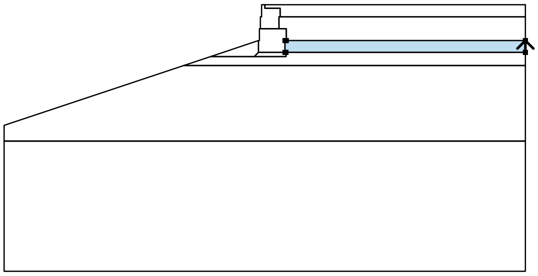
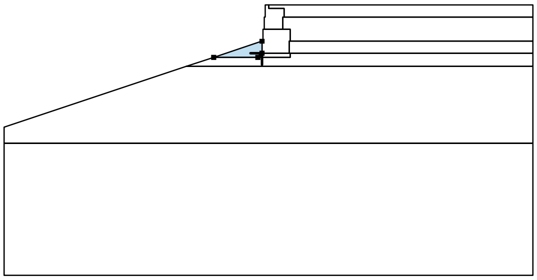
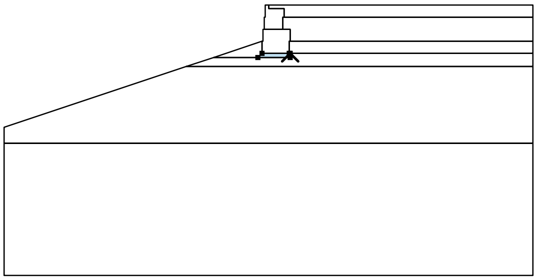
Unit weight :	γ = 125.0 pcf
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 26.00 °
Cohesion of soil :	c_{ef} = 100.0 psf
Saturated unit weight :	γ_{sat} = 130.0 pcf

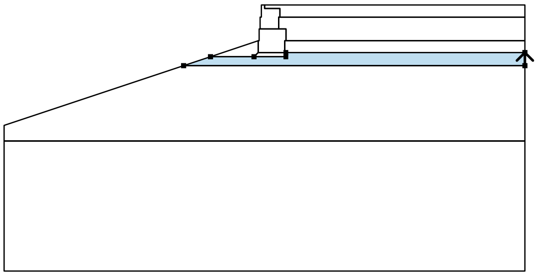
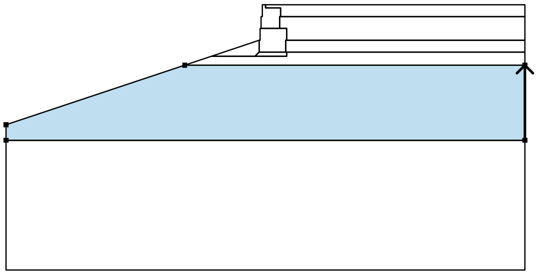
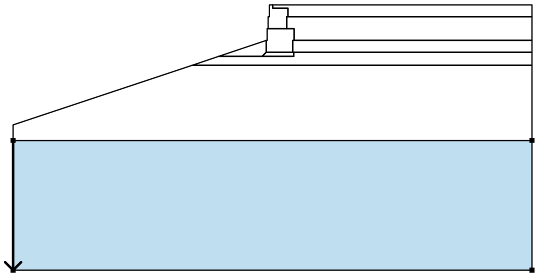
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure ▦
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		-0.82	-6.00	2.55	-6.00	Material of structure 🟥
		2.55	-4.50	2.69	-4.50	
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
5		32.80	-6.00	32.80	-4.50	Upper Lean Clay ▨
		2.69	-4.50	2.55	-4.50	
		2.55	-6.00	2.68	-6.00	
6		-1.32	-6.50	-0.82	-6.00	Upper Lean Clay ▨
		-0.82	-4.50	-6.82	-6.50	
7		2.68	-6.50	2.68	-6.00	#57 Stone ▨
		2.55	-6.00	-0.82	-6.00	
		-1.32	-6.50			

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
8		32.80 2.68 -1.32 -10.21	-7.63 -6.00 -6.50 -7.63	32.80 2.68 -6.82	-6.00 -6.50 -6.50	Upper Lean Clay ▨
9		32.80 -10.21 -32.80	-17.13 -7.63 -17.13	32.80 -32.80	-7.63 -15.16	Upper Fat Clay ▨
10		-32.80 32.80	-17.13 -33.53	-32.80 32.80	-33.53 -17.13	Upper Sand ▨

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft

Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft

Resisting moment : M_p = 82044.5 lbfft/ft

Factor of safety = 1.56 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

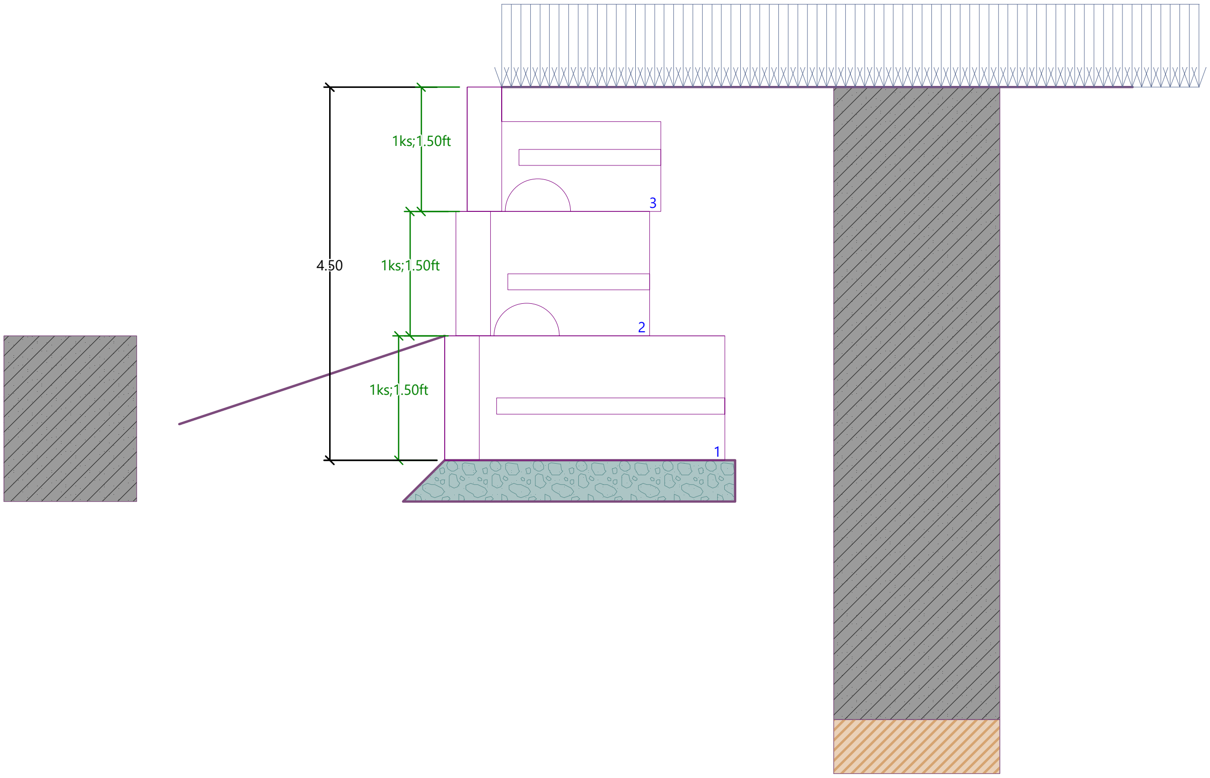
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1 [$\mathrm{lbf/ft^2}$]	Mag.2 [$\mathrm{lbf/ft^2}$]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
	new	change						
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability
Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

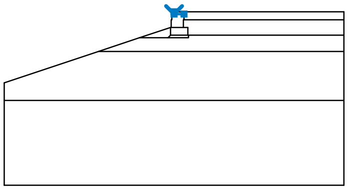
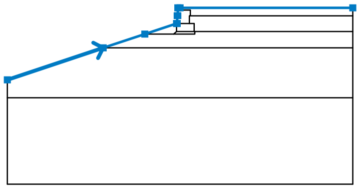
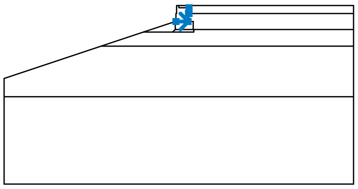
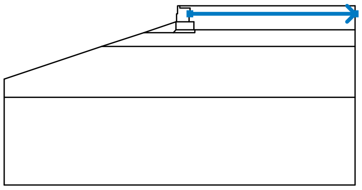
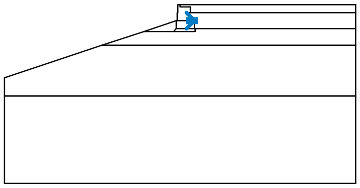
(input for current task)

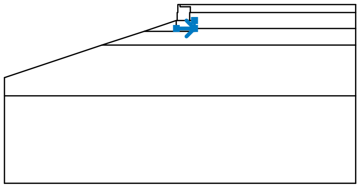
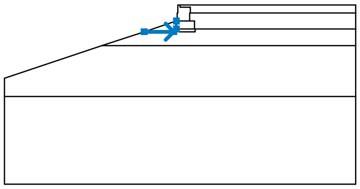
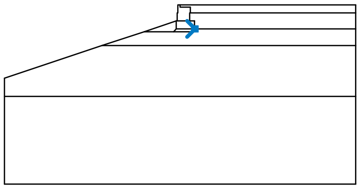
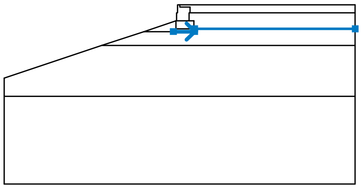
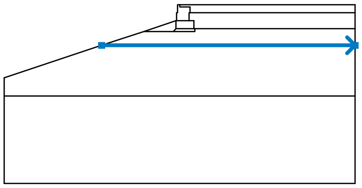
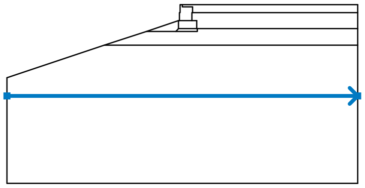
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

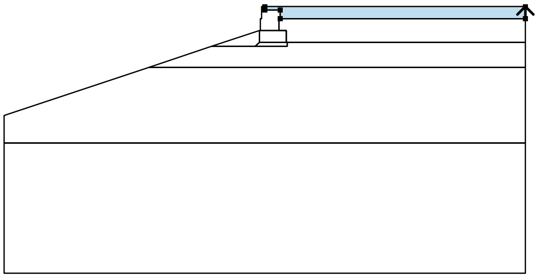
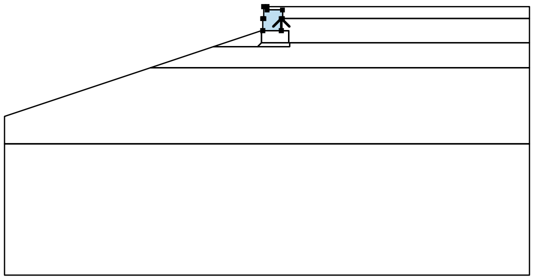
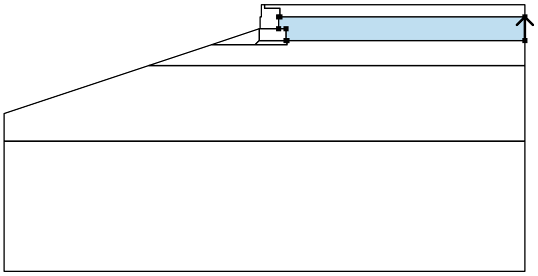
Upper Fat Clay

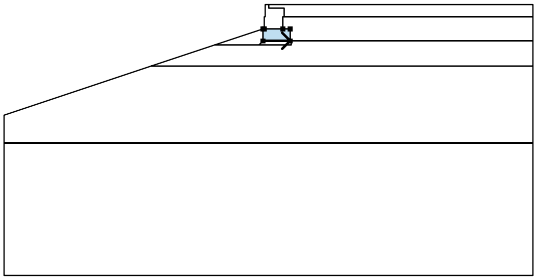
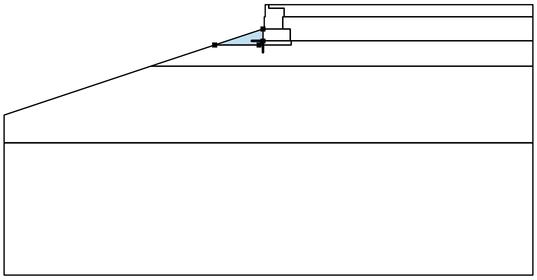
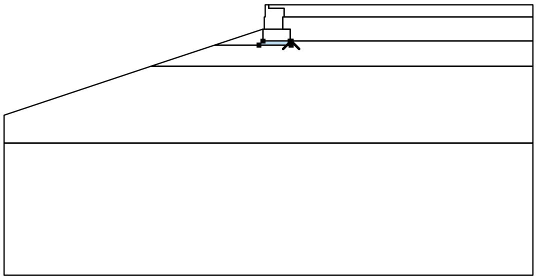
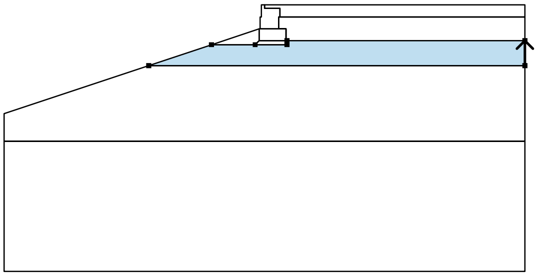
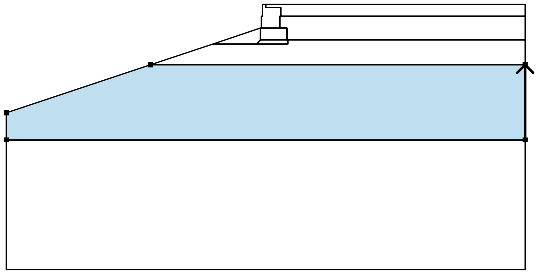
Unit weight :	γ =	125.0 pcf
Stress-state :	effective	
Angle of internal friction :	φ_{ef} =	26.00 °
Cohesion of soil :	c_{ef} =	100.0 psf
Saturated unit weight :	γ_{sat} =	130.0 pcf

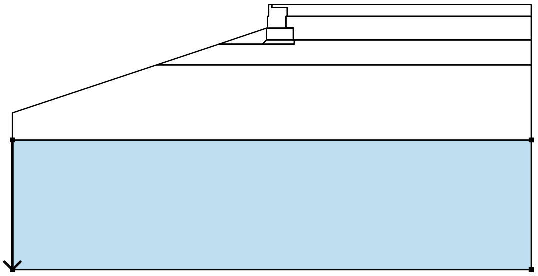
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure 🟥
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69	-4.50	2.69	-4.50	Material of structure
		2.69	-3.00	1.78	-3.00	▦
		-0.55	-3.00	-0.69	-3.00	
5		-1.19	-5.00	-0.69	-4.50	Upper Lean Clay
		-0.69	-3.00	-6.69	-5.00	▨
6		2.81	-5.00	2.81	-4.50	#57 Stone
		2.69	-4.50	-0.69	-4.50	▩
		-1.19	-5.00			
7		32.80	-7.63	32.80	-4.50	Upper Lean Clay
		2.81	-4.50	2.81	-5.00	▨
		-1.19	-5.00	-6.69	-5.00	
		-14.58	-7.63			
8		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-14.58	-7.63	-32.80	-13.70	▨
		-32.80	-17.13			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
9		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	Magnitude q_2, z	Magnitude unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

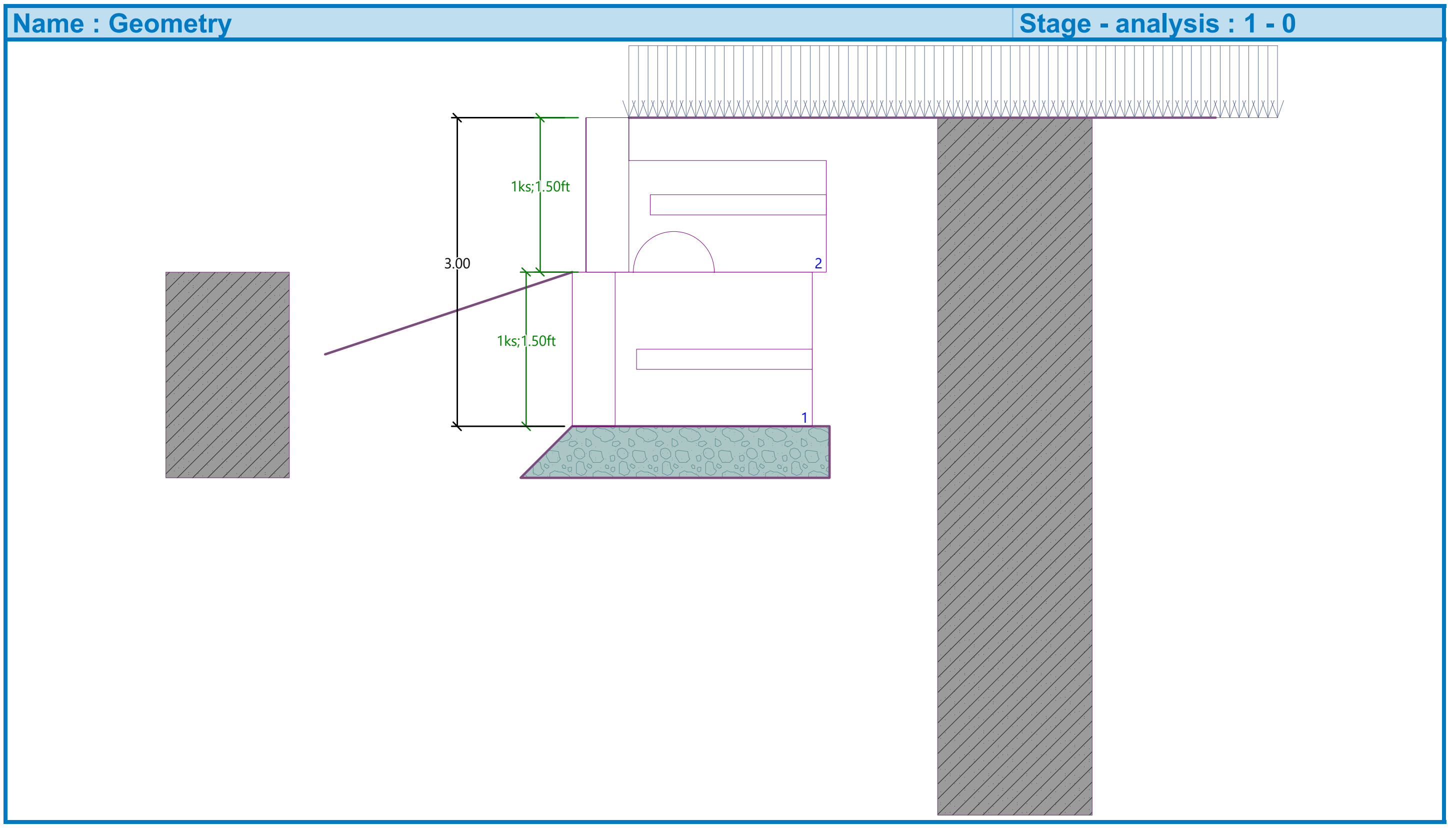
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	🟩	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft
Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft
Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

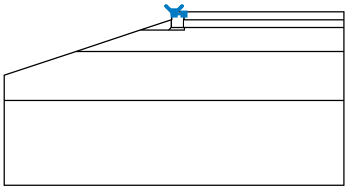
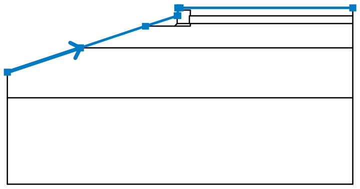
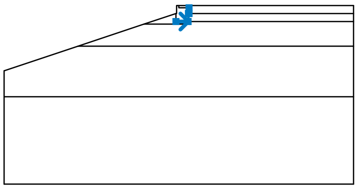
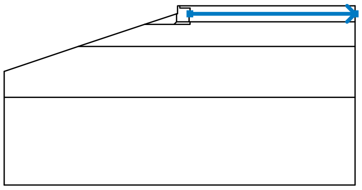
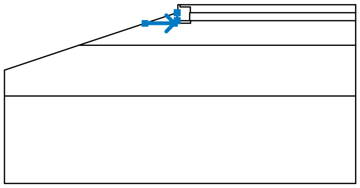
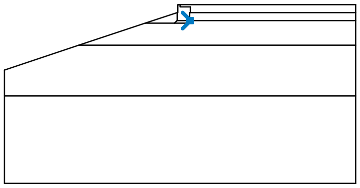
(input for current task)

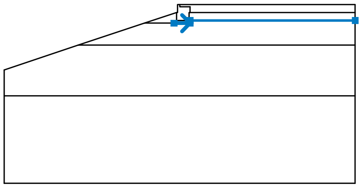
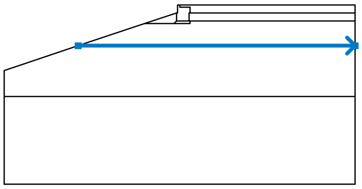
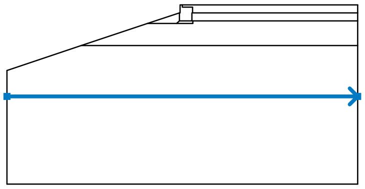
Stability analysis

Earthquake analysis :	Standard
Verification methodology :	Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		-1.05 32.80	-3.50 -3.00	1.95	-3.50	1.95	-3.00
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

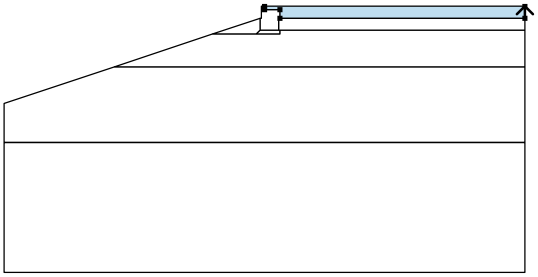
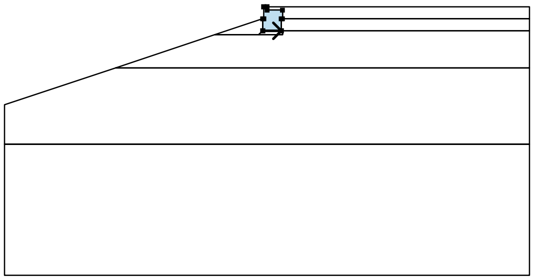
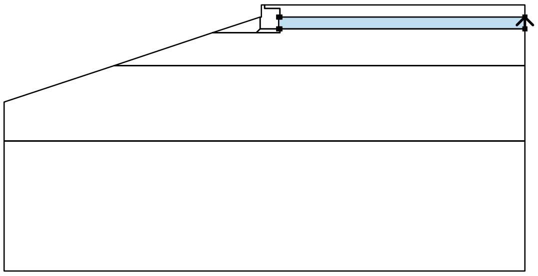
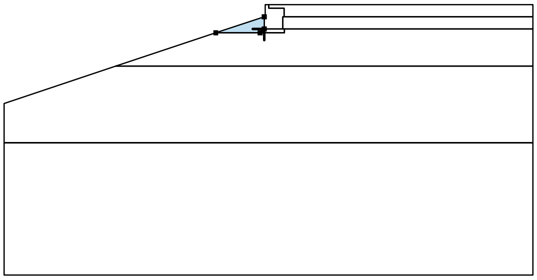
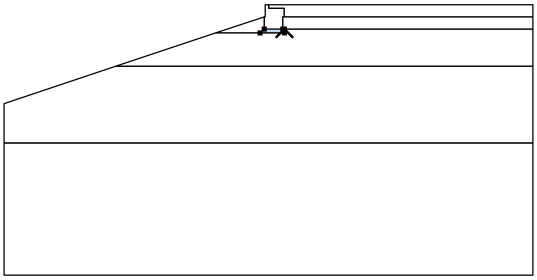
Upper Fat Clay

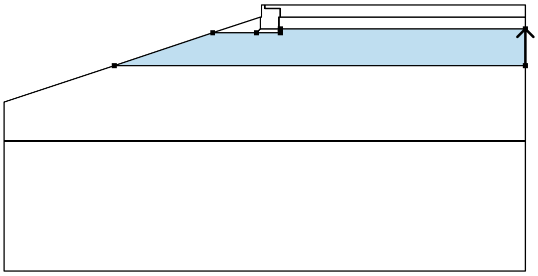
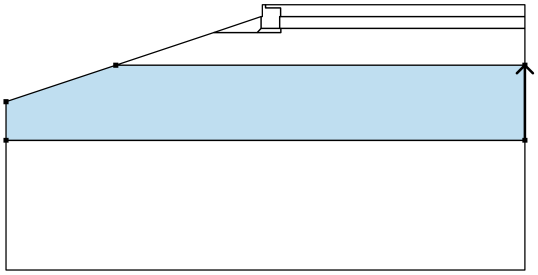
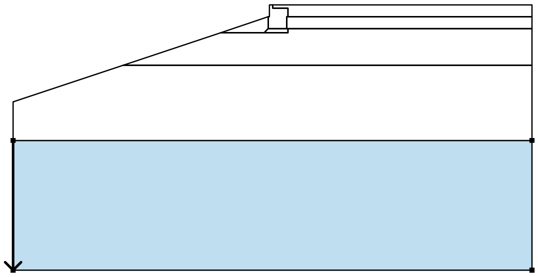
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure ▦
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay ▨
		-0.55	-1.50	-6.55	-3.50	
5		1.95	-3.50	1.95	-3.00	#57 Stone ▩
		1.78	-3.00	-0.55	-3.00	
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay ▨
		1.95	-3.00	1.95	-3.50	
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-18.94	-7.63	-32.80	-12.25	
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft

Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft

Resisting moment : M_p = 131009.9 lbfft/ft

Factor of safety = 2.07 > 1.30

Slope stability ACCEPTABLE

Geotechnical, Environmental and Materials Engineers

WALL #5

MAX. WALL HEIGHT = 9.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H9
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

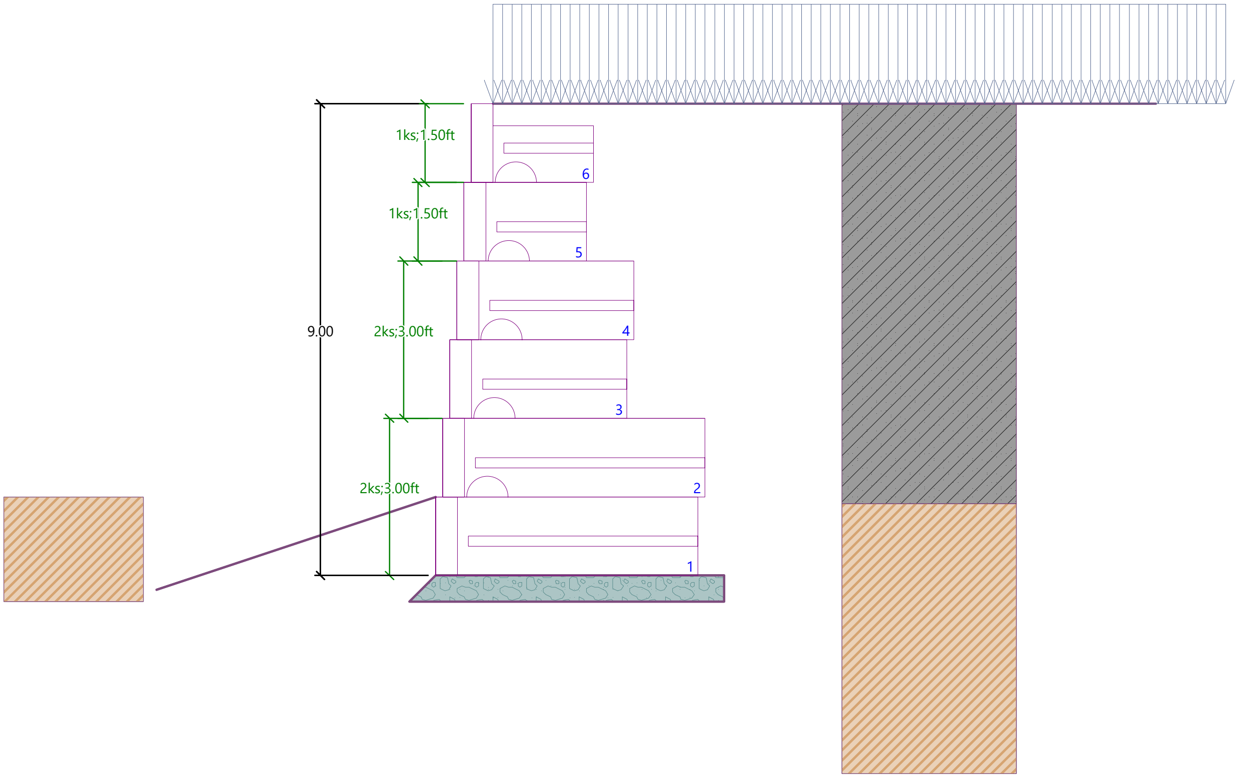
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	2	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Fat Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	4228.1	2.77	1.000
FF resistance	-1104.2	-0.85	-368.0	0.33	1.000
Weight - earth wedge	0.0	-0.75	23.3	5.68	1.000
Weight - earth wedge	0.0	-4.21	191.7	4.67	1.000
Weight - earth wedge	0.0	-6.91	66.6	3.71	1.000
Weight - earth wedge	0.0	-9.29	89.1	2.49	1.000
Active pressure	1350.5	-2.88	1368.3	5.21	1.000
Traffic/Construction Surcharge	798.9	-4.37	841.2	4.66	1.000
Traffic/Construction Surcharge	0.0	-9.50	411.5	2.42	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 25109.9 lbfft/ft
Overturning moment M_{ovr} = 6439.5 lbfft/ft

Safety factor = 3.90 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3886.86 lbf/ft
Active horizontal force H_{act} = 1045.10 lbf/ft

Safety factor = 3.72 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.56	3913.1	2.25	1.000
FF resistance	-429.5	-0.45	-143.1	0.00	1.000
Weight - earth wedge	0.0	-3.71	191.7	4.17	1.000
Weight - earth wedge	0.0	-6.41	66.6	3.21	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - earth wedge	0.0	-8.79	89.1	1.99	1.000
Active pressure	1117.3	-2.87	942.8	4.43	1.000
Traffic/Construction Surcharge	744.0	-4.16	727.3	3.98	1.000
Traffic/Construction Surcharge	0.0	-9.00	411.5	1.92	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 17843.7 lbfft/ft
Overturning moment M_{ovr} = 6112.9 lbfft/ft

Safety factor = 2.92 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 5201.54 lbf/ft
Active horizontal force H_{act} = 1431.68 lbf/ft

Safety factor = 3.63 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	1885.3	6851.89	1045.10	0.046	1257.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	1885.3	6851.89	1045.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.046
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1257.3 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 4.77 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

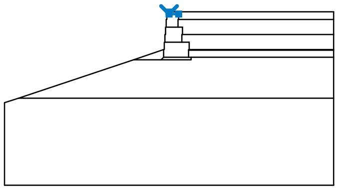
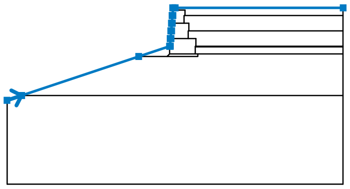
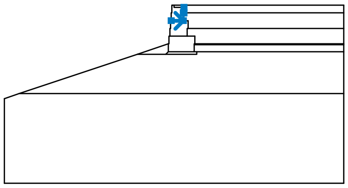
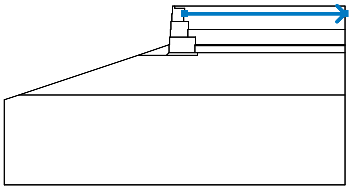
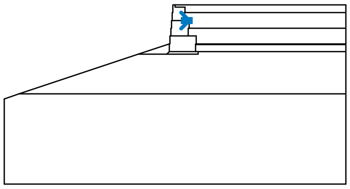
(input for current task)

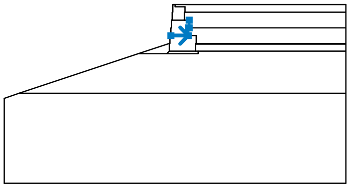
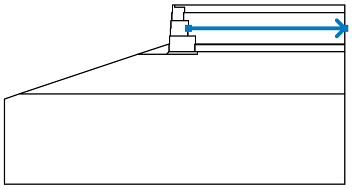
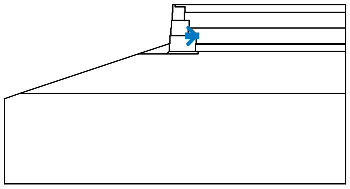
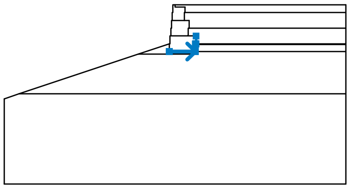
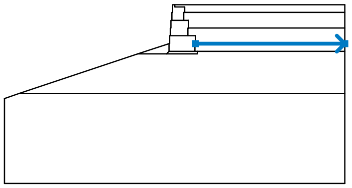
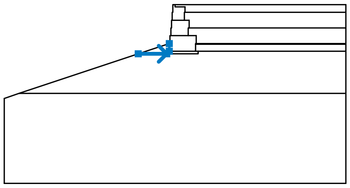
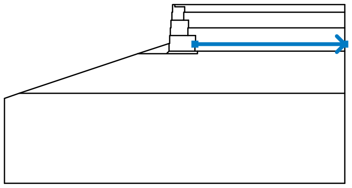
Stability analysis

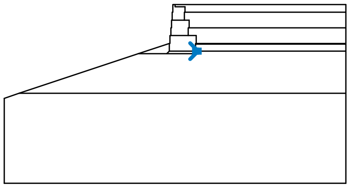
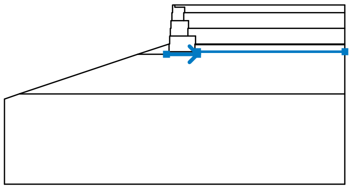
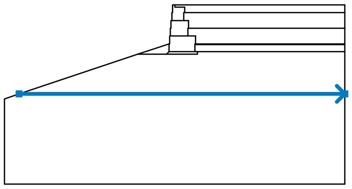
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-18.07	-29.98	-17.13	-7.09	-9.50
		-1.09	-7.50	-0.96	-7.50	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-1.09	-9.00	3.91	-9.00	3.91	-7.63
		3.91	-7.50	4.04	-7.50	4.04	-6.00
10		4.04	-7.50	32.80	-7.50		
11		-7.09	-9.50	-1.59	-9.50	-1.09	-9.00
		-1.09	-7.50				
12		3.91	-7.63	32.80	-7.63		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		3.91	-9.00	4.41	-9.00		
14		-1.59 32.80	-9.50 -9.00	4.41	-9.50	4.41	-9.00
15		-29.98	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

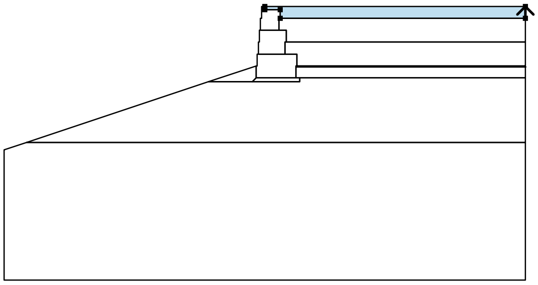
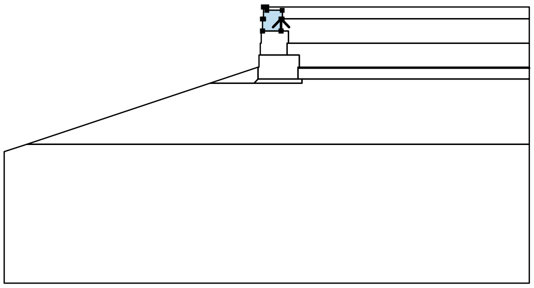
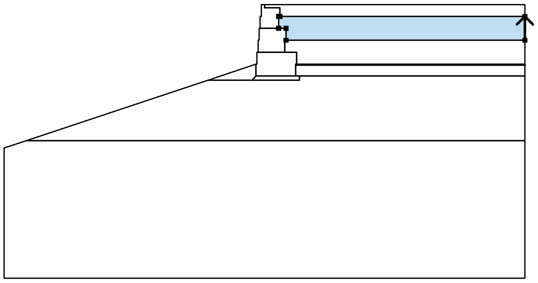
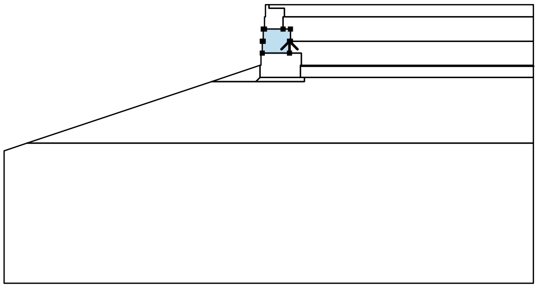
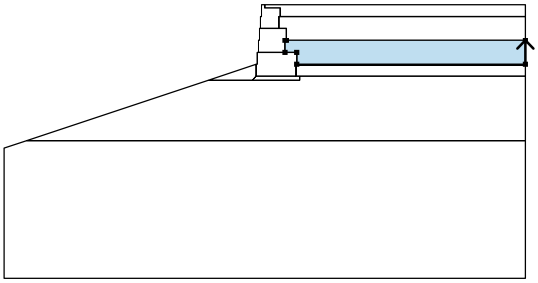
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

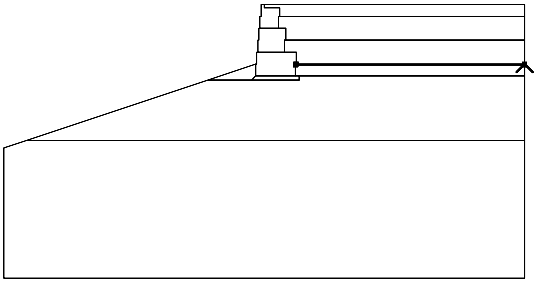
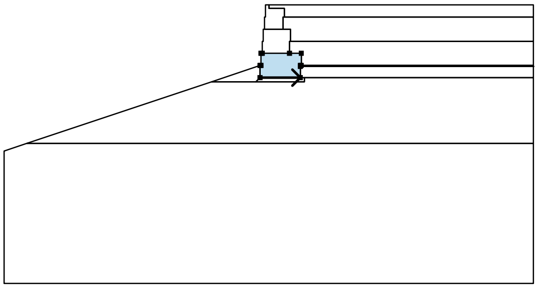
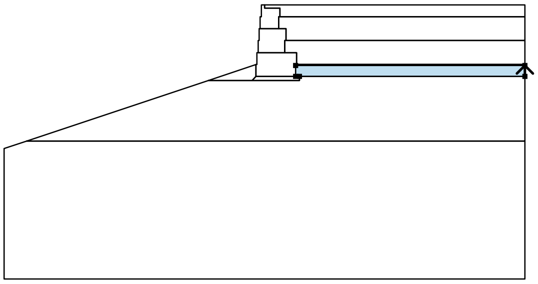
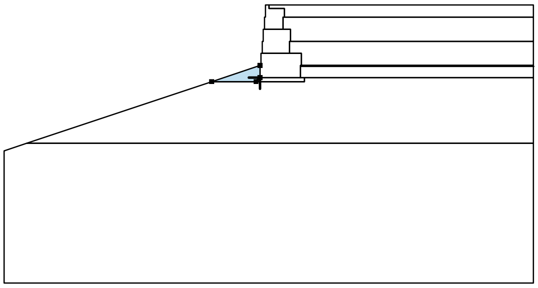
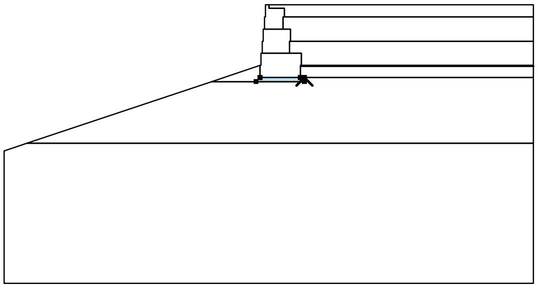
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

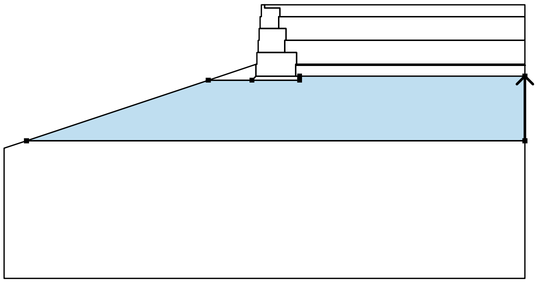
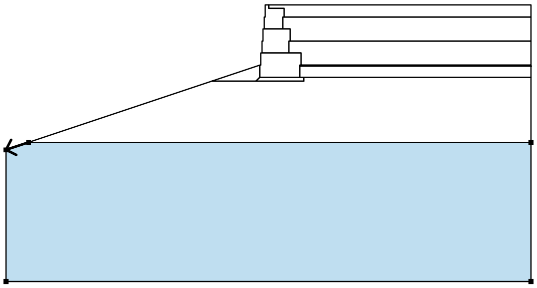
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	▦
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	▦
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.04	-7.50	3.91	-7.50	▨
		3.91	-7.63			
7		-1.09	-9.00	3.91	-9.00	Material of structure
		3.91	-7.63	3.91	-7.50	▦
		4.04	-7.50	4.04	-6.00	
		2.55	-6.00	-0.82	-6.00	
		-0.96	-6.00	-0.96	-7.50	
		-1.09	-7.50			
8		32.80	-9.00	32.80	-7.63	Upper Fat Clay
		3.91	-7.63	3.91	-9.00	▨
		4.41	-9.00			
9		-1.59	-9.50	-1.09	-9.00	Upper Fat Clay
		-1.09	-7.50	-7.09	-9.50	▨
10		4.41	-9.50	4.41	-9.00	#57 Stone
		3.91	-9.00	-1.09	-9.00	▨
		-1.59	-9.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		32.80	-17.13	32.80	-9.00	Upper Fat Clay
		4.41	-9.00	4.41	-9.50	▨
		-1.59	-9.50	-7.09	-9.50	
		-29.98	-17.13			
12		-29.98	-17.13	-32.80	-18.07	Upper Sand
		-32.80	-34.47	32.80	-34.47	▨
		32.80	-17.13			

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-21.44	[ft]	Angles :	α_1 =	-12.94	[°]
	z =	21.42	[ft]		α_2 =	57.32	[°]
Radius :	R =	39.67	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 12614.0 lbf/ft
Sum of passive forces : F_p = 17332.9 lbf/ft

Sliding moment : M_a = 500395.9 lbfft/ft
Resisting moment : M_p = 687595.3 lbfft/ft
Factor of safety = 1.37 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

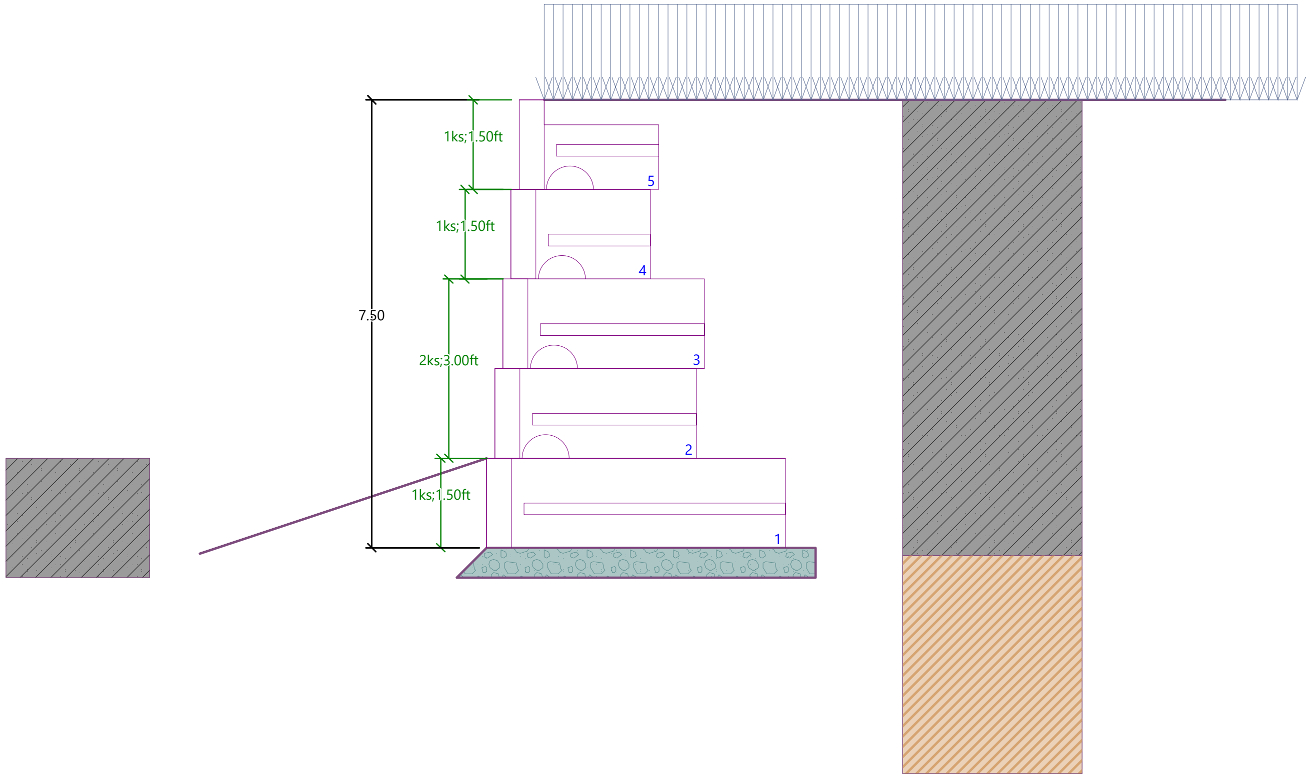
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

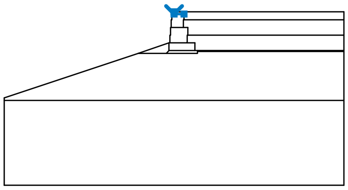
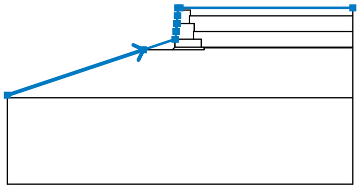
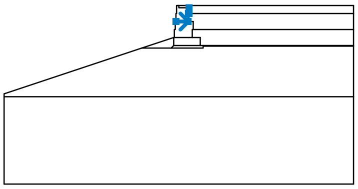
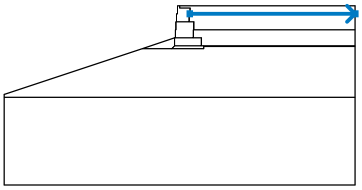
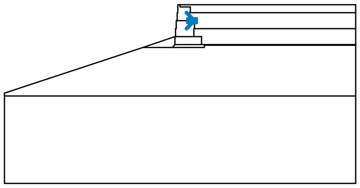
(input for current task)

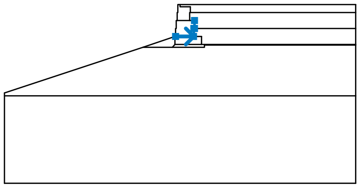
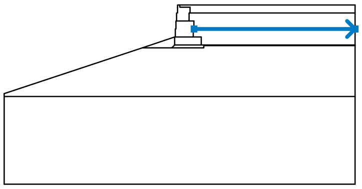
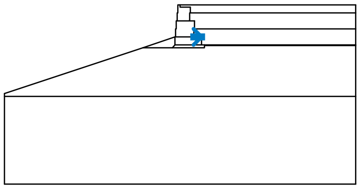
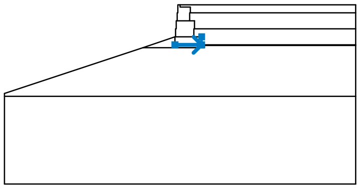
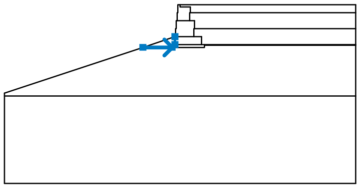
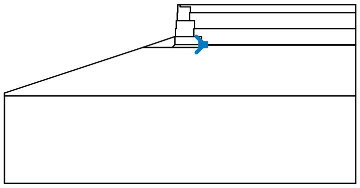
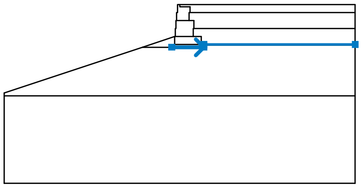
Stability analysis

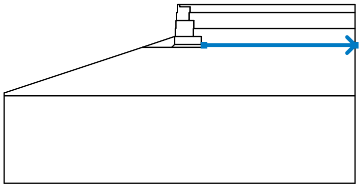
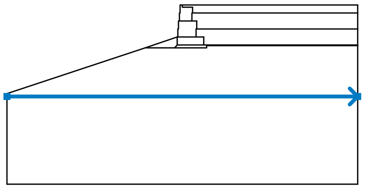
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

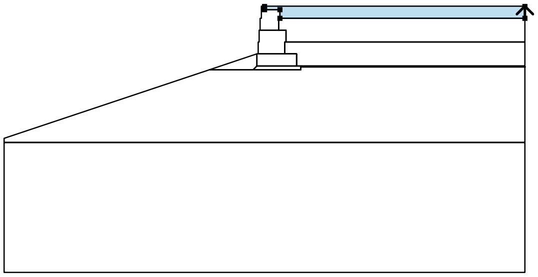
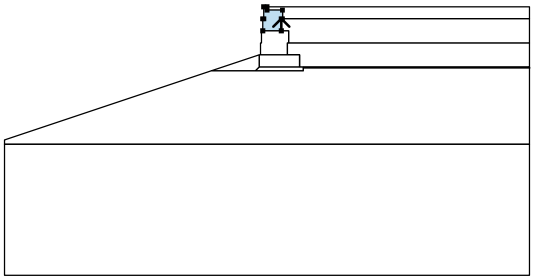
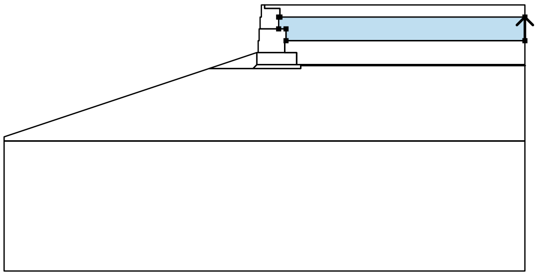
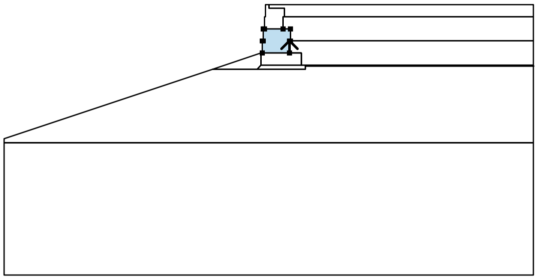
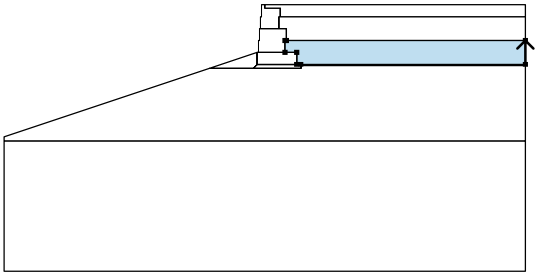
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

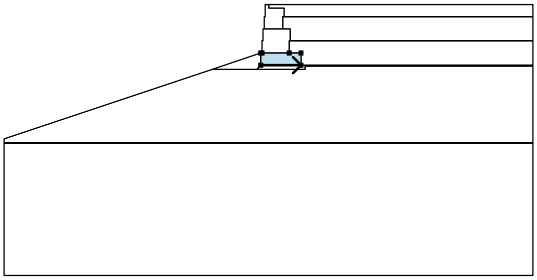
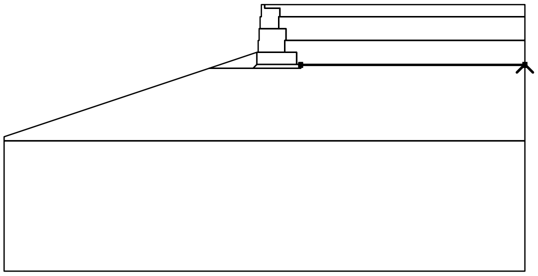
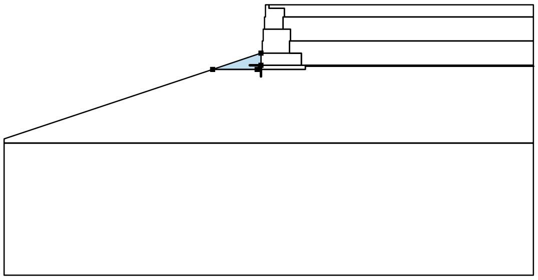
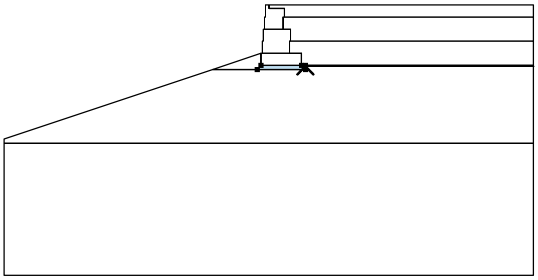
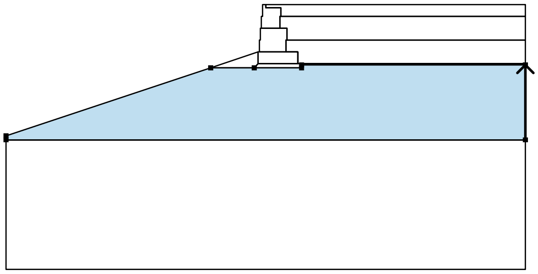
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

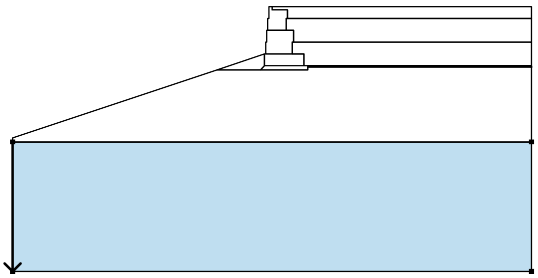
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure ▦
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure ▦
		2.69	-4.50	2.69	-3.00	
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay ▨
		2.69	-4.50	2.55	-4.50	
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure ▦
		4.04	-6.00	2.55	-6.00	
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay ▨
		4.54	-7.50	4.54	-7.63	
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay ▨
		-0.96	-6.00	-6.96	-8.00	
9		4.54	-8.00	4.54	-7.63	#57 Stone ▩
		4.54	-7.50	4.04	-7.50	
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		4.54	-7.63	4.54	-8.00	
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
11		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30
Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

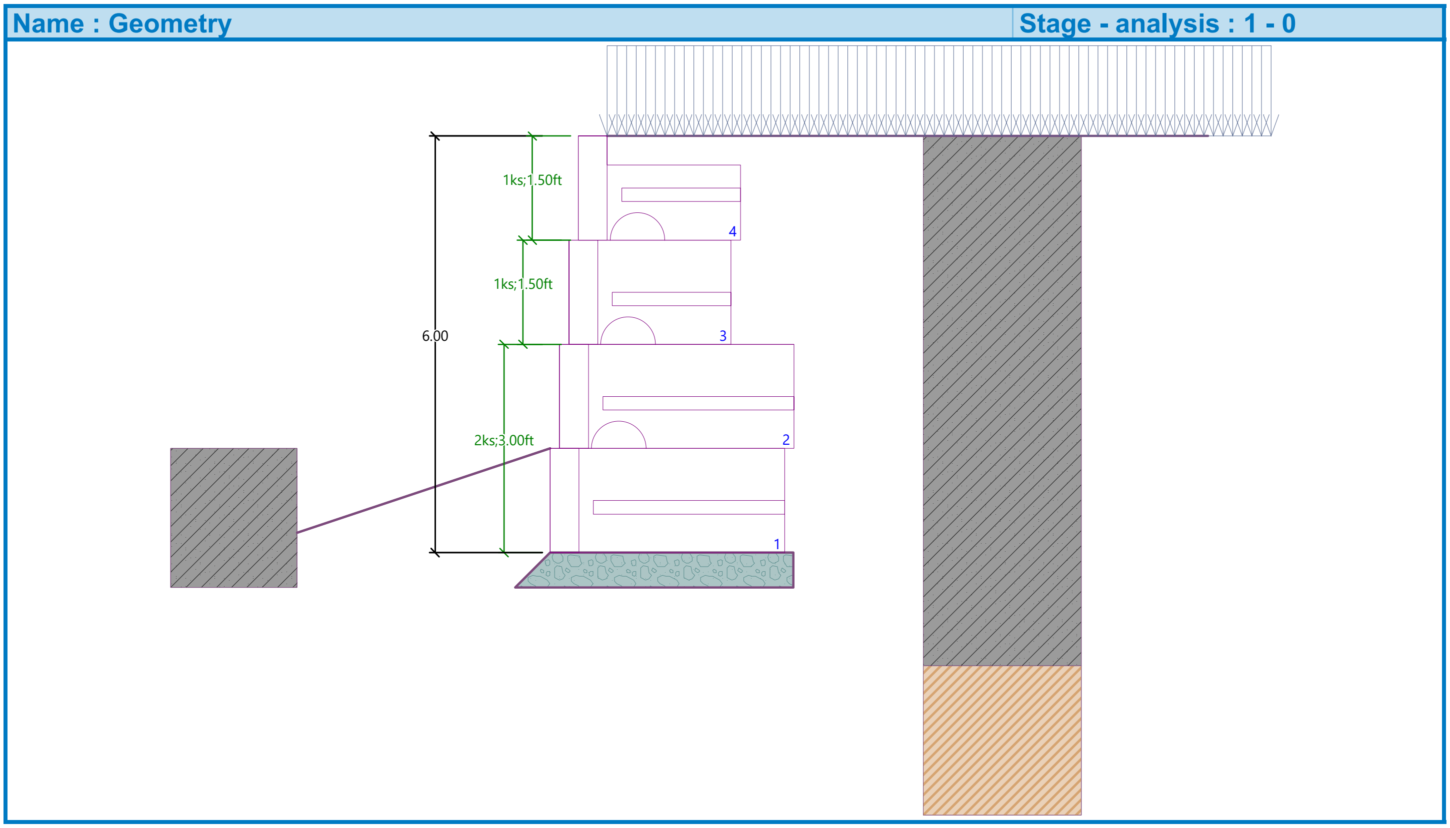
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

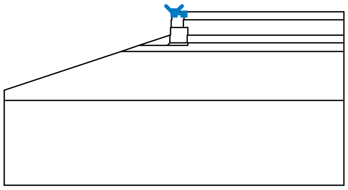
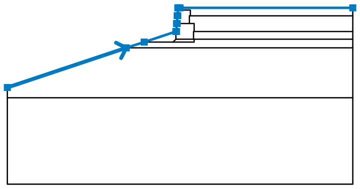
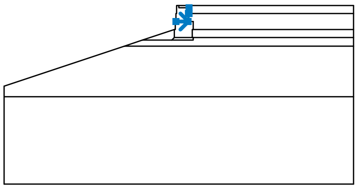
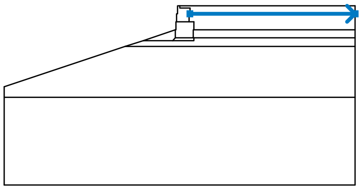
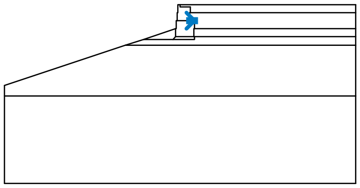
(input for current task)

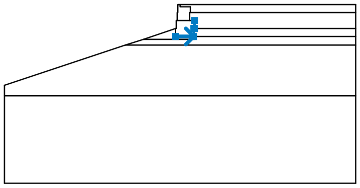
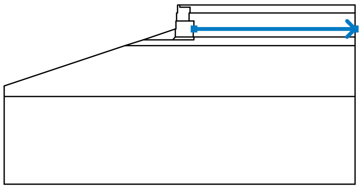
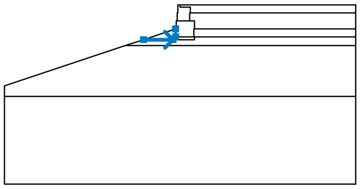
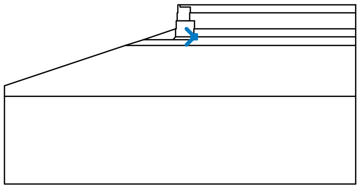
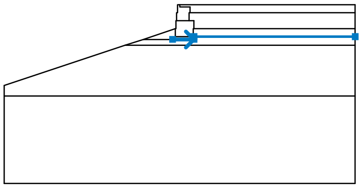
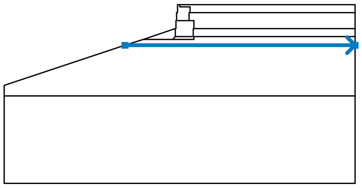
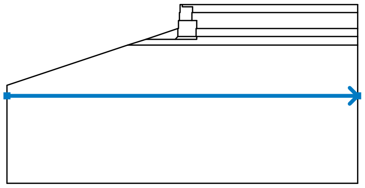
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		-6.82	-6.50	-1.32	-6.50	-0.82	-6.00
		-0.82	-4.50				
9		2.55	-6.00	2.68	-6.00		
10		-1.32	-6.50	2.68	-6.50	2.68	-6.00
		32.80	-6.00				
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

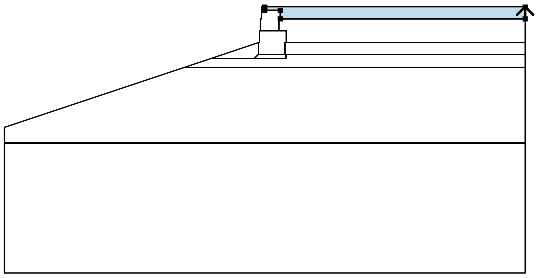
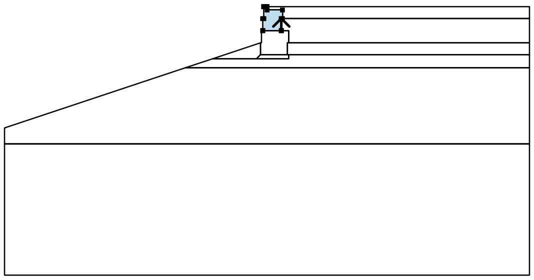
Upper Fat Clay

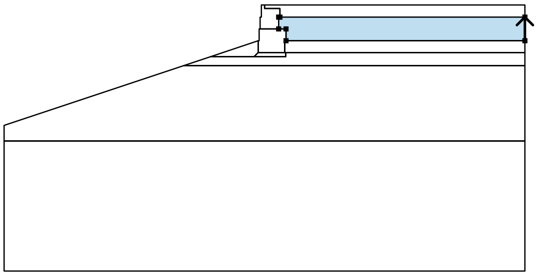
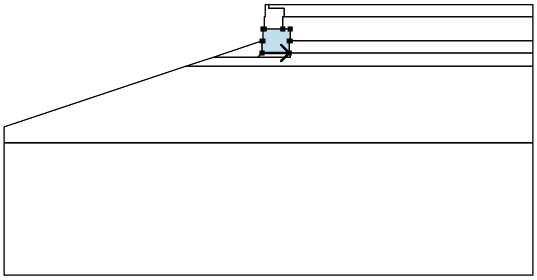
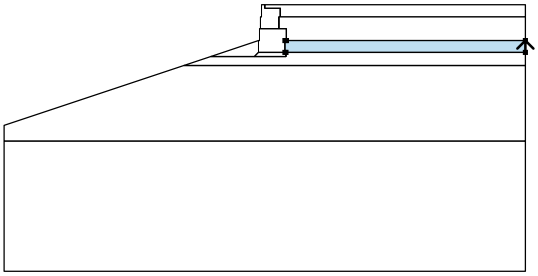
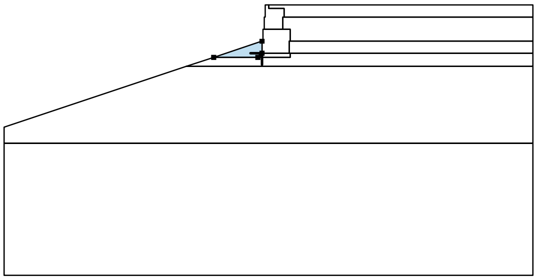
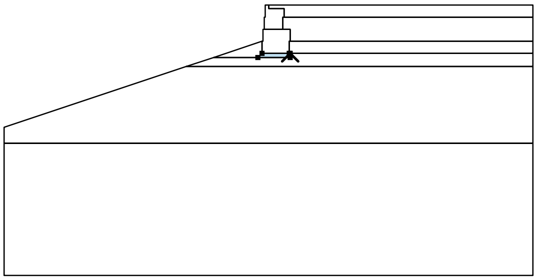
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

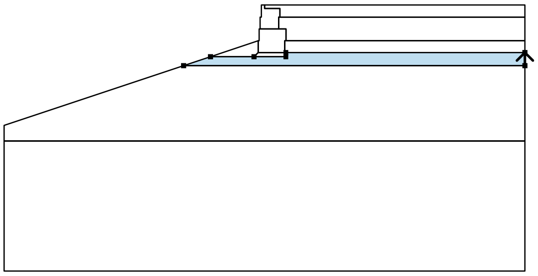
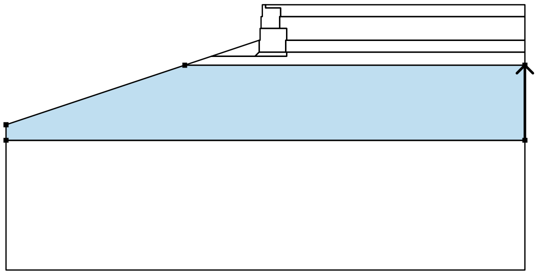
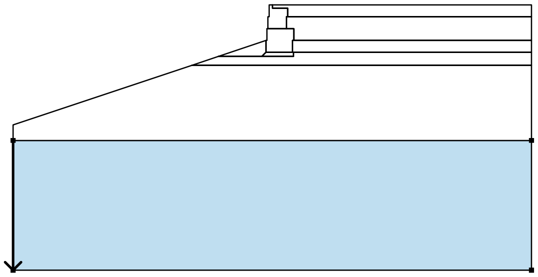
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	▦
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		-0.82	-6.00	2.55	-6.00	Material of structure
		2.55	-4.50	2.69	-4.50	🟥
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
5		32.80	-6.00	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	2.68	-6.00	
6		-1.32	-6.50	-0.82	-6.00	Upper Lean Clay
		-0.82	-4.50	-6.82	-6.50	▨
7		2.68	-6.50	2.68	-6.00	#57 Stone
		2.55	-6.00	-0.82	-6.00	▨
		-1.32	-6.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
8		32.80	-7.63	32.80	-6.00	Upper Lean Clay
		2.68	-6.00	2.68	-6.50	▨
		-1.32	-6.50	-6.82	-6.50	
		-10.21	-7.63			
9		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-10.21	-7.63	-32.80	-15.16	▨
		-32.80	-17.13			
10		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft

Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft

Resisting moment : M_p = 82044.5 lbfft/ft

Factor of safety = 1.56 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

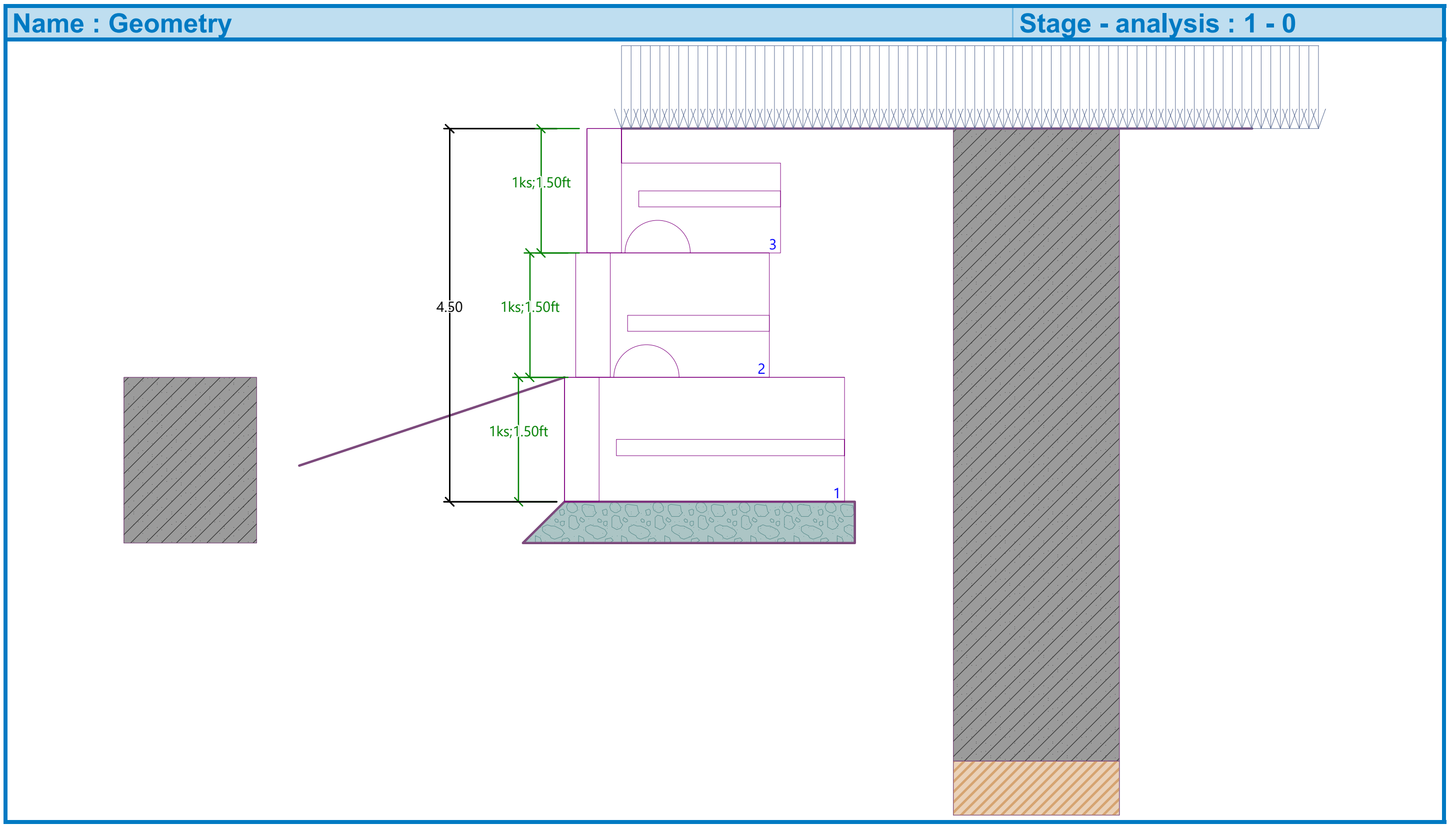
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

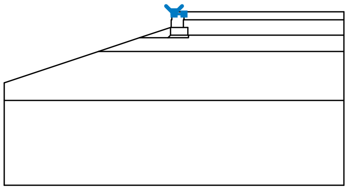
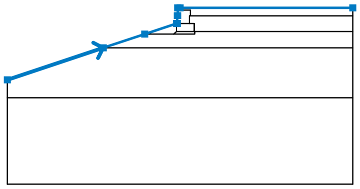
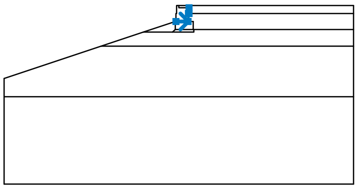
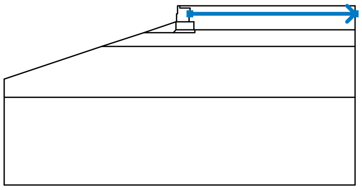
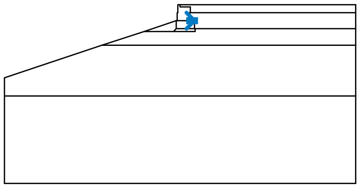
(input for current task)

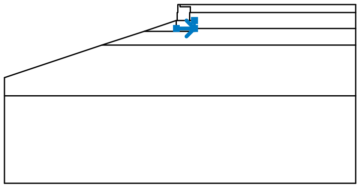
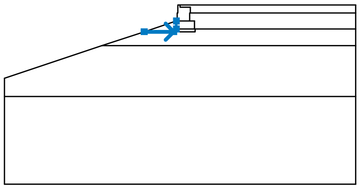
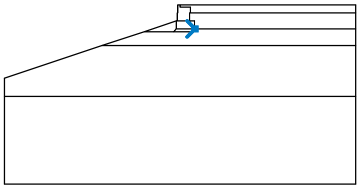
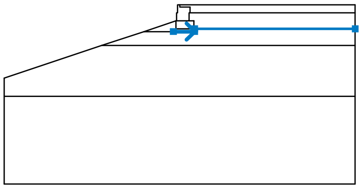
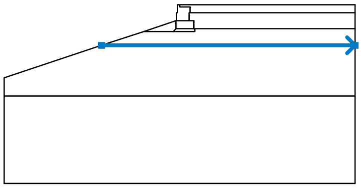
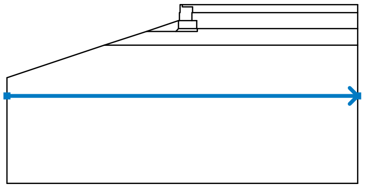
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

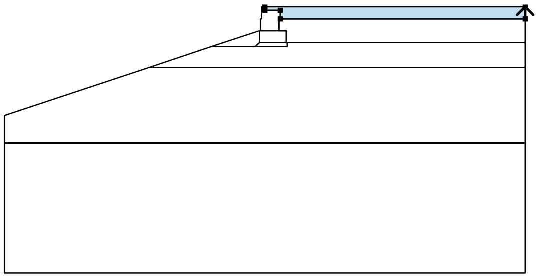
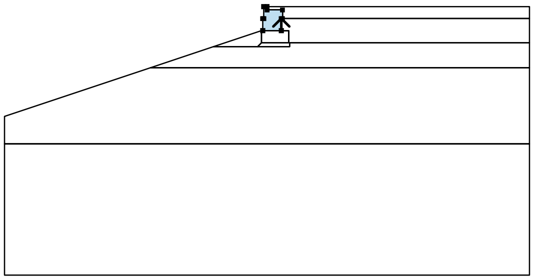
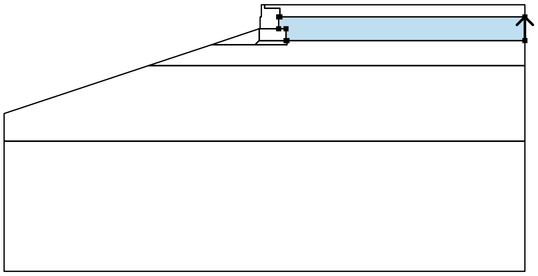
Upper Fat Clay

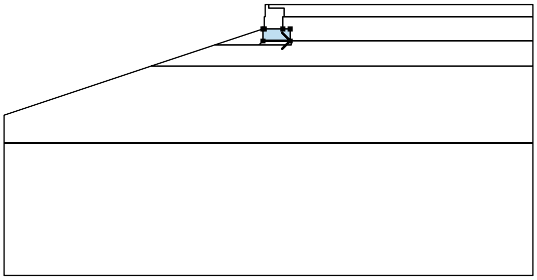
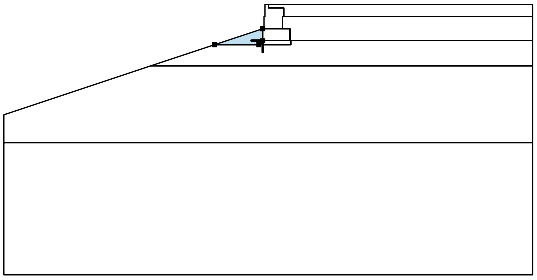
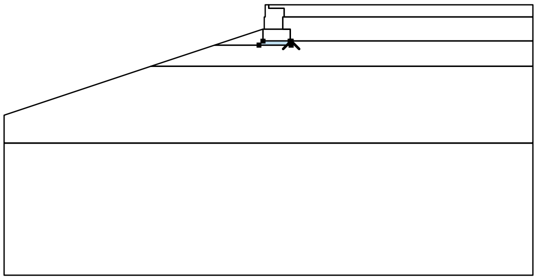
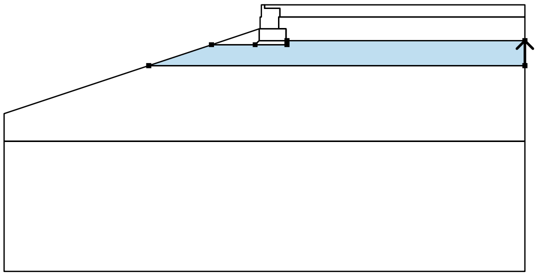
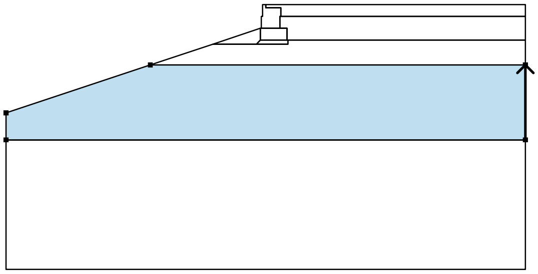
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

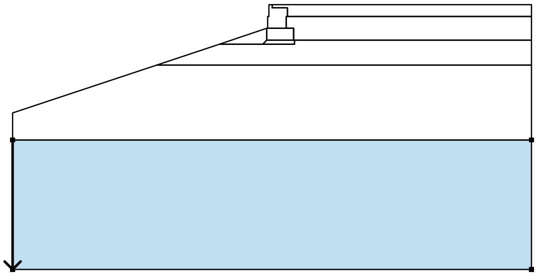
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69	-4.50	2.69	-4.50	Material of structure ▦
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
5		-1.19	-5.00	-0.69	-4.50	Upper Lean Clay ▨
		-0.69	-3.00	-6.69	-5.00	
6		2.81	-5.00	2.81	-4.50	#57 Stone ▩
		2.69	-4.50	-0.69	-4.50	
		-1.19	-5.00			
7		32.80	-7.63	32.80	-4.50	Upper Lean Clay ▨
		2.81	-4.50	2.81	-5.00	
		-1.19	-5.00	-6.69	-5.00	
		-14.58	-7.63			
8		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-14.58	-7.63	-32.80	-13.70	
		-32.80	-17.13			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
9		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

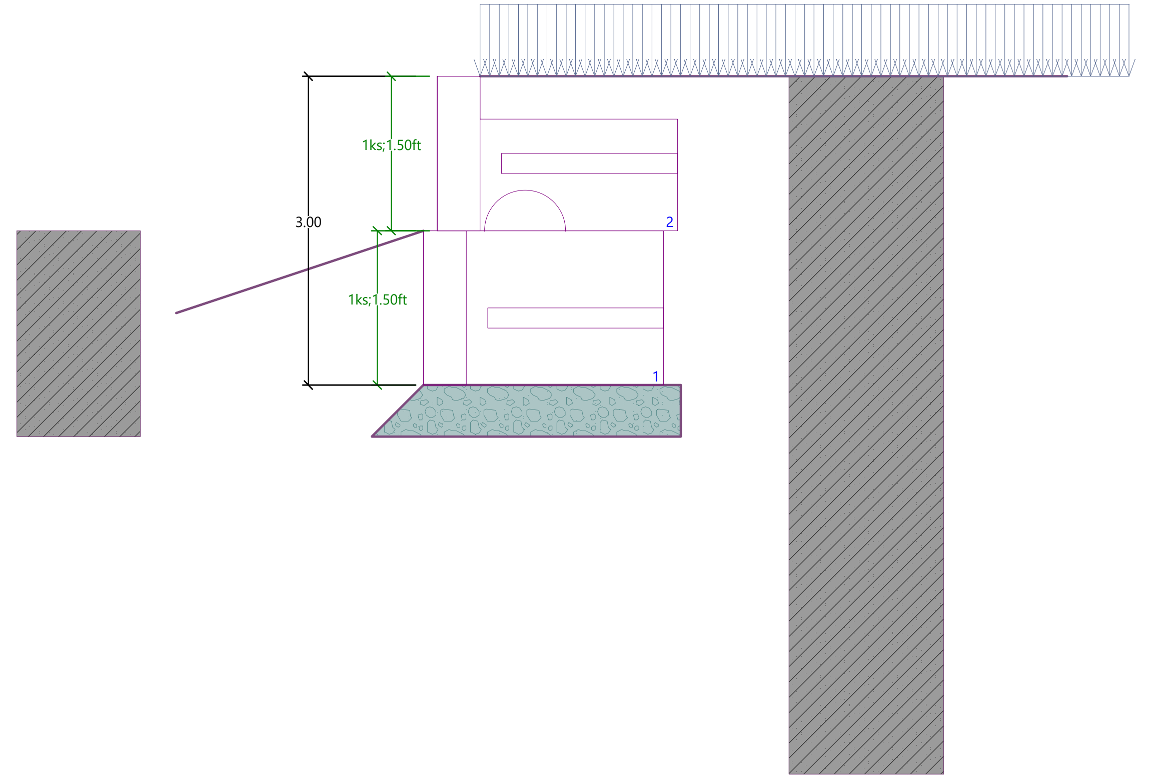
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft
Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft
Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

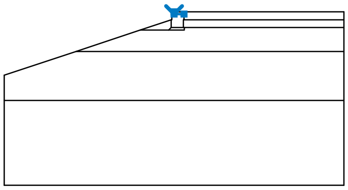
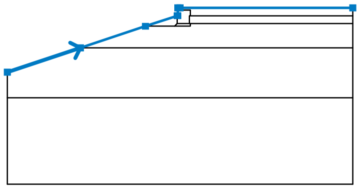
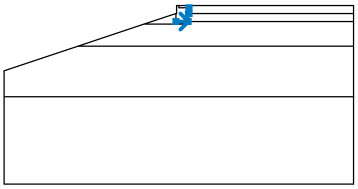
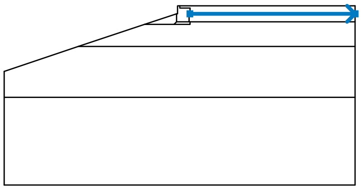
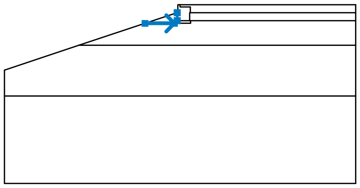
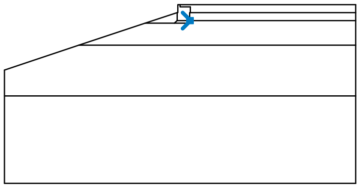
(input for current task)

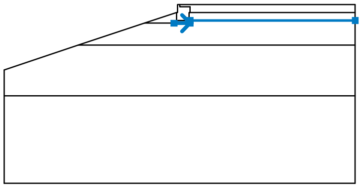
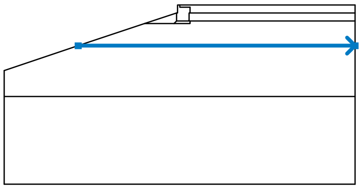
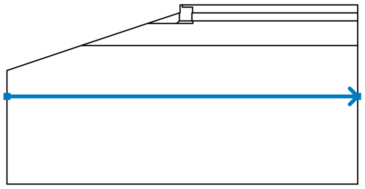
Stability analysis

Earthquake analysis :	Standard
Verification methodology :	Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		-1.05	-3.50	1.95	-3.50	1.95	-3.00
		32.80	-3.00				
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

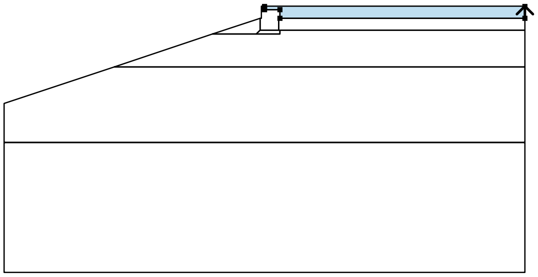
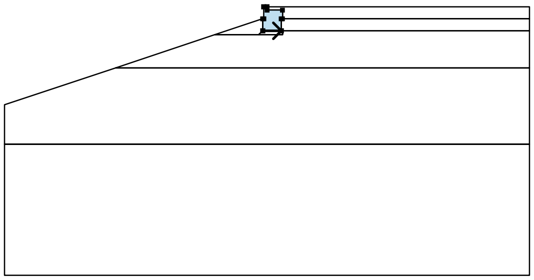
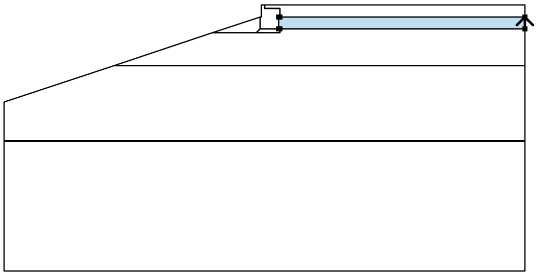
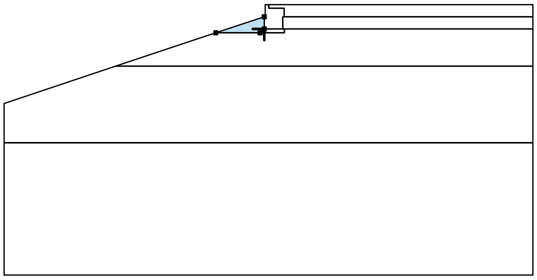
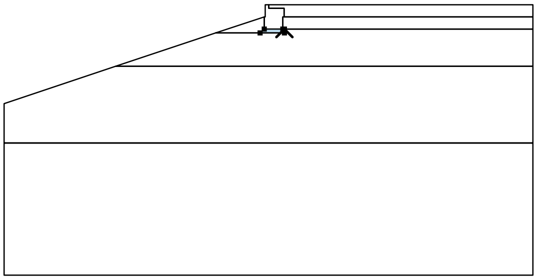
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

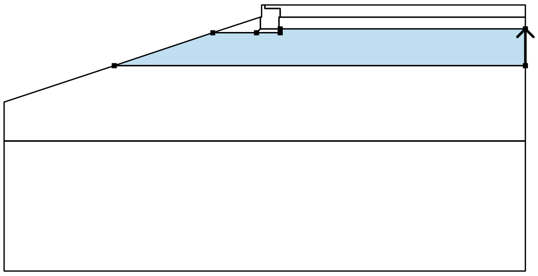
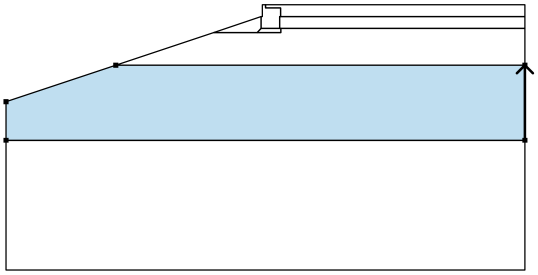
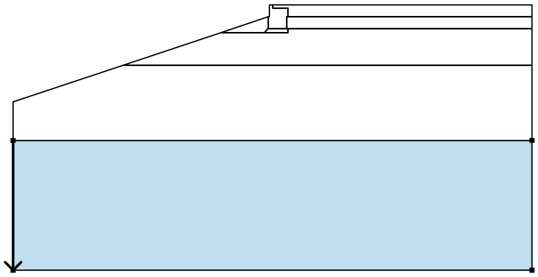
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure
		1.78	-1.50	1.92	-1.50	▦
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay
		-0.55	-1.50	-6.55	-3.50	▨
5		1.95	-3.50	1.95	-3.00	#57 Stone
		1.78	-3.00	-0.55	-3.00	▩
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay
		1.95	-3.00	1.95	-3.50	▨
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-18.94	-7.63	-32.80	-12.25	▨
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft
Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft
Resisting moment : M_p = 131009.9 lbfft/ft
Factor of safety = 2.07 > 1.30
Slope stability ACCEPTABLE

WALL #6

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

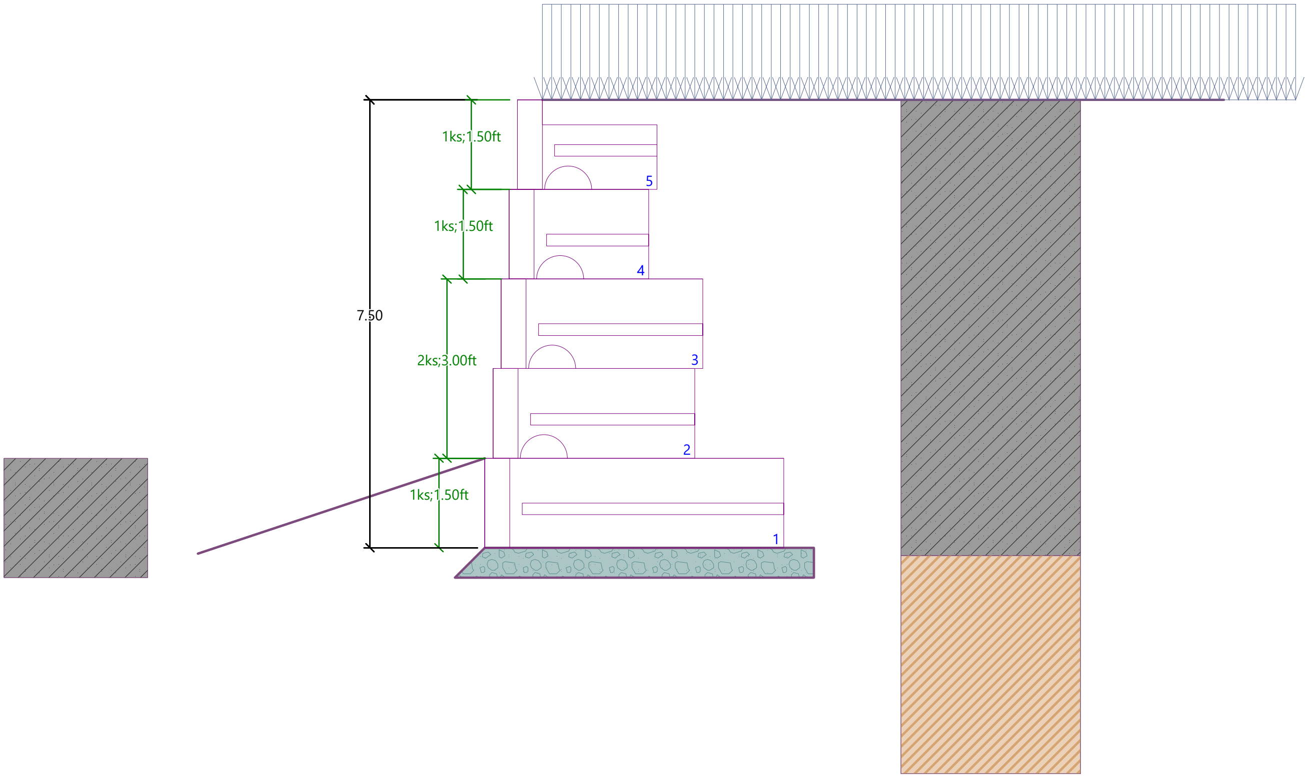
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

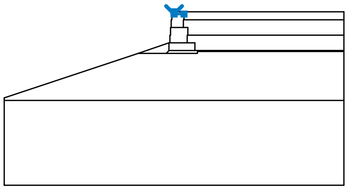
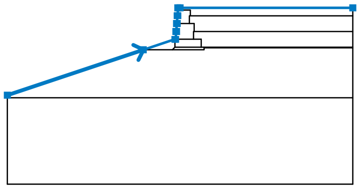
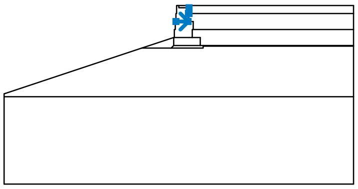
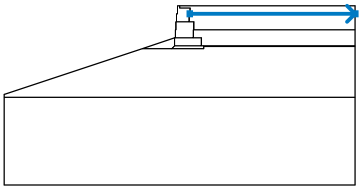
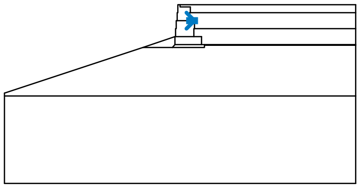
(input for current task)

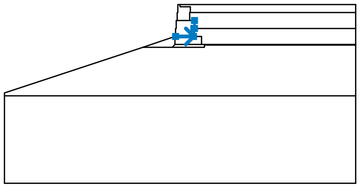
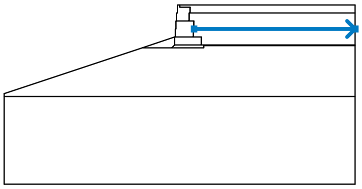
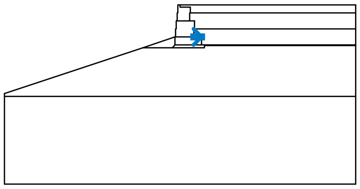
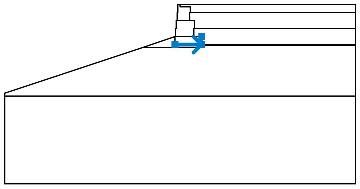
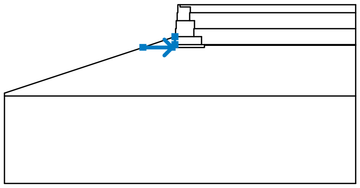
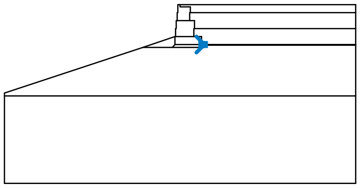
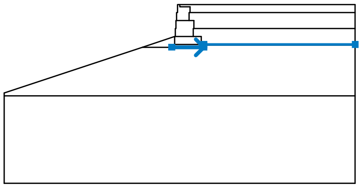
Stability analysis

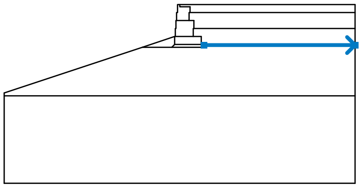
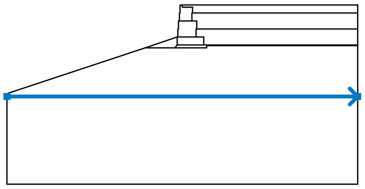
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

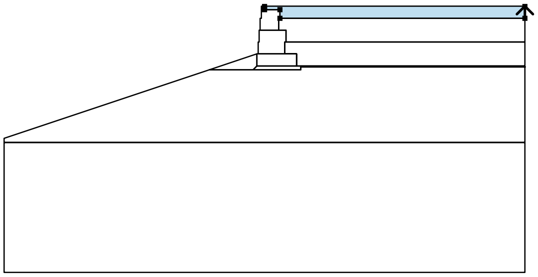
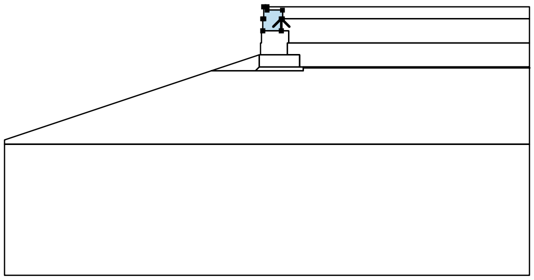
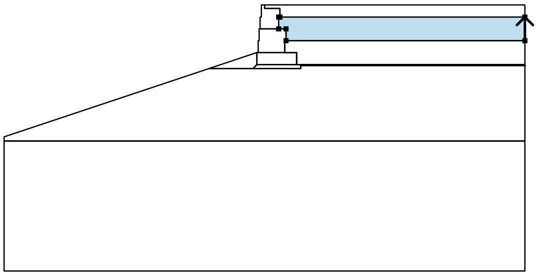
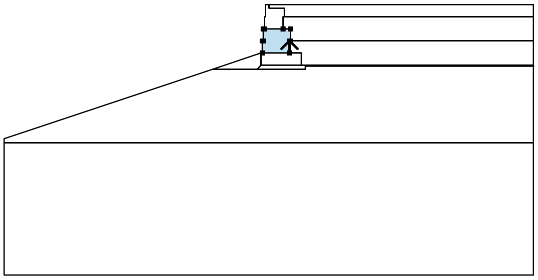
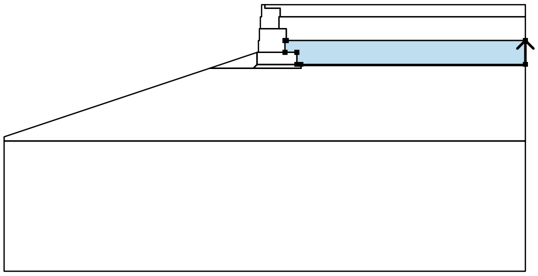
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

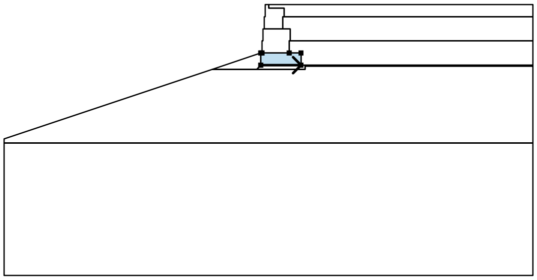
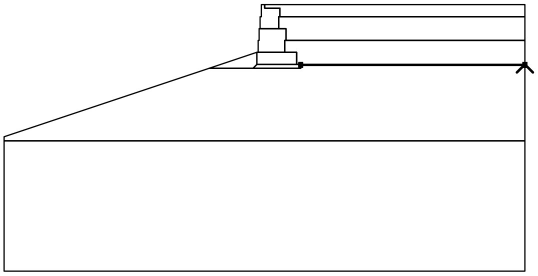
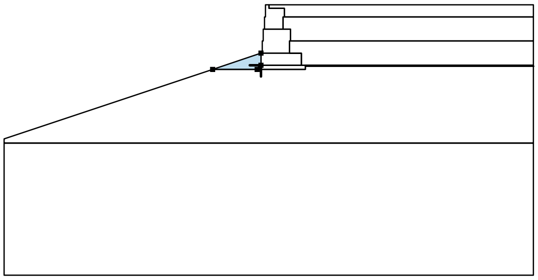
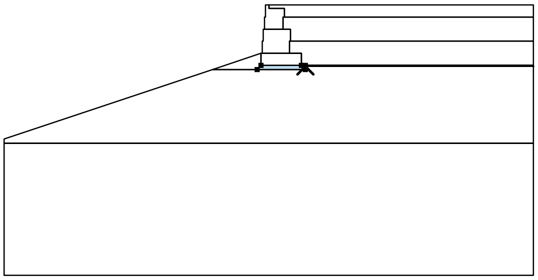
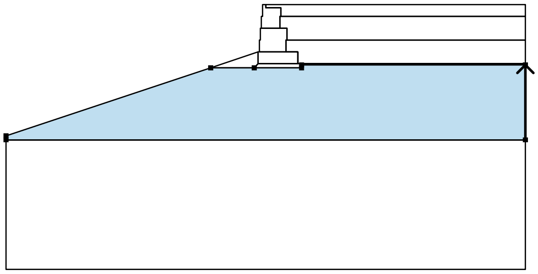
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

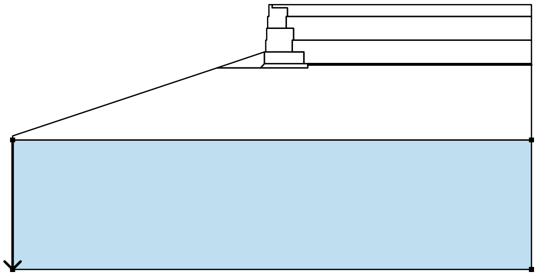
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	▦
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	▦
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure
		4.04	-6.00	2.55	-6.00	▦
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.54	-7.50	4.54	-7.63	▨
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay
		-0.96	-6.00	-6.96	-8.00	▨
9		4.54	-8.00	4.54	-7.63	#57 Stone
		4.54	-7.50	4.04	-7.50	▩
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		4.54	-7.63	4.54	-8.00	▨
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)

Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

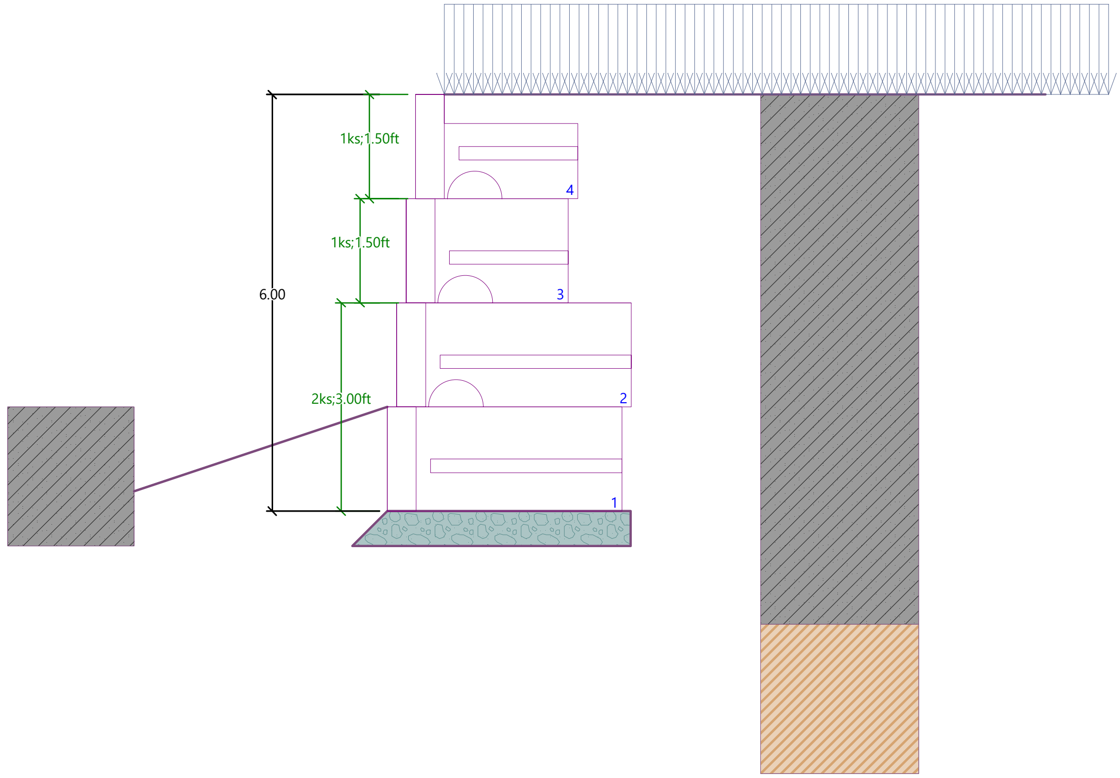
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

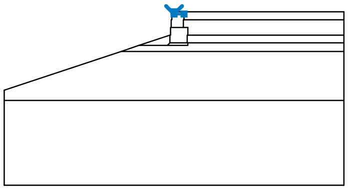
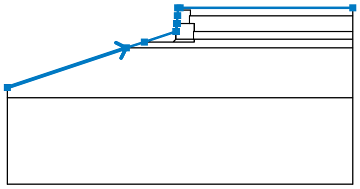
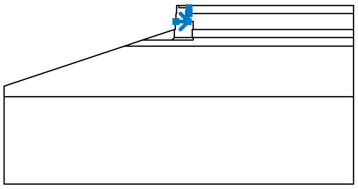
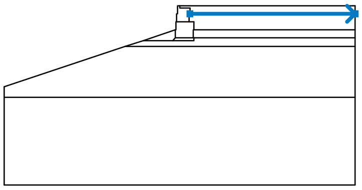
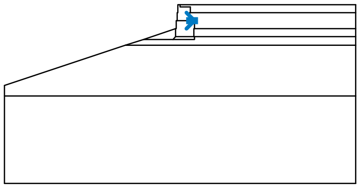
(input for current task)

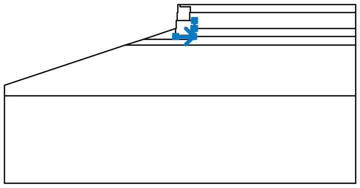
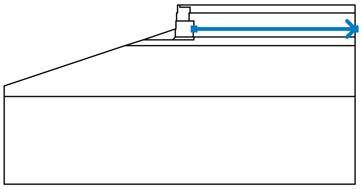
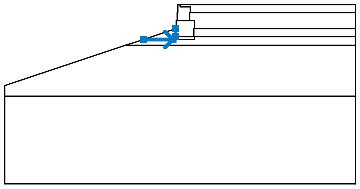
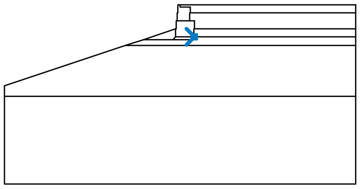
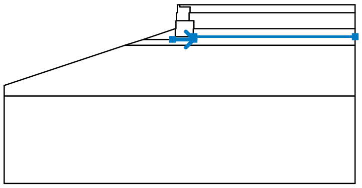
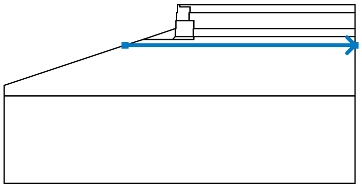
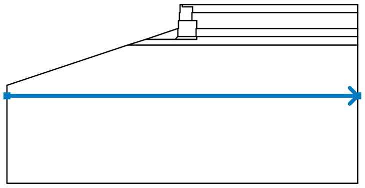
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		-6.82	-6.50	-1.32	-6.50	-0.82	-6.00
		-0.82	-4.50				
9		2.55	-6.00	2.68	-6.00		
10		-1.32	-6.50	2.68	-6.50	2.68	-6.00
		32.80	-6.00				
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

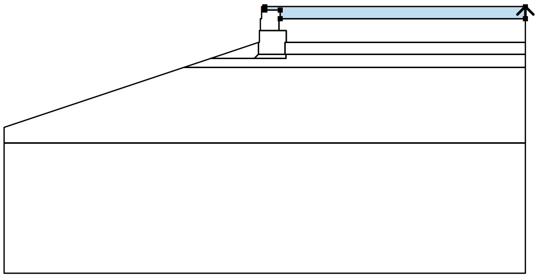
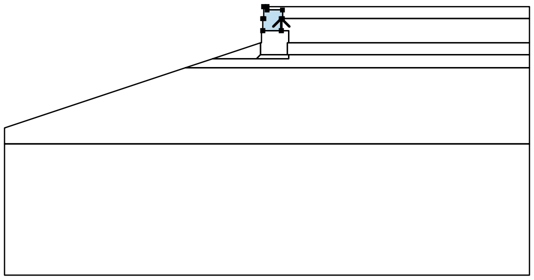
Upper Fat Clay

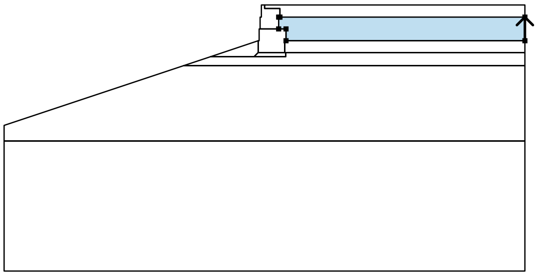
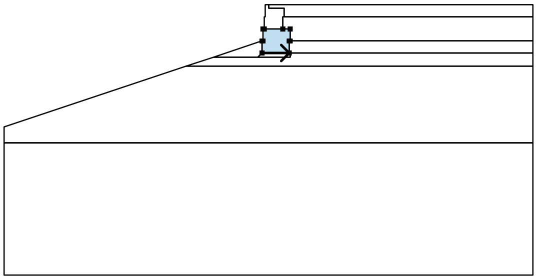
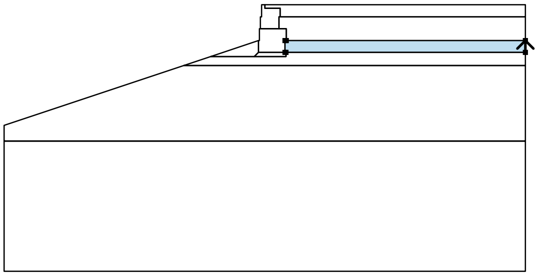
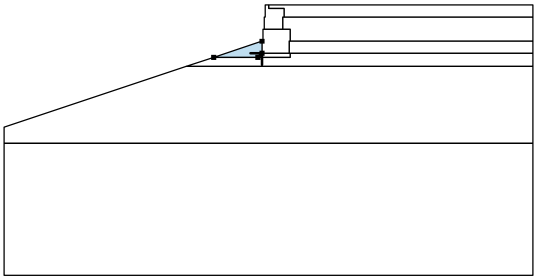
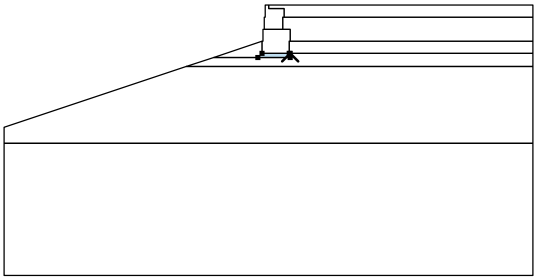
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

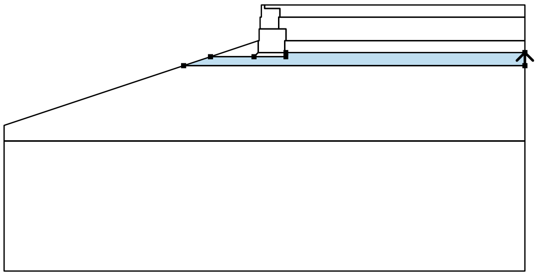
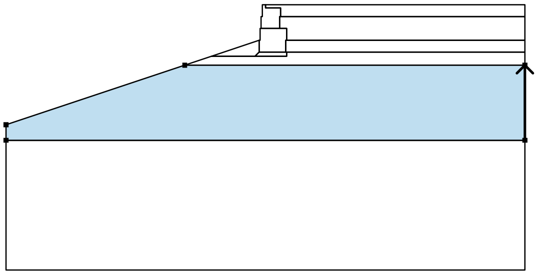
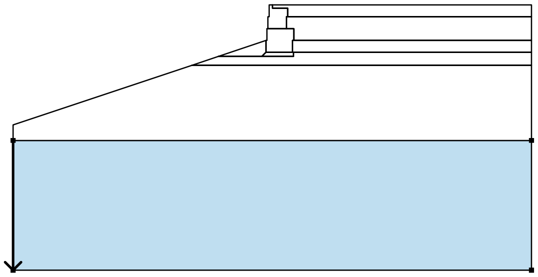
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		-0.82	-6.00	2.55	-6.00	Material of structure 🟥
		2.55	-4.50	2.69	-4.50	
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
5		32.80	-6.00	32.80	-4.50	Upper Lean Clay ▨
		2.69	-4.50	2.55	-4.50	
		2.55	-6.00	2.68	-6.00	
6		-1.32	-6.50	-0.82	-6.00	Upper Lean Clay ▨
		-0.82	-4.50	-6.82	-6.50	
7		2.68	-6.50	2.68	-6.00	#57 Stone 🟦
		2.55	-6.00	-0.82	-6.00	
		-1.32	-6.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
8		32.80	-7.63	32.80	-6.00	Upper Lean Clay ▨
		2.68	-6.00	2.68	-6.50	
		-1.32	-6.50	-6.82	-6.50	
		-10.21	-7.63			
9		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-10.21	-7.63	-32.80	-15.16	
		-32.80	-17.13			
10		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft

Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft

Resisting moment : M_p = 82044.5 lbfft/ft

Factor of safety = 1.56 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

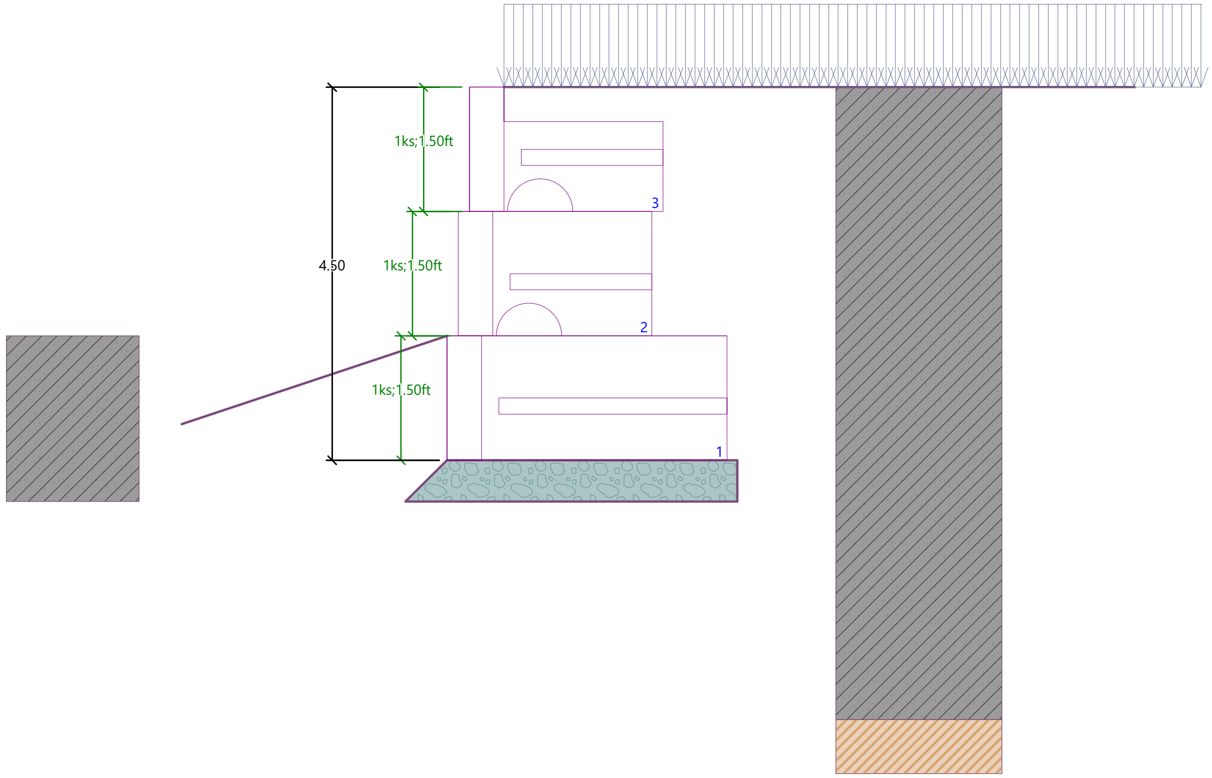
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

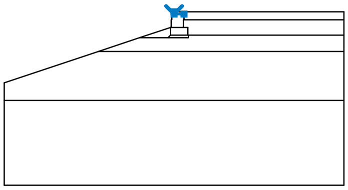
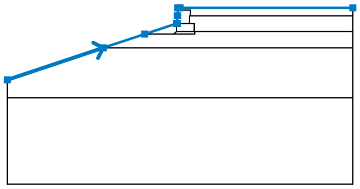
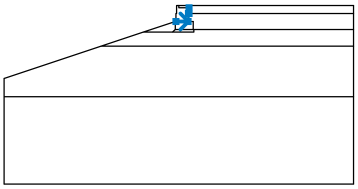
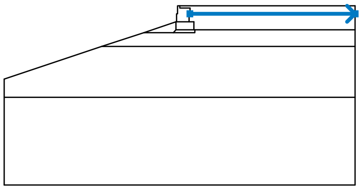
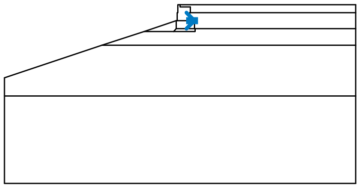
(input for current task)

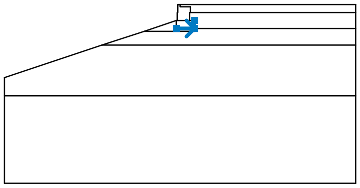
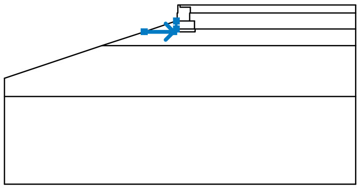
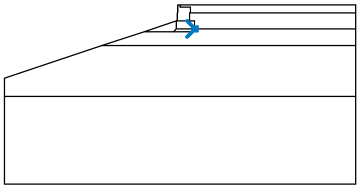
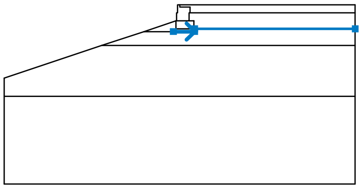
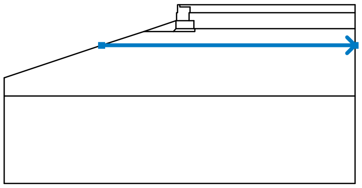
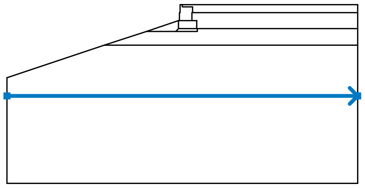
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▦	110.0		
2	Upper Sand	▧	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

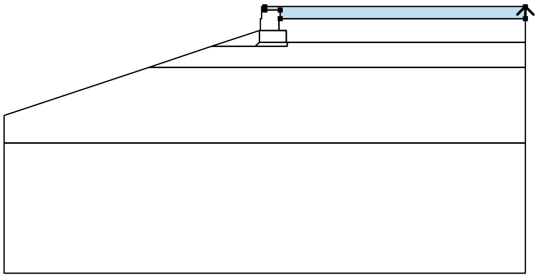
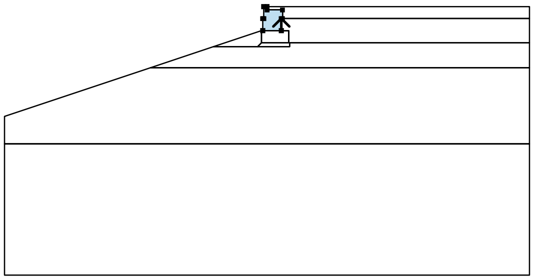
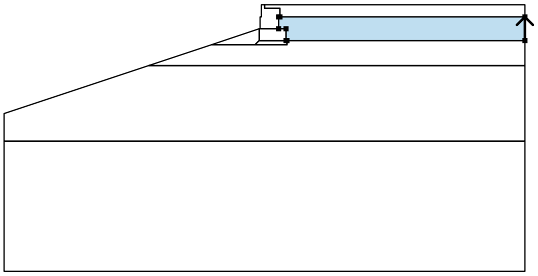
Upper Fat Clay

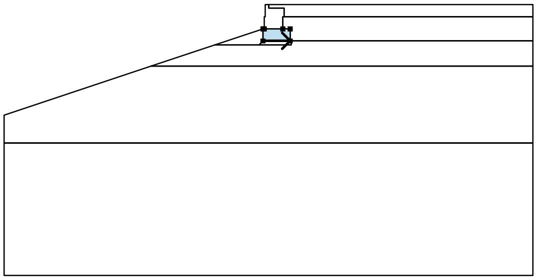
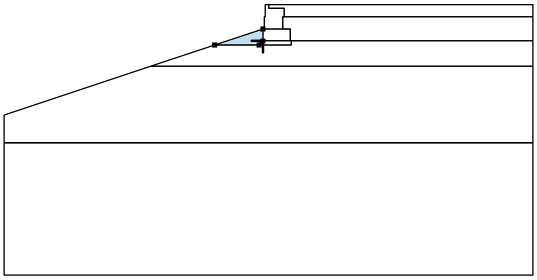
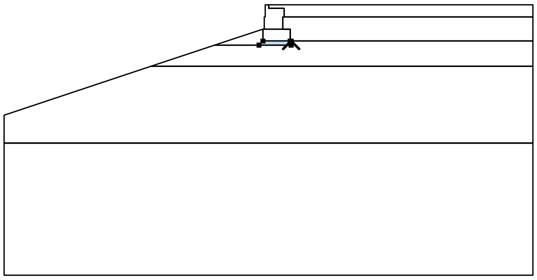
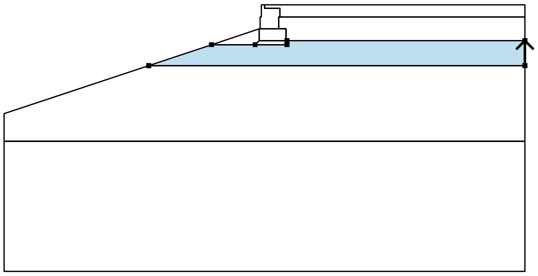
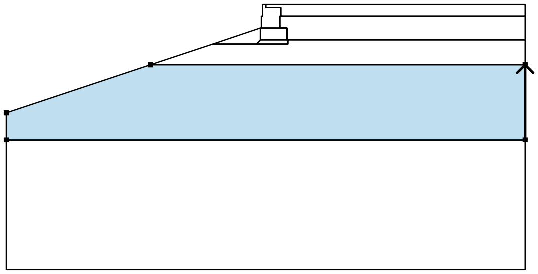
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

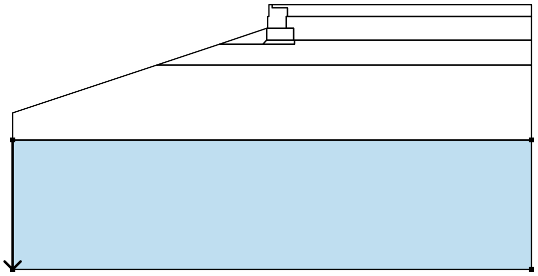
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69	-4.50	2.69	-4.50	Material of structure
		2.69	-3.00	1.78	-3.00	▦
		-0.55	-3.00	-0.69	-3.00	
5		-1.19	-5.00	-0.69	-4.50	Upper Lean Clay
		-0.69	-3.00	-6.69	-5.00	▨
6		2.81	-5.00	2.81	-4.50	#57 Stone
		2.69	-4.50	-0.69	-4.50	▩
		-1.19	-5.00			
7		32.80	-7.63	32.80	-4.50	Upper Lean Clay
		2.81	-4.50	2.81	-5.00	▨
		-1.19	-5.00	-6.69	-5.00	
		-14.58	-7.63			
8		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-14.58	-7.63	-32.80	-13.70	▨
		-32.80	-17.13			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
9		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

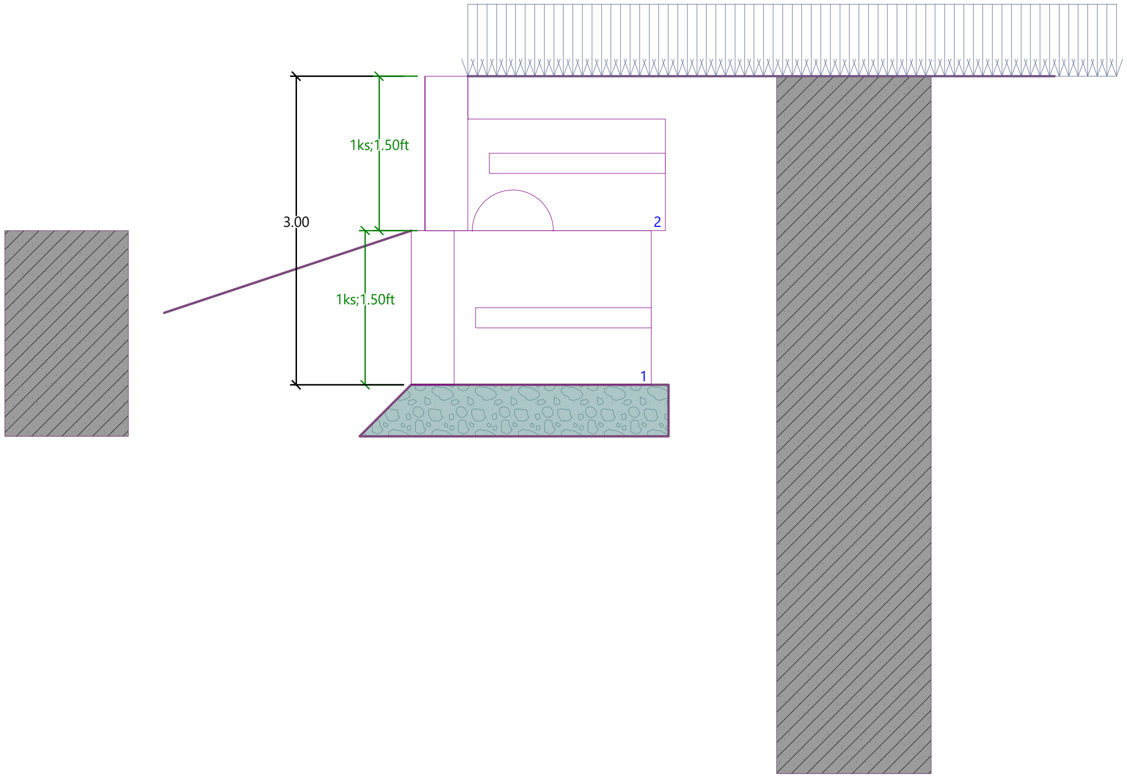
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft
Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft
Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

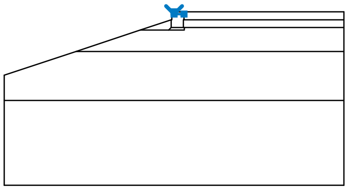
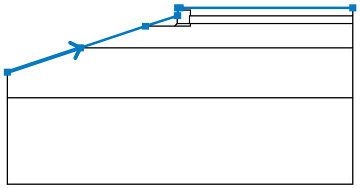
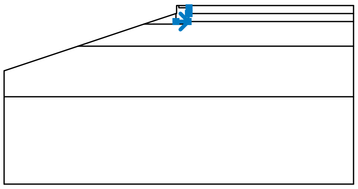
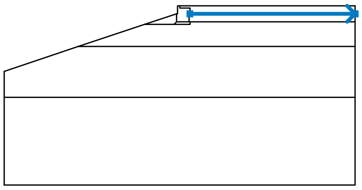
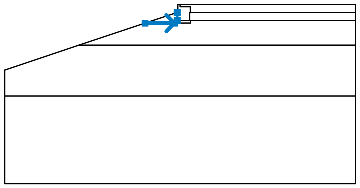
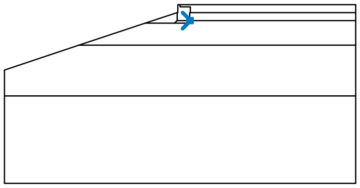
(input for current task)

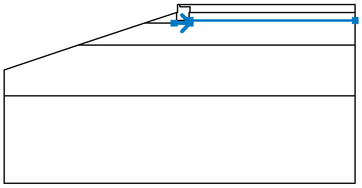
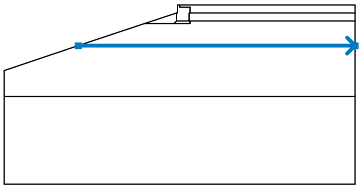
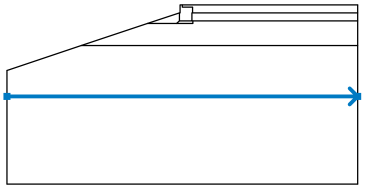
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		-1.05	-3.50	1.95	-3.50	1.95	-3.00
		32.80	-3.00				
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_{s} [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

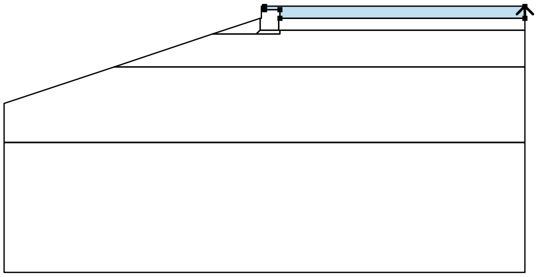
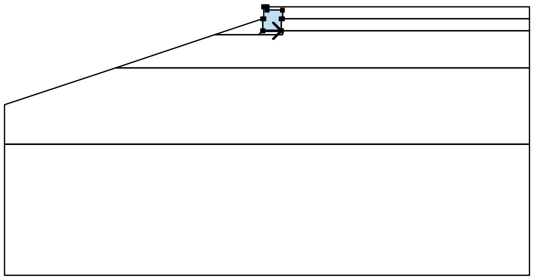
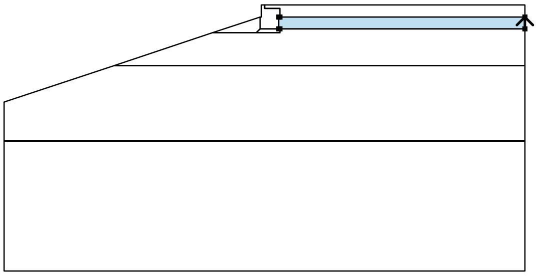
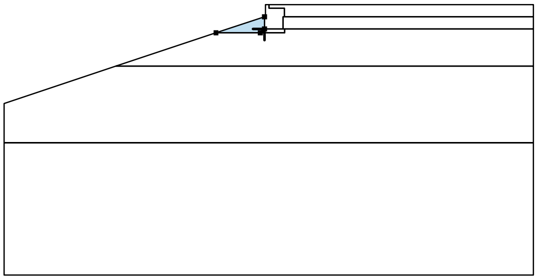
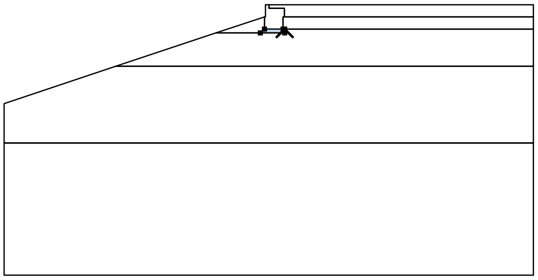
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

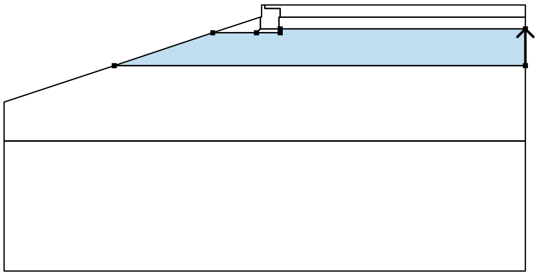
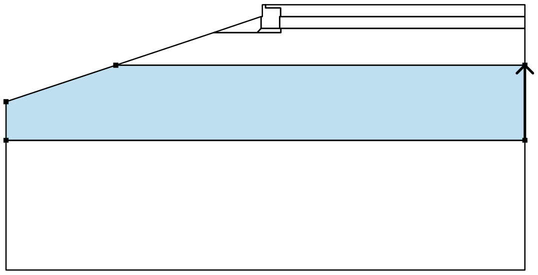
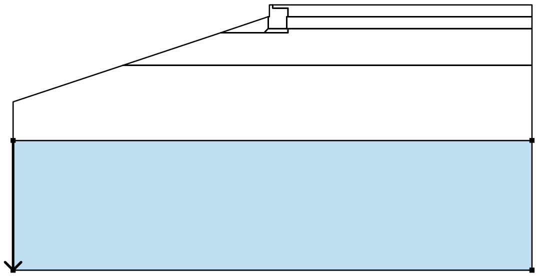
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure
		1.78	-1.50	1.92	-1.50	🟥
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay
		-0.55	-1.50	-6.55	-3.50	▨
5		1.95	-3.50	1.95	-3.00	#57 Stone
		1.78	-3.00	-0.55	-3.00	▨
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay ▨
		1.95	-3.00	1.95	-3.50	
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-18.94	-7.63	-32.80	-12.25	
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft
Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft
Resisting moment : M_p = 131009.9 lbfft/ft
Factor of safety = 2.07 > 1.30

Slope stability ACCEPTABLE

WALL #7

MAX. WALL HEIGHT = 9.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H9
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

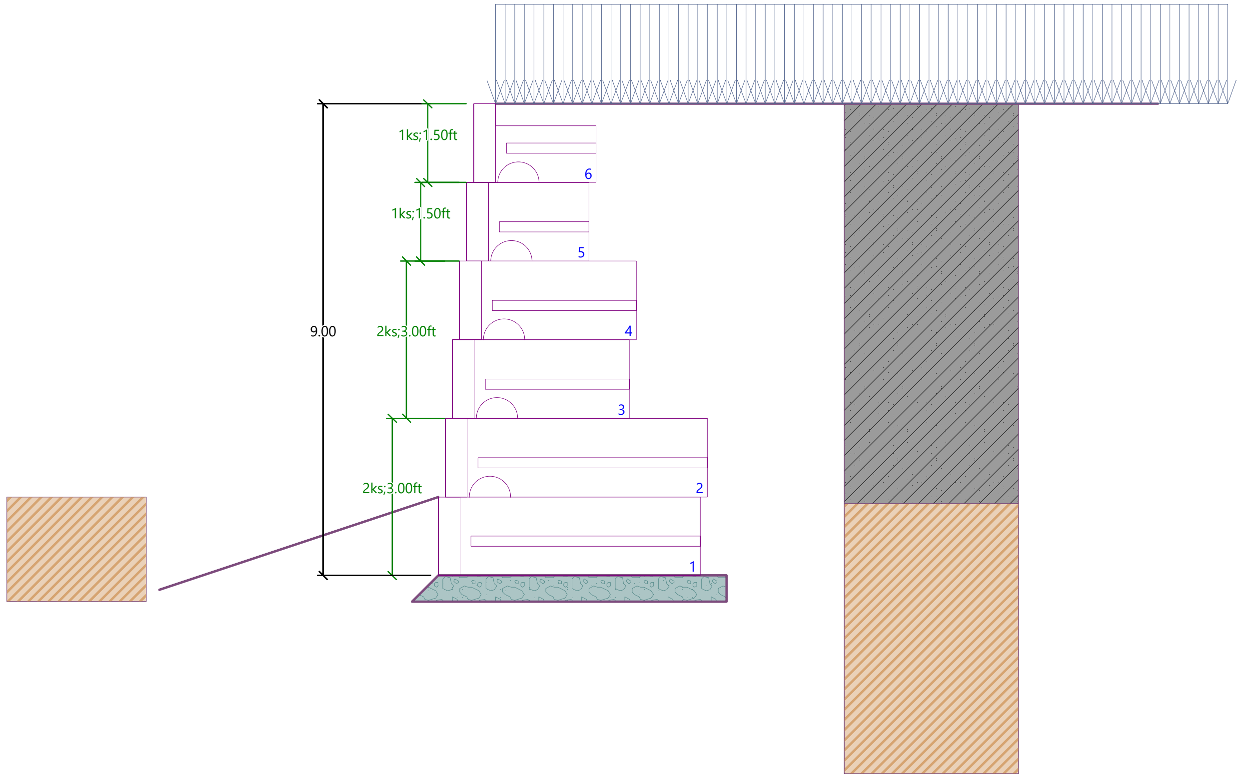
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	2	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Fat Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	4228.1	2.77	1.000
FF resistance	-1104.2	-0.85	-368.0	0.33	1.000
Weight - earth wedge	0.0	-0.75	23.3	5.68	1.000
Weight - earth wedge	0.0	-4.21	191.7	4.67	1.000
Weight - earth wedge	0.0	-6.91	66.6	3.71	1.000
Weight - earth wedge	0.0	-9.29	89.1	2.49	1.000
Active pressure	1350.5	-2.88	1368.3	5.21	1.000
Traffic/Construction Surcharge	798.9	-4.37	841.2	4.66	1.000
Traffic/Construction Surcharge	0.0	-9.50	411.5	2.42	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 25109.9 lbfft/ft
Overturning moment M_{ovr} = 6439.5 lbfft/ft

Safety factor = 3.90 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3886.86 lbf/ft
Active horizontal force H_{act} = 1045.10 lbf/ft

Safety factor = 3.72 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.56	3913.1	2.25	1.000
FF resistance	-429.5	-0.45	-143.1	0.00	1.000
Weight - earth wedge	0.0	-3.71	191.7	4.17	1.000
Weight - earth wedge	0.0	-6.41	66.6	3.21	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - earth wedge	0.0	-8.79	89.1	1.99	1.000
Active pressure	1117.3	-2.87	942.8	4.43	1.000
Traffic/Construction Surcharge	744.0	-4.16	727.3	3.98	1.000
Traffic/Construction Surcharge	0.0	-9.00	411.5	1.92	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 17843.7 lbfft/ft
Overturning moment M_{ovr} = 6112.9 lbfft/ft

Safety factor = 2.92 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 5201.54 lbf/ft
Active horizontal force H_{act} = 1431.68 lbf/ft

Safety factor = 3.63 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	1885.3	6851.89	1045.10	0.046	1257.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	1885.3	6851.89	1045.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.046
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1257.3 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 4.77 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

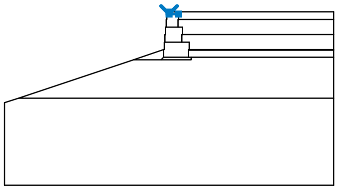
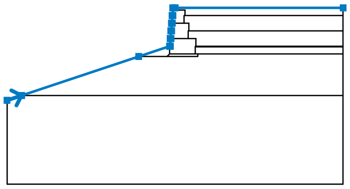
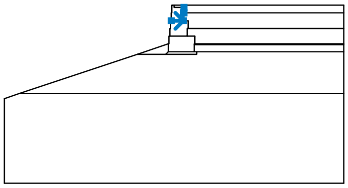
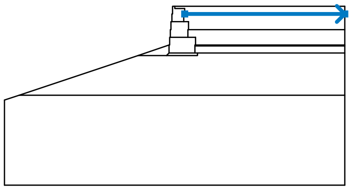
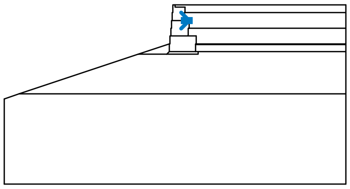
(input for current task)

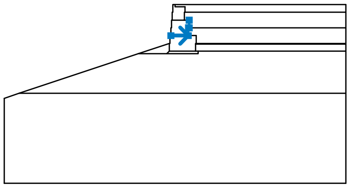
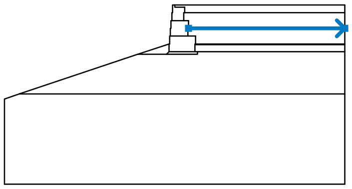
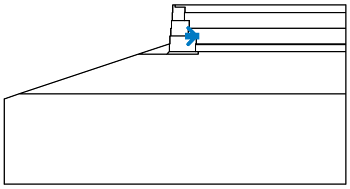
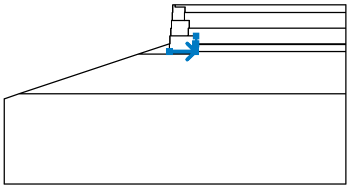
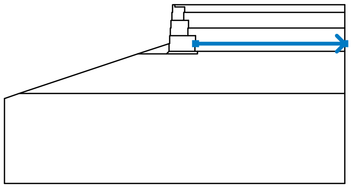
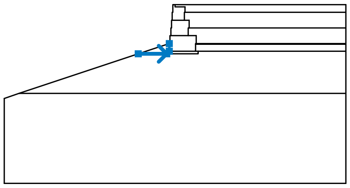
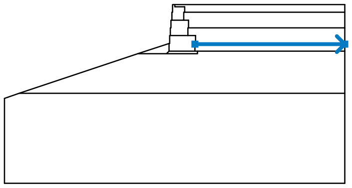
Stability analysis

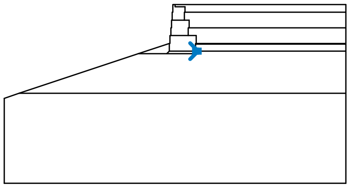
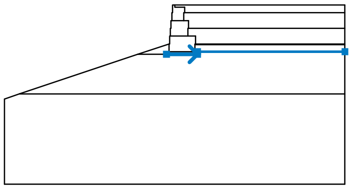
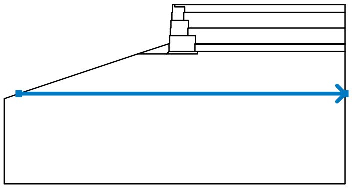
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-18.07	-29.98	-17.13	-7.09	-9.50
		-1.09	-7.50	-0.96	-7.50	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-1.09	-9.00	3.91	-9.00	3.91	-7.63
		3.91	-7.50	4.04	-7.50	4.04	-6.00
10		4.04	-7.50	32.80	-7.50		
11		-7.09	-9.50	-1.59	-9.50	-1.09	-9.00
		-1.09	-7.50				
12		3.91	-7.63	32.80	-7.63		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		3.91	-9.00	4.41	-9.00		
14		-1.59	-9.50	4.41	-9.50	4.41	-9.00
		32.80	-9.00				
15		-29.98	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

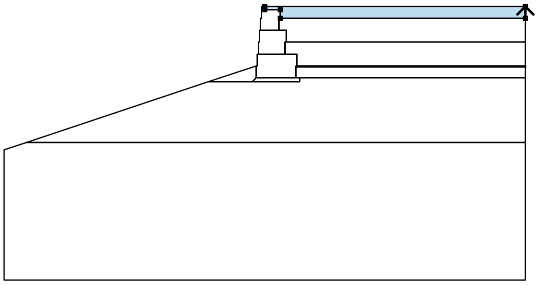
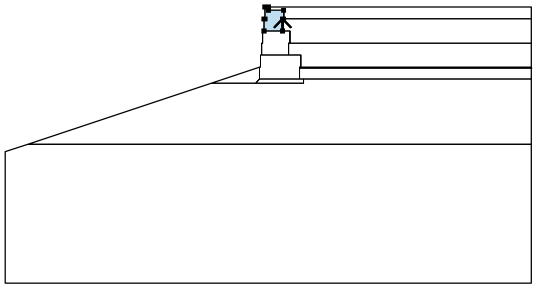
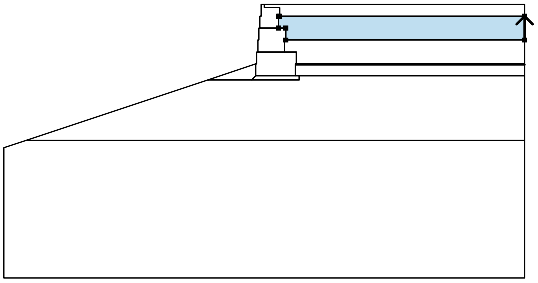
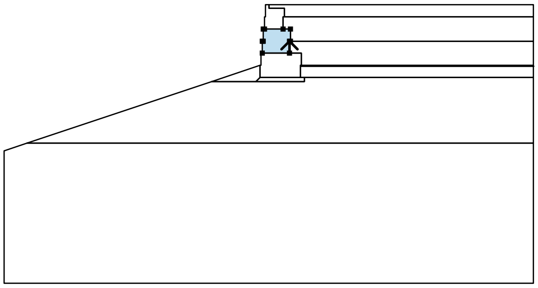
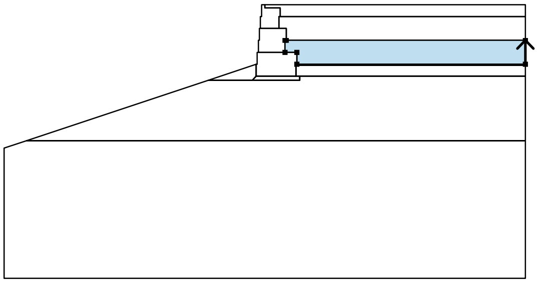
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

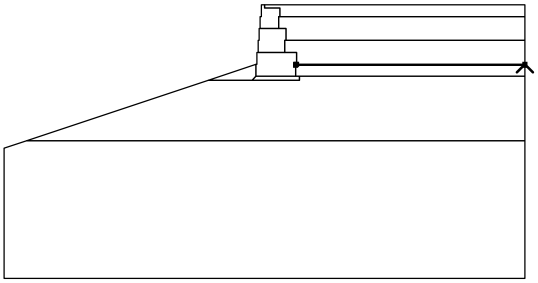
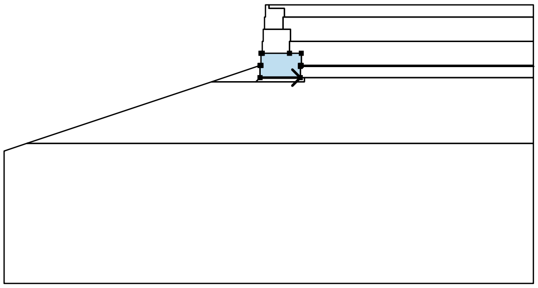
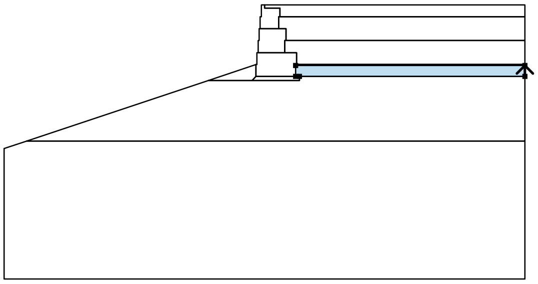
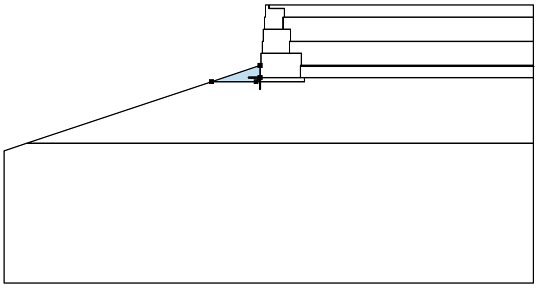
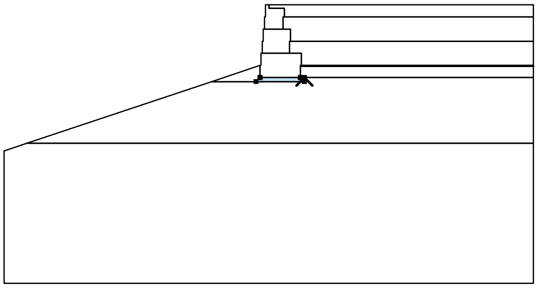
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

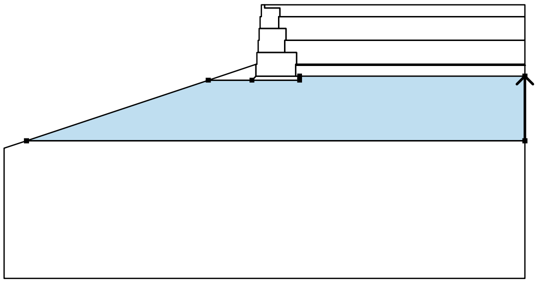
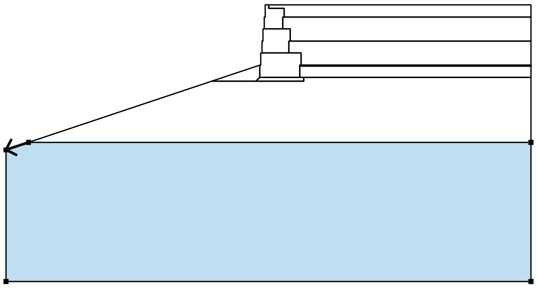
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.04	-7.50	3.91	-7.50	▨
		3.91	-7.63			
7		-1.09	-9.00	3.91	-9.00	Material of structure
		3.91	-7.63	3.91	-7.50	▦
		4.04	-7.50	4.04	-6.00	
		2.55	-6.00	-0.82	-6.00	
		-0.96	-6.00	-0.96	-7.50	
		-1.09	-7.50			
8		32.80	-9.00	32.80	-7.63	Upper Fat Clay
		3.91	-7.63	3.91	-9.00	▨
		4.41	-9.00			
9		-1.59	-9.50	-1.09	-9.00	Upper Fat Clay
		-1.09	-7.50	-7.09	-9.50	▨
10		4.41	-9.50	4.41	-9.00	#57 Stone
		3.91	-9.00	-1.09	-9.00	▩
		-1.59	-9.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		32.80	-17.13	32.80	-9.00	Upper Fat Clay
		4.41	-9.00	4.41	-9.50	▨
		-1.59	-9.50	-7.09	-9.50	
		-29.98	-17.13			
12		-29.98	-17.13	-32.80	-18.07	Upper Sand
		-32.80	-34.47	32.80	-34.47	▨
		32.80	-17.13			

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters

Center :	x =	-21.44	[ft]	Angles :	α_1 =	-12.94	[°]
	z =	21.42	[ft]		α_2 =	57.32	[°]
Radius :	R =	39.67	[ft]				

The slip surface after optimization.

Slope stability verification (Bishop)

Sum of active forces : F_a = 12614.0 lbf/ft
Sum of passive forces : F_p = 17332.9 lbf/ft

Sliding moment : M_a = 500395.9 lbfft/ft
Resisting moment : M_p = 687595.3 lbfft/ft
Factor of safety = 1.37 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

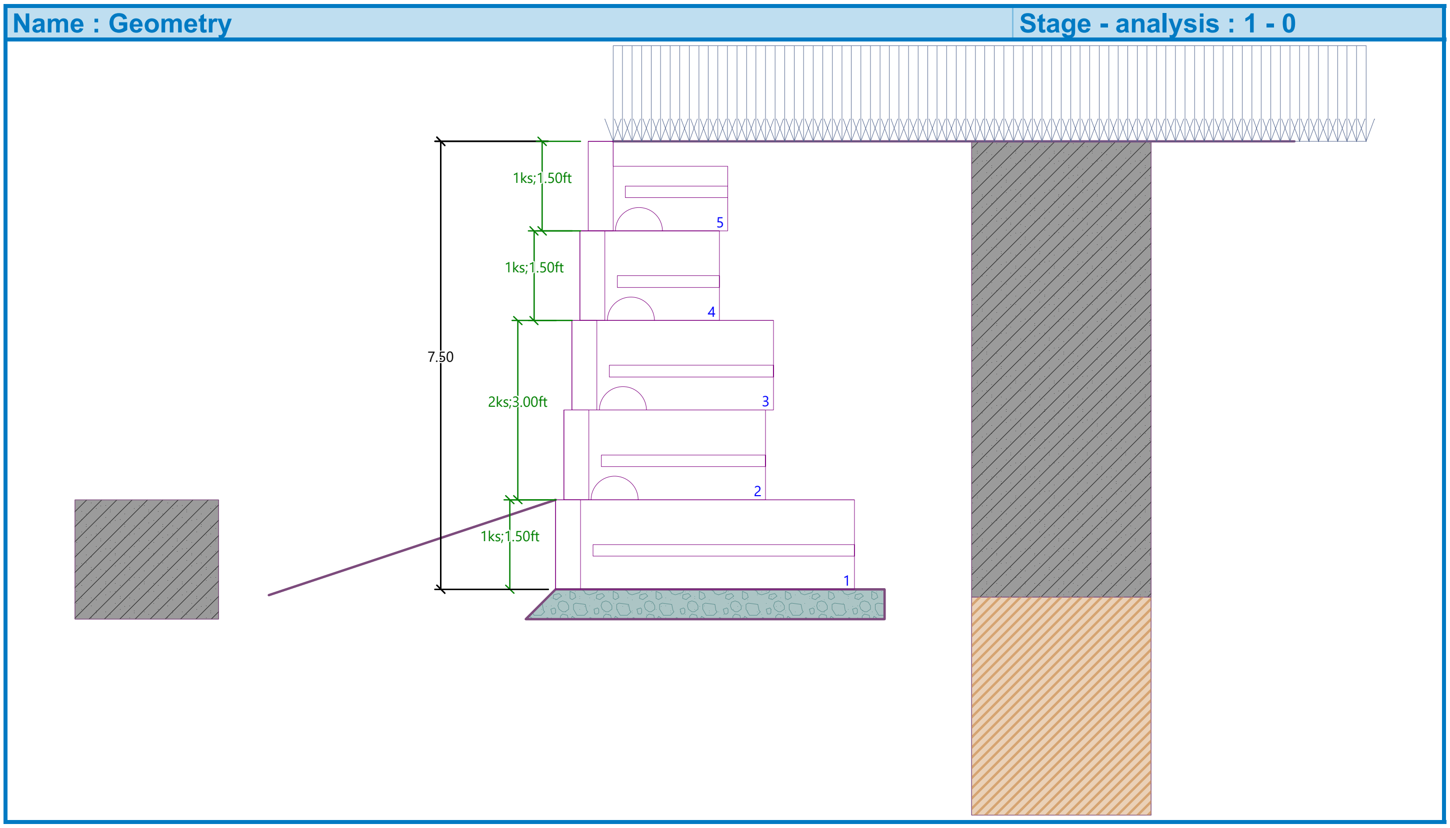
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability
Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

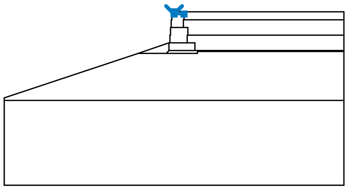
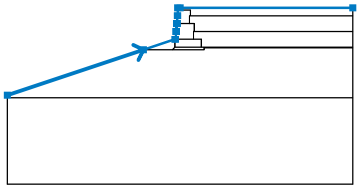
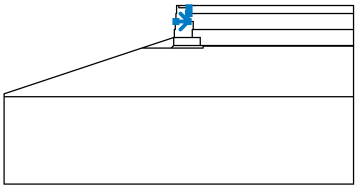
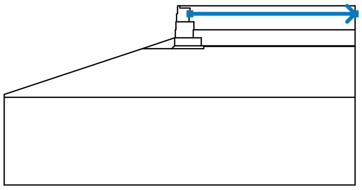
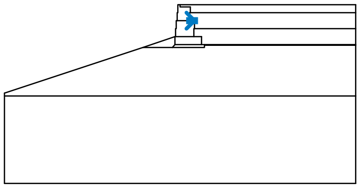
(input for current task)

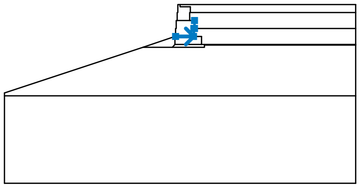
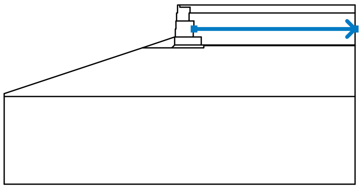
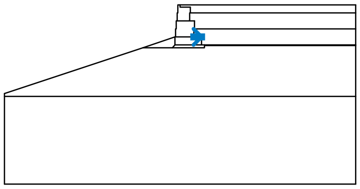
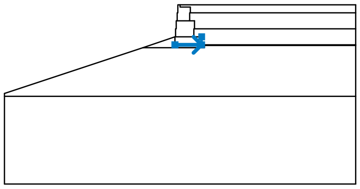
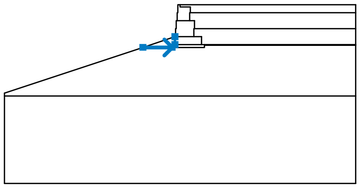
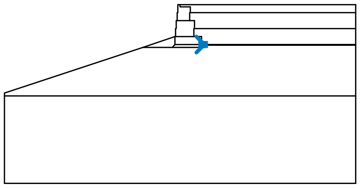
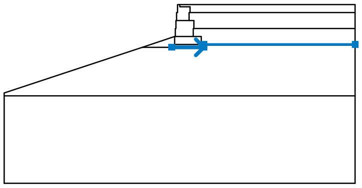
Stability analysis

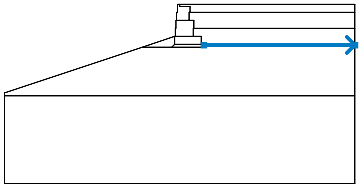
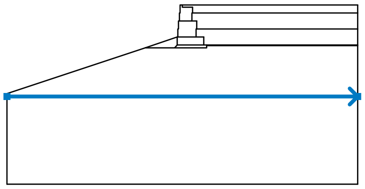
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

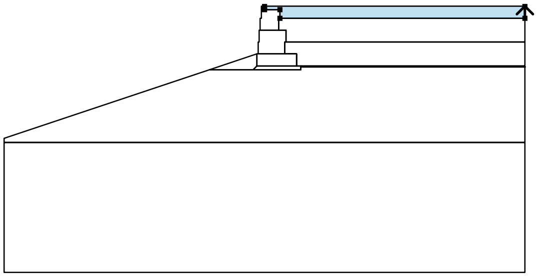
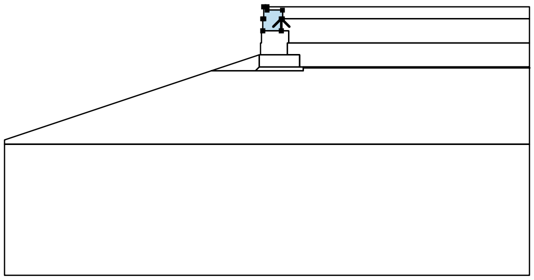
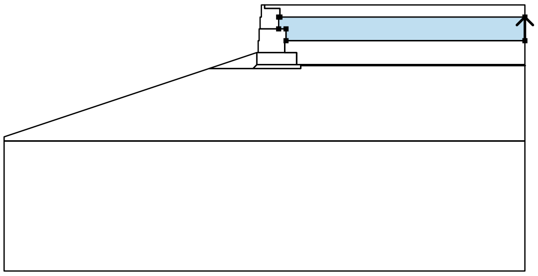
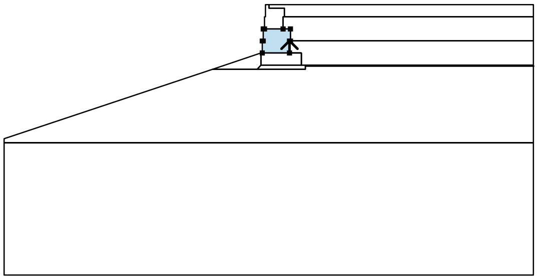
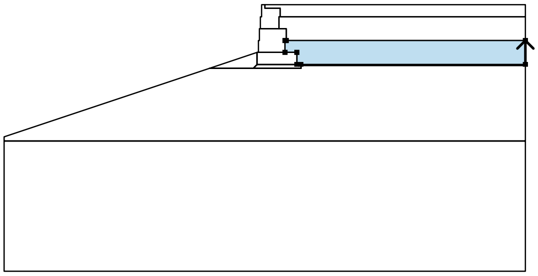
Upper Fat Clay

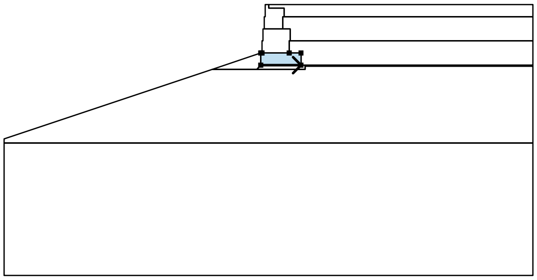
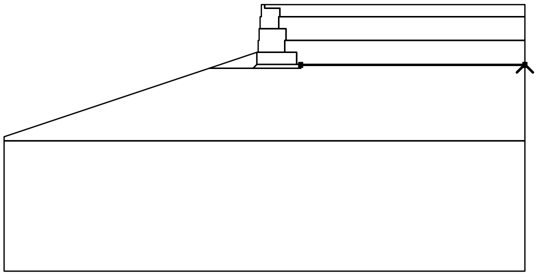
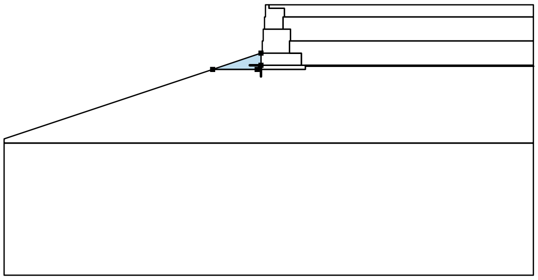
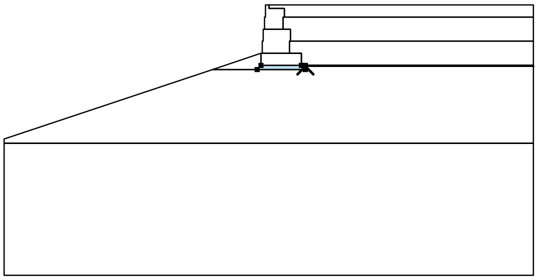
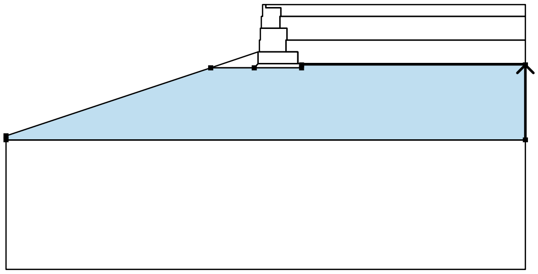
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

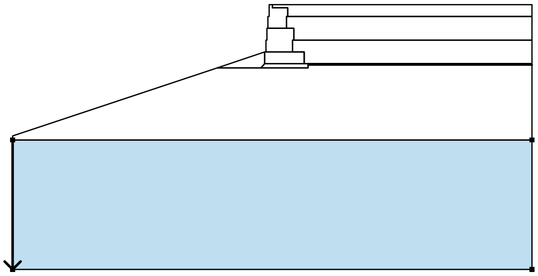
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure
		4.04	-6.00	2.55	-6.00	▦
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.54	-7.50	4.54	-7.63	▨
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay
		-0.96	-6.00	-6.96	-8.00	▨
9		4.54	-8.00	4.54	-7.63	#57 Stone
		4.54	-7.50	4.04	-7.50	░
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		4.54	-7.63	4.54	-8.00	▨
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		-32.80 32.80	-17.13 -33.53	-32.80 32.80	-33.53 -17.13	Upper Sand ▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters								
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

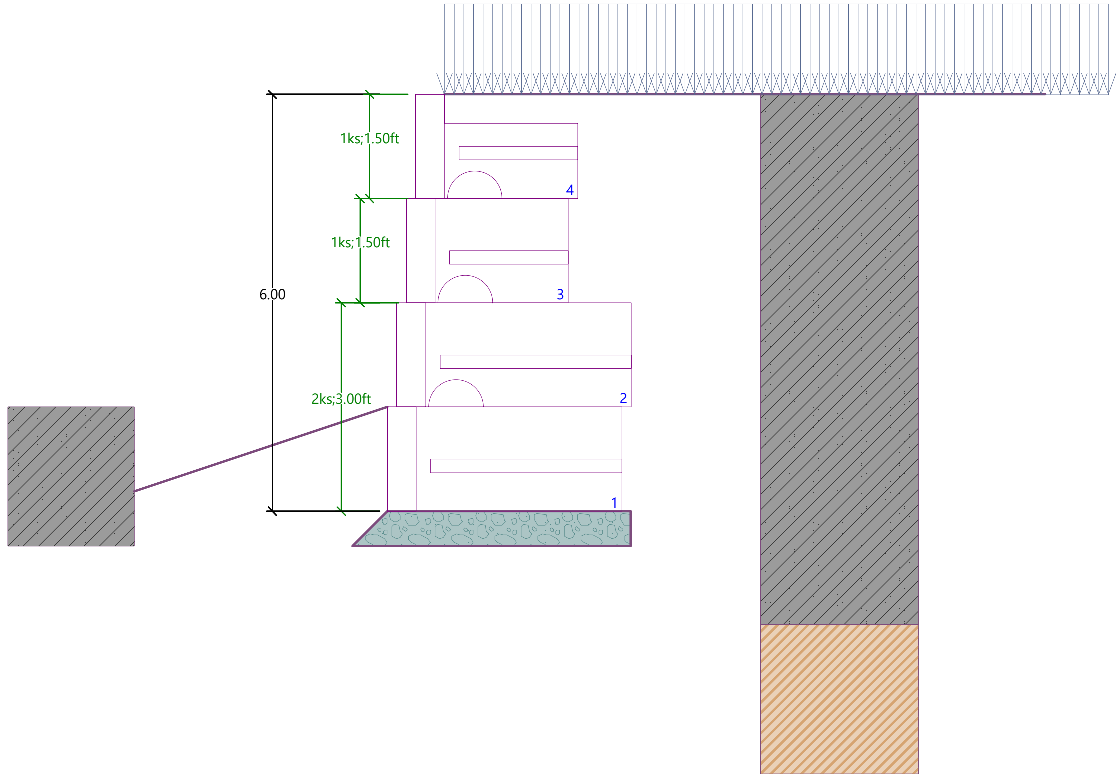
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

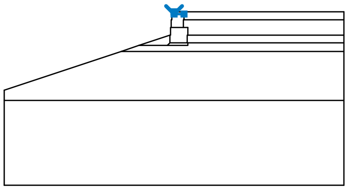
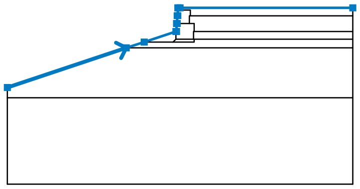
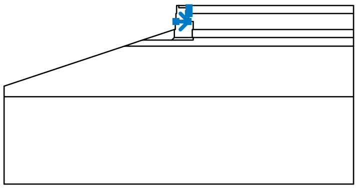
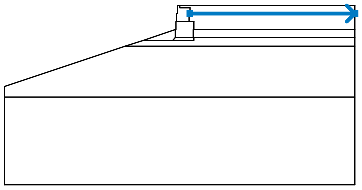
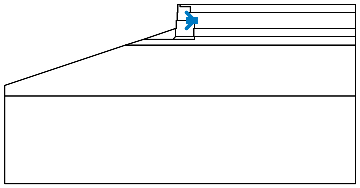
(input for current task)

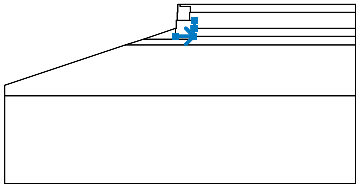
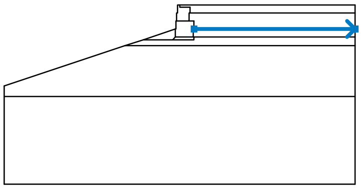
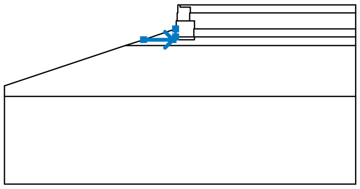
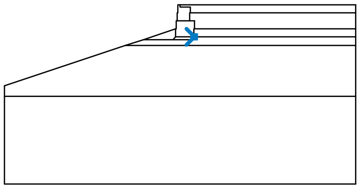
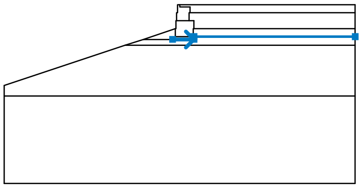
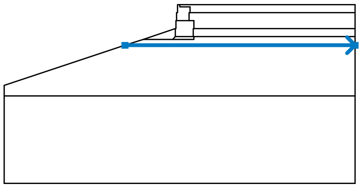
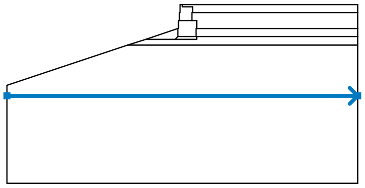
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82 2.69	-6.00 -4.50	2.55 2.69	-6.00 -3.00	2.55	-4.50
7		2.69	-4.50	32.80	-4.50		
8		-6.82 -0.82	-6.50 -4.50	-1.32	-6.50	-0.82	-6.00
9		2.55	-6.00	2.68	-6.00		
10		-1.32 32.80	-6.50 -6.00	2.68	-6.50	2.68	-6.00
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight :	γ = 120.0 pcf
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 24.00 °
Cohesion of soil :	c_{ef} = 100.0 psf
Saturated unit weight :	γ_{sat} = 125.0 pcf

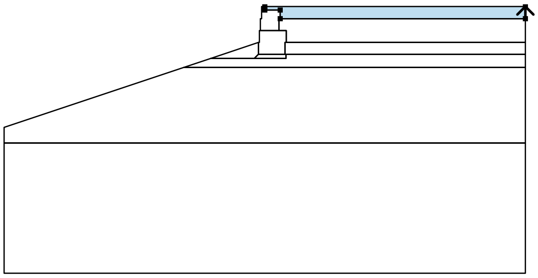
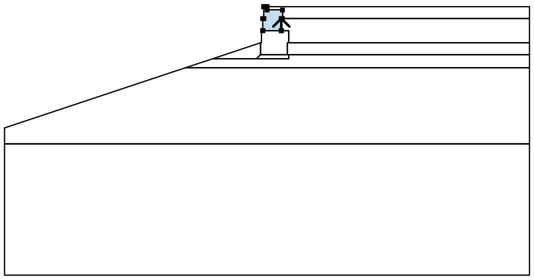
Upper Fat Clay

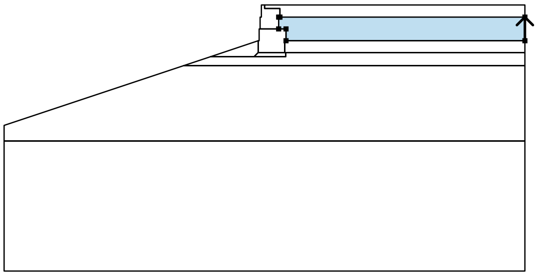
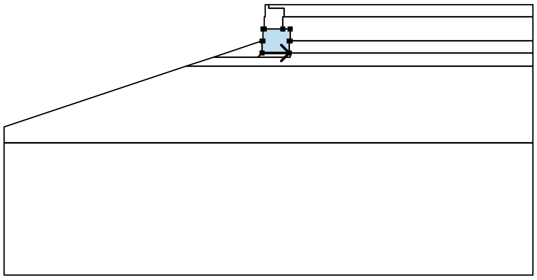
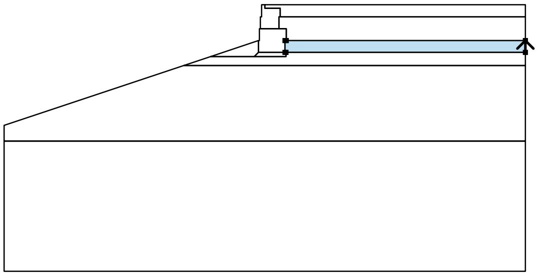
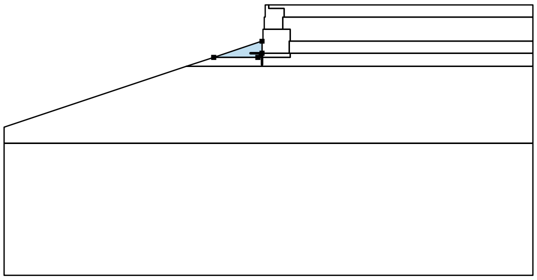
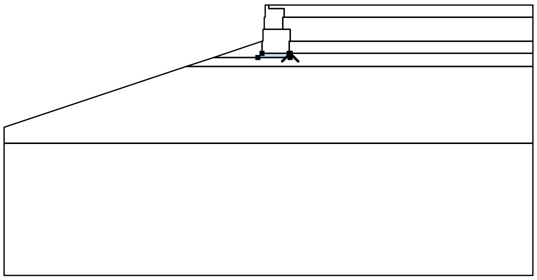
Unit weight :	γ = 125.0 pcf
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 26.00 °
Cohesion of soil :	c_{ef} = 100.0 psf
Saturated unit weight :	γ_{sat} = 130.0 pcf

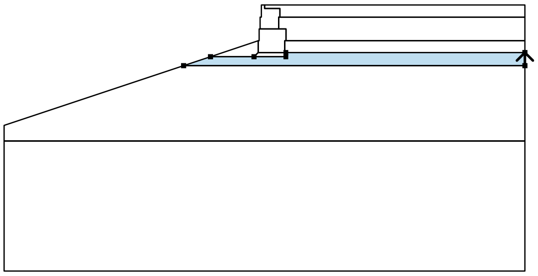
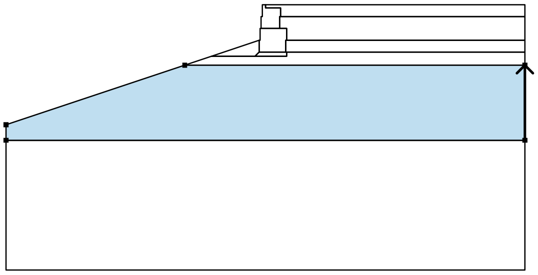
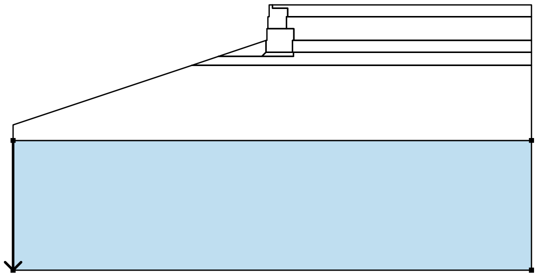
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure ▦
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80 1.92 1.78 2.69	-4.50 -1.50 -3.00 -4.50	32.80 1.78 2.69	-1.50 -1.50 -3.00	Upper Lean Clay ▨
4		-0.82 2.55 2.69 -0.55 -0.69	-6.00 -4.50 -3.00 -3.00 -4.50	2.55 2.69 1.78 -0.69 -0.82	-6.00 -4.50 -3.00 -3.00 -4.50	Material of structure 🟥
5		32.80 2.69 2.55	-6.00 -4.50 -6.00	32.80 2.55 2.68	-4.50 -4.50 -6.00	Upper Lean Clay ▨
6		-1.32 -0.82	-6.50 -4.50	-0.82 -6.82	-6.00 -6.50	Upper Lean Clay ▨
7		2.68 2.55 -1.32	-6.50 -6.00 -6.50	2.68 -0.82	-6.00 -6.00	#57 Stone ▨

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
8		32.80	-7.63	32.80	-6.00	Upper Lean Clay ▨
		2.68	-6.00	2.68	-6.50	
		-1.32	-6.50	-6.82	-6.50	
		-10.21	-7.63			
9		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-10.21	-7.63	-32.80	-15.16	
		-32.80	-17.13			
10		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft

Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft

Resisting moment : M_p = 82044.5 lbfft/ft

Factor of safety = 1.56 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

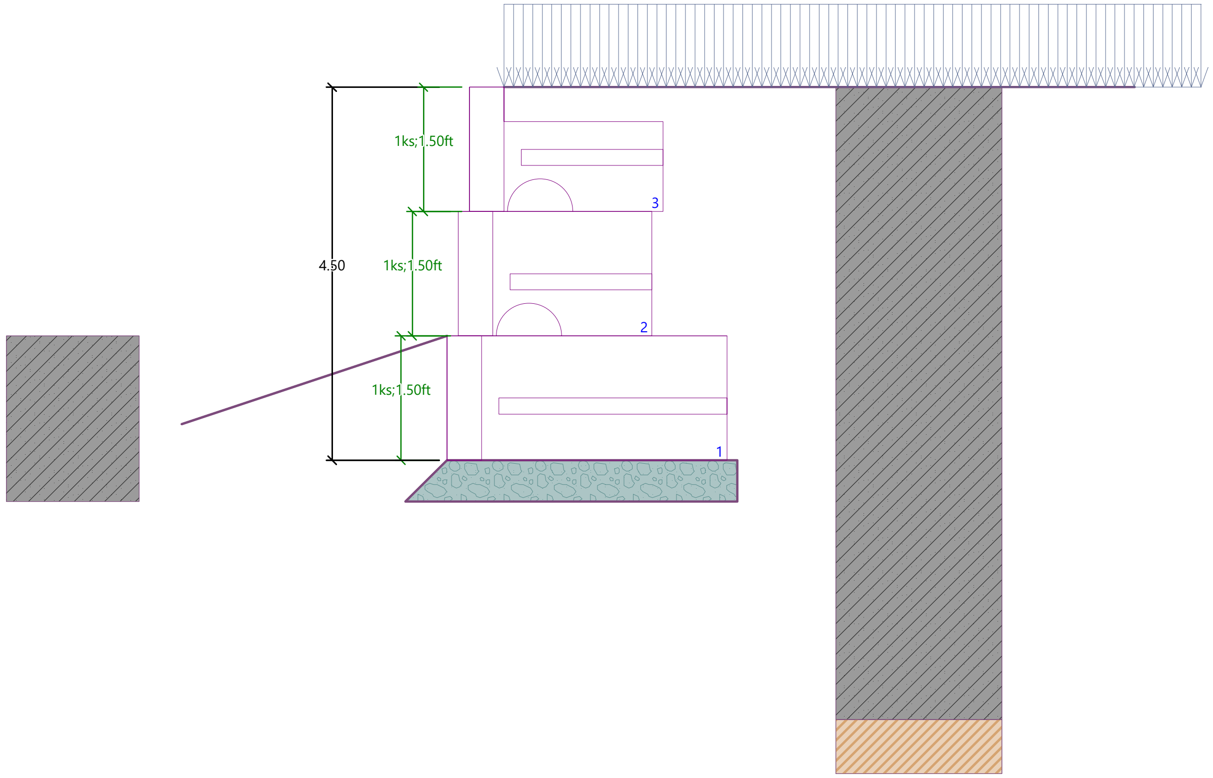
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability
Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

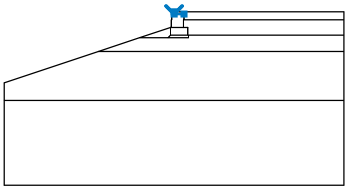
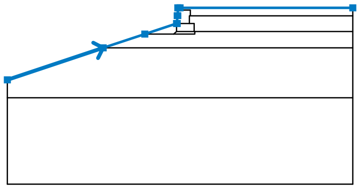
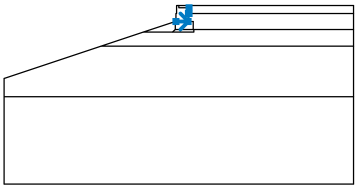
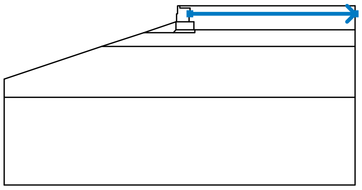
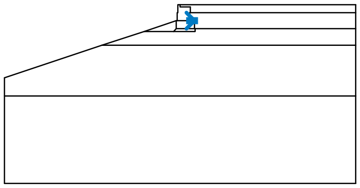
(input for current task)

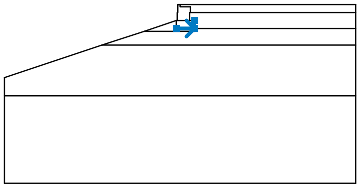
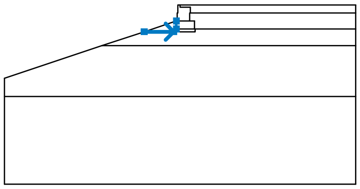
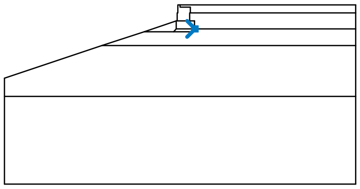
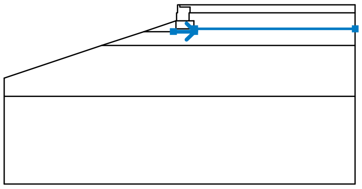
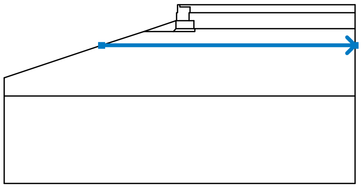
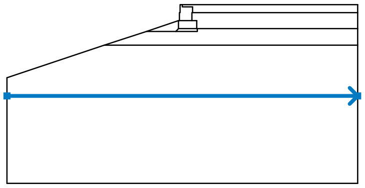
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▩	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

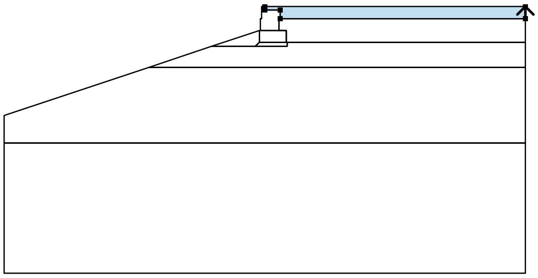
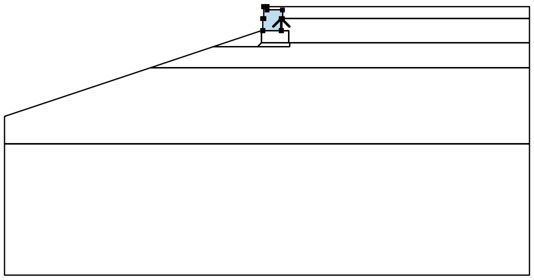
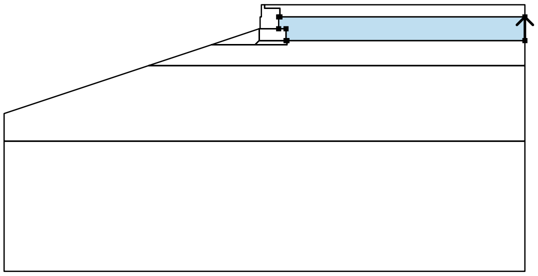
Upper Fat Clay

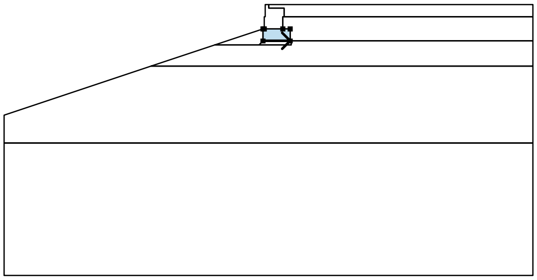
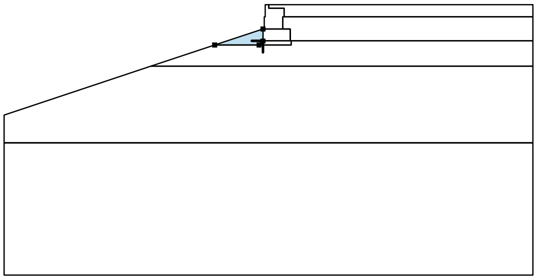
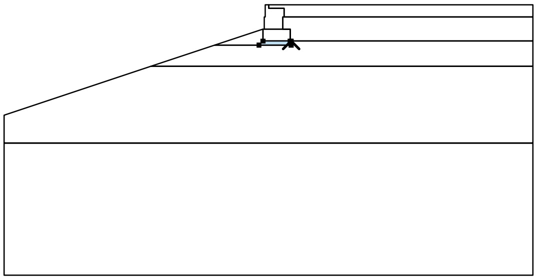
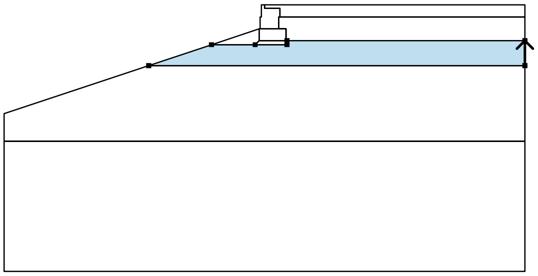
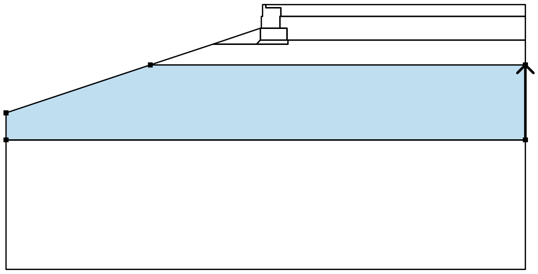
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

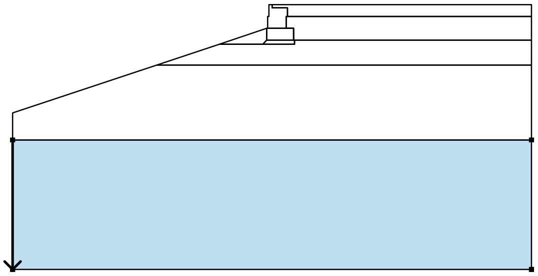
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure 🟥
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69	-4.50	2.69	-4.50	Material of structure ▦
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
5		-1.19	-5.00	-0.69	-4.50	Upper Lean Clay ▨
		-0.69	-3.00	-6.69	-5.00	
6		2.81	-5.00	2.81	-4.50	#57 Stone ▨
		2.69	-4.50	-0.69	-4.50	
		-1.19	-5.00			
7		32.80	-7.63	32.80	-4.50	Upper Lean Clay ▨
		2.81	-4.50	2.81	-5.00	
		-1.19	-5.00	-6.69	-5.00	
		-14.58	-7.63			
8		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-14.58	-7.63	-32.80	-13.70	
		-32.80	-17.13			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
9		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

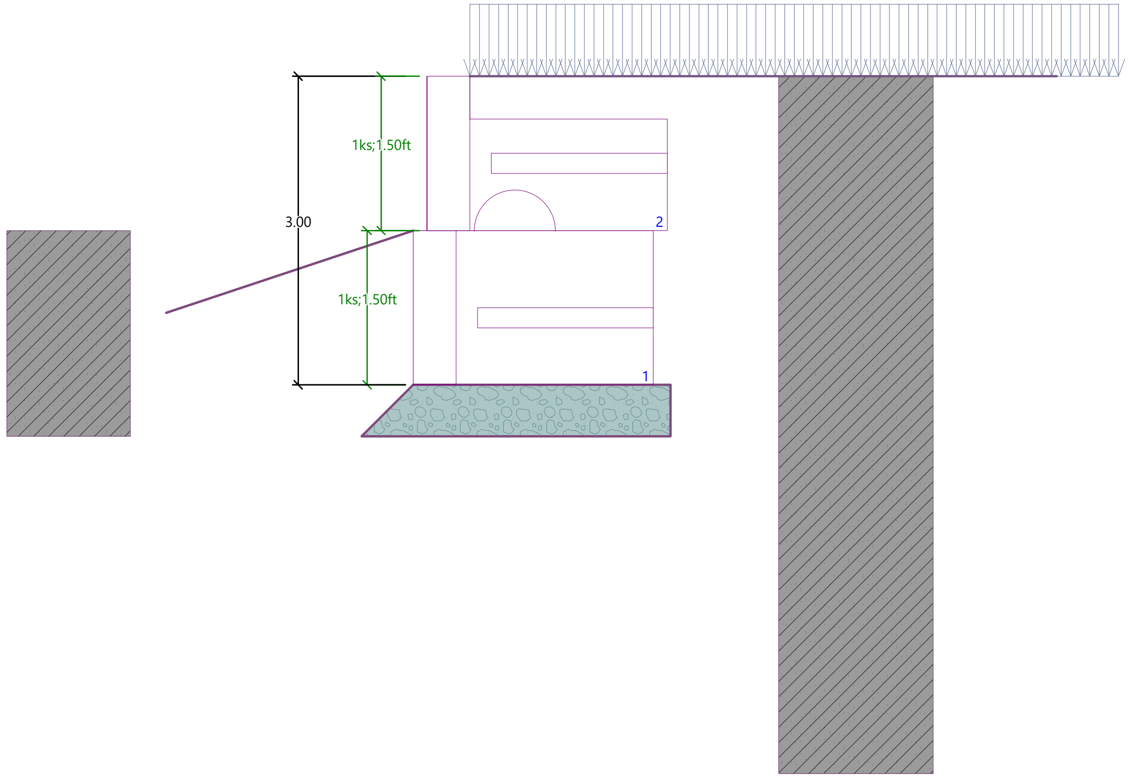
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft

Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft

Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf

Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

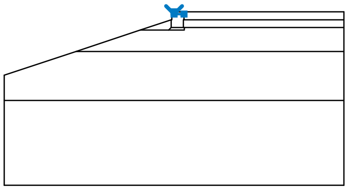
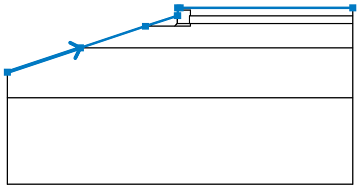
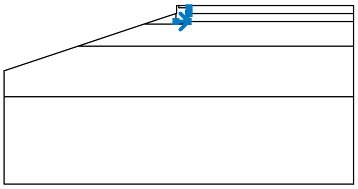
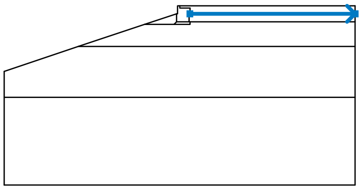
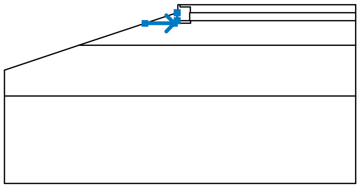
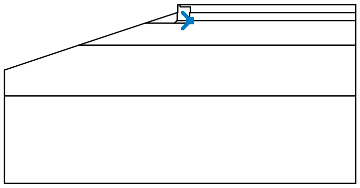
(input for current task)

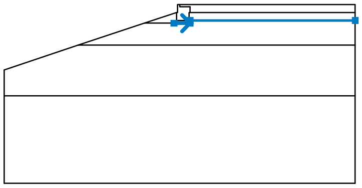
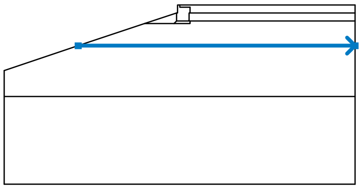
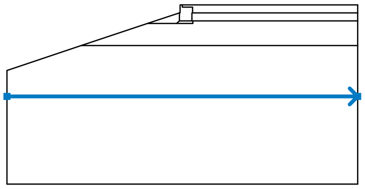
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		-1.05 32.80	-3.50 -3.00	1.95	-3.50	1.95	-3.00
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

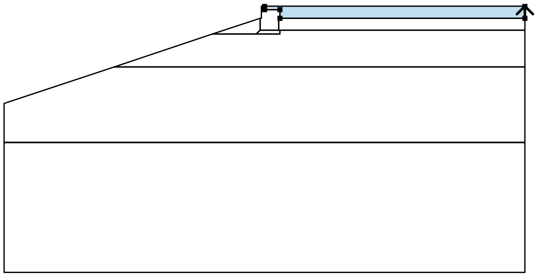
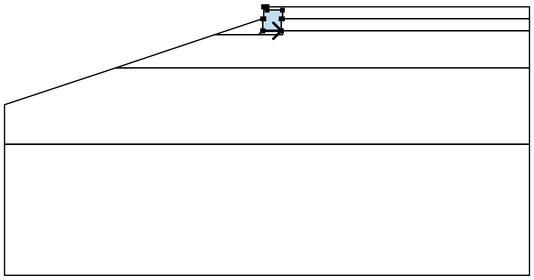
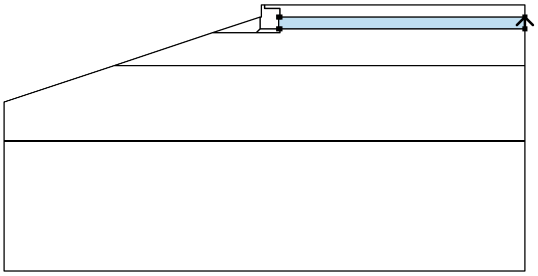
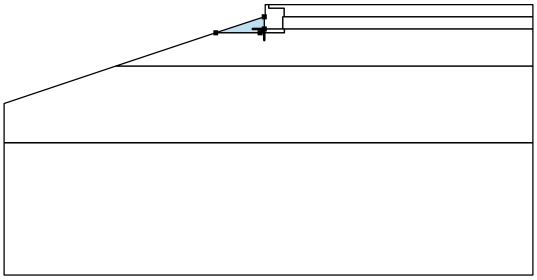
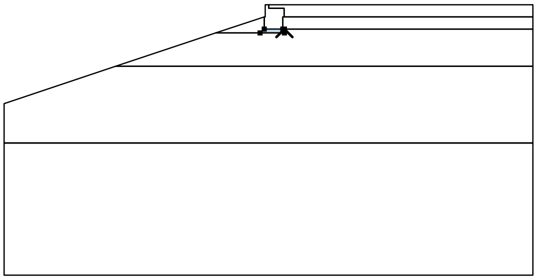
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

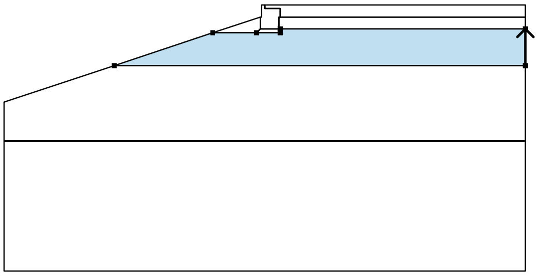
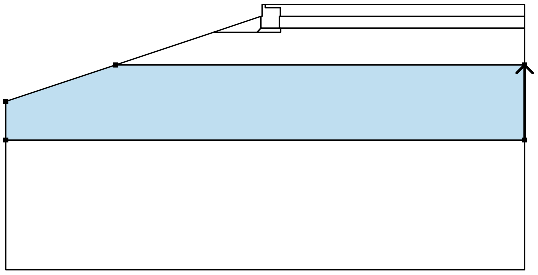
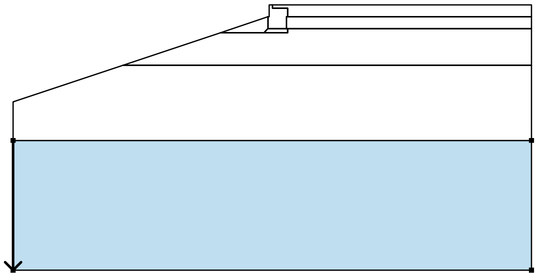
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure ▦
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay ▨
		-0.55	-1.50	-6.55	-3.50	
5		1.95	-3.50	1.95	-3.00	#57 Stone ▒
		1.78	-3.00	-0.55	-3.00	
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay
		1.95	-3.00	1.95	-3.50	▨
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		-18.94	-7.63	-32.80	-12.25	▨
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft
Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft
Resisting moment : M_p = 131009.9 lbfft/ft
Factor of safety = 2.07 > 1.30

Slope stability ACCEPTABLE

WALL #8

MAX. WALL HEIGHT = 9.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H9
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

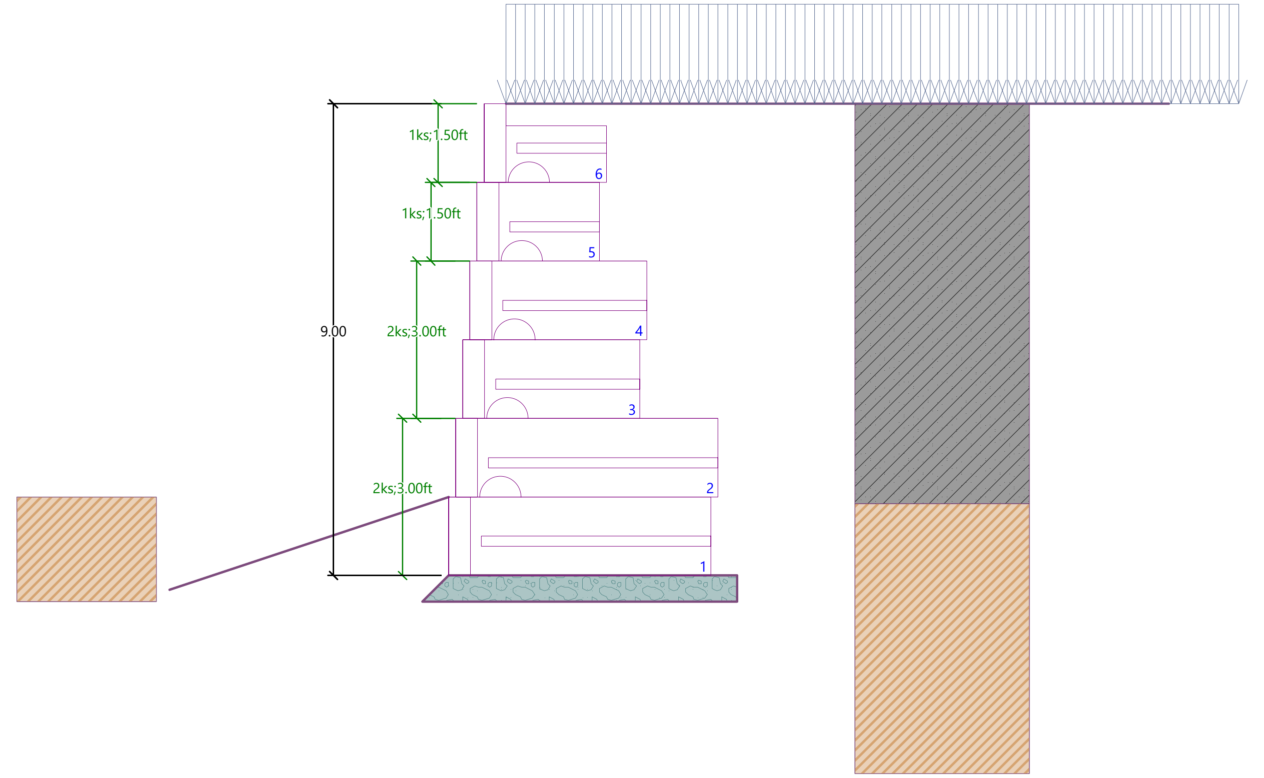
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	2	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Fat Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.78	4228.1	2.77	1.000
FF resistance	-1104.2	-0.85	-368.0	0.33	1.000
Weight - earth wedge	0.0	-0.75	23.3	5.68	1.000
Weight - earth wedge	0.0	-4.21	191.7	4.67	1.000
Weight - earth wedge	0.0	-6.91	66.6	3.71	1.000
Weight - earth wedge	0.0	-9.29	89.1	2.49	1.000
Active pressure	1350.5	-2.88	1368.3	5.21	1.000
Traffic/Construction Surcharge	798.9	-4.37	841.2	4.66	1.000
Traffic/Construction Surcharge	0.0	-9.50	411.5	2.42	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 25109.9 lbfft/ft
Overturning moment M_{ovr} = 6439.5 lbfft/ft

Safety factor = 3.90 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3886.86 lbf/ft
Active horizontal force H_{act} = 1045.10 lbf/ft

Safety factor = 3.72 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.56	3913.1	2.25	1.000
FF resistance	-429.5	-0.45	-143.1	0.00	1.000
Weight - earth wedge	0.0	-3.71	191.7	4.17	1.000
Weight - earth wedge	0.0	-6.41	66.6	3.21	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - earth wedge	0.0	-8.79	89.1	1.99	1.000
Active pressure	1117.3	-2.87	942.8	4.43	1.000
Traffic/Construction Surcharge	744.0	-4.16	727.3	3.98	1.000
Traffic/Construction Surcharge	0.0	-9.00	411.5	1.92	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 17843.7 lbfft/ft
Overturning moment M_{ovr} = 6112.9 lbfft/ft

Safety factor = 2.92 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 5201.54 lbf/ft
Active horizontal force H_{act} = 1431.68 lbf/ft

Safety factor = 3.63 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	1885.3	6851.89	1045.10	0.046	1257.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	1885.3	6851.89	1045.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.046
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1257.3 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 4.77 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

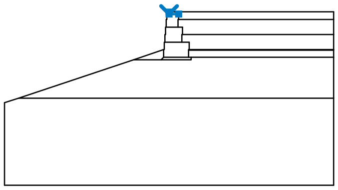
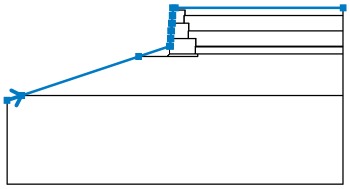
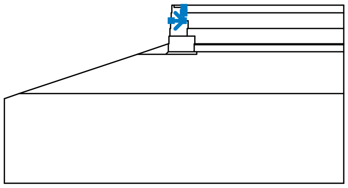
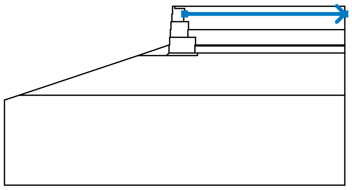
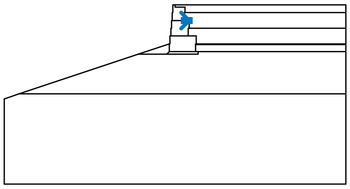
(input for current task)

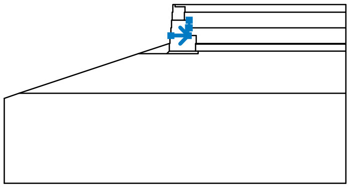
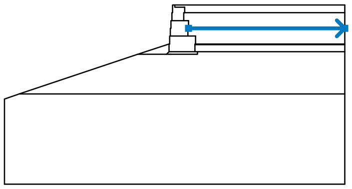
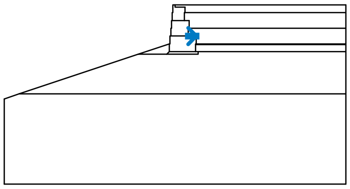
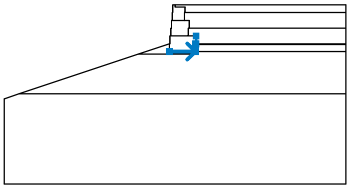
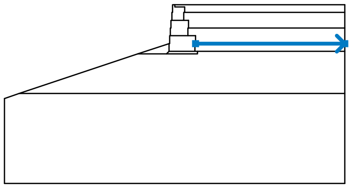
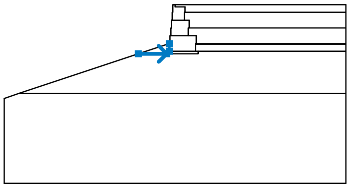
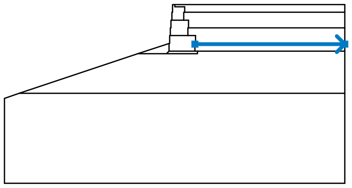
Stability analysis

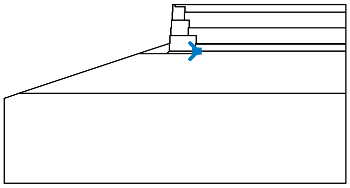
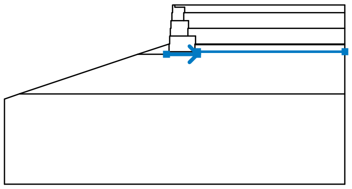
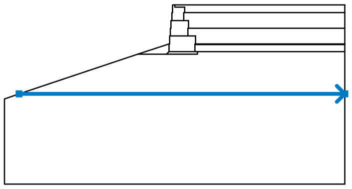
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-18.07	-29.98	-17.13	-7.09	-9.50
		-1.09	-7.50	-0.96	-7.50	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-1.09	-9.00	3.91	-9.00	3.91	-7.63
		3.91	-7.50	4.04	-7.50	4.04	-6.00
10		4.04	-7.50	32.80	-7.50		
11		-7.09	-9.50	-1.59	-9.50	-1.09	-9.00
		-1.09	-7.50				
12		3.91	-7.63	32.80	-7.63		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		3.91	-9.00	4.41	-9.00		
14		-1.59	-9.50	4.41	-9.50	4.41	-9.00
		32.80	-9.00				
15		-29.98	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

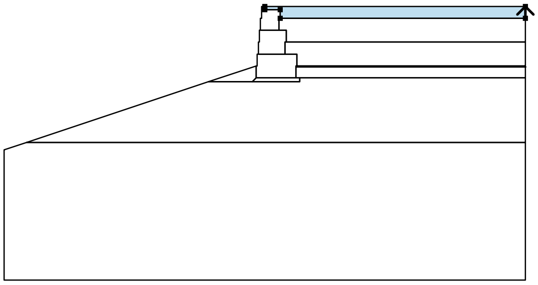
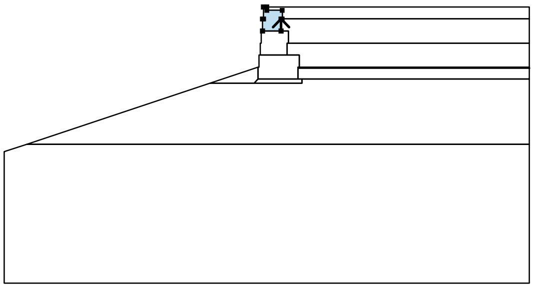
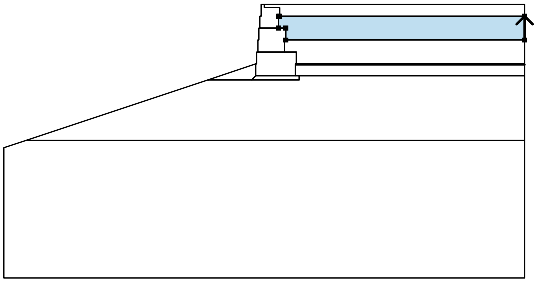
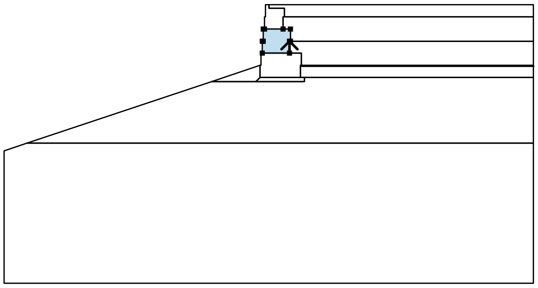
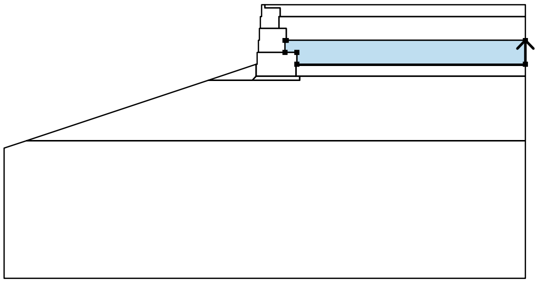
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

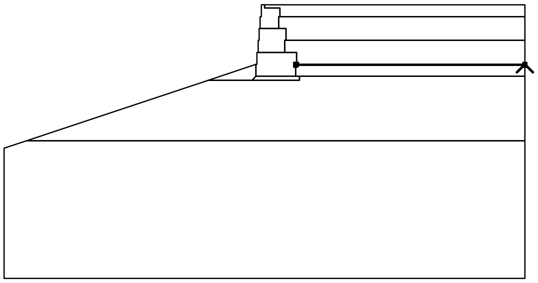
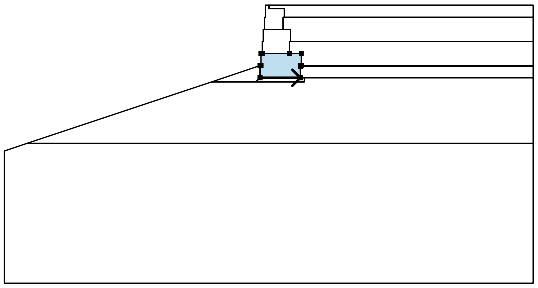
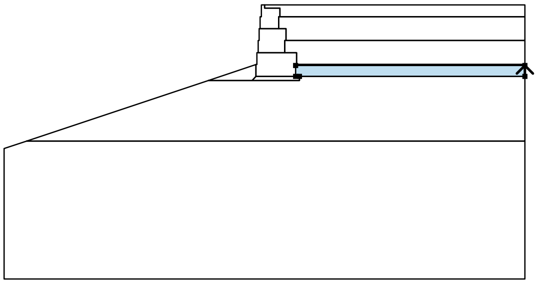
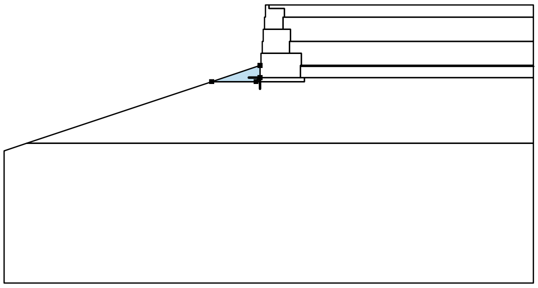
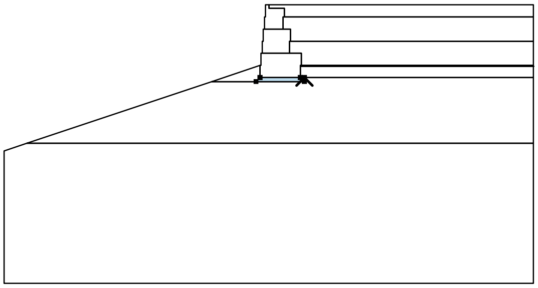
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

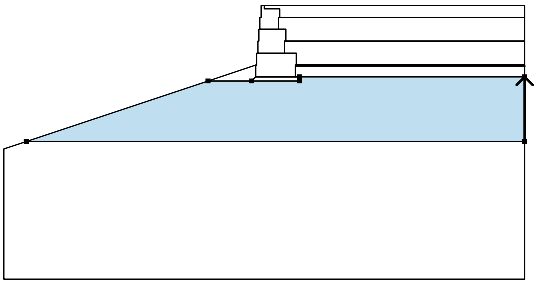
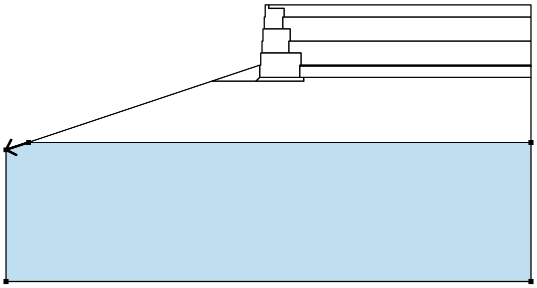
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.04	-7.50	3.91	-7.50	▨
		3.91	-7.63			
7		-1.09	-9.00	3.91	-9.00	Material of structure
		3.91	-7.63	3.91	-7.50	▦
		4.04	-7.50	4.04	-6.00	
		2.55	-6.00	-0.82	-6.00	
		-0.96	-6.00	-0.96	-7.50	
		-1.09	-7.50			
8		32.80	-9.00	32.80	-7.63	Upper Fat Clay
		3.91	-7.63	3.91	-9.00	▨
		4.41	-9.00			
9		-1.59	-9.50	-1.09	-9.00	Upper Fat Clay
		-1.09	-7.50	-7.09	-9.50	▨
10		4.41	-9.50	4.41	-9.00	#57 Stone
		3.91	-9.00	-1.09	-9.00	▩
		-1.59	-9.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		32.80	-17.13	32.80	-9.00	Upper Fat Clay
		4.41	-9.00	4.41	-9.50	▨
		-1.59	-9.50	-7.09	-9.50	
		-29.98	-17.13			
12		-29.98	-17.13	-32.80	-18.07	Upper Sand
		-32.80	-34.47	32.80	-34.47	▨
		32.80	-17.13			

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-21.44	[ft]	Angles :	α_1 =	-12.94	[°]
	z =	21.42	[ft]		α_2 =	57.32	[°]
Radius :	R =	39.67	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 12614.0 lbf/ft

Sum of passive forces : F_p = 17332.9 lbf/ft

Sliding moment : M_a = 500395.9 lbfft/ft

Resisting moment : M_p = 687595.3 lbfft/ft

Factor of safety = 1.37 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 7.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H7.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)
Reduce parameters of contact base - soil	

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

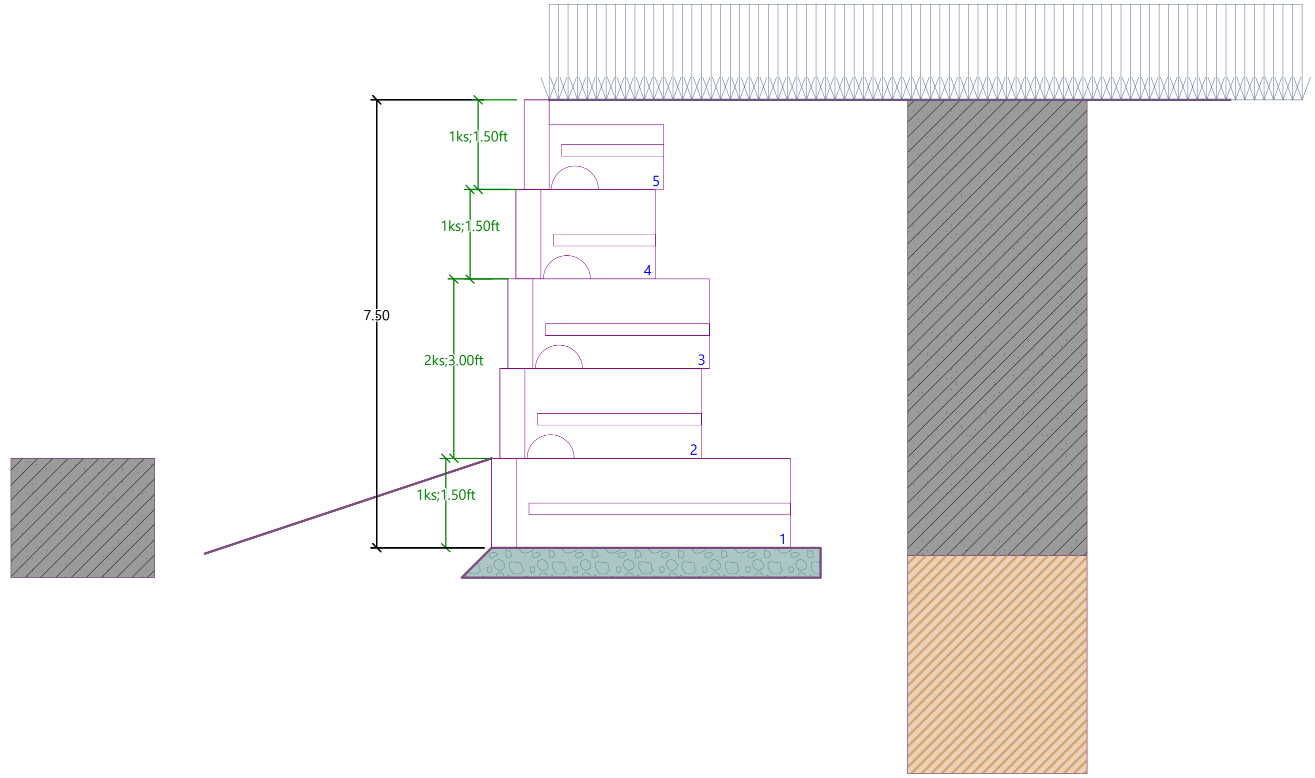
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	2	1.62
3	Block 28	1	1.62
4	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 6.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-3.18	3253.1	2.57	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.76	23.1	5.67	1.000
Weight - earth wedge	0.0	-2.71	191.7	4.54	1.000
Weight - earth wedge	0.0	-5.41	66.6	3.58	1.000
Weight - earth wedge	0.0	-7.79	89.1	2.35	1.000
Active pressure	1009.5	-2.29	1233.5	5.06	1.000
Traffic/Construction Surcharge	682.7	-3.53	821.6	4.53	1.000
Traffic/Construction Surcharge	0.0	-8.00	411.5	2.28	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 20605.0 lbfft/ft
Overturning moment M_{ovr} = 3841.3 lbfft/ft

Safety factor = 5.36 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 3387.36 lbf/ft
Active horizontal force H_{act} = 669.86 lbf/ft

Safety factor = 5.06 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 2

Check for overturning stability
Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1746.7 lbfft/ft

Safety factor = 3.43 > 2.00
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 9035.39 lbf/ft
Active horizontal force H_{act} = 771.43 lbf/ft

Safety factor = 11.71 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	484.9	5749.52	669.86	0.014	986.0

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	484.9	5749.52	669.86

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.014
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 986.0 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 6.09 > 3.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

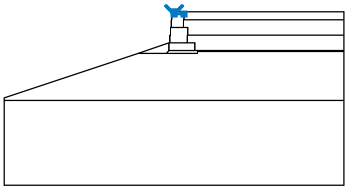
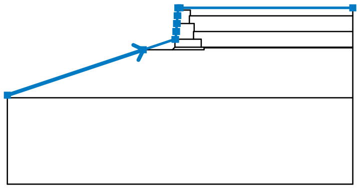
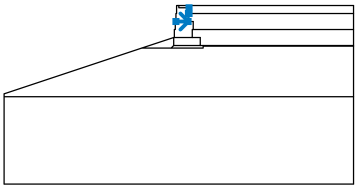
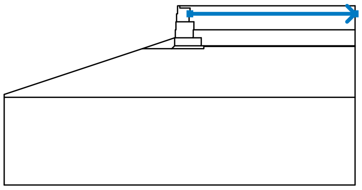
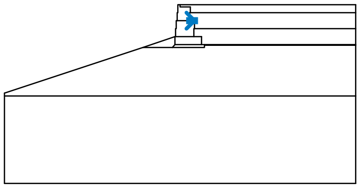
(input for current task)

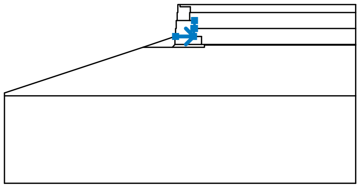
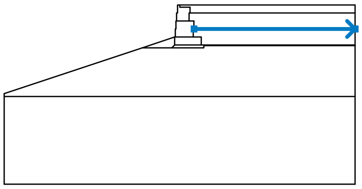
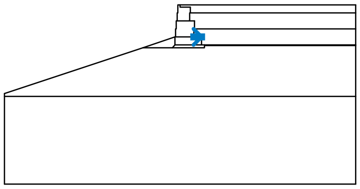
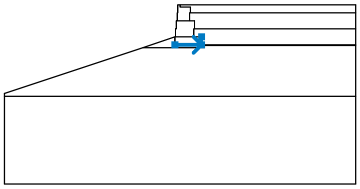
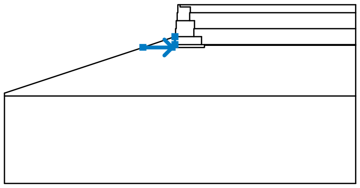
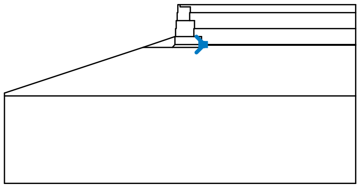
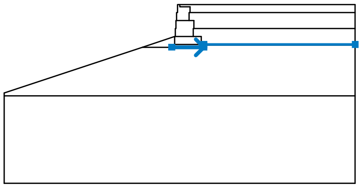
Stability analysis

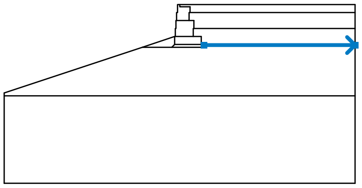
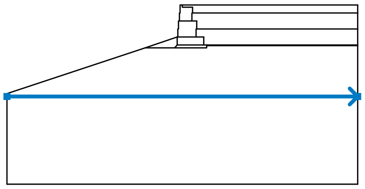
Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-16.61	-6.96	-8.00	-0.96	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		2.55	-6.00	4.04	-6.00		
9		-0.96	-7.50	4.04	-7.50	4.04	-6.00
10		-6.96	-8.00	-1.46	-8.00	-0.96	-7.50
		-0.96	-6.00				
11		4.04	-7.50	4.54	-7.50		
12		-1.46	-8.00	4.54	-8.00	4.54	-7.63
		4.54	-7.50	32.80	-7.50		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
13		4.54	-7.63	32.80	-7.63		
14		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

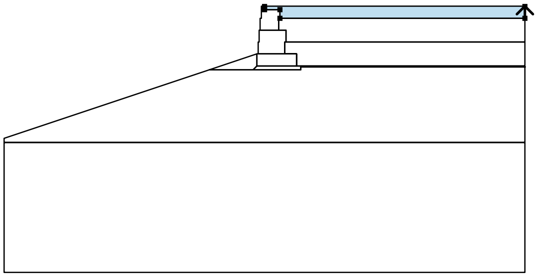
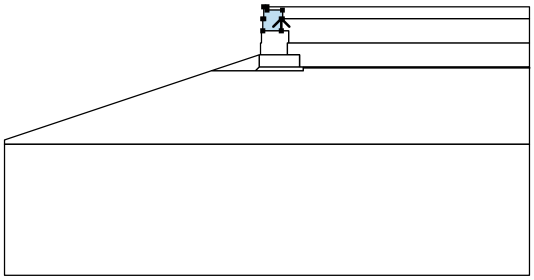
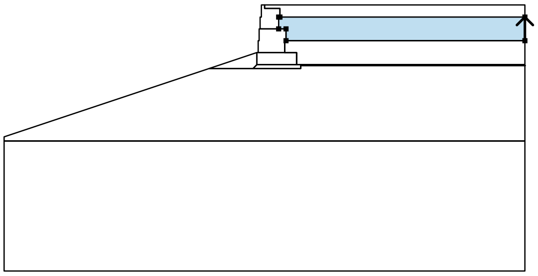
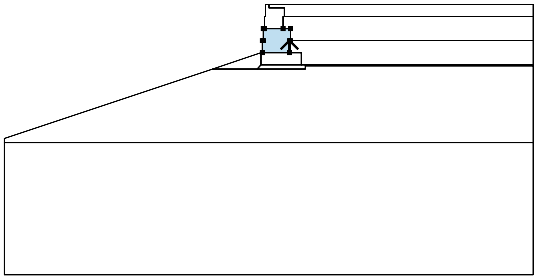
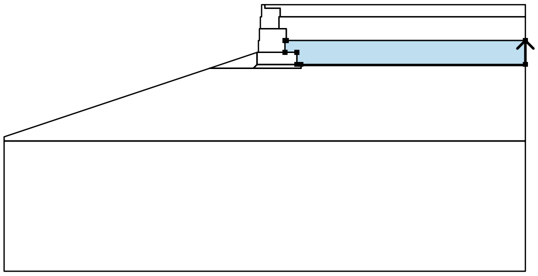
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

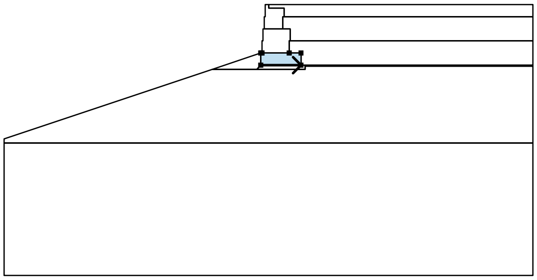
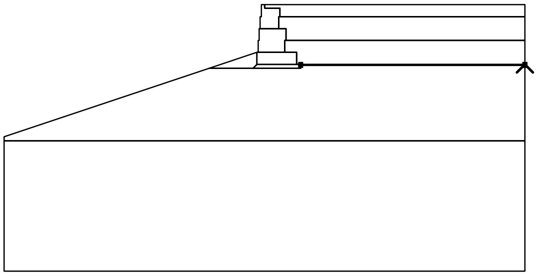
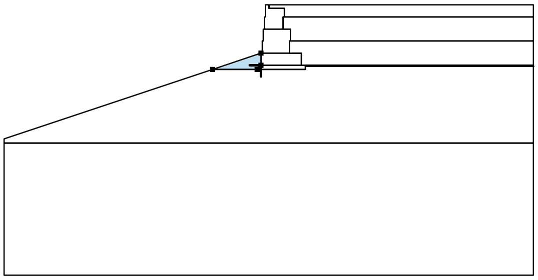
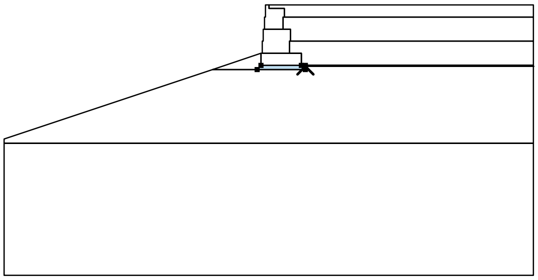
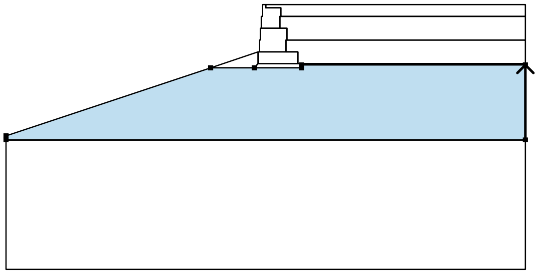
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

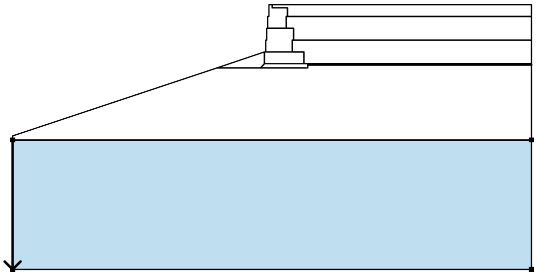
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		2.55	-6.00	2.55	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	🟥
		1.78	-3.00	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
		-0.82	-4.50	-0.82	-6.00	
5		32.80	-7.50	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	4.04	-6.00	
		4.04	-7.50	4.54	-7.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		-0.96	-7.50	4.04	-7.50	Material of structure
		4.04	-6.00	2.55	-6.00	🟥
		-0.82	-6.00	-0.96	-6.00	
7		32.80	-7.63	32.80	-7.50	Upper Lean Clay
		4.54	-7.50	4.54	-7.63	▨
8		-1.46	-8.00	-0.96	-7.50	Upper Lean Clay
		-0.96	-6.00	-6.96	-8.00	▨
9		4.54	-8.00	4.54	-7.63	#57 Stone
		4.54	-7.50	4.04	-7.50	▨
		-0.96	-7.50	-1.46	-8.00	
10		32.80	-17.13	32.80	-7.63	Upper Fat Clay
		4.54	-7.63	4.54	-8.00	🟧
		-1.46	-8.00	-6.96	-8.00	
		-32.80	-16.61	-32.80	-17.13	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
11		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-6.14	[ft]	Angles :	α_1 =	-20.12	[°]
	z =	6.60	[ft]		α_2 =	67.68	[°]
Radius :	R =	17.38	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 6260.9 lbf/ft

Sum of passive forces : F_p = 9395.6 lbf/ft

Sliding moment : M_a = 108815.0 lbfft/ft
Resisting moment : M_p = 163294.7 lbfft/ft
Factor of safety = 1.50 > 1.30
Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 6.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H6
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

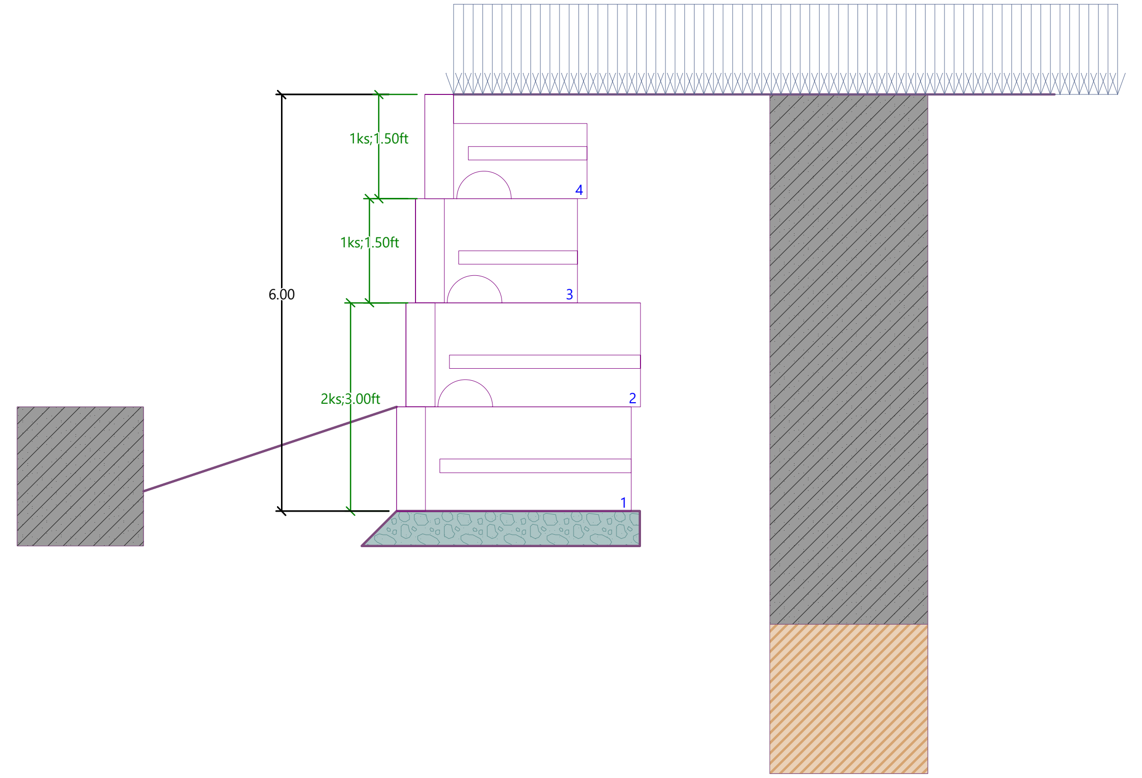
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	2	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.83	2173.1	2.14	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.3	3.92	1.000
Weight - earth wedge	0.0	-3.91	66.6	3.44	1.000
Weight - earth wedge	0.0	-6.29	89.1	2.22	1.000
Active pressure	420.0	-1.78	275.2	3.81	1.000
Traffic/Construction Surcharge	502.0	-2.85	399.5	3.58	1.000
Traffic/Construction Surcharge	0.0	-6.50	411.5	2.15	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 8335.3 lbfft/ft
Overturning moment M_{ovr} = 1300.7 lbfft/ft

Safety factor = 6.41 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 1769.41 lbf/ft
Active horizontal force H_{act} = -100.46 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.61	1963.1	1.66	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-3.41	66.6	2.94	1.000
Weight - earth wedge	0.0	-5.79	89.1	1.72	1.000
Active pressure	317.9	-1.76	188.6	3.24	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	453.5	-2.62	361.1	3.04	1.000
Traffic/Construction Surcharge	0.0	-6.00	411.5	1.65	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 5988.7 lbfft/ft
Overturning moment M_{ovr} = 1563.5 lbfft/ft

Safety factor = 3.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2471.70 lbf/ft
Active horizontal force H_{act} = 368.07 lbf/ft

Safety factor = 6.72 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-883.1	3075.75	-100.46	0.000	768.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-883.1	3075.75	-100.46

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 768.9 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 7.80 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

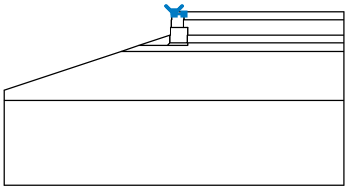
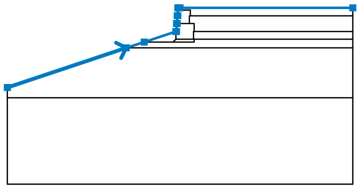
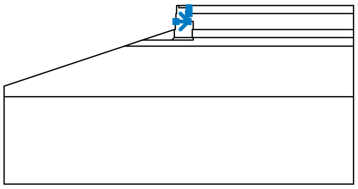
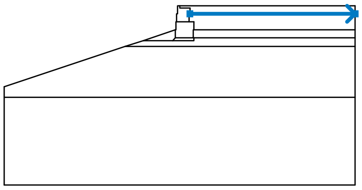
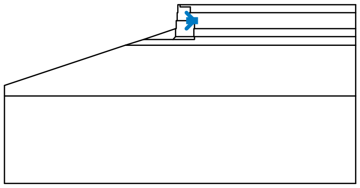
(input for current task)

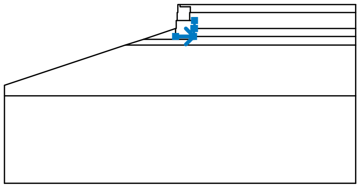
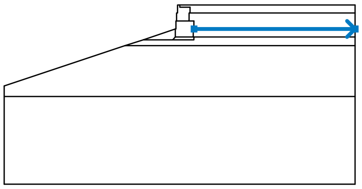
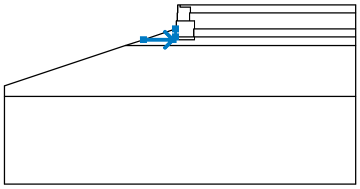
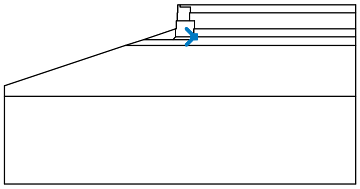
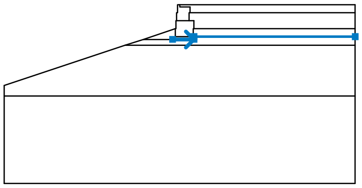
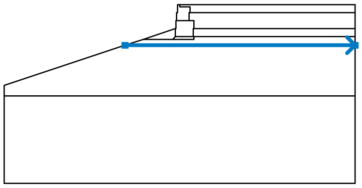
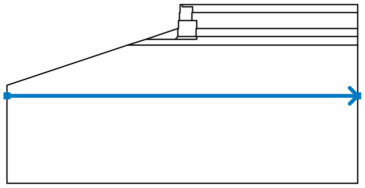
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_S =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-15.16	-10.21	-7.63	-6.82	-6.50
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	32.80	0.00
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.82	-6.00	2.55	-6.00	2.55	-4.50
		2.69	-4.50	2.69	-3.00		
7		2.69	-4.50	32.80	-4.50		
8		-6.82	-6.50	-1.32	-6.50	-0.82	-6.00
		-0.82	-4.50				
9		2.55	-6.00	2.68	-6.00		
10		-1.32	-6.50	2.68	-6.50	2.68	-6.00
		32.80	-6.00				
11		-10.21	-7.63	32.80	-7.63		
12		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand

Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay

Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

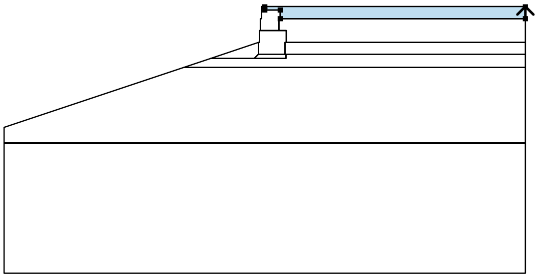
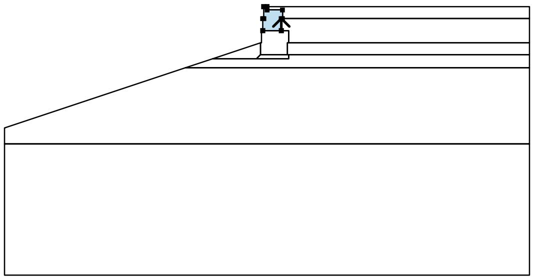
Upper Fat Clay

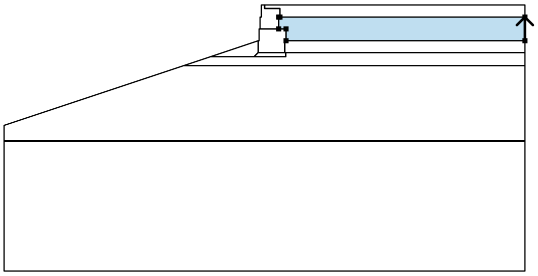
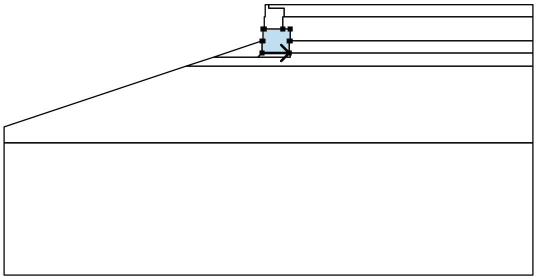
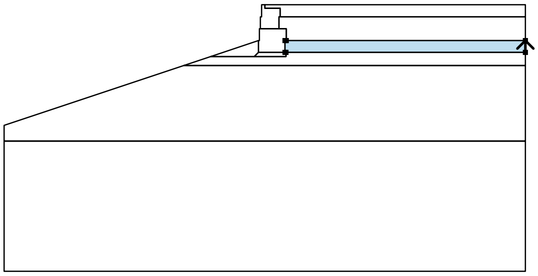
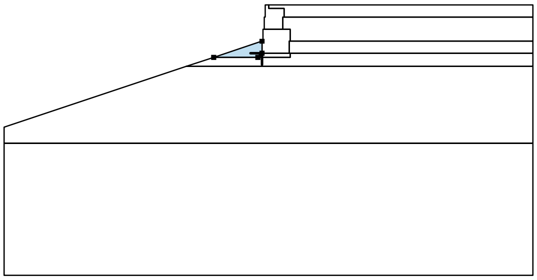
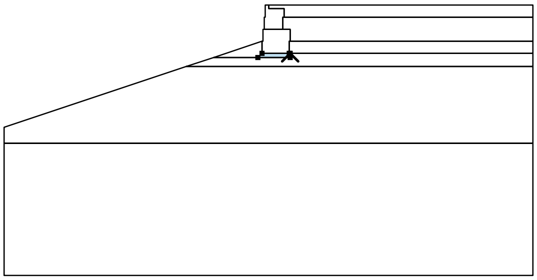
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

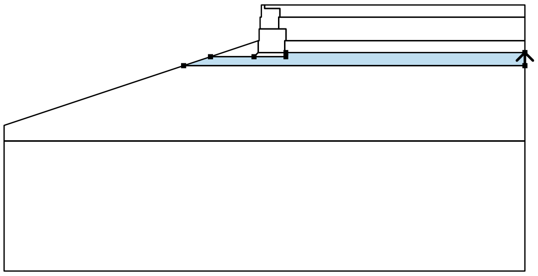
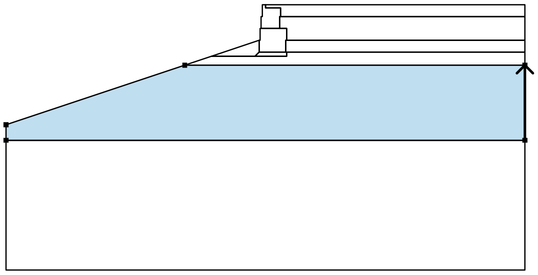
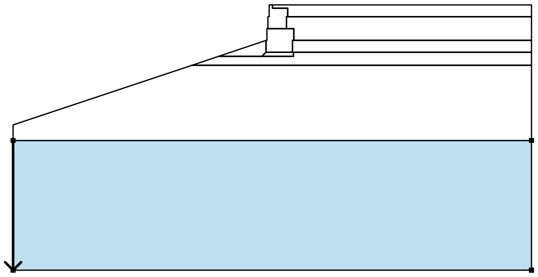
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure 🟥
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50			
4		-0.82	-6.00	2.55	-6.00	Material of structure
		2.55	-4.50	2.69	-4.50	▦
		2.69	-3.00	1.78	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
5		32.80	-6.00	32.80	-4.50	Upper Lean Clay
		2.69	-4.50	2.55	-4.50	▨
		2.55	-6.00	2.68	-6.00	
6		-1.32	-6.50	-0.82	-6.00	Upper Lean Clay
		-0.82	-4.50	-6.82	-6.50	▨
7		2.68	-6.50	2.68	-6.00	#57 Stone
		2.55	-6.00	-0.82	-6.00	▒
		-1.32	-6.50			

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
8		32.80 2.68 -1.32 -10.21	-7.63 -6.00 -6.50 -7.63	32.80 2.68 -6.82	-6.00 -6.50 -6.50	Upper Lean Clay ▨
9		32.80 -10.21 -32.80	-17.13 -7.63 -17.13	32.80 -32.80	-7.63 -15.16	Upper Fat Clay ▨
10		-32.80 32.80	-17.13 -33.53	-32.80 32.80	-33.53 -17.13	Upper Sand ▨

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-4.63	[ft]	Angles :	α_1 =	-19.45	[°]
	z =	5.52	[ft]		α_2 =	66.00	[°]
Radius :	R =	13.57	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3878.9 lbf/ft

Sum of passive forces : F_p = 6046.0 lbf/ft

Sliding moment : M_a = 52637.0 lbfft/ft

Resisting moment : M_p = 82044.5 lbfft/ft

Factor of safety = 1.56 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 4.5 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H4.5
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

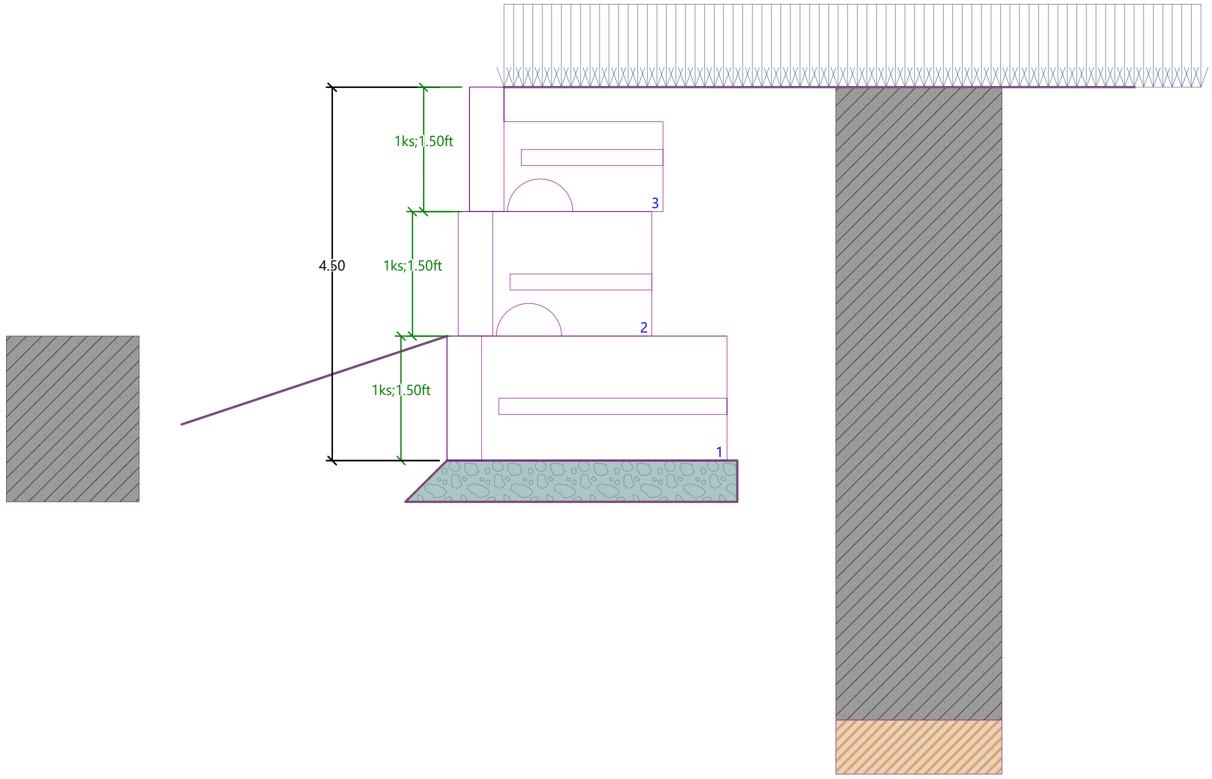
Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41	1	1.62
2	Block 28	1	1.62
3	Top block 28	1	-

Name : Geometry | Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 4.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.15	1565.6	2.01	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.56	1.4	3.92	1.000
Weight - earth wedge	0.0	-2.41	66.6	3.31	1.000
Weight - earth wedge	0.0	-4.79	89.1	2.08	1.000
Active pressure	236.1	-1.41	218.0	3.69	1.000
Traffic/Construction Surcharge	376.2	-2.09	376.9	3.45	1.000
Traffic/Construction Surcharge	0.0	-5.00	411.5	2.01	1.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 6369.0 lbfft/ft
Overturning moment M_{ovr} = 241.9 lbfft/ft

Safety factor = 26.33 > 2.00

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 1463.43 lbf/ft
Active horizontal force H_{act} = -410.11 lbf/ft

Safety factor = 1000.00 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.94	1355.6	1.51	1.000
FF resistance	-403.4	-0.45	-134.4	0.00	1.000
Weight - earth wedge	0.0	-1.91	66.6	2.81	1.000
Weight - earth wedge	0.0	-4.29	89.1	1.58	1.000
Active pressure	169.7	-1.33	157.3	3.09	1.000

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Traffic/Construction Surcharge	328.2	-1.86	337.7	2.89	1.000
Traffic/Construction Surcharge	0.0	-4.50	411.5	1.51	1.000

Verification of most stressed block No. 1

Check for overturning stability

Resisting moment M_{res} = 4452.9 lbfft/ft
Overturning moment M_{ovr} = 651.6 lbfft/ft

Safety factor = 6.83 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 1916.01 lbf/ft
Active horizontal force H_{act} = 94.45 lbf/ft

Safety factor = 20.29 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1350.1	2388.51	-410.11	0.000	597.1

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1350.1	2388.51	-410.11

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 597.1 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 10.05 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

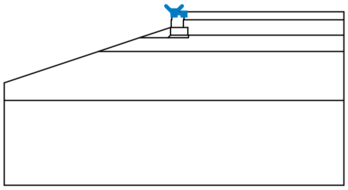
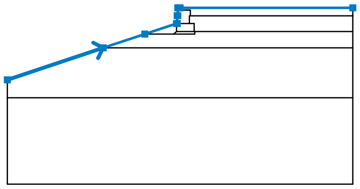
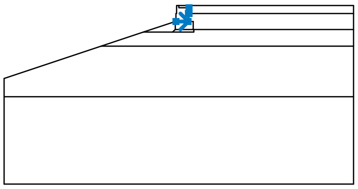
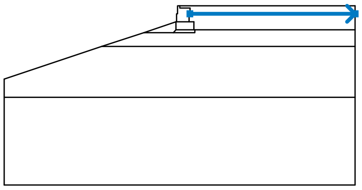
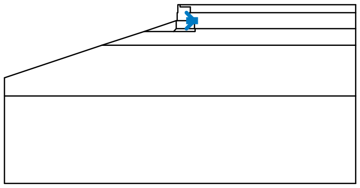
(input for current task)

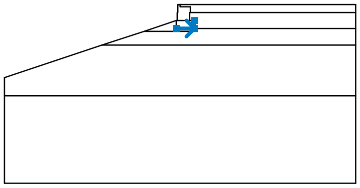
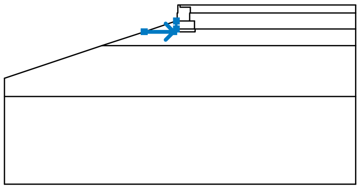
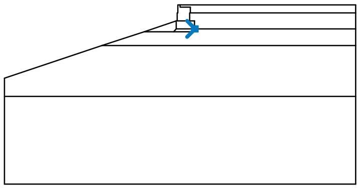
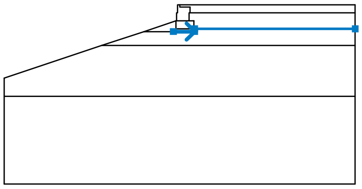
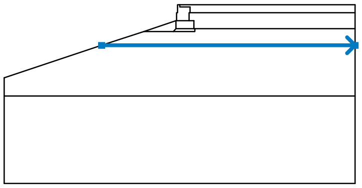
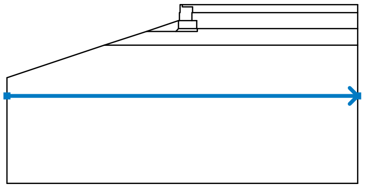
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-13.70	-14.58	-7.63	-6.69	-5.00
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		32.80	0.00				
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		1.78	-3.00	2.69	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-0.69	-4.50	2.69	-4.50	2.69	-3.00
7		-6.69	-5.00	-1.19	-5.00	-0.69	-4.50
		-0.69	-3.00				
8		2.69	-4.50	2.81	-4.50		
9		-1.19	-5.00	2.81	-5.00	2.81	-4.50
		32.80	-4.50				
10		-14.58	-7.63	32.80	-7.63		
11		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

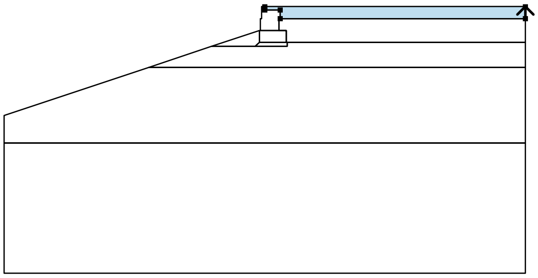
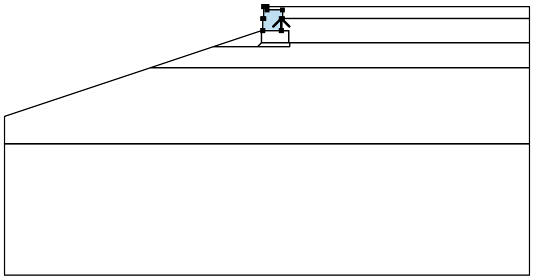
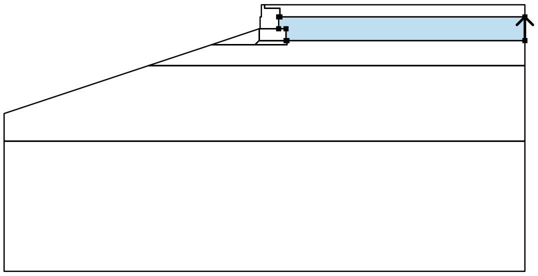
Upper Fat Clay

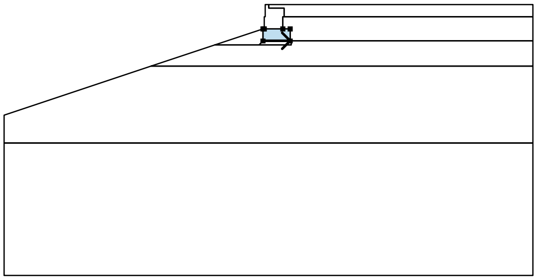
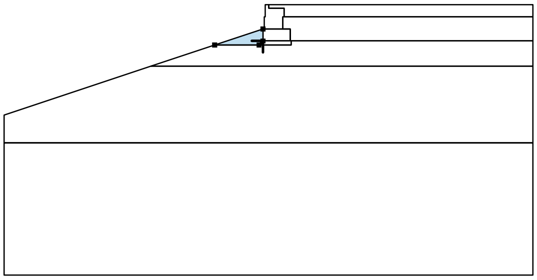
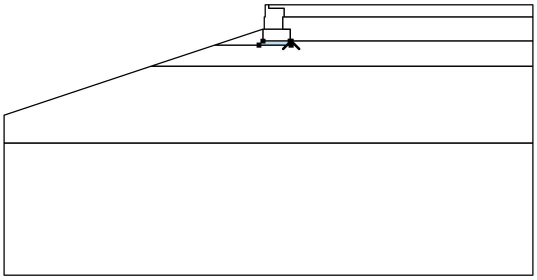
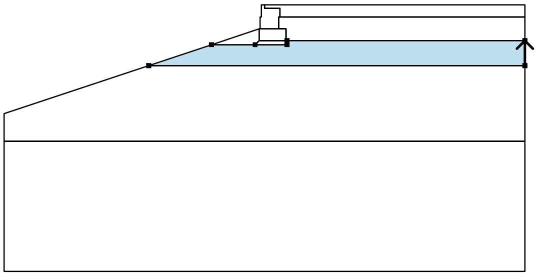
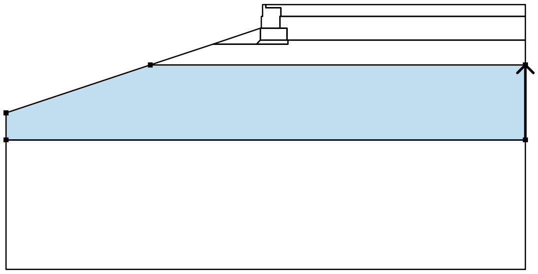
Unit weight :	γ = 125.0 pcf
Stress-state :	effective
Angle of internal friction :	φ_{ef} = 26.00 °
Cohesion of soil :	c_{ef} = 100.0 psf
Saturated unit weight :	γ_{sat} = 130.0 pcf

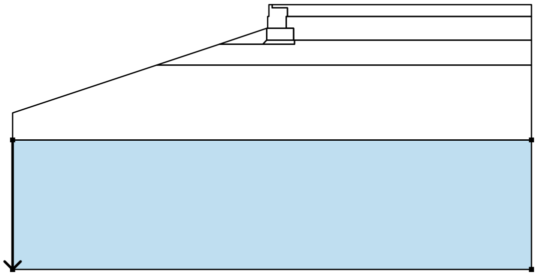
Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	🟥	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay
		0.00	0.00	0.00	-0.42	▨
		1.92	-0.42	1.92	-1.50	
2		1.78	-3.00	1.78	-1.50	Material of structure
		1.92	-1.50	1.92	-0.42	🟥
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
3		32.80	-4.50	32.80	-1.50	Upper Lean Clay
		1.92	-1.50	1.78	-1.50	▨
		1.78	-3.00	2.69	-3.00	
		2.69	-4.50	2.81	-4.50	

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
4		-0.69 2.69 -0.55	-4.50 -3.00 -3.00	2.69 1.78 -0.69	-4.50 -3.00 -3.00	Material of structure ▦
5		-1.19 -0.69	-5.00 -3.00	-0.69 -6.69	-4.50 -5.00	Upper Lean Clay ▨
6		2.81 2.69 -1.19	-5.00 -4.50 -5.00	2.81 -0.69	-4.50 -4.50	#57 Stone ▩
7		32.80 2.81 -1.19 -14.58	-7.63 -4.50 -5.00 -7.63	32.80 2.81 -6.69	-4.50 -5.00 -5.00	Upper Lean Clay ▨
8		32.80 -14.58 -32.80	-17.13 -7.63 -17.13	32.80 -32.80	-7.63 -13.70	Upper Fat Clay ▨

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
9		-32.80	-17.13	-32.80	-33.53	Upper Sand
		32.80	-33.53	32.80	-17.13	▨

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-5.00	[ft]	Angles :	α_1 =	-22.68	[°]
	z =	5.68	[ft]		α_2 =	63.52	[°]
Radius :	R =	12.74	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 3001.2 lbf/ft

Sum of passive forces : F_p = 5270.6 lbf/ft

Sliding moment : M_a = 38235.1 lbfft/ft
Resisting moment : M_p = 67147.7 lbfft/ft
Factor of safety = 1.76 > 1.30

Slope stability ACCEPTABLE

MAX. WALL HEIGHT = 3.0 FEET

Analysis of Redi Rock wall

Input data

Project

Task : Chemours Barrier Wall Retaining Walls
Part : H3
Description : Gravity
Author : GEOS
Date : 2/19/2021

Settings

(input for current task)

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : Safety factors (ASD)
Reduce parameters of contact base - soil

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	2.00	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	3.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Reduction coefficients			
Permanent design situation			
Reduction coeff. of contact base - soil :	μ =	1.00	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

Setbacks

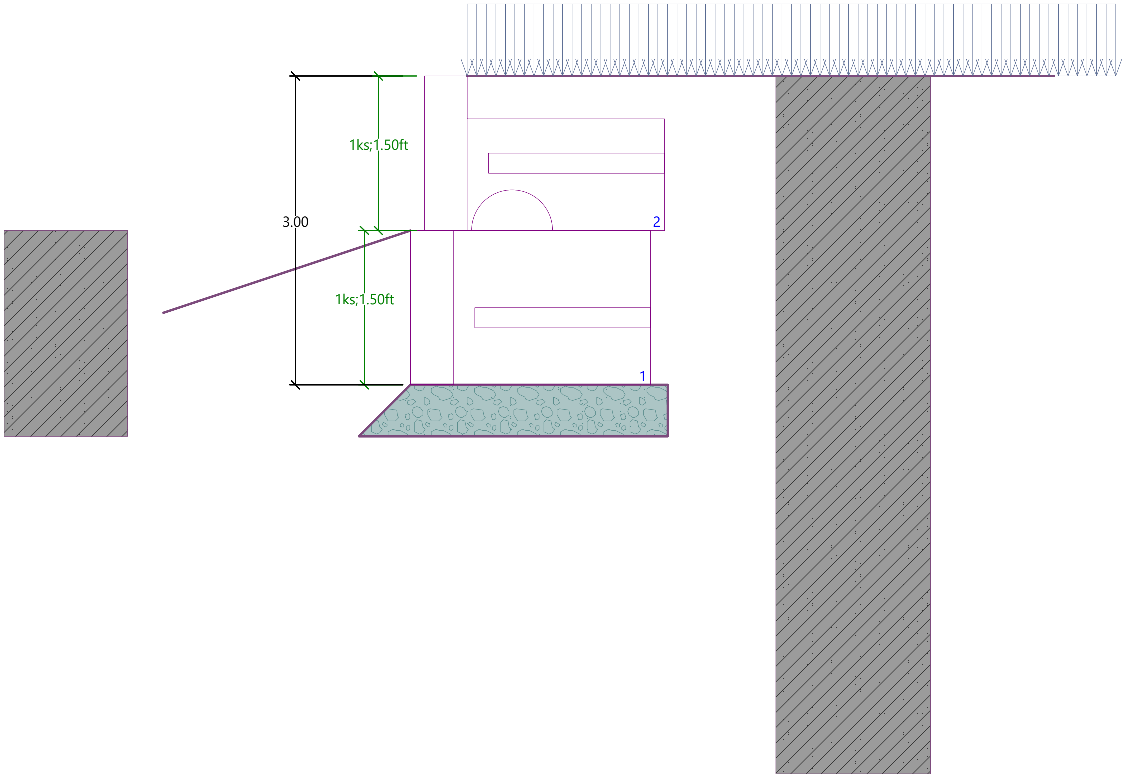
No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28	1	1.62
2	Top block 28	1	-

Name : Geometry

Stage - analysis : 1 - 0



Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 0.50 ft
Height h = 0.50 ft
Width b = 3.00 ft

Material

Soil creating foundation - #57 Stone

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	#57 Stone	▨	40.00	0.0	105.00	47.50	26.67
2	Upper Sand	▨	28.00	0.0	115.00	57.50	18.67
3	Upper Lean Clay	▨	24.00	100.0	120.00	62.50	16.00
4	Upper Fat Clay	▨	26.00	100.0	125.00	67.50	17.33

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

#57 Stone

Unit weight : γ = 105.0 pcf
Stress-state : effective

Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 26.67 °
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 18.67 °
Saturated unit weight : γ_{sat} = 120.0 pcf

Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 16.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Angle of friction struc.-soil : δ = 17.33 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	7.63	0.00 .. 7.63	Upper Lean Clay	▨
2	9.50	7.63 .. 17.13	Upper Fat Clay	▨
3	-	17.13 .. ∞	Upper Sand	▨

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge		Action	Mag.1	Mag.2	Ord.x	Length	Depth
	new	change		[lbf/ft^2]	[lbf/ft^2]	x [ft]	l [ft]	z [ft]
1	Yes		permanent	250.0				on terrain

No.	Name
1	Traffic/Construction Surcharge

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - Upper Lean Clay
Soil thickness in front of structure h = 2.00 ft
Soil slope in front of structure β = -18.43 °

Settings of the stage of construction

Design situation : permanent

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-1.62	905.6	1.69	1.000
FF resistance	-1022.4	-0.86	-340.7	0.34	1.000
Weight - earth wedge	0.0	-0.58	2.3	2.90	1.000
Weight - earth wedge	0.0	-3.29	89.1	1.94	1.000
Active pressure	38.5	-0.44	38.2	2.94	1.000
Traffic/Construction Surcharge	193.1	-1.39	165.5	2.90	1.000
Traffic/Construction Surcharge	0.0	-3.50	411.5	1.88	1.000

Verification of complete wall

Check for overturning stability
Resisting moment M_{res} = 2956.8 lbfft/ft
Overturning moment M_{ovr} = -592.1 lbfft/ft

Safety factor = 1000.00 > 2.00
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 866.10 lbf/ft
Active horizontal force H_{act} = -790.78 lbf/ft

Safety factor = 1000.00 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-0.75	328.1	1.17	1.000
Weight - earth wedge	0.0	-1.29	89.1	1.31	1.000
Active pressure	0.0	-1.50	0.0	2.06	1.000
Traffic/Construction Surcharge	54.2	-0.83	95.6	2.24	1.000
Traffic/Construction Surcharge	0.0	-1.50	411.5	1.24	1.000

Verification of most stressed block No. 2

Check for overturning stability

Resisting moment M_{res} = 1223.6 lbfft/ft
Overturning moment M_{ovr} = 45.1 lbfft/ft

Safety factor = 27.15 > 2.00

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 6953.65 lbf/ft
Active horizontal force H_{act} = 54.19 lbf/ft

Safety factor = 128.32 > 1.50

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-1641.6	1271.47	-790.78	0.000	423.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-1641.6	1271.47	-790.78

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 423.8 psf
Bearing capacity of foundation soil R_d = 6000.0 psf

Safety factor = 14.16 > 3.00

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

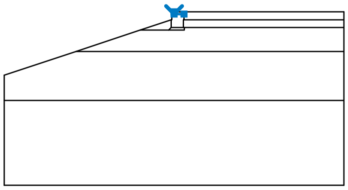
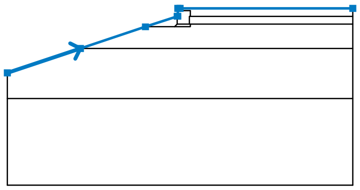
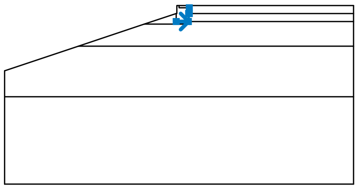
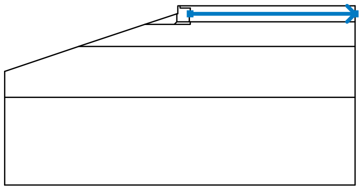
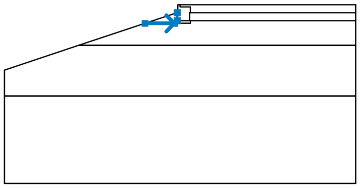
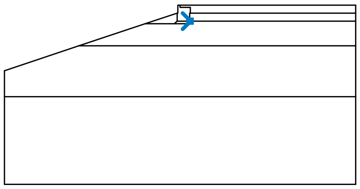
(input for current task)

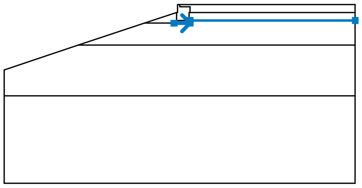
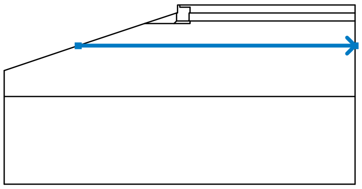
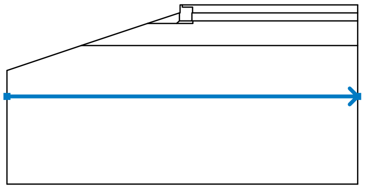
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor :	SF_S =	1.30	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.42	1.92	-0.42
2		-32.80	-12.25	-18.94	-7.63	-6.55	-3.50
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	0.00		
3		-0.55	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
4		1.92	-1.50	32.80	-1.50		
5		-6.55	-3.50	-1.05	-3.50	-0.55	-3.00
		-0.55	-1.50				
6		1.78	-3.00	1.95	-3.00		

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		-1.05	-3.50	1.95	-3.50	1.95	-3.00
		32.80	-3.00				
8		-18.94	-7.63	32.80	-7.63		
9		-32.80	-17.13	32.80	-17.13		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	#57 Stone	▨	40.00	0.0	105.0
2	Upper Sand	▨	28.00	0.0	115.0
3	Upper Lean Clay	▨	24.00	100.0	120.0
4	Upper Fat Clay	▨	26.00	100.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	#57 Stone	▨	110.0		
2	Upper Sand	▨	120.0		

No.	Name	Pattern	γ_{sat} [pcf]	γ_{s} [pcf]	n [–]
3	Upper Lean Clay	▨	125.0		
4	Upper Fat Clay	▨	130.0		

Soil parameters

#57 Stone
Unit weight : γ = 105.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 40.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 110.0 pcf

Upper Sand
Unit weight : γ = 115.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 120.0 pcf

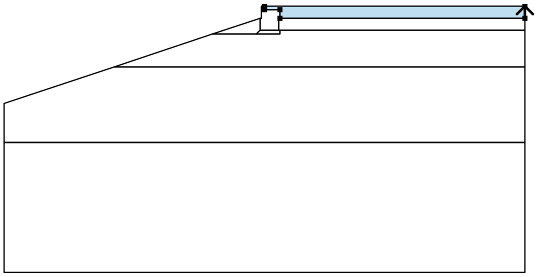
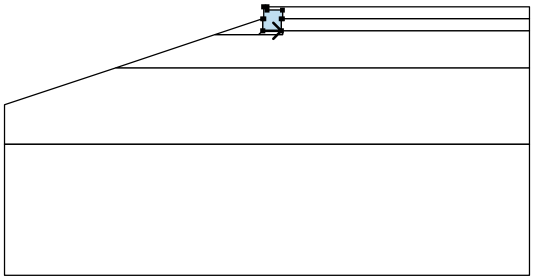
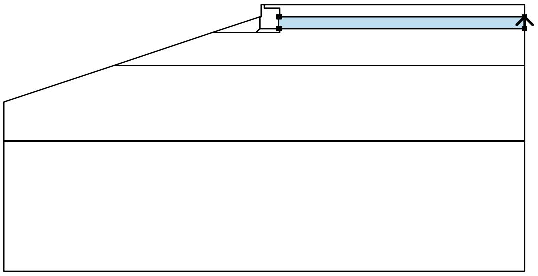
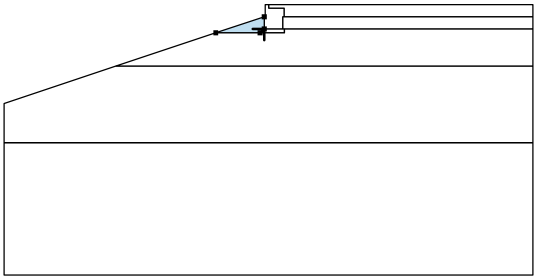
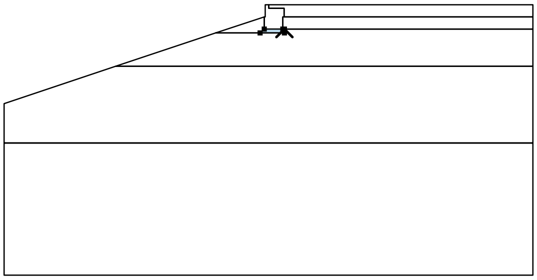
Upper Lean Clay
Unit weight : γ = 120.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 24.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

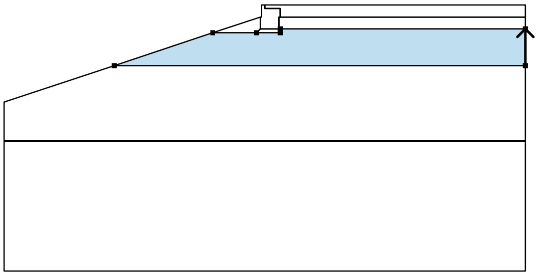
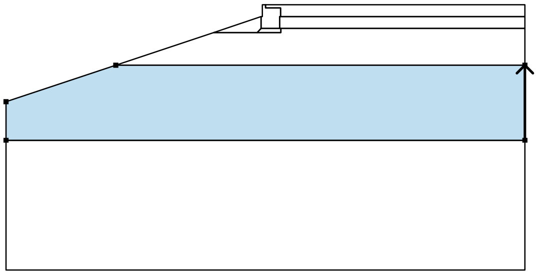
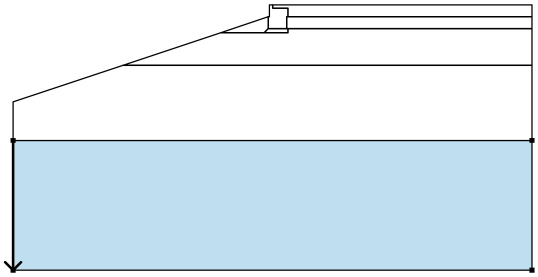
Upper Fat Clay
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 26.00 °
Cohesion of soil : c_{ef} = 100.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure	▦	120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	0.00	Upper Lean Clay ▨
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		-0.55	-3.00	1.78	-3.00	Material of structure 🟥
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
3		32.80	-3.00	32.80	-1.50	Upper Lean Clay ▨
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.95	-3.00	
4		-1.05	-3.50	-0.55	-3.00	Upper Lean Clay ▨
		-0.55	-1.50	-6.55	-3.50	
5		1.95	-3.50	1.95	-3.00	#57 Stone 🟦
		1.78	-3.00	-0.55	-3.00	
		-1.05	-3.50			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
6		32.80	-7.63	32.80	-3.00	Upper Lean Clay ▨
		1.95	-3.00	1.95	-3.50	
		-1.05	-3.50	-6.55	-3.50	
		-18.94	-7.63			
7		32.80	-17.13	32.80	-7.63	Upper Fat Clay ▨
		-18.94	-7.63	-32.80	-12.25	
		-32.80	-17.13			
8		-32.80	-17.13	-32.80	-33.53	Upper Sand ▨
		32.80	-33.53	32.80	-17.13	

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	on terrain	x = 0.00	l = 32.80		0.00	250.0		lbf/ft^2

Surcharges

No.	Name
1	Traffic/Construction Surcharge

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-10.05	[ft]	Angles :	α_1 =	-17.40	[°]
	z =	12.63	[ft]		α_2 =	51.39	[°]
Radius :	R =	20.24	[ft]				
The slip surface after optimization.							

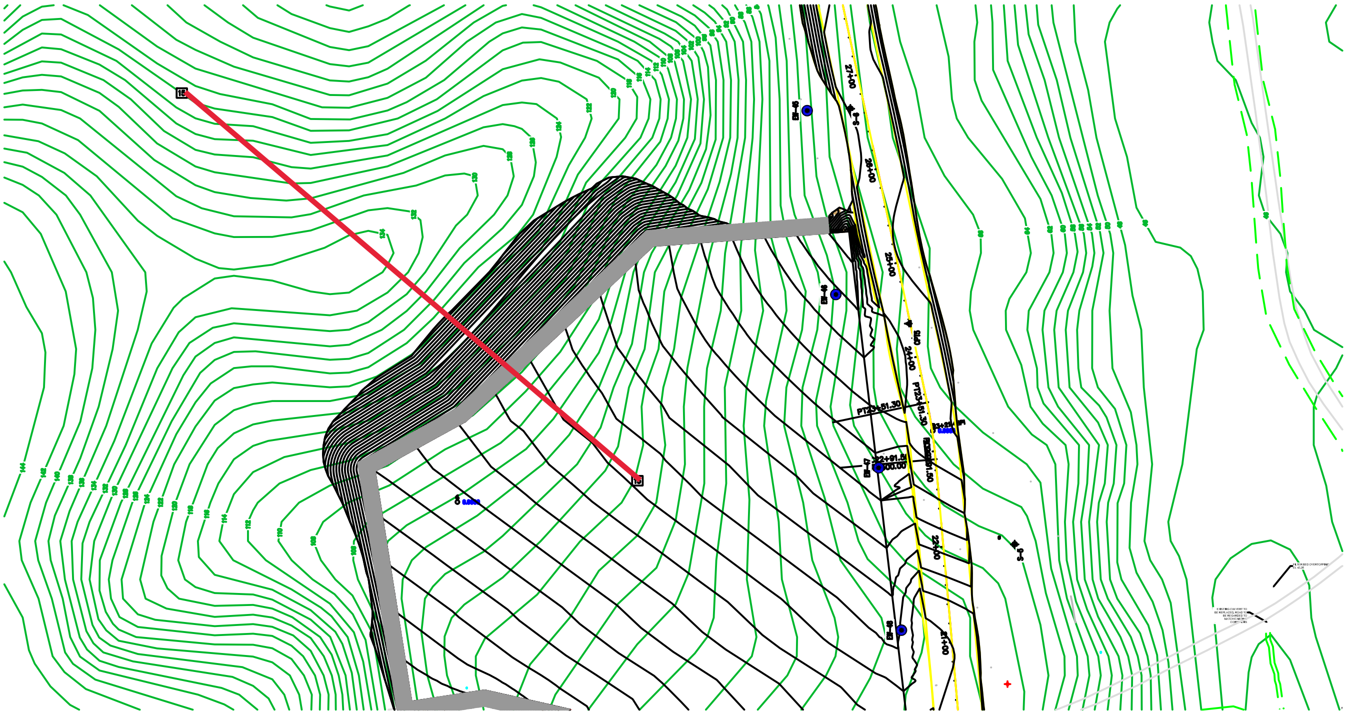
Slope stability verification (Bishop)

Sum of active forces : F_a = 3126.5 lbf/ft
Sum of passive forces : F_p = 6472.8 lbf/ft

Sliding moment : M_a = 63280.9 lbfft/ft
Resisting moment : M_p = 131009.9 lbfft/ft
Factor of safety = 2.07 > 1.30
Slope stability ACCEPTABLE

Attachments

Slope Stability Models and Results

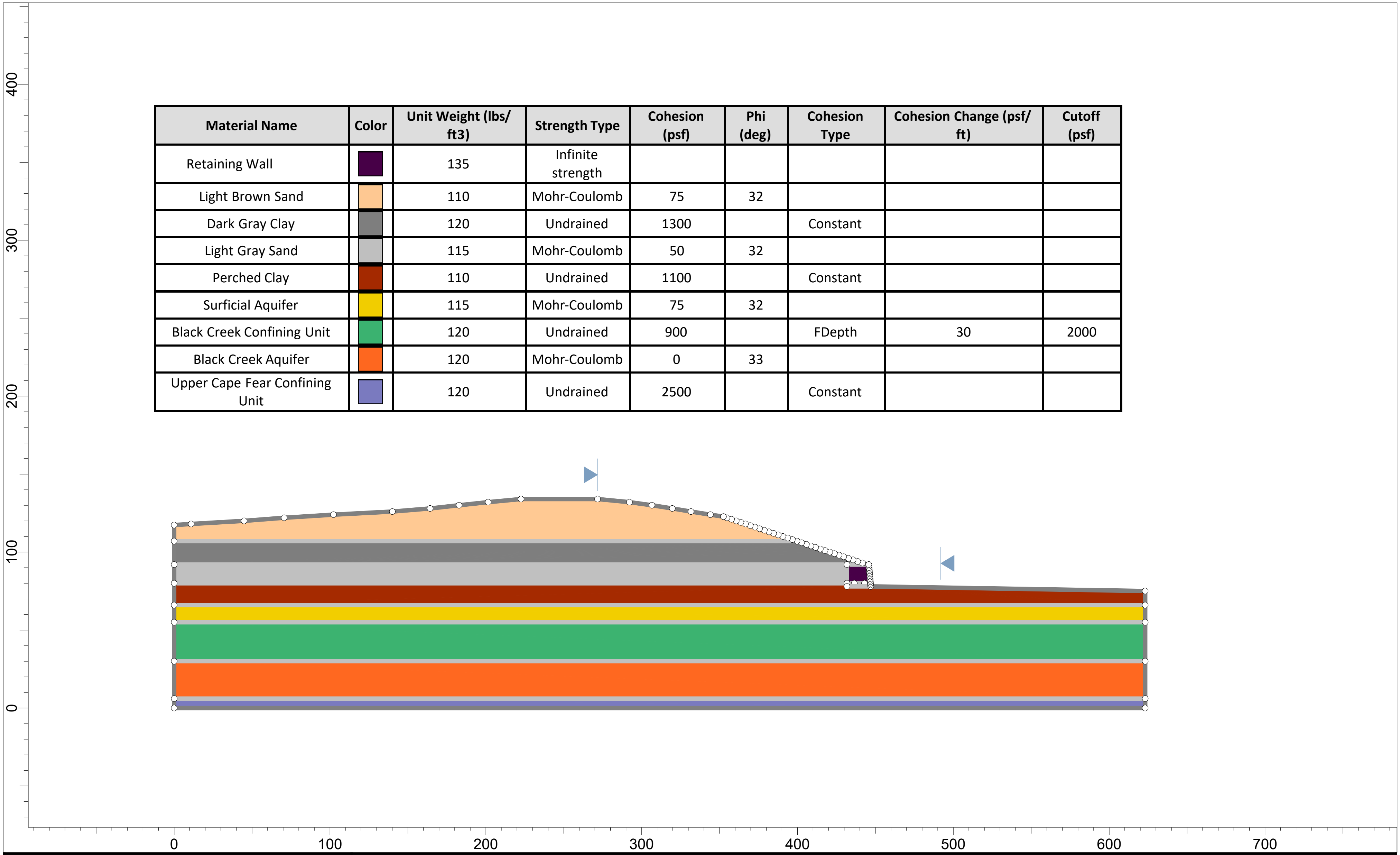


Location: Wastewater Treatment Pad, Tallest Retaining Wall

Section: 15

Approximate Station: 25+00

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ ft)	Cutoff (psf)
Retaining Wall	🟪	135	Infinite strength					
Light Brown Sand	🟧	110	Mohr-Coulomb	75	32			
Dark Gray Clay	⬛	120	Undrained	1300		Constant		
Light Gray Sand	⬜	115	Mohr-Coulomb	50	32			
Perched Clay	🟫	110	Undrained	1100		Constant		
Surficial Aquifer	🟨	115	Mohr-Coulomb	75	32			
Black Creek Confining Unit	🟩	120	Undrained	900		FDepth	30	2000
Black Creek Aquifer	🟧	120	Mohr-Coulomb	0	33			
Upper Cape Fear Confining Unit	🟦	120	Undrained	2500		Constant		



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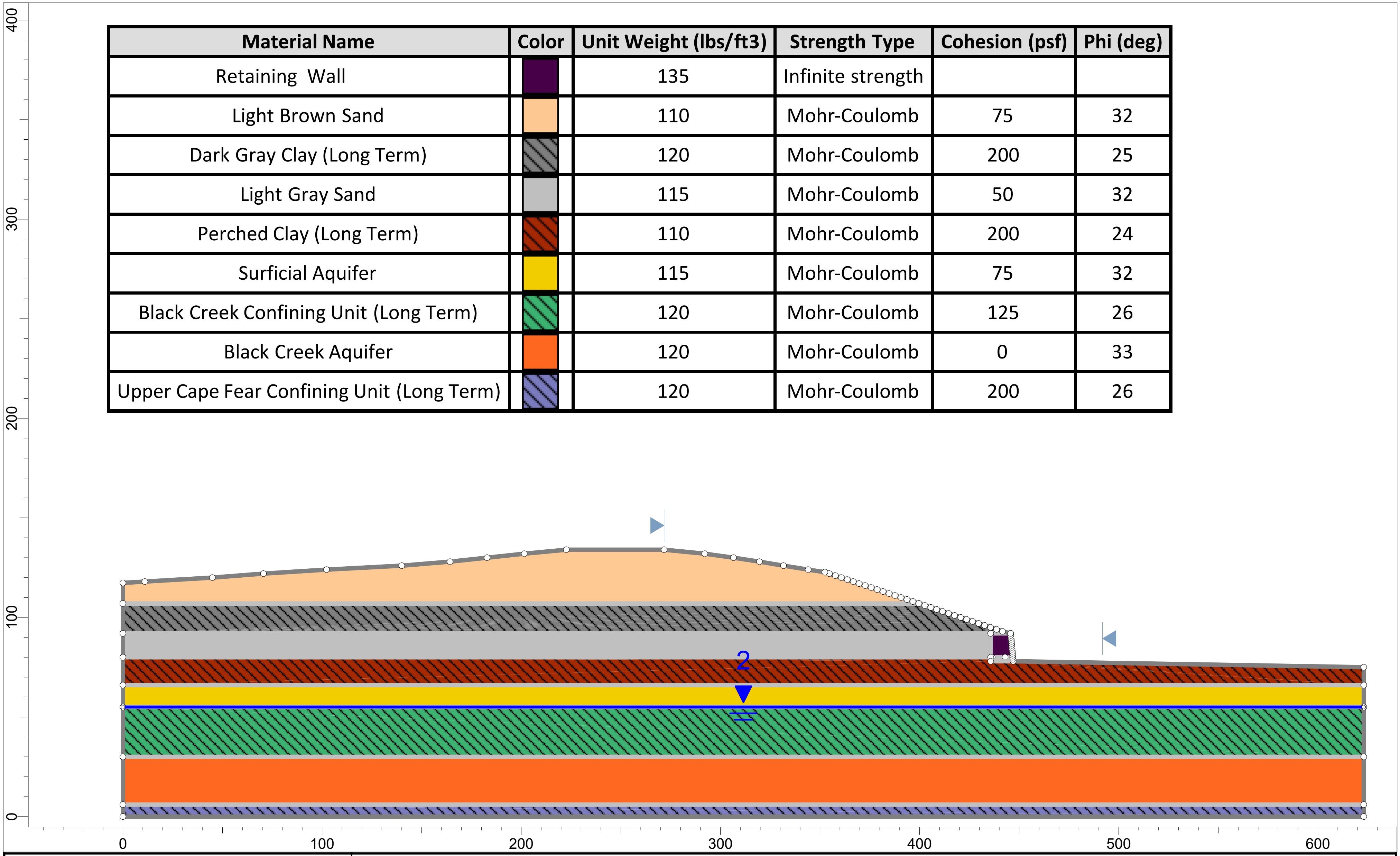
SLIDE 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair

Group	Material Parameters	*Scenario*	Short Term Stability
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_25+00_wastewater-treatment_section_15_2.slmd

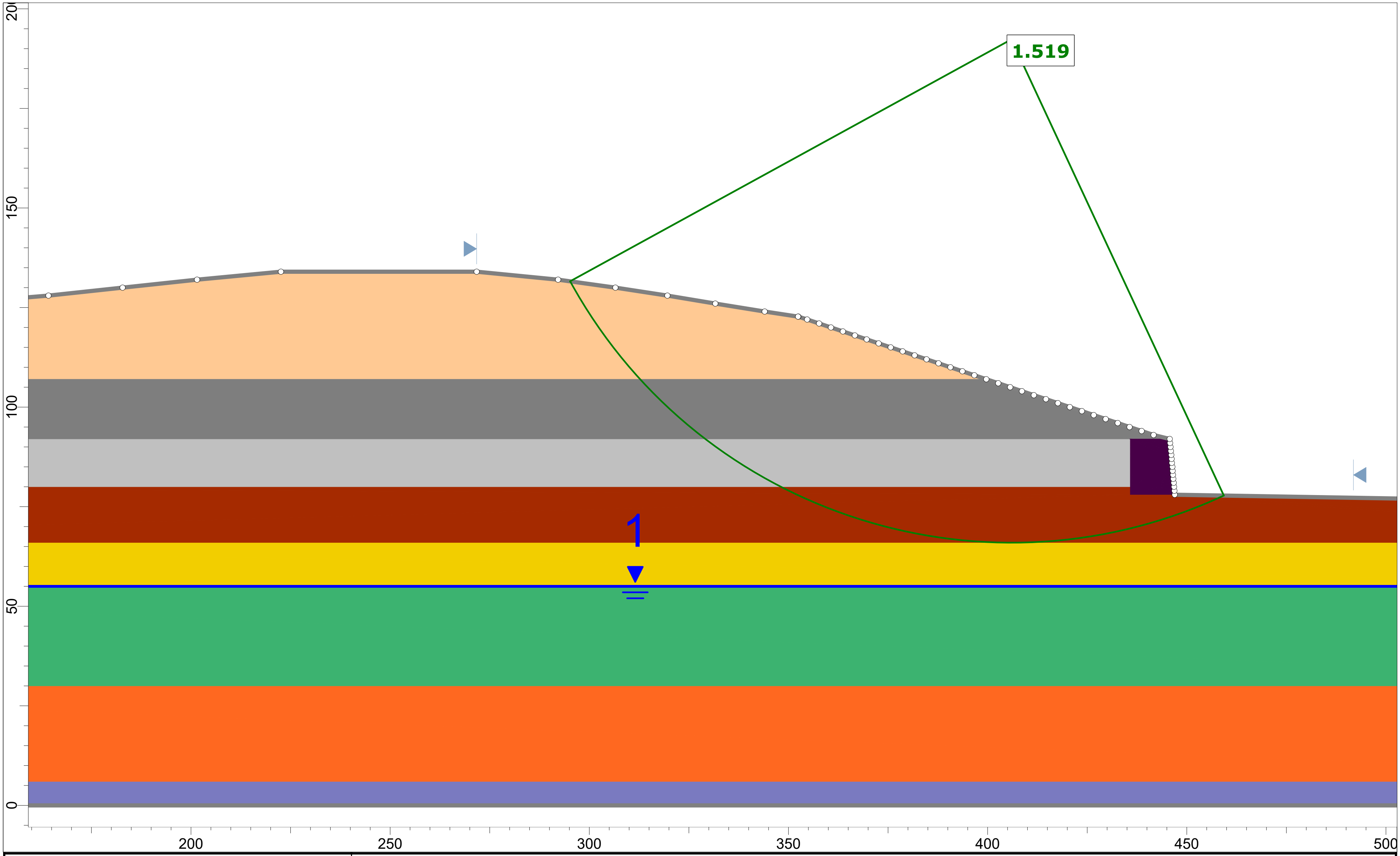
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Retaining Wall	🟪	135	Infinite strength		
Light Brown Sand	🟧	110	Mohr-Coulomb	75	32
Dark Gray Clay (Long Term)	▨	120	Mohr-Coulomb	200	25
Light Gray Sand	⬜	115	Mohr-Coulomb	50	32
Perched Clay (Long Term)	▨	110	Mohr-Coulomb	200	24
Surficial Aquifer	🟨	115	Mohr-Coulomb	75	32
Black Creek Confining Unit (Long Term)	▨	120	Mohr-Coulomb	125	26
Black Creek Aquifer	🟧	120	Mohr-Coulomb	0	33
Upper Cape Fear Confining Unit (Long Term)	▨	120	Mohr-Coulomb	200	26



Geotechnical, Environmental and Materials Engineers

SLIDE 9.017

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Material Parameters	*Scenario*	Long Term Stability
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_25+00_wastewater-treatment_section_15_2.slmd



Project
45-20803 Barrier Wall Road Interim Design and Repair

Group	Wastewater Treatment Pad	Scenario	Short Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	section_25+00_wastewater-treatment_section_15_2.slmd

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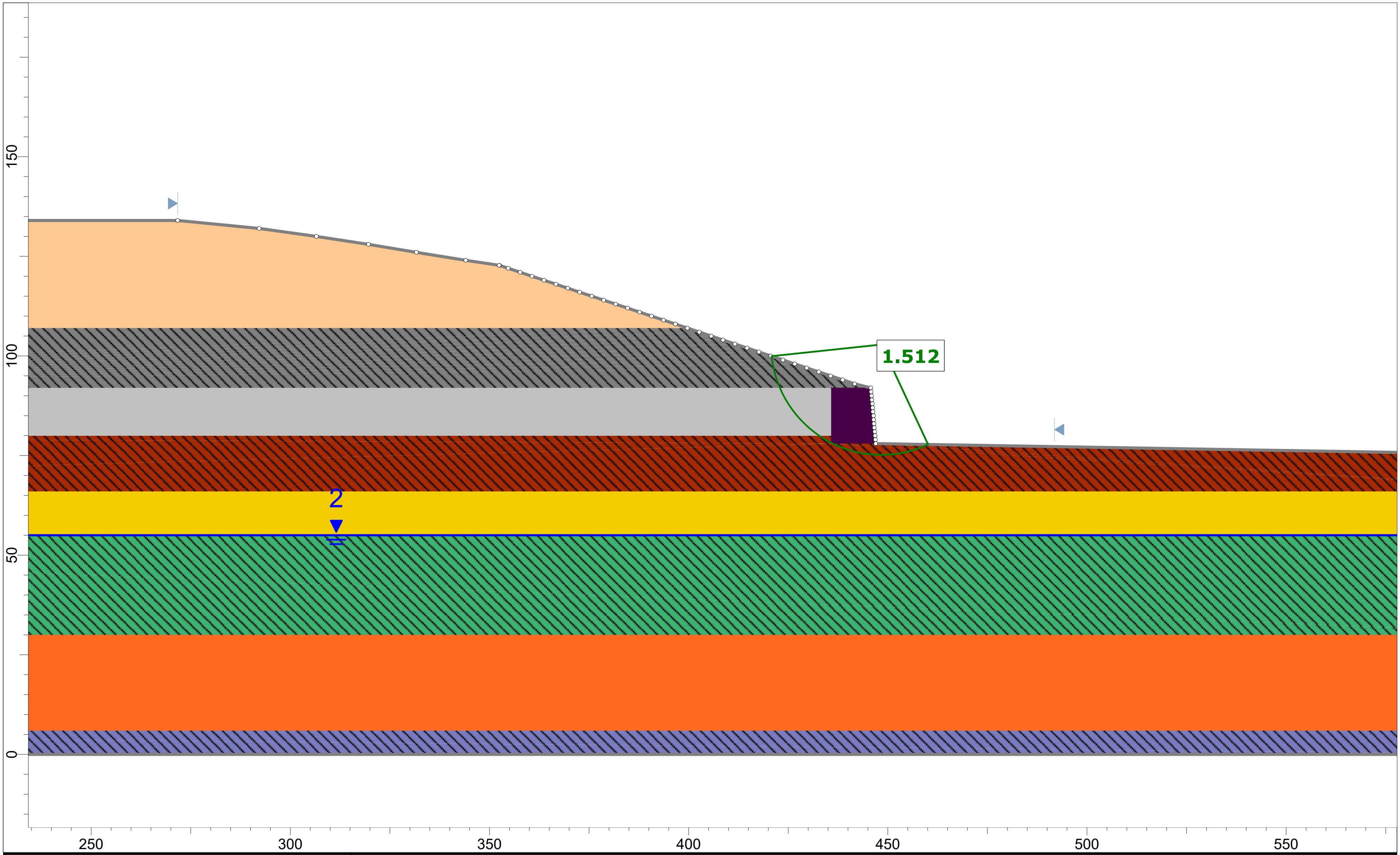
SLIDEINTERPRET 9.016



Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Wastewater Treatment Pad	*Scenario*	Long Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_25+00_wastewater-treatment_section_15_2.slmd

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45-20803 Barrier Wall Road Interim Design and Repair
Tallest Retaining Wall Section
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.018

Table of Contents

Slide Analysis Information

section_25+00_wastewater-treatment_section_15_2

Project Summary

File Name:	section_25+00_wastewater-treatment_section_15_2.slmd
Slide Modeler Version:	9.018
Project Title:	45-20803 Barrier Wall Road Interim Design and Repair
Analysis:	Station 25+00 Wastewater Treatment Pad: Lonbg Term Slope Stability
Company:	GeoServices LLC
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name		Scenario Name	Global Minimum	Compute Time
Ground Profile	◆	Master Scenario	Spencer: 3.084840	00h:00m:01.229s
		Long Term	Spencer: 4.767960	00h:00m:01.620s
Wastewater Treatment	◆	Master Scenario	Spencer: 1.518790	00h:00m:01.440s
		Long Term	Spencer: 1.511940	00h:00m:01.53s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Materials

Retaining Wall	
Color	🟪
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	135
Allow Sliding Along Boundary	Yes
Water Surface	Assigned per scenario
Ru Value	0
Light Brown Sand	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay	
Color	⬛
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0
Light Gray Sand	
Color	⬜
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay	
Color	🟥
Strength Type	Undrained
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1100
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Perched Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	200
Friction Angle [deg]	24
Water Surface	Assigned per scenario
Ru Value	0
Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit	
Color	🟪
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	2500
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material		Ground Profile	Long Term	Wastewater Treatment	Long Term
Retaining Wall	🟪	✗	✗	✓	✓
Light Brown Sand	🟧	✓	✓	✓	✓
Dark Gray Clay	⬛	✓	✗	✓	✗
Dark Gray Clay (Long Term)	▨	✗	✓	✗	✓
Light Gray Sand	⬜	✓	✓	✓	✓
Perched Clay	🟥	✓	✗	✓	✗
Perched Clay (Long Term)	▨	✗	✓	✗	✓
Surficial Aquifer	🟨	✓	✓	✓	✓
Black Creek Confining Unit	🟩	✓	✗	✓	✗
Black Creek Confining Unit (Long Term)	▨	✗	✓	✗	✓
Black Creek Aquifer	🟧	✓	✓	✓	✓
Upper Cape Fear Confining Unit	🟦	✓	✗	✓	✗
Upper Cape Fear Confining Unit (Long Term)	▨	✗	✓	✗	✓

Global Minimums

Ground Profile - Master Scenario

Method: spencer

FS	3.084840
Center:	428.244, 263.350
Radius:	233.410
Left Slip Surface Endpoint:	233.953, 134.000
Right Slip Surface Endpoint:	592.178, 97.201
Resisting Moment:	1.57387e+08 lb-ft
Driving Moment:	5.10194e+07 lb-ft
Resisting Horizontal Force:	592771 lb
Driving Horizontal Force:	192156 lb
Total Slice Area:	21255.5 ft2
Surface Horizontal Width:	358.225 ft
Surface Average Height:	59.3356 ft

Ground Profile - Long Term

Method: spencer

FS	4.767960
Center:	385.976, 321.041
Radius:	221.191
Left Slip Surface Endpoint:	267.903, 134.000
Right Slip Surface Endpoint:	451.480, 109.772
Resisting Moment:	3.90485e+07 lb-ft
Driving Moment:	8.18977e+06 lb-ft
Resisting Horizontal Force:	171435 lb
Driving Horizontal Force:	35955.5 lb
Total Slice Area:	2552.75 ft2
Surface Horizontal Width:	183.577 ft
Surface Average Height:	13.9056 ft

Wastewater Treatment - Master Scenario

Method: spencer

FS	1.518790
Center:	405.974, 192.348
Radius:	126.368
Left Slip Surface Endpoint:	295.176, 131.581
Right Slip Surface Endpoint:	459.318, 77.791
Resisting Moment:	2.78557e+07 lb-ft
Driving Moment:	1.83407e+07 lb-ft
Resisting Horizontal Force:	194875 lb
Driving Horizontal Force:	128310 lb
Total Slice Area:	5218.16 ft2
Surface Horizontal Width:	164.142 ft
Surface Average Height:	31.7905 ft

◆ Wastewater Treatment - Long Term

Method: spencer

FS	1.511940
Center:	448.389, 102.854
Radius:	27.688
Left Slip Surface Endpoint:	420.855, 99.932
Right Slip Surface Endpoint:	460.129, 77.778
Resisting Moment:	857636 lb-ft
Driving Moment:	567243 lb-ft
Resisting Horizontal Force:	25848.8 lb
Driving Horizontal Force:	17096.5 lb
Total Slice Area:	390.978 ft2
Surface Horizontal Width:	39.2742 ft
Surface Average Height:	9.9551 ft

Global Minimum Support Data

All Open Scenarios

No Supports Present

Valid and Invalid Surfaces

🔷 Ground Profile - Master Scenario

Method: spencer

Number of Valid Surfaces:	9112
Number of Invalid Surfaces:	0

🔷 Ground Profile - Long Term

Method: spencer

Number of Valid Surfaces:	11456
Number of Invalid Surfaces:	0

🟩 Wastewater Treatment - Master Scenario

Method: spencer

Number of Valid Surfaces:	9977
Number of Invalid Surfaces:	0

🟩 Wastewater Treatment - Long Term

Method: spencer

Number of Valid Surfaces:	5493
Number of Invalid Surfaces:	0

Slice Data

Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 3.08484

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.9949	3822.56	-54.8545	Light Brown Sand	75	32	100.558	310.206	376.408	0	376.408	519.246	519.246
2	6.9949	11085.7	-51.9693	Light Brown Sand	75	32	261.826	807.692	1172.55	0	1172.55	1507.3	1507.3
3	6.9949	17650.6	-49.26	Light Brown Sand	75	32	414.767	1279.49	1927.59	0	1927.59	2409.12	2409.12
4	7.40739	25483.8	-46.6206	Dark Gray Clay	1300	0	421.416	1300	2833.4	0	2833.4	3279.36	3279.36
5	7.40739	32150.5	-44.0321	Dark Gray Clay	1300	0	421.416	1300	3733.91	0	3733.91	4141.32	4141.32
6	7.02535	35895.1	-41.614	Light Gray Sand	50	32	860.291	2653.86	4167.04	0	4167.04	4931.22	4931.22
7	7.02535	40232.1	-39.3456	Light Gray Sand	50	32	976.987	3013.85	4743.16	0	4743.16	5544.11	5544.11
8	6.60268	41334.3	-37.2129	Perched Clay	1100	0	356.583	1100	5739.76	0	5739.76	6010.54	6010.54
9	6.60268	44324.3	-35.2034	Perched Clay	1100	0	356.583	1100	6210.35	0	6210.35	6461.93	6461.93
10	6.60268	46928.9	-33.2426	Perched Clay	1100	0	356.583	1100	6625.07	0	6625.07	6858.79	6858.79
11	6.47194	48351.2	-31.3435	Surficial Aquifer	75	32	1339.17	4131.14	6491.18	0	6491.18	7306.8	7306.8
12	6.47194	50481.5	-29.5007	Surficial Aquifer	75	32	1411.25	4353.47	6846.99	0	6846.99	7645.45	7645.45
13	6.47194	52393.8	-27.6908	Surficial Aquifer	75	32	1477.93	4559.19	7176.21	0	7176.21	7951.84	7951.84
14	7.13746	59773.7	-25.8205	Black Creek Confining Unit	951.8	0	308.541	951.8	8002.86	0	8002.86	8152.15	8152.15
15	7.13746	61683.3	-23.8891	Black Creek Confining Unit	1051.02	0	340.705	1051.02	8283.47	0	8283.47	8434.37	8434.37
16	7.13746	63366.1	-21.9862	Black Creek Confining Unit	1141.67	0	370.091	1141.67	8536.4	0	8536.4	8685.82	8685.82
17	7.13746	64851.1	-20.1085	Black Creek Confining Unit	1224.09	0	396.808	1224.09	8765.08	0	8765.08	8910.35	8910.35
18	7.13746	66139.5	-18.2531	Black Creek Confining Unit	1298.6	0	420.962	1298.6	8969.19	0	8969.19	9108.03	9108.03
19	7.13746	67214.3	-16.4173	Black Creek Confining Unit	1365.45	0	442.632	1365.45	9145.97	0	9145.97	9276.38	9276.38
20	7.13746	68080.7	-14.5987	Black Creek Confining Unit	1424.88	0	461.898	1424.88	9295.75	0	9295.75	9416.06	9416.06

21	7.13746	68758	-12.795	Black Creek Confining Unit	1477.08	0	478.819	1477.08	9420.86	0	9420.86	9529.6	9529.6
22	7.13746	69246.8	-11.0042	Black Creek Confining Unit	1522.21	0	493.449	1522.21	9521.02	0	9521.02	9616.97	9616.97
23	7.13746	69622	-9.22417	Black Creek Confining Unit	1560.42	0	505.835	1560.42	9606.38	0	9606.38	9688.52	9688.52
24	7.13746	69827.2	-7.45311	Black Creek Confining Unit	1591.81	0	516.011	1591.81	9668.84	0	9668.84	9736.35	9736.35
25	7.13746	69812.8	-5.68919	Black Creek Confining Unit	1616.48	0	524.008	1616.48	9701.28	0	9701.28	9753.49	9753.49
26	7.13746	69588.1	-3.93066	Black Creek Confining Unit	1634.51	0	529.852	1634.51	9704.68	0	9704.68	9741.09	9741.09
27	7.13746	69198.4	-2.17584	Black Creek Confining Unit	1645.93	0	533.554	1645.93	9685.13	0	9685.13	9705.4	9705.4
28	10.584	101519	0	Black Creek Confining Unit	1650	0	534.874	1650	9625.21	0	9625.21	9625.21	9625.21
29	7.6865	72663.9	2.24333	Black Creek Confining Unit	1645.48	0	533.409	1645.48	9530.96	0	9530.96	9510.07	9510.07
30	7.6865	71507.8	4.13343	Black Creek Confining Unit	1632.63	0	529.243	1632.63	9416.84	0	9416.84	9378.6	9378.6
31	7.6865	70116.3	6.02804	Black Creek Confining Unit	1612.12	0	522.594	1612.12	9270.98	0	9270.98	9215.8	9215.8
32	7.6865	68487.2	7.92931	Black Creek Confining Unit	1583.89	0	513.443	1583.89	9092.75	0	9092.75	9021.24	9021.24
33	7.6865	66629.6	9.83941	Black Creek Confining Unit	1547.83	0	501.754	1547.83	8883	0	8883	8795.98	8795.98
34	7.6865	64554.7	11.7606	Black Creek Confining Unit	1503.83	0	487.49	1503.83	8642.79	0	8642.79	8541.3	8541.3
35	7.6865	62189.9	13.6954	Black Creek Confining Unit	1451.73	0	470.601	1451.73	8362.16	0	8362.16	8247.48	8247.48
36	7.6865	59638.6	15.6462	Black Creek Confining Unit	1391.34	0	451.025	1391.34	8054.27	0	8054.27	7927.95	7927.95
37	7.6865	56850	17.6159	Black Creek Confining Unit	1322.44	0	428.69	1322.44	7711.93	0	7711.93	7575.81	7575.81
38	7.6865	53798.6	19.6073	Black Creek Confining Unit	1244.76	0	403.509	1244.76	7331.15	0	7331.15	7187.41	7187.41
39	7.6865	50500.7	21.6237	Black Creek Confining Unit	1157.98	0	375.378	1157.98	6913.44	0	6913.44	6764.63	6764.63

40	7.6865	46915.9	23.6687	Black Creek Confining Unit	1061.74	0	344.18	1061.74	6452.62	0	6452.62	6301.76	6301.76
41	7.6865	43032.4	25.7463	Black Creek Confining Unit	955.601	0	309.773	955.601	5946.2	0	5946.2	5796.81	5796.81
42	6.47194	33065.3	27.6908	Surficial Aquifer	75	32	1247.78	3849.2	6039.99	0	6039.99	5385.14	5385.14
43	6.47194	30016.1	29.5007	Surficial Aquifer	75	32	1149.91	3547.29	5556.82	0	5556.82	4906.21	4906.21
44	6.47194	26764.1	31.3435	Surficial Aquifer	75	32	1042.55	3216.09	5026.78	0	5026.78	4391.82	4391.82
45	6.60268	23831.6	33.2426	Perched Clay	1100	0	356.583	1100	4030.28	0	4030.28	3796.56	3796.56
46	6.60268	20183	35.2034	Perched Clay	1100	0	356.583	1100	3484.07	0	3484.07	3232.5	3232.5
47	6.60268	16285.1	37.2129	Perched Clay	1100	0	356.583	1100	2896.84	0	2896.84	2626.06	2626.06
48	7.02535	12640.5	39.3456	Light Gray Sand	50	32	493.202	1521.45	2354.81	0	2354.81	1950.47	1950.47
49	7.02535	7386.62	41.614	Light Gray Sand	50	32	303.555	936.418	1418.56	0	1418.56	1148.92	1148.92
50	5.44374	1812.01	43.6915	Dark Gray Clay	1300	0	421.416	1300	813.366	0	813.366	410.772	410.772

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 4.76796

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.66398	456.112	-31.7051	Light Brown Sand	75	32	29.1442	138.958	102.354	0	102.354	120.358	120.358
2	3.66398	1283.18	-30.596	Light Brown Sand	75	32	55.378	264.04	302.526	0	302.526	335.271	335.271
3	3.66398	1993.04	-29.4994	Light Brown Sand	75	32	78.1856	372.786	476.558	0	476.558	520.792	520.792
4	3.66398	2665.61	-28.4146	Light Brown Sand	75	32	100.048	477.024	643.371	0	643.371	697.5	697.5
5	3.66398	3302.21	-27.3409	Light Brown Sand	75	32	120.98	576.829	803.095	0	803.095	865.646	865.646
6	3.66398	3903.9	-26.2774	Light Brown Sand	75	32	140.994	672.252	955.803	0	955.803	1025.42	1025.42
7	3.66398	4467.3	-25.2236	Light Brown Sand	75	32	159.956	762.664	1100.49	0	1100.49	1175.84	1175.84
8	3.66398	4953.27	-24.1788	Light Brown Sand	75	32	176.57	841.877	1227.26	0	1227.26	1306.54	1306.54
9	3.66398	5395.4	-23.1425	Light Brown Sand	75	32	191.894	914.942	1344.19	0	1344.19	1426.21	1426.21
10	3.66398	5806.06	-22.1142	Light Brown Sand	75	32	206.312	983.689	1454.2	0	1454.2	1538.04	1538.04
11	3.66398	6183.82	-21.0934	Light Brown Sand	75	32	219.762	1047.82	1556.83	0	1556.83	1641.6	1641.6
12	3.66398	6515.48	-20.0795	Light Brown Sand	75	32	231.787	1105.15	1648.59	0	1648.59	1733.32	1733.32
13	3.66398	6814.34	-19.0721	Light Brown Sand	75	32	242.81	1157.71	1732.7	0	1732.7	1816.65	1816.65
14	3.66398	7084.22	-18.0708	Light Brown Sand	75	32	252.945	1206.03	1810.02	0	1810.02	1892.55	1892.55
15	3.66398	7318.11	-17.0752	Light Brown Sand	75	32	261.938	1248.91	1878.65	0	1878.65	1959.11	1959.11
16	3.66398	7512.43	-16.0849	Light Brown Sand	75	32	269.658	1285.72	1937.55	0	1937.55	2015.31	2015.31
17	3.66398	7679.05	-15.0995	Light Brown Sand	75	32	276.487	1318.28	1989.66	0	1989.66	2064.26	2064.26
18	3.71902	7955.52	-14.1113	Dark Gray Clay (Long Term)	200	25	241.979	1153.75	2045.32	0	2045.32	2106.15	2106.15
19	3.71902	8111.41	-13.12	Dark Gray Clay (Long Term)	200	25	246.769	1176.58	2094.29	0	2094.29	2151.8	2151.8
20	3.71902	8237.65	-12.1328	Dark Gray Clay (Long Term)	200	25	250.831	1195.95	2135.83	0	2135.83	2189.75	2189.75
21	3.71902	8334.69	-11.1491	Dark Gray Clay (Long Term)	200	25	254.172	1211.88	2169.97	0	2169.97	2220.07	2220.07
22	3.71902	8414.67	-10.1688	Dark Gray Clay (Long Term)	200	25	257.089	1225.79	2199.82	0	2199.82	2245.94	2245.94

23	3.71902	8470.04	-9.1915	Dark Gray Clay (Long Term)	200	25	259.392	1236.77	2223.35	0	2223.35	2265.32	2265.32
24	3.71902	8496.4	-8.21688	Dark Gray Clay (Long Term)	200	25	260.954	1244.22	2239.33	0	2239.33	2277.01	2277.01
25	3.71902	8494.45	-7.24465	Dark Gray Clay (Long Term)	200	25	261.789	1248.2	2247.87	0	2247.87	2281.15	2281.15
26	3.71902	8465.35	-6.27451	Dark Gray Clay (Long Term)	200	25	261.919	1248.82	2249.2	0	2249.2	2278	2278
27	3.71902	8407.94	-5.30618	Dark Gray Clay (Long Term)	200	25	261.307	1245.9	2242.95	0	2242.95	2267.22	2267.22
28	3.71902	8322.27	-4.33936	Dark Gray Clay (Long Term)	200	25	259.948	1239.42	2229.04	0	2229.04	2248.77	2248.77
29	3.71902	8212.15	-3.37378	Dark Gray Clay (Long Term)	200	25	257.932	1229.81	2208.43	0	2208.43	2223.63	2223.63
30	3.71902	8076.92	-2.40916	Dark Gray Clay (Long Term)	200	25	255.235	1216.95	2180.87	0	2180.87	2191.61	2191.61
31	3.71902	7913.7	-1.44522	Dark Gray Clay (Long Term)	200	25	251.779	1200.47	2145.51	0	2145.51	2151.86	2151.86
32	3.71902	7724.2	-0.481696	Dark Gray Clay (Long Term)	200	25	247.595	1180.52	2102.73	0	2102.73	2104.82	2104.82
33	3.71902	7529.42	0.481696	Dark Gray Clay (Long Term)	200	25	243.239	1159.75	2058.2	0	2058.2	2056.15	2056.15
34	3.71902	7313.9	1.44522	Dark Gray Clay (Long Term)	200	25	238.296	1136.19	2007.66	0	2007.66	2001.65	2001.65
35	3.71902	7070.46	2.40916	Dark Gray Clay (Long Term)	200	25	232.567	1108.87	1949.07	0	1949.07	1939.29	1939.29
36	3.71902	6799.02	3.37378	Dark Gray Clay (Long Term)	200	25	226.04	1077.75	1882.35	0	1882.35	1869.02	1869.02
37	3.71902	6493.45	4.33936	Dark Gray Clay (Long Term)	200	25	218.543	1042	1805.68	0	1805.68	1789.1	1789.1
38	3.71902	6152.7	5.30618	Dark Gray Clay (Long Term)	200	25	210.035	1001.44	1718.69	0	1718.69	1699.18	1699.18
39	3.71902	5783.66	6.27451	Dark Gray Clay (Long Term)	200	25	200.693	956.894	1623.17	0	1623.17	1601.1	1601.1
40	3.71902	5386.21	7.24465	Dark Gray Clay (Long Term)	200	25	190.503	908.311	1518.98	0	1518.98	1494.76	1494.76
41	3.71902	4965.68	8.21688	Dark Gray Clay (Long Term)	200	25	179.603	856.34	1407.53	0	1407.53	1381.59	1381.59
42	3.71902	4524.8	9.1915	Dark Gray Clay (Long Term)	200	25	168.059	801.298	1289.49	0	1289.49	1262.29	1262.29
43	3.71902	4054.99	10.1688	Dark Gray Clay (Long Term)	200	25	155.625	742.012	1162.35	0	1162.35	1134.43	1134.43
44	3.71902	3555.91	11.1491	Dark Gray Clay (Long Term)	200	25	142.28	678.383	1025.89	0	1025.89	997.854	997.854
45	3.71902	3028.36	12.1328	Dark Gray Clay (Long Term)	200	25	128.033	610.456	880.227	0	880.227	852.702	852.702
46	3.71902	2477.33	13.12	Dark Gray Clay (Long Term)	200	25	113.013	538.842	726.648	0	726.648	700.308	700.308
47	3.71902	1897.13	14.1113	Dark Gray Clay (Long Term)	200	25	97.0478	462.72	563.405	0	563.405	539.008	539.008

48	3.23967	1170.56	15.0424	Light Brown Sand	75	32	68.2789	325.551	400.966	0	400.966	382.616	382.616
49	3.23967	715.658	15.9132	Light Brown Sand	75	32	48.3817	230.682	249.143	0	249.143	235.349	235.349
50	3.23967	241.743	16.7878	Light Brown Sand	75	32	27.4478	130.87	89.4109	0	89.4109	81.1303	81.1303

Wastewater Treatment - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.51879

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.52147	1071.4	-59.6763	Light Brown Sand	75	32	97.417	147.956	116.754	0	116.754	283.305	283.305
2	3.52147	3084.2	-56.6428	Light Brown Sand	75	32	229.579	348.682	437.983	0	437.983	786.724	786.724
3	3.52147	4864.11	-53.8377	Light Brown Sand	75	32	358.996	545.239	752.54	0	752.54	1243.72	1243.72
4	3.52147	6450.79	-51.2103	Light Brown Sand	75	32	484.619	736.034	1057.88	0	1057.88	1660.84	1660.84
5	3.52147	7867.93	-48.7255	Light Brown Sand	75	32	605.545	919.695	1351.79	0	1351.79	2041.69	2041.69
6	3.27706	8534.7	-46.4372	Dark Gray Clay	1300	0	855.945	1300	1547.61	0	1547.61	2447.6	2447.6
7	3.27706	9660.41	-44.3206	Dark Gray Clay	1300	0	855.945	1300	1908.09	0	1908.09	2743.98	2743.98
8	3.27706	10688.1	-42.278	Dark Gray Clay	1300	0	855.945	1300	2243.42	0	2243.42	3021.67	3021.67
9	3.27706	11624	-40.2997	Dark Gray Clay	1300	0	855.945	1300	2555.05	0	2555.05	3280.94	3280.94
10	3.27706	12484.4	-38.3778	Dark Gray Clay	1300	0	855.945	1300	2847.01	0	2847.01	3524.88	3524.88
11	3.15909	12766.3	-36.5387	Light Gray Sand	50	32	1238.46	1880.96	2930.14	0	2930.14	3847.85	3847.85
12	3.15909	13411.2	-34.7754	Light Gray Sand	50	32	1327.26	2015.83	3145.98	0	3145.98	4067.61	4067.61
13	3.15909	14005.8	-33.049	Light Gray Sand	50	32	1413.11	2146.22	3354.66	0	3354.66	4274.06	4274.06
14	3.15909	14551.6	-31.3558	Light Gray Sand	50	32	1495.88	2271.92	3555.81	0	3555.81	4467.31	4467.31
15	3.15909	15051.8	-29.6927	Light Gray Sand	50	32	1575.66	2393.1	3749.74	0	3749.74	4648.22	4648.22
16	3.15909	15517.3	-28.0567	Light Gray Sand	50	32	1653.38	2511.14	3938.65	0	3938.65	4819.87	4819.87
17	3.27173	16506.6	-26.4169	Perched Clay	1100	0	724.261	1100	4385.34	0	4385.34	4745.13	4745.13
18	3.27173	16845.4	-24.7718	Perched Clay	1100	0	724.261	1100	4532.02	0	4532.02	4866.25	4866.25
19	3.27173	16989	-23.1482	Perched Clay	1100	0	724.261	1100	4623.77	0	4623.77	4933.42	4933.42
20	3.27173	17079.1	-21.5441	Perched Clay	1100	0	724.261	1100	4699.82	0	4699.82	4985.75	4985.75
21	3.27173	17131.2	-19.9575	Perched Clay	1100	0	724.261	1100	4764.39	0	4764.39	5027.39	5027.39
22	3.27173	17148.5	-18.3867	Perched Clay	1100	0	724.261	1100	4818.34	0	4818.34	5059.09	5059.09
23	3.27173	17127.4	-16.8302	Perched Clay	1100	0	724.261	1100	4860.69	0	4860.69	5079.77	5079.77
24	3.27173	17074.7	-15.2863	Perched Clay	1100	0	724.261	1100	4893.17	0	4893.17	5091.12	5091.12
25	3.27173	16990.1	-13.7537	Perched Clay	1100	0	724.261	1100	4915.79	0	4915.79	5093.06	5093.06
26	3.27173	16869.7	-12.2312	Perched Clay	1100	0	724.261	1100	4927.26	0	4927.26	5084.27	5084.27
27	3.27173	16716.3	-10.7173	Perched Clay	1100	0	724.261	1100	4928.38	0	4928.38	5065.46	5065.46
28	3.27173	16530.7	-9.21097	Perched Clay	1100	0	724.261	1100	4919.37	0	4919.37	5036.82	5036.82
29	3.27173	16312.9	-7.71105	Perched Clay	1100	0	724.261	1100	4900.1	0	4900.1	4998.17	4998.17
30	3.27173	16064.2	-6.21644	Perched Clay	1100	0	724.261	1100	4870.92	0	4870.92	4949.81	4949.81

31	3.27173	15785.1	-4.72606	Perched Clay	1100	0	724.261	1100	4831.9	0	4831.9	4891.77	4891.77
32	3.27173	15473.5	-3.23888	Perched Clay	1100	0	724.261	1100	4782.38	0	4782.38	4823.37	4823.37
33	3.27173	15105.9	-1.75388	Perched Clay	1100	0	724.261	1100	4715.14	0	4715.14	4737.32	4737.32
34	4.4629	19936.7	0	Perched Clay	1100	0	724.261	1100	4617.47	0	4617.47	4617.47	4617.47
35	3.19453	13761.3	1.73636	Perched Clay	1100	0	724.261	1100	4508.45	0	4508.45	4486.5	4486.5
36	3.19453	13305.4	3.18627	Perched Clay	1100	0	724.261	1100	4406.69	0	4406.69	4366.37	4366.37
37	3.19453	12821.1	4.63823	Perched Clay	1100	0	724.261	1100	4294.97	0	4294.97	4236.22	4236.22
38	3.19453	12308.2	6.09318	Perched Clay	1100	0	724.261	1100	4173.09	0	4173.09	4095.78	4095.78
39	3.19453	11767.8	7.55208	Perched Clay	1100	0	724.261	1100	4041.36	0	4041.36	3945.34	3945.34
40	3.19453	11195.3	9.01594	Perched Clay	1100	0	724.261	1100	3898.2	0	3898.2	3783.28	3783.28
41	3.19453	10593.5	10.4858	Perched Clay	1100	0	724.261	1100	3744.29	0	3744.29	3610.25	3610.25
42	3.19453	9964.2	11.9626	Perched Clay	1100	0	724.261	1100	3580.22	0	3580.22	3426.77	3426.77
43	3.19453	9660.18	13.4475	Perched Clay	1100	0	724.261	1100	3522	0	3522	3348.82	3348.82
44	3.19453	9536.37	14.9418	Perched Clay	1100	0	724.261	1100	3523.52	0	3523.52	3330.25	3330.25
45	3.19453	8827.72	16.4464	Perched Clay	1100	0	724.261	1100	3330.93	0	3330.93	3117.13	3117.13
46	3.19453	7691.97	17.9629	Perched Clay	1100	0	724.261	1100	2993.55	0	2993.55	2758.74	2758.74
47	3.19453	1818.44	19.4925	Perched Clay	1100	0	724.261	1100	1052.47	0	1052.47	796.101	796.101
48	3.19453	1234.49	21.0367	Perched Clay	1100	0	724.261	1100	885.037	0	885.037	606.487	606.487
49	3.19453	766.017	22.5971	Perched Clay	1100	0	724.261	1100	755.767	0	755.767	454.329	454.329
50	3.19453	261.457	24.1754	Perched Clay	1100	0	724.261	1100	613.901	0	613.901	288.779	288.779

Wastewater Treatment - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.51194

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.687145	149.494	-79.8894	Dark Gray Clay (Long Term)	200	25	104.01	157.257	-91.6637	0	-91.6637	491.621	491.621
2	0.687145	384.357	-73.3535	Dark Gray Clay (Long Term)	200	25	148.197	224.065	51.6071	0	51.6071	547.255	547.255
3	0.687145	533.75	-68.896	Dark Gray Clay (Long Term)	200	25	188.587	285.132	182.565	0	182.565	671.198	671.198
4	0.820053	782.652	-64.9191	Light Gray Sand	50	32	181.274	274.076	358.596	0	358.596	745.912	745.912
5	0.820053	908.558	-61.158	Light Gray Sand	50	32	227.796	344.414	471.16	0	471.16	884.801	884.801
6	0.820053	1013.11	-57.8061	Light Gray Sand	50	32	271.179	410.006	576.13	0	576.13	1006.86	1006.86
7	0.820053	1102.15	-54.7434	Light Gray Sand	50	32	311.945	471.642	674.768	0	674.768	1116.05	1116.05
8	0.820053	1179.1	-51.8982	Light Gray Sand	50	32	350.441	529.846	767.913	0	767.913	1214.82	1214.82
9	0.820053	1246.32	-49.2238	Light Gray Sand	50	32	386.957	585.056	856.27	0	856.27	1304.94	1304.94
10	0.820053	1305.27	-46.6876	Light Gray Sand	50	32	421.662	637.528	940.237	0	940.237	1387.5	1387.5
11	0.820053	1357.08	-44.2657	Light Gray Sand	50	32	454.702	687.482	1020.18	0	1020.18	1463.38	1463.38
12	0.820053	1402.67	-41.94	Light Gray Sand	50	32	486.22	735.136	1096.45	0	1096.45	1533.32	1533.32
13	0.820053	1442.78	-39.6965	Light Gray Sand	50	32	516.344	780.681	1169.34	0	1169.34	1597.96	1597.96
14	0.820053	1477.86	-37.5239	Light Gray Sand	50	32	545.122	824.192	1238.96	0	1238.96	1657.61	1657.61
15	0.820053	1508.32	-35.4129	Light Gray Sand	50	32	572.625	865.775	1305.51	0	1305.51	1712.65	1712.65
16	0.78206	1461.75	-33.4024	Perched Clay (Long Term)	200	24	539.037	814.992	1381.29	0	1381.29	1736.76	1736.76
17	0.78206	1479.91	-31.4843	Perched Clay (Long Term)	200	24	555.318	839.607	1436.58	0	1436.58	1776.67	1776.67
18	0.78206	1495	-29.6047	Perched Clay (Long Term)	200	24	570.755	862.948	1489.01	0	1489.01	1813.31	1813.31
19	0.78206	1554.38	-27.7595	Perched Clay (Long Term)	200	24	599.745	906.778	1587.45	0	1587.45	1903.12	1903.12
20	0.78206	1743.05	-25.9452	Perched Clay (Long Term)	200	24	669.599	1012.39	1824.66	0	1824.66	2150.46	2150.46
21	0.78206	1750.7	-24.1585	Perched Clay (Long Term)	200	24	684.403	1034.78	1874.94	0	1874.94	2181.93	2181.93
22	0.78206	1755.26	-22.3964	Perched Clay (Long Term)	200	24	698.294	1055.78	1922.11	0	1922.11	2209.87	2209.87
23	0.78206	1757.42	-20.6564	Perched Clay (Long Term)	200	24	711.469	1075.7	1966.86	0	1966.86	2235.08	2235.08
24	0.78206	1757.19	-18.9361	Perched Clay (Long Term)	200	24	723.932	1094.54	2009.18	0	2009.18	2257.54	2257.54
25	0.78206	1754.7	-17.2334	Perched Clay (Long Term)	200	24	735.714	1112.36	2049.18	0	2049.18	2277.39	2277.39
26	0.78206	1750.02	-15.5463	Perched Clay (Long Term)	200	24	746.834	1129.17	2086.95	0	2086.95	2294.71	2294.71

27	0.78206	1744.44	-13.8729	Perched Clay (Long Term)	200	24	757.738	1145.65	2123.97	0	2123.97	2311.11	2311.11
28	0.78206	1741.48	-12.2114	Perched Clay (Long Term)	200	24	769.73	1163.78	2164.7	0	2164.7	2331.29	2331.29
29	0.78206	1736.95	-10.5604	Perched Clay (Long Term)	200	24	781.35	1181.36	2204.16	0	2204.16	2349.83	2349.83
30	0.78206	1730.43	-8.91817	Perched Clay (Long Term)	200	24	792.443	1198.13	2241.83	0	2241.83	2366.18	2366.18
31	0.78206	1721.93	-7.28331	Perched Clay (Long Term)	200	24	803.021	1214.12	2277.74	0	2277.74	2380.37	2380.37
32	0.78206	1635.83	-5.6544	Perched Clay (Long Term)	200	24	783.442	1184.52	2211.27	0	2211.27	2288.84	2288.84
33	0.78206	884.579	-4.03006	Perched Clay (Long Term)	200	24	497.237	751.793	1239.35	0	1239.35	1274.38	1274.38
34	0.78206	259.329	-2.40897	Perched Clay (Long Term)	200	24	250.921	379.377	402.886	0	402.886	413.442	413.442
35	0.78206	241.909	-0.789801	Perched Clay (Long Term)	200	24	247.292	373.89	390.563	0	390.563	393.972	393.972
36	0.78206	240.747	0.828733	Perched Clay (Long Term)	200	24	250.406	378.599	401.141	0	401.141	397.518	397.518
37	0.78206	237.684	2.44793	Perched Clay (Long Term)	200	24	252.832	382.267	409.38	0	409.38	398.571	398.571
38	0.78206	232.714	4.06909	Perched Clay (Long Term)	200	24	254.533	384.839	415.155	0	415.155	397.048	397.048
39	0.78206	225.829	5.69352	Perched Clay (Long Term)	200	24	255.466	386.25	418.326	0	418.326	392.856	392.856
40	0.78206	217.013	7.32255	Perched Clay (Long Term)	200	24	255.586	386.43	418.728	0	418.728	385.884	385.884
41	0.78206	206.25	8.95757	Perched Clay (Long Term)	200	24	254.834	385.293	416.174	0	416.174	376.006	376.006
42	0.78206	193.513	10.6	Perched Clay (Long Term)	200	24	253.148	382.744	410.449	0	410.449	363.074	363.074
43	0.78206	178.775	12.2513	Perched Clay (Long Term)	200	24	250.453	378.67	401.3	0	401.3	346.916	346.916
44	0.78206	161.999	13.913	Perched Clay (Long Term)	200	24	246.663	372.94	388.428	0	388.428	327.326	327.326
45	0.78206	143.144	15.5867	Perched Clay (Long Term)	200	24	241.674	365.396	371.484	0	371.484	304.068	304.068
46	0.78206	122.16	17.2742	Perched Clay (Long Term)	200	24	235.361	355.851	350.047	0	350.047	276.857	276.857
47	0.78206	98.9932	18.9773	Perched Clay (Long Term)	200	24	227.575	344.08	323.609	0	323.609	245.349	245.349
48	0.78206	73.5768	20.698	Perched Clay (Long Term)	200	24	218.134	329.806	291.549	0	291.549	209.132	209.132
49	0.78206	45.8369	22.4385	Perched Clay (Long Term)	200	24	206.812	312.688	253.101	0	253.101	167.697	167.697
50	0.78206	15.6881	24.2011	Perched Clay (Long Term)	200	24	195.893	296.178	216.02	0	216.02	127.977	127.977

Interslice Data

Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 3.08484

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	233.953	134	0	0	0
2	240.948	124.064	3036.03	189.533	3.57222
3	247.943	115.121	11689.5	729.75	3.57221
4	254.938	107	24439.6	1525.71	3.57221
5	262.345	99.1613	43525.9	2717.22	3.57221
6	269.753	92	67141.3	4191.48	3.57221
7	276.778	85.7595	87097.1	5437.28	3.57221
8	283.803	80	107546	6713.88	3.57222
9	290.406	74.986	133970	8363.42	3.5722
10	297.009	70.3277	160543	10022.3	3.5722
11	303.611	66	186858	11665.1	3.5722
12	310.083	62.0583	203770	12720.9	3.57221
13	316.555	58.3965	219702	13715.5	3.57221
14	323.027	55	234503	14639.5	3.57221
15	330.165	51.5465	259938	16227.3	3.5722
16	337.302	48.3852	283690	17710.1	3.57221
17	344.44	45.5035	305646	19080.8	3.57221
18	351.577	42.8903	325716	20333.7	3.57221
19	358.714	40.5363	343822	21464.1	3.57222
20	365.852	38.4333	359895	22467.4	3.57221
21	372.989	36.5743	373876	23340.3	3.57222
22	380.127	34.9534	385727	24080.1	3.57222
23	387.264	33.5655	395416	24685	3.57222
24	394.402	32.4064	402938	25154.5	3.57221
25	401.539	31.4727	408280	25488	3.57221
26	408.677	30.7616	411435	25685	3.57222
27	415.814	30.2712	412410	25745.8	3.57221
28	422.952	30	411225	25671.9	3.57222
29	433.536	30	405559	25318.2	3.57222
30	441.222	30.3011	398586	24882.9	3.57222
31	448.909	30.8566	389284	24302.2	3.57222
32	456.595	31.6683	377739	23581.4	3.57221
33	464.282	32.7389	364055	22727.1	3.57221
34	471.968	34.072	348353	21746.9	3.57221
35	479.655	35.6723	330772	20649.3	3.5722
36	487.341	37.5454	311488	19445.5	3.57221
37	495.028	39.6982	290680	18146.5	3.57221
38	502.714	42.1388	268560	16765.6	3.57221
39	510.401	44.877	245382	15318.7	3.57222
40	518.087	47.924	221430	13823.4	3.57222
41	525.774	51.2931	197042	12300.9	3.57221
42	533.46	55	172617	10776.1	3.57221
43	539.932	58.3965	144020	8990.88	3.57222
44	546.404	62.0583	116225	7255.65	3.5722
45	552.876	66	89657.9	5597.15	3.57222
46	559.479	70.3277	69859.9	4361.2	3.57221
47	566.081	74.986	51274	3200.92	3.57221
48	572.684	80	34392.8	2147.07	3.57222
49	579.709	85.7595	17362.6	1083.91	3.57222
50	586.735	92	6375.81	398.028	3.57222
51	592.178	97.2006	0	0	0

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 4.76796

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	267.903	134	0	0	0
2	271.567	131.737	124.873	15.1313	6.90905
3	275.231	129.57	577.383	69.9638	6.90907
4	278.895	127.497	1278.76	154.952	6.90905
5	282.559	125.515	2187.52	265.07	6.90906
6	286.223	123.62	3265.62	395.708	6.90907
7	289.887	121.811	4478.07	542.626	6.90908
8	293.551	120.085	5791.37	701.764	6.90908
9	297.215	118.44	7163.25	867.999	6.90907
10	300.879	116.874	8565.14	1037.87	6.90906
11	304.543	115.385	9974.24	1208.62	6.90908
12	308.207	113.972	11369.3	1377.66	6.90906
13	311.871	112.633	12727.9	1542.3	6.90912
14	315.535	111.366	14033.1	1700.45	6.90909
15	319.199	110.171	15270.2	1850.35	6.90907
16	322.863	109.045	16424.7	1990.24	6.90905
17	326.526	107.989	17483.6	2118.56	6.90908
18	330.19	107	18437.4	2234.14	6.90909
19	333.909	106.065	19449.7	2356.79	6.90905
20	337.629	105.198	20347.2	2465.55	6.90907
21	341.348	104.399	21121.9	2559.42	6.90906
22	345.067	103.666	21767	2637.6	6.90909
23	348.786	102.999	22278.3	2699.54	6.90905
24	352.505	102.397	22651.5	2744.77	6.90907
25	356.224	101.86	22883.5	2772.88	6.90906
26	359.943	101.387	22972.5	2783.67	6.90908
27	363.662	100.978	22918.1	2777.07	6.90906
28	367.381	100.633	22720.9	2753.18	6.90907
29	371.1	100.351	22383.1	2712.25	6.90908
30	374.819	100.131	21908	2654.67	6.90905
31	378.538	99.9749	21299.9	2580.99	6.90906
32	382.257	99.8811	20564.8	2491.91	6.90905
33	385.976	99.8498	19709.6	2388.29	6.90907
34	389.695	99.8811	18740.6	2270.87	6.90906
35	393.414	99.9749	17665.9	2140.65	6.90908
36	397.133	100.131	16495.9	1998.88	6.90909
37	400.852	100.351	15242.5	1846.99	6.90906
38	404.571	100.633	13920.1	1686.75	6.90906
39	408.29	100.978	12545.3	1520.16	6.90906
40	412.009	101.387	11135.1	1349.28	6.90905
41	415.728	101.86	9708.42	1176.41	6.90909
42	419.447	102.397	8284.52	1003.87	6.90909
43	423.166	102.999	6883.46	834.096	6.90907
44	426.885	103.666	5529.27	670.004	6.90908
45	430.604	104.399	4248.15	514.765	6.90907
46	434.323	105.198	3068.2	371.786	6.90907
47	438.042	106.065	2018	244.529	6.90907
48	441.761	107	1130.3	136.963	6.90908
49	445.001	107.871	559.981	67.8551	6.90907
50	448.24	108.794	173.104	20.9758	6.90911
51	451.48	109.772	0	0	0

Wastewater Treatment - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.51879

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	295.176	131.581	0	0	0
2	298.697	125.561	360.678	75.03	11.7514
3	302.219	120.212	1897.02	394.628	11.7514
4	305.74	115.393	4261.64	886.527	11.7513
5	309.262	111.012	7194.08	1496.55	11.7514
6	312.783	107	10490.1	2182.2	11.7513
7	316.06	103.554	13024.3	2709.39	11.7514
8	319.337	100.354	16332.3	3397.53	11.7514
9	322.615	97.3744	20218.4	4205.94	11.7514
10	325.892	94.5953	24520.9	5100.95	11.7513
11	329.169	92	29111.3	6055.88	11.7514
12	332.328	89.6591	32067.3	6670.81	11.7514
13	335.487	87.4655	34785.3	7236.22	11.7514
14	338.646	85.4101	37226.8	7744.1	11.7513
15	341.805	83.4851	39357.1	8187.27	11.7514
16	344.964	81.6837	41145.9	8559.37	11.7513
17	348.123	80	42566.6	8854.92	11.7514
18	351.395	78.3747	47330.1	9845.85	11.7514
19	354.667	76.8649	51808.5	10777.5	11.7514
20	357.938	75.4661	55912.1	11631.1	11.7513
21	361.21	74.1745	59618.7	12402.2	11.7514
22	364.482	72.9864	62915.1	13087.9	11.7513
23	367.754	71.8989	65791.1	13686.2	11.7514
24	371.025	70.9092	68237.6	14195.1	11.7513
25	374.297	70.015	70249	14613.6	11.7514
26	377.569	69.2142	71821.6	14940.7	11.7514
27	380.841	68.505	72952.2	15175.9	11.7514
28	384.112	67.8857	73640	15319	11.7514
29	387.384	67.3552	73885.9	15370.1	11.7513
30	390.656	66.9122	73692.6	15329.9	11.7514
31	393.927	66.5558	73064.5	15199.2	11.7513
32	397.199	66.2853	72007.4	14979.3	11.7513
33	400.471	66.1002	70528.8	14671.8	11.7514
34	403.743	66	68637.2	14278.3	11.7514
35	408.206	66	65412.5	13607.4	11.7513
36	411.4	66.0968	62667.6	13036.4	11.7513
37	414.595	66.2747	59575.7	12393.2	11.7513
38	417.789	66.5338	56154.4	11681.5	11.7513
39	420.984	66.8749	52423.1	10905.3	11.7513
40	424.178	67.2984	48403.2	10069.1	11.7514
41	427.373	67.8053	44119.1	9177.88	11.7514
42	430.567	68.3965	39597.1	8237.18	11.7513
43	433.762	69.0733	34865.6	7252.92	11.7514
44	436.956	69.8372	29867.1	6213.11	11.7514
45	440.151	70.6897	24555.1	5108.07	11.7513
46	443.345	71.6327	19105.7	3974.47	11.7514
47	446.54	72.6684	13697.1	2849.35	11.7514
48	449.734	73.7991	10198.8	2121.61	11.7514
49	452.929	75.0278	6803.2	1415.24	11.7514
50	456.123	76.3573	3490.12	726.033	11.7514
51	459.318	77.7914	0	0	0

Wastewater Treatment - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.51194

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	420.855	99.9321	0	0	0
2	421.542	96.0786	-424.766	-149.208	19.3549
3	422.229	93.7804	-408.098	-143.353	19.3549
4	422.917	92	-212.772	-74.741	19.355
5	423.737	90.2479	266.738	93.6978	19.355
6	424.557	88.7588	781.344	274.464	19.3549
7	425.377	87.4562	1309.17	459.875	19.355
8	426.197	86.2962	1835.88	644.892	19.3549
9	427.017	85.2504	2351.28	825.94	19.355
10	427.837	84.2996	2847.81	1000.36	19.355
11	428.657	83.4297	3319.55	1166.06	19.3549
12	429.477	82.6304	3761.73	1321.39	19.3549
13	430.297	81.8936	4170.49	1464.98	19.355
14	431.117	81.2129	4542.65	1595.71	19.355
15	431.937	80.5831	4875.47	1712.62	19.355
16	432.757	80	5166.61	1814.89	19.355
17	433.539	79.4843	5457	1916.89	19.3549
18	434.321	79.0053	5710.32	2005.88	19.355
19	435.103	78.561	5925.16	2081.35	19.355
20	435.885	78.1493	6109.1	2145.96	19.355
21	436.668	77.7688	6279.22	2205.71	19.3549
22	437.45	77.418	6401.15	2248.55	19.355
23	438.232	77.0958	6473.97	2274.12	19.3549
24	439.014	76.8009	6496.9	2282.18	19.355
25	439.796	76.5326	6469.26	2272.47	19.3549
26	440.578	76.29	6390.42	2244.78	19.355
27	441.36	76.0725	6259.82	2198.9	19.355
28	442.142	75.8793	6076.87	2134.64	19.355
29	442.924	75.7101	5840.67	2051.67	19.355
30	443.706	75.5643	5550.37	1949.69	19.355
31	444.488	75.4415	5205.13	1828.42	19.355
32	445.27	75.3416	4804.16	1687.57	19.355
33	446.052	75.2642	4362.07	1532.28	19.355
34	446.834	75.2091	4041.11	1419.53	19.355
35	447.616	75.1762	3857.93	1355.18	19.3549
36	448.398	75.1654	3668.55	1288.66	19.355
37	449.18	75.1767	3467.99	1218.21	19.355
38	449.963	75.2101	3256.37	1143.87	19.3549
39	450.745	75.2658	3034.02	1065.77	19.355
40	451.527	75.3437	2801.41	984.058	19.355
41	452.309	75.4442	2559.25	898.992	19.3549
42	453.091	75.5675	2308.45	810.895	19.355
43	453.873	75.7139	2050.2	720.18	19.355
44	454.655	75.8837	1785.99	627.369	19.355
45	455.437	76.0774	1517.64	533.106	19.355
46	456.219	76.2956	1247.41	438.181	19.355
47	457.001	76.5388	978.03	343.555	19.355
48	457.783	76.8077	712.845	250.403	19.355
49	458.565	77.1032	455.932	160.156	19.3549
50	459.347	77.4261	212.29	74.5717	19.355
51	460.129	77.7776	0	0	0

Discharge Sections

Entity Information

◆ Ground Profile

Shared Entities

Type	Coordinates (x,y)

External Boundary	0, 117.35 0, 107 0, 92 0, 80 0, 66 0, 55 0, 30 0, 6 0, 0 623.07, 0 623.07, 6 623.07, 30 623.07, 55 623.07, 66 623.07, 80 623.07, 92 623.07, 95.23 611.01, 96 579.64, 98 552.49, 100 528.7, 102 506.04, 104 484.88, 106 475.745, 107 466.61, 108 449.53, 110 432.45, 112 416.15, 114 400.99, 116 384.77, 118 370.88, 120 357.4, 122 344.04, 124 331.65, 126 319.62, 128 306.57, 130 292.16, 132 271.74, 134 222.59, 134 201.53, 132 182.83, 130 164.22, 128 140.01, 126 102.24, 124 70.56, 122 44.87, 120 10.99, 118
Material Boundary	0, 6 623.07, 6
Material Boundary	0, 30 623.07, 30
Material Boundary	0, 55 623.07, 55
Material Boundary	0, 66 623.07, 66
Material Boundary	0, 80 623.07, 80

Material Boundary	0, 92 623.07, 92
Material Boundary	0, 107 475.745, 107

Wastewater Treatment

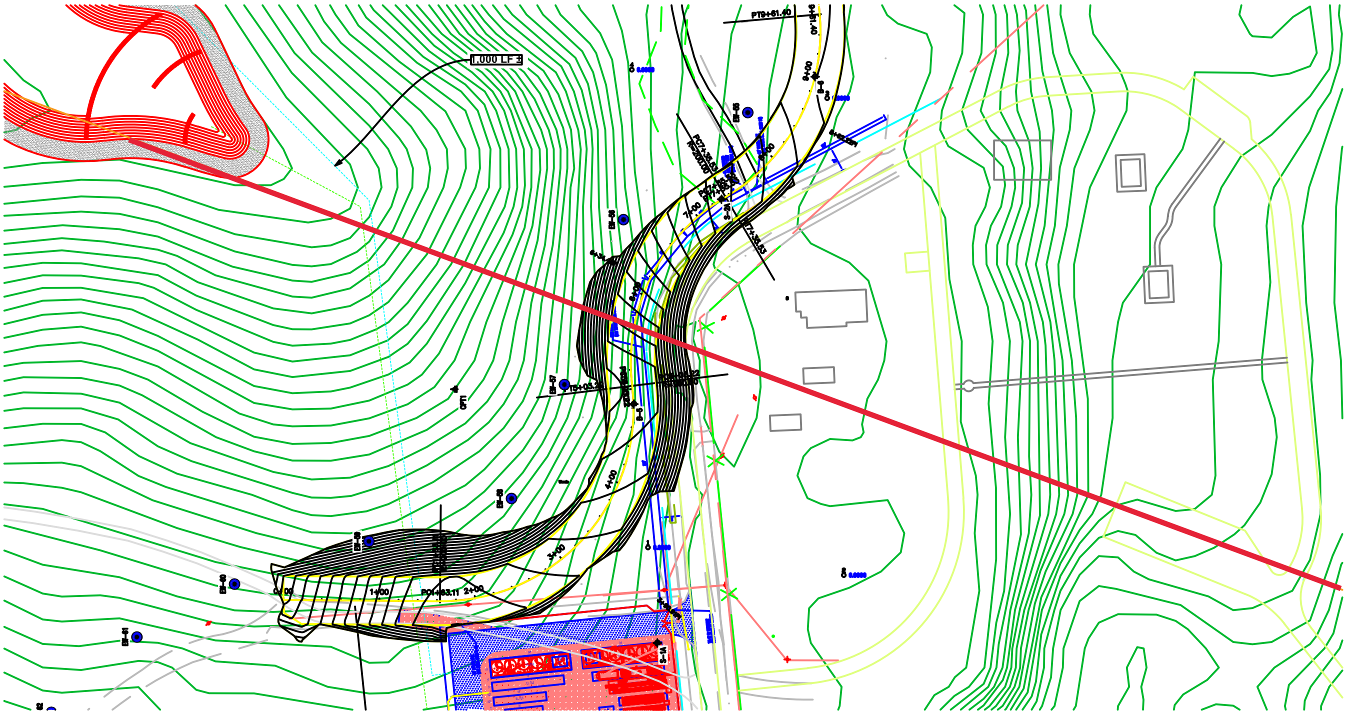
Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 117.35 0, 107 0, 92 0, 80 0, 66 0, 55 0, 30 0, 6 0, 0 623.07, 0 623.07, 6 623.07, 30 623.07, 55 623.07, 66 623.07, 75.02 446.99, 78 446.9, 79 446.81, 80 446.72, 81 446.62, 82 446.54, 83 446.44, 84 446.39, 85 446.27, 86 446.19, 87 446.11, 88 446.02, 89 445.91, 90 445.81, 91 445.72, 92 441.66, 93 438.66, 94 435.65, 95 432.67, 96 429.65, 97 426.65, 98 423.67, 99 420.65, 100 417.64, 101 414.64, 102 411.63, 103 408.63, 104 405.66, 105 402.67, 106 399.68, 107 396.68, 108 393.68, 109 390.67, 110 387.68, 111

	384.68, 112 381.68, 113 378.68, 114 375.68, 115 372.65, 116 369.64, 117 366.67, 118 363.66, 119 360.67, 120 357.69, 121 354.69, 122 352.48, 122.73 352.434, 122.743 344.04, 124 331.65, 126 319.62, 128 306.57, 130 292.16, 132 271.74, 134 222.59, 134 201.53, 132 182.83, 130 164.22, 128 140.01, 126 102.24, 124 70.56, 122 44.87, 120 10.99, 118
Material Boundary	0, 6 623.07, 6
Material Boundary	0, 30 623.07, 30
Material Boundary	0, 55 623.07, 55
Material Boundary	0, 66 623.07, 66
Material Boundary	0, 92 435.72, 92 445.72, 92
Material Boundary	0, 107 399.68, 107
Material Boundary	0, 80 435.72, 80 436.44, 80 442.952, 80 446.81, 80
Material Boundary	435.72, 92 435.72, 80 435.72, 78 446.99, 78

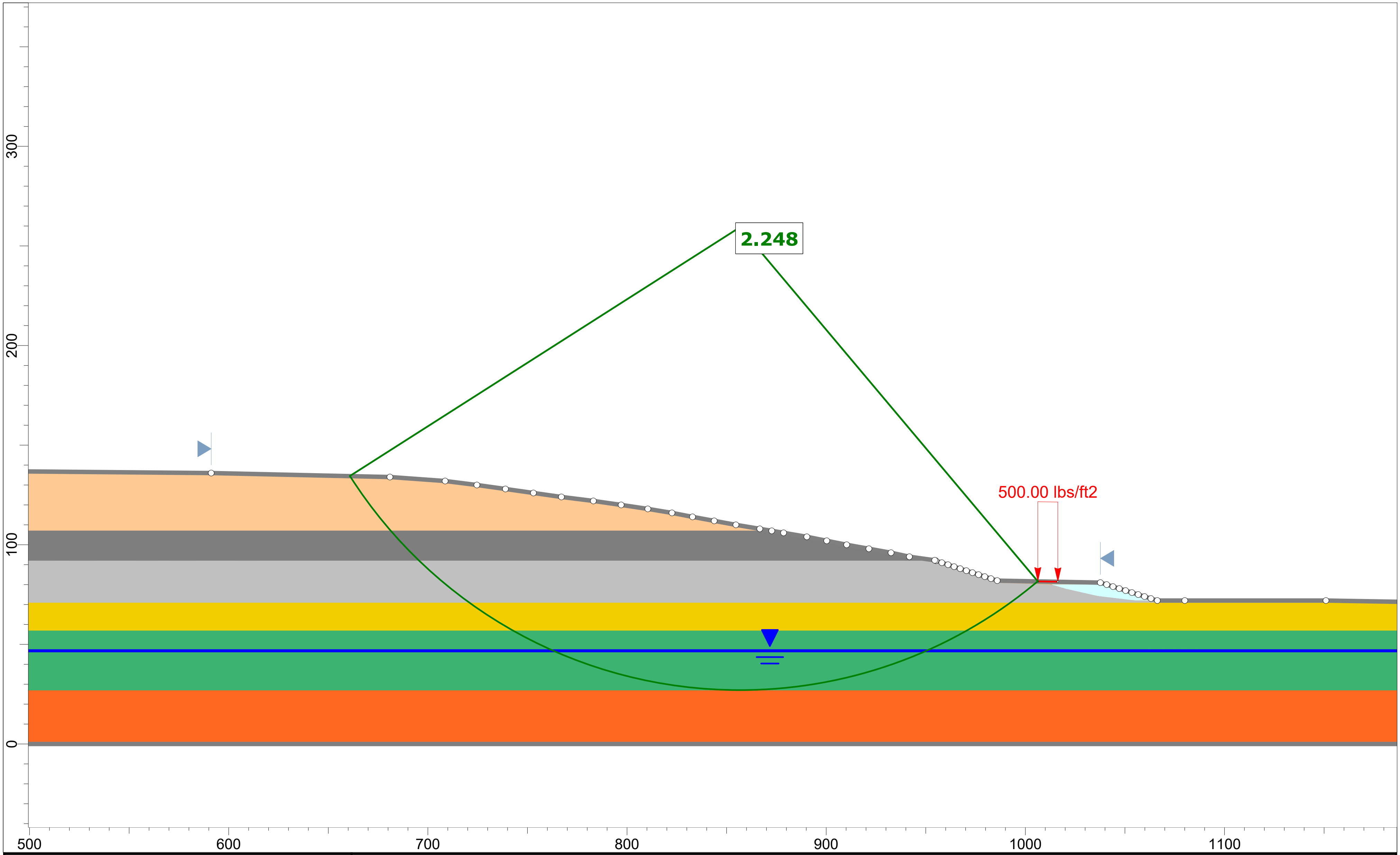
Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Long Term
Piezoline	0, 55 623.07, 55	Assigned to: 🟨 Surficial Aquifer 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	Not assigned to any materials

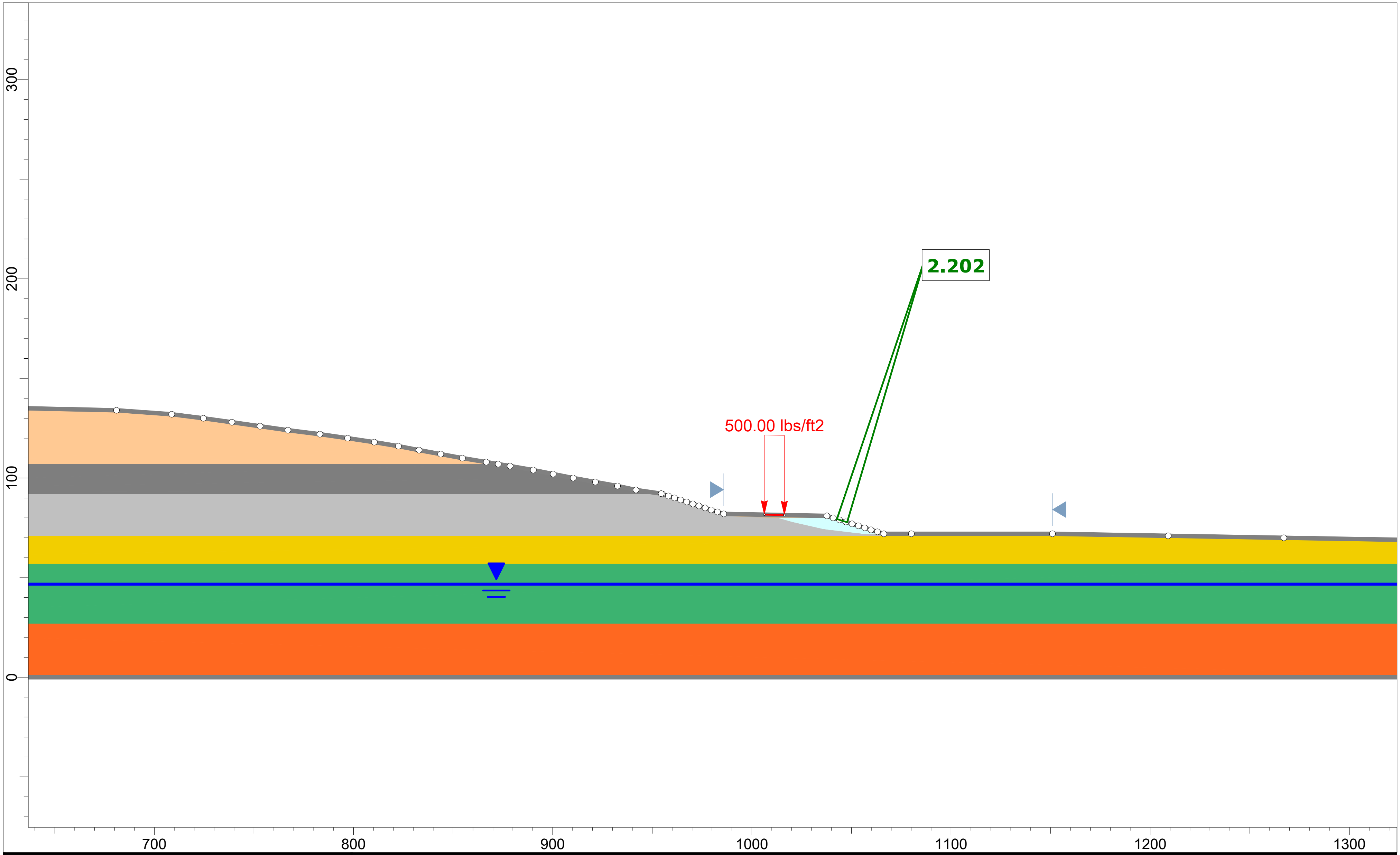


Section: 2, Unsupported Cut and Fill

Approximate Station: 5+67



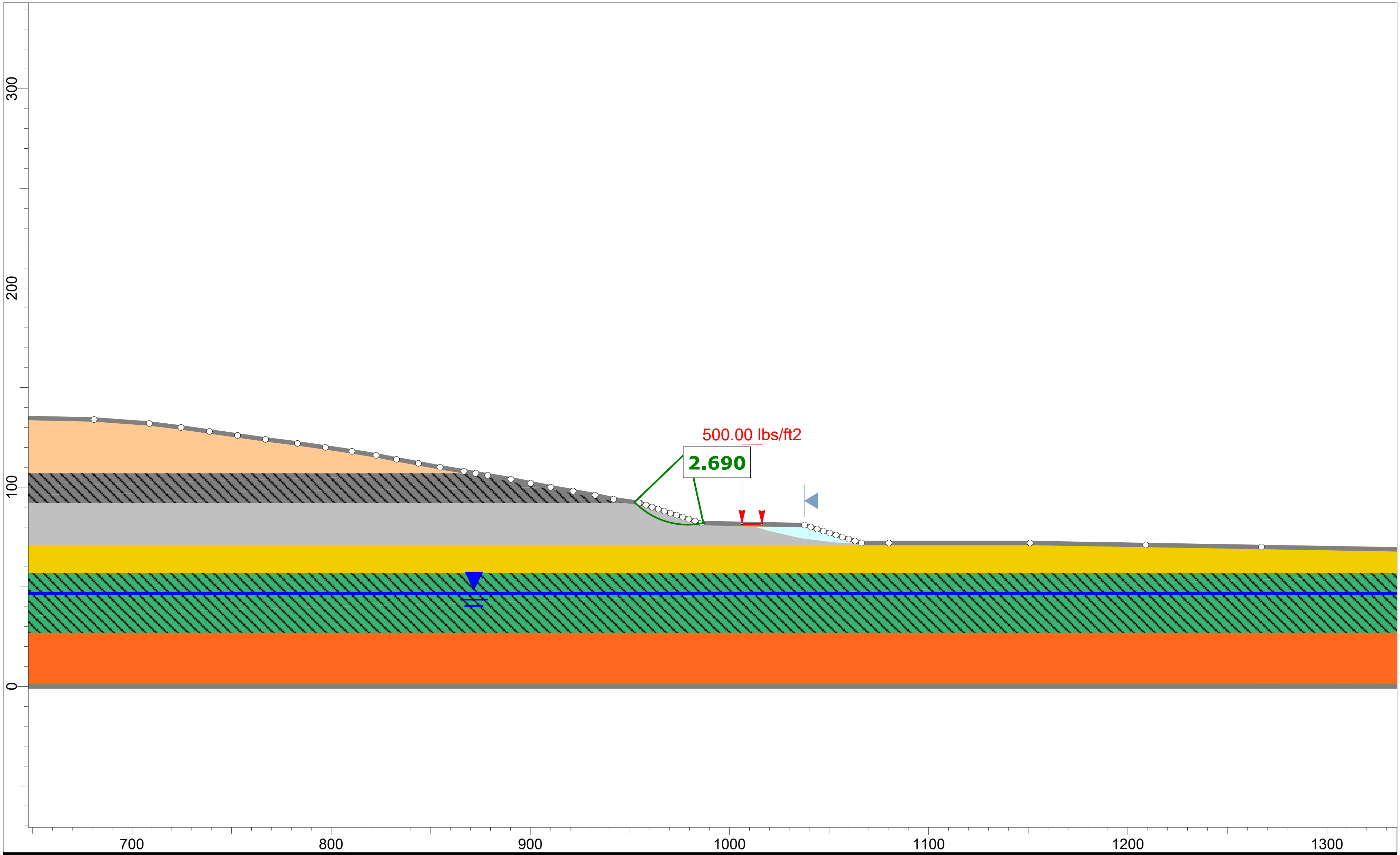
GEOS Geotechnical, Environmental and Materials Engineers SLIDEINTERPRET 9.016	*Project* 45-20803 Barrier Wall Road Interim Design and Repair		
	Group Roadway Upslope	*Scenario* Short Term Slope Stability Analysis	
	Drawn By	*Company*	
	Date 4/9/2021, 11:24:47 AM	*File Name* station_5+67_section_2-reduced.slmd	



Geotectnical, Environmental and Materials Engineers

SLIDEINTERPRET 9.016

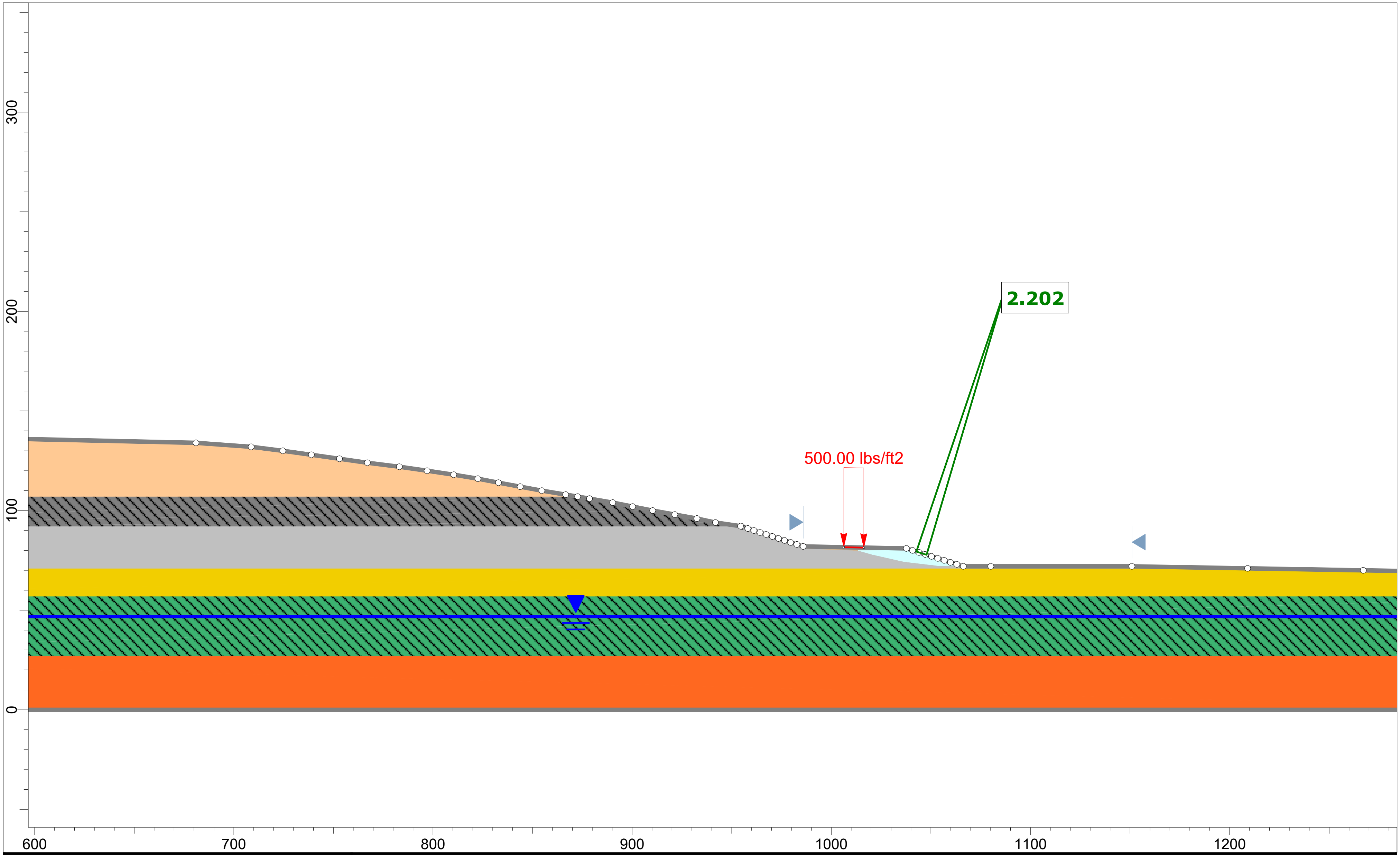
Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	
Date	4/9/2021, 11:24:47 AM	*File Name*	station_5+67_section_2-reduced.slmd



Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Upslope	*Scenario*	Long Term Slope Stability Analysis
Drawn By		*Company*	
Date	4/9/2021, 11:24:47 AM	*File Name*	station_5+67_section_2-reduced.slmd

GEOS
Geotechnical, Environmental and Materials Engineers

SLIDEINTERPRET 9.016



Geotechnical, Environmental and Materials Engineers

SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	*Scenario*	Long Term Slope Stability Analysis
Drawn By		*Company*	
Date	4/9/2021, 11:24:47 AM	*File Name*	station_5+67_section_2-reduced.slmd

rocscience

GEOS
Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Unsupported Cut and Fill
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.016

Table of Contents

Slide Analysis Information

station_5+67_section_2-reduced

Project Summary

File Name:	station_5+67_section_2-reduced.slmd
Slide Modeler Version:	9.016
Project Title:	SLIDE - An Interactive Slope Stability Program
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Short Term Upslope ◆	Master Scenario	Spencer: 2.248270	00h:00m:01.161s
	Short Term Stability Downslope	Spencer: 2.202360	00h:00m:01.492s
	Long Term Upslope	Spencer: 2.690120	00h:00m:01.258s
	Long Term Downslope	Spencer: 2.202360	00h:00m:01.434s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Loading

All Open Scenarios

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Materials

Compacted Fill	
Color	🟦
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	135
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Ru Value	0

Light Brown Sand	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0

Dark Gray Clay	
Color	⬛
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0

Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0

Light Gray Sand	
Color	⬜
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0

Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75

Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Hu Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Hu Value	0
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Hu Value	1
Roadway	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	145
Cohesion [psf]	0
Friction Angle [deg]	45
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material		Short Term Upslope	Short Term Stability Downslope	Long Term Upslope	Long Term Downslope
Compacted Fill	🟦	✓	✓	✓	✓
Light Brown Sand	🟧	✓	✓	✓	✓
Dark Gray Clay	⬛	✓	✓	✗	✗
Dark Gray Clay (Long Term)	▨	✗	✗	✓	✓
Light Gray Sand	⬜	✓	✓	✓	✓
Surficial Aquifer	🟨	✓	✓	✓	✓
Black Creek Confining Unit	🟩	✓	✓	✗	✗
Black Creek Confining Unit (Long Term)	▨	✗	✗	✓	✓
Black Creek Aquifer	🟧	✓	✓	✓	✓
Roadway	🟫	✓	✓	✓	✓

Global Minimums

◆ Short Term Upslope - Master Scenario

Method: spencer

FS	2.248270
Center:	856.711, 259.345
Radius:	232.315
Left Slip Surface Endpoint:	660.825, 134.449
Right Slip Surface Endpoint:	1006.307, 81.606
Resisting Moment:	1.55269e+08 lb-ft
Driving Moment:	6.90618e+07 lb-ft
Resisting Horizontal Force:	589051 lb
Driving Horizontal Force:	262002 lb
Total Slice Area:	20534.8 ft2
Surface Horizontal Width:	345.482 ft
Surface Average Height:	59.4381 ft

◆ Short Term Upslope - Short Term Stability Downslope

Method: spencer

FS	2.202360
Center:	1087.741, 212.440
Radius:	140.441
Left Slip Surface Endpoint:	1042.697, 79.419
Right Slip Surface Endpoint:	1047.816, 77.794
Resisting Moment:	1152.29 lb-ft
Driving Moment:	523.206 lb-ft
Resisting Horizontal Force:	7.81936 lb
Driving Horizontal Force:	3.55045 lb
Total Slice Area:	0.0910817 ft2
Surface Horizontal Width:	5.11882 ft
Surface Average Height:	0.0177935 ft

◆ Short Term Upslope - Long Term Upslope

Method: spencer

FS	2.690120
Center:	979.034, 118.088
Radius:	36.962
Left Slip Surface Endpoint:	952.383, 92.478
Right Slip Surface Endpoint:	986.933, 81.980
Resisting Moment:	372536 lb-ft
Driving Moment:	138483 lb-ft
Resisting Horizontal Force:	9375.89 lb
Driving Horizontal Force:	3485.3 lb
Total Slice Area:	114.987 ft2
Surface Horizontal Width:	34.5496 ft
Surface Average Height:	3.32819 ft

◆ Short Term Upslope - Long Term Downslope

Method: spencer

FS	2.202360
Center:	1087.741, 212.440
Radius:	140.441
Left Slip Surface Endpoint:	1042.697, 79.419
Right Slip Surface Endpoint:	1047.816, 77.794
Resisting Moment:	1152.29 lb-ft
Driving Moment:	523.206 lb-ft
Resisting Horizontal Force:	7.81936 lb
Driving Horizontal Force:	3.55045 lb
Total Slice Area:	0.0910817 ft2
Surface Horizontal Width:	5.11882 ft
Surface Average Height:	0.0177935 ft

Global Minimum Support Data

All Open Scenarios

No Supports Present

Valid and Invalid Surfaces

Short Term Upslope - Master Scenario

Method: spencer

Number of Valid Surfaces:	8611
Number of Invalid Surfaces:	0

Short Term Upslope - Short Term Stability Downslope

Method: spencer

Number of Valid Surfaces:	10050
Number of Invalid Surfaces:	0

Short Term Upslope - Long Term Upslope

Method: spencer

Number of Valid Surfaces:	12624
Number of Invalid Surfaces:	0

Short Term Upslope - Long Term Downslope

Method: spencer

Number of Valid Surfaces:	10052
Number of Invalid Surfaces:	0

Slice Data

Short Term Upslope - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.24827

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	6.83237	3745.31	-55.9727	Light Brown Sand	75	32	124.744	280.459	328.804	0	328.804	513.555	513.555
2	6.83237	10848.6	-53.0647	Light Brown Sand	75	32	325.783	732.449	1052.14	0	1052.14	1485.48	1485.48
3	6.83237	17246.1	-50.3422	Light Brown Sand	75	32	518.866	1166.55	1746.85	0	1746.85	2372.76	2372.76
4	7.12476	24288.8	-47.7159	Dark Gray Clay	1300	0	578.222	1300	2561.42	0	2561.42	3197.23	3197.23
5	7.12476	30298.3	-45.1638	Dark Gray Clay	1300	0	578.222	1300	3402.33	0	3402.33	3983.87	3983.87
6	6.2845	31199.9	-42.8603	Light Gray Sand	50	32	1063.69	2391.47	3747.13	0	3747.13	4734.2	4734.2
7	6.2845	34952.6	-40.7795	Light Gray Sand	50	32	1211.72	2724.28	4279.74	0	4279.74	5324.91	5324.91
8	6.2845	38325	-38.7621	Light Gray Sand	50	32	1349.92	3034.98	4776.97	0	4776.97	5860.86	5860.86
9	6.2845	41302.5	-36.8003	Light Gray Sand	50	32	1476.97	3320.63	5234.1	0	5234.1	6339.03	6339.03
10	7.28895	51300.2	-34.7386	Surficial Aquifer	75	32	1616.02	3633.25	5694.4	0	5694.4	6814.99	6814.99
11	7.28895	54566.2	-32.578	Surficial Aquifer	75	32	1745.71	3924.82	6161	0	6161	7276.48	7276.48
12	7.28895	57497.6	-30.4684	Surficial Aquifer	75	32	1866.92	4197.34	6597.13	0	6597.13	7695.44	7695.44
13	6.83759	56391.5	-28.4663	Black Creek Confining Unit	955.603	0	425.039	955.603	7664.06	0	7664.06	7894.52	7894.52
14	6.83759	58584.7	-26.5644	Black Creek Confining Unit	1062.49	0	472.581	1062.49	7998.11	0	7998.11	8234.39	8234.39
15	6.83759	60544.8	-24.6936	Black Creek Confining Unit	1160.93	0	516.366	1160.93	8304.69	0	8304.69	8542.12	8542.12
16	7.20166	65653.3	-22.8021	Black Creek Confining Unit	1253.51	0	557.544	1253.51	8592.73	0	8592.73	8827.12	8827.12
17	7.20166	67421.8	-20.8881	Black Creek Confining Unit	1340.15	0	596.081	1340.15	8870.29	0	8870.29	9097.77	9097.77
18	7.20166	68966.4	-18.9982	Black Creek Confining Unit	1418.56	0	630.956	1418.56	9121.41	0	9121.41	9338.64	9338.64
19	7.20166	70211.5	-17.1296	Black Creek Confining Unit	1489.05	0	662.309	1489.05	9335.26	0	9335.26	9539.38	9539.38
20	7.20166	71202	-15.2796	Black Creek Confining Unit	1551.86	0	690.246	1551.86	9517.23	0	9517.23	9705.79	9705.79

21	7.20166	71952.9	-13.4458	Black Creek Confining Unit	1607.19	0	714.856	1607.19	9668.79	0	9668.79	9839.7	9839.7
22	7.20166	72477	-11.626	Black Creek Confining Unit	1655.24	0	736.228	1655.24	9791.18	0	9791.18	9942.66	9942.66
23	7.20166	72729.8	-9.81797	Black Creek Confining Unit	1696.16	0	754.429	1696.16	9877.83	0	9877.83	10008.4	10008.4
24	7.20166	72720.4	-8.01978	Black Creek Confining Unit	1730.08	0	769.516	1730.08	9929.52	0	9929.52	10037.9	10037.9
25	7.20166	72399.4	-6.22952	Black Creek Confining Unit	1757.09	0	781.53	1757.09	9938.98	0	9938.98	10024.3	10024.3
26	7.20166	71920.4	-4.44535	Black Creek Confining Unit	1777.28	0	790.51	1777.28	9926.88	0	9926.88	9988.33	9988.33
27	7.20166	71260.7	-2.6655	Black Creek Confining Unit	1790.71	0	796.484	1790.71	9889.76	0	9889.76	9926.84	9926.84
28	7.20166	70410	-0.888213	Black Creek Confining Unit	1797.41	0	799.464	1797.41	9825.82	0	9825.82	9838.21	9838.21
29	7.20166	69434.2	0.888213	Black Creek Confining Unit	1797.41	0	799.464	1797.41	9743.89	0	9743.89	9731.49	9731.49
30	7.20166	68289.6	2.6655	Black Creek Confining Unit	1790.71	0	796.484	1790.71	9637.6	0	9637.6	9600.52	9600.52
31	7.20166	66922.3	4.44535	Black Creek Confining Unit	1777.28	0	790.51	1777.28	9499.03	0	9499.03	9437.58	9437.58
32	7.20166	65289.7	6.22952	Black Creek Confining Unit	1757.09	0	781.53	1757.09	9321.8	0	9321.8	9236.49	9236.49
33	7.20166	63433.9	8.01978	Black Creek Confining Unit	1730.08	0	769.516	1730.08	9111.33	0	9111.33	9002.92	9002.92
34	7.20166	61248.4	9.81797	Black Creek Confining Unit	1696.16	0	754.429	1696.16	8852.08	0	8852.08	8721.53	8721.53
35	7.20166	58825.1	11.626	Black Creek Confining Unit	1655.24	0	736.228	1655.24	8556.45	0	8556.45	8404.97	8404.97
36	7.20166	56220.1	13.4458	Black Creek Confining Unit	1607.19	0	714.856	1607.19	8231.81	0	8231.81	8060.9	8060.9
37	7.20166	53496.7	15.2796	Black Creek Confining Unit	1551.86	0	690.246	1551.86	7886.6	0	7886.6	7698.04	7698.04
38	7.20166	50568.1	17.1296	Black Creek Confining Unit	1489.05	0	662.309	1489.05	7507.95	0	7507.95	7303.82	7303.82
39	7.20166	47391.7	18.9982	Black Creek Confining Unit	1418.56	0	630.956	1418.56	7088.99	0	7088.99	6871.76	6871.76

40	7.20166	43827.5	20.8881	Black Creek Confining Unit	1340.15	0	596.081	1340.15	6608.67	0	6608.67	6381.19	6381.19
41	7.20166	40286.2	22.8021	Black Creek Confining Unit	1253.51	0	557.544	1253.51	6125.17	0	6125.17	5890.78	5890.78
42	6.83759	34814.7	24.6936	Black Creek Confining Unit	1160.93	0	516.366	1160.93	5622.87	0	5622.87	5385.44	5385.44
43	6.83759	30538.3	26.5644	Black Creek Confining Unit	1062.49	0	472.581	1062.49	4983.18	0	4983.18	4746.9	4746.9
44	6.83759	25864.5	28.4663	Black Creek Confining Unit	955.603	0	425.039	955.603	4272.7	0	4272.7	4042.25	4042.25
45	7.28895	22228.3	30.4684	Surficial Aquifer	75	32	1165.05	2619.35	4071.82	0	4071.82	3386.41	3386.41
46	7.28895	16502	32.578	Surficial Aquifer	75	32	897.841	2018.59	3110.39	0	3110.39	2536.69	2536.69
47	7.28895	11508.3	34.7386	Surficial Aquifer	75	32	656.825	1476.72	2243.22	0	2243.22	1787.76	1787.76
48	6.01331	6134.77	36.758	Light Gray Sand	50	32	437.254	983.065	1493.22	0	1493.22	1166.61	1166.61
49	6.01331	2859.12	38.6329	Light Gray Sand	50	32	225.777	507.608	732.326	0	732.326	551.878	551.878
50	1.56811	152.154	39.8341	Roadway	0	45	95.7389	215.247	215.247	0	215.247	135.384	135.384

Short Term Upslope - Short Term Stability Downslope

Global Minimum Query (spencer) - Safety Factor: 2.20236

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.102376	0.0153745	-18.6849	Compacted Fill	0	35	0.0431108	0.0949456	0.135596	0	0.135596	0.150176	0.150176
2	0.102376	0.045517	-18.6408	Compacted Fill	0	35	0.127664	0.281161	0.40154	0	0.40154	0.444604	0.444604
3	0.102376	0.0744471	-18.5967	Compacted Fill	0	35	0.208856	0.459977	0.656915	0	0.656915	0.72719	0.72719
4	0.102376	0.102166	-18.5527	Compacted Fill	0	35	0.28669	0.631394	0.901724	0	0.901724	0.997942	0.997942
5	0.102376	0.128674	-18.5086	Compacted Fill	0	35	0.361163	0.795412	1.13597	0	1.13597	1.25687	1.25687
6	0.102376	0.153973	-18.4646	Compacted Fill	0	35	0.432278	0.952031	1.35964	0	1.35964	1.50398	1.50398
7	0.102376	0.178062	-18.4206	Compacted Fill	0	35	0.500032	1.10125	1.57275	0	1.57275	1.73929	1.73929
8	0.102376	0.200945	-18.3765	Compacted Fill	0	35	0.564431	1.24308	1.7753	0	1.7753	1.9628	1.9628
9	0.102376	0.22262	-18.3325	Compacted Fill	0	35	0.625465	1.3775	1.96727	0	1.96727	2.17452	2.17452
10	0.102376	0.24309	-18.2885	Compacted Fill	0	35	0.683144	1.50453	2.14869	0	2.14869	2.37447	2.37447
11	0.102376	0.262354	-18.2446	Compacted Fill	0	35	0.737463	1.62416	2.31954	0	2.31954	2.56264	2.56264
12	0.102376	0.280415	-18.2006	Compacted Fill	0	35	0.788422	1.73639	2.47982	0	2.47982	2.73905	2.73905
13	0.102376	0.297263	-18.1566	Compacted Fill	0	35	0.835999	1.84117	2.62946	0	2.62946	2.90362	2.90362
14	0.102376	0.311272	-18.1127	Compacted Fill	0	35	0.875611	1.92841	2.75405	0	2.75405	3.04046	3.04046
15	0.102376	0.322874	-18.0687	Compacted Fill	0	35	0.908466	2.00077	2.8574	0	2.8574	3.15378	3.15378
16	0.102376	0.333275	-18.0248	Compacted Fill	0	35	0.937962	2.06573	2.95017	0	2.95017	3.25538	3.25538
17	0.102376	0.342477	-17.9809	Compacted Fill	0	35	0.964098	2.12329	3.03237	0	3.03237	3.34527	3.34527
18	0.102376	0.35048	-17.937	Compacted Fill	0	35	0.986869	2.17344	3.10399	0	3.10399	3.42344	3.42344
19	0.102376	0.357286	-17.8931	Compacted Fill	0	35	1.00628	2.21618	3.16504	0	3.16504	3.48992	3.48992
20	0.102376	0.362895	-17.8492	Compacted Fill	0	35	1.02232	2.25152	3.21551	0	3.21551	3.54471	3.54471
21	0.102376	0.367308	-17.8053	Compacted Fill	0	35	1.03501	2.27946	3.2554	0	3.2554	3.58781	3.58781
22	0.102376	0.370525	-17.7615	Compacted Fill	0	35	1.04433	2.29999	3.28472	0	3.28472	3.61924	3.61924

23	0.102376	0.372549	-17.7176	Compacted Fill	0	35	1.05029	2.31311	3.30346	0	3.30346	3.63901	3.63901
24	0.102376	0.373379	-17.6738	Compacted Fill	0	35	1.05288	2.31883	3.31163	0	3.31163	3.64712	3.64712
25	0.102376	0.373017	-17.63	Compacted Fill	0	35	1.05212	2.31714	3.30923	0	3.30923	3.64358	3.64358
26	0.102376	0.371463	-17.5861	Compacted Fill	0	35	1.04799	2.30805	3.29624	0	3.29624	3.6284	3.6284
27	0.102376	0.368719	-17.5423	Compacted Fill	0	35	1.0405	2.29156	3.27268	0	3.27268	3.6016	3.6016
28	0.102376	0.364785	-17.4985	Compacted Fill	0	35	1.02965	2.26766	3.23855	0	3.23855	3.56316	3.56316
29	0.102376	0.359661	-17.4547	Compacted Fill	0	35	1.01543	2.23635	3.19384	0	3.19384	3.51313	3.51313
30	0.102376	0.35335	-17.411	Compacted Fill	0	35	0.997857	2.19764	3.13856	0	3.13856	3.45148	3.45148
31	0.102376	0.345851	-17.3672	Compacted Fill	0	35	0.97692	2.15153	3.0727	0	3.0727	3.37823	3.37823
32	0.102376	0.337166	-17.3234	Compacted Fill	0	35	0.952614	2.098	2.99626	0	2.99626	3.29339	3.29339
33	0.102376	0.327296	-17.2797	Compacted Fill	0	35	0.924953	2.03708	2.90925	0	2.90925	3.19698	3.19698
34	0.102376	0.316241	-17.236	Compacted Fill	0	35	0.893927	1.96875	2.81167	0	2.81167	3.089	3.089
35	0.102376	0.304001	-17.1922	Compacted Fill	0	35	0.859537	1.89301	2.7035	0	2.7035	2.96944	2.96944
36	0.102376	0.290579	-17.1485	Compacted Fill	0	35	0.821787	1.80987	2.58476	0	2.58476	2.83834	2.83834
37	0.102376	0.275975	-17.1048	Compacted Fill	0	35	0.780672	1.71932	2.45545	0	2.45545	2.69569	2.69569
38	0.102376	0.260189	-17.0611	Compacted Fill	0	35	0.736197	1.62137	2.31555	0	2.31555	2.54149	2.54149
39	0.102376	0.243223	-17.0174	Compacted Fill	0	35	0.688357	1.51601	2.16508	0	2.16508	2.37576	2.37576
40	0.102376	0.225077	-16.9738	Compacted Fill	0	35	0.637153	1.40324	2.00404	0	2.00404	2.19852	2.19852
41	0.102376	0.205752	-16.9301	Compacted Fill	0	35	0.582589	1.28307	1.83242	0	1.83242	2.00976	2.00976
42	0.102376	0.185249	-16.8864	Compacted Fill	0	35	0.524664	1.1555	1.65022	0	1.65022	1.80949	1.80949
43	0.102376	0.163569	-16.8428	Compacted Fill	0	35	0.463371	1.02051	1.45744	0	1.45744	1.59772	1.59772
44	0.102376	0.141187	-16.7992	Compacted Fill	0	35	0.400063	0.881083	1.25832	0	1.25832	1.3791	1.3791
45	0.102376	0.121834	-16.7555	Compacted Fill	0	35	0.345309	0.760494	1.0861	0	1.0861	1.19006	1.19006
46	0.102376	0.102295	-16.7119	Compacted Fill	0	35	0.29	0.638685	0.912137	0	0.912137	0.999207	0.999207
47	0.102376	0.0815824	-16.6683	Compacted Fill	0	35	0.231336	0.509486	0.727621	0	0.727621	0.796886	0.796886

48	0.102376	0.0596964	-16.6247	Compacted Fill	0	35	0.169317	0.372896	0.532551	0	0.532551	0.583106	0.583106
49	0.102376	0.0366379	-16.5811	Compacted Fill	0	35	0.103941	0.228915	0.326925	0	0.326925	0.357874	0.357874
50	0.102376	0.0124078	-16.5376	Compacted Fill	0	35	0.0352092	0.0775434	0.110744	0	0.110744	0.121198	0.121198

Short Term Upslope - Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.69012

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.467408	11.509	-45.6228	Dark Gray Clay (Long Term)	200	25	70.3857	189.346	-22.8478	0	-22.8478	49.0849	49.0849
2	0.688324	56.4439	-44.3586	Light Gray Sand	50	32	29.7613	80.0615	48.1085	0	48.1085	77.2108	77.2108
3	0.688324	100.199	-42.8843	Light Gray Sand	50	32	40.6163	109.263	94.8404	0	94.8404	132.563	132.563
4	0.688324	139.654	-41.4445	Light Gray Sand	50	32	50.7513	136.527	138.472	0	138.472	183.285	183.285
5	0.688324	169.195	-40.036	Light Gray Sand	50	32	58.7126	157.944	172.747	0	172.747	222.075	222.075
6	0.688324	195.999	-38.656	Light Gray Sand	50	32	66.1855	178.047	204.919	0	204.919	257.86	257.86
7	0.688324	220.682	-37.3021	Light Gray Sand	50	32	73.2919	197.164	235.512	0	235.512	291.349	291.349
8	0.688324	243.345	-35.9722	Light Gray Sand	50	32	80.0317	215.295	264.527	0	264.527	322.614	322.614
9	0.688324	264.097	-34.6643	Light Gray Sand	50	32	86.4088	232.45	291.981	0	291.981	351.734	351.734
10	0.688324	283.067	-33.3768	Light Gray Sand	50	32	92.436	248.664	317.928	0	317.928	378.825	378.825
11	0.688324	300.304	-32.1081	Light Gray Sand	50	32	98.1075	263.921	342.345	0	342.345	403.907	403.907
12	0.688324	315.869	-30.8568	Light Gray Sand	50	32	103.422	278.217	365.224	0	365.224	427.015	427.015
13	0.688324	329.83	-29.6216	Light Gray Sand	50	32	108.381	291.559	386.576	0	386.576	448.199	448.199
14	0.688324	342.296	-28.4014	Light Gray Sand	50	32	113.001	303.987	406.464	0	406.464	467.567	467.567
15	0.688324	353.335	-27.1951	Light Gray Sand	50	32	117.287	315.515	424.912	0	424.912	485.176	485.176
16	0.688324	362.931	-26.0017	Light Gray Sand	50	32	121.22	326.097	441.847	0	441.847	500.975	500.975
17	0.688324	371.129	-24.8203	Light Gray Sand	50	32	124.803	335.734	457.269	0	457.269	514.99	514.99
18	0.688324	377.963	-23.6501	Light Gray Sand	50	32	128.031	344.42	471.172	0	471.172	527.241	527.241
19	0.688324	383.432	-22.4903	Light Gray Sand	50	32	130.896	352.126	483.503	0	483.503	537.696	537.696
20	0.688324	387.607	-21.3401	Light Gray Sand	50	32	133.405	358.875	494.303	0	494.303	546.423	546.423
21	0.688324	390.526	-20.1989	Light Gray Sand	50	32	135.559	364.671	503.579	0	503.579	553.452	553.452
22	0.688324	392.216	-19.066	Light Gray Sand	50	32	137.358	369.509	511.322	0	511.322	558.795	558.795
23	0.688324	392.705	-17.9407	Light Gray Sand	50	32	138.799	373.385	517.525	0	517.525	562.464	562.464
24	0.688324	392.014	-16.8226	Light Gray Sand	50	32	139.879	376.292	522.177	0	522.177	564.469	564.469
25	0.688324	390.167	-15.7111	Light Gray Sand	50	32	140.597	378.223	525.266	0	525.266	564.815	564.815
26	0.688324	387.181	-14.6055	Light Gray Sand	50	32	140.948	379.168	526.779	0	526.779	563.508	563.508
27	0.688324	383.084	-13.5055	Light Gray Sand	50	32	140.933	379.126	526.712	0	526.712	560.561	560.561
28	0.688324	377.926	-12.4106	Light Gray Sand	50	32	140.557	378.116	525.094	0	525.094	556.025	556.025
29	0.688324	371.685	-11.3203	Light Gray Sand	50	32	139.805	376.093	521.858	0	521.858	549.845	549.845
30	0.688324	364.367	-10.2341	Light Gray Sand	50	32	138.67	373.04	516.972	0	516.972	542.008	542.008
31	0.688324	355.984	-9.15155	Light Gray Sand	50	32	137.146	368.94	510.411	0	510.411	532.505	532.505
32	0.688324	346.546	-8.07234	Light Gray Sand	50	32	135.227	363.778	502.15	0	502.15	521.329	521.329

33	0.688324	336.063	-6.996	Light Gray Sand	50	32	132.907	357.536	492.161	0	492.161	508.47	508.47
34	0.688324	324.542	-5.92214	Light Gray Sand	50	32	130.177	350.192	480.409	0	480.409	493.912	493.912
35	0.688324	311.989	-4.85036	Light Gray Sand	50	32	127.03	341.727	466.86	0	466.86	477.64	477.64
36	0.688324	298.401	-3.78028	Light Gray Sand	50	32	123.454	332.106	451.464	0	451.464	459.621	459.621
37	0.688324	283.748	-2.71152	Light Gray Sand	50	32	119.427	321.272	434.126	0	434.126	439.782	439.782
38	0.688324	268.072	-1.64371	Light Gray Sand	50	32	114.952	309.234	414.861	0	414.861	418.159	418.159
39	0.688324	251.38	-0.576461	Light Gray Sand	50	32	110.019	295.964	393.625	0	393.625	394.732	394.732
40	0.688324	233.675	0.490583	Light Gray Sand	50	32	104.617	281.433	370.37	0	370.37	369.474	369.474
41	0.688324	215.097	1.5578	Light Gray Sand	50	32	98.7837	265.74	345.256	0	345.256	342.57	342.57
42	0.688324	195.587	2.62555	Light Gray Sand	50	32	92.4851	248.796	318.141	0	318.141	313.9	313.9
43	0.688324	175.059	3.69422	Light Gray Sand	50	32	85.675	230.476	288.822	0	288.822	283.29	283.29
44	0.688324	153.51	4.76418	Light Gray Sand	50	32	78.3359	210.733	257.228	0	257.228	250.699	250.699
45	0.688324	131.01	5.83581	Light Gray Sand	50	32	70.4783	189.595	223.398	0	223.398	216.194	216.194
46	0.688324	107.762	6.90949	Light Gray Sand	50	32	62.163	167.226	187.6	0	187.6	180.067	180.067
47	0.688324	83.5052	7.98561	Light Gray Sand	50	32	53.272	143.308	149.324	0	149.324	141.851	141.851
48	0.688324	58.2032	9.06458	Light Gray Sand	50	32	43.7709	117.749	108.421	0	108.421	101.438	101.438
49	0.688324	31.8473	10.1468	Light Gray Sand	50	32	33.6334	90.4778	64.778	0	64.778	58.7586	58.7586
50	1.04261	17.575	11.5135	Roadway	0	45	8.09492	21.7763	21.7763	0	21.7763	20.1274	20.1274

Short Term Upslope - Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.20236

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.102376	0.0153745	-18.6849	Compacted Fill	0	35	0.0431108	0.0949456	0.135596	0	0.135596	0.150176	0.150176
2	0.102376	0.045517	-18.6408	Compacted Fill	0	35	0.127664	0.281161	0.40154	0	0.40154	0.444604	0.444604
3	0.102376	0.0744471	-18.5967	Compacted Fill	0	35	0.208856	0.459977	0.656915	0	0.656915	0.72719	0.72719
4	0.102376	0.102166	-18.5527	Compacted Fill	0	35	0.28669	0.631394	0.901724	0	0.901724	0.997942	0.997942
5	0.102376	0.128674	-18.5086	Compacted Fill	0	35	0.361163	0.795412	1.13597	0	1.13597	1.25687	1.25687
6	0.102376	0.153973	-18.4646	Compacted Fill	0	35	0.432278	0.952031	1.35964	0	1.35964	1.50398	1.50398
7	0.102376	0.178062	-18.4206	Compacted Fill	0	35	0.500032	1.10125	1.57275	0	1.57275	1.73929	1.73929
8	0.102376	0.200945	-18.3765	Compacted Fill	0	35	0.564431	1.24308	1.7753	0	1.7753	1.9628	1.9628
9	0.102376	0.22262	-18.3325	Compacted Fill	0	35	0.625465	1.3775	1.96727	0	1.96727	2.17452	2.17452
10	0.102376	0.24309	-18.2885	Compacted Fill	0	35	0.683144	1.50453	2.14869	0	2.14869	2.37447	2.37447
11	0.102376	0.262354	-18.2446	Compacted Fill	0	35	0.737463	1.62416	2.31954	0	2.31954	2.56264	2.56264
12	0.102376	0.280415	-18.2006	Compacted Fill	0	35	0.788422	1.73639	2.47982	0	2.47982	2.73905	2.73905
13	0.102376	0.297263	-18.1566	Compacted Fill	0	35	0.835999	1.84117	2.62946	0	2.62946	2.90362	2.90362
14	0.102376	0.311272	-18.1127	Compacted Fill	0	35	0.875611	1.92841	2.75405	0	2.75405	3.04046	3.04046
15	0.102376	0.322874	-18.0687	Compacted Fill	0	35	0.908466	2.00077	2.8574	0	2.8574	3.15378	3.15378
16	0.102376	0.333275	-18.0248	Compacted Fill	0	35	0.937962	2.06573	2.95017	0	2.95017	3.25538	3.25538
17	0.102376	0.342477	-17.9809	Compacted Fill	0	35	0.964098	2.12329	3.03237	0	3.03237	3.34527	3.34527
18	0.102376	0.35048	-17.937	Compacted Fill	0	35	0.986869	2.17344	3.10399	0	3.10399	3.42344	3.42344
19	0.102376	0.357286	-17.8931	Compacted Fill	0	35	1.00628	2.21618	3.16504	0	3.16504	3.48992	3.48992
20	0.102376	0.362895	-17.8492	Compacted Fill	0	35	1.02232	2.25152	3.21551	0	3.21551	3.54471	3.54471
21	0.102376	0.367308	-17.8053	Compacted Fill	0	35	1.03501	2.27946	3.2554	0	3.2554	3.58781	3.58781
22	0.102376	0.370525	-17.7615	Compacted Fill	0	35	1.04433	2.29999	3.28472	0	3.28472	3.61924	3.61924

23	0.102376	0.372549	-17.7176	Compacted Fill	0	35	1.05029	2.31311	3.30346	0	3.30346	3.63901	3.63901
24	0.102376	0.373379	-17.6738	Compacted Fill	0	35	1.05288	2.31883	3.31163	0	3.31163	3.64712	3.64712
25	0.102376	0.373017	-17.63	Compacted Fill	0	35	1.05212	2.31714	3.30923	0	3.30923	3.64358	3.64358
26	0.102376	0.371463	-17.5861	Compacted Fill	0	35	1.04799	2.30805	3.29624	0	3.29624	3.6284	3.6284
27	0.102376	0.368719	-17.5423	Compacted Fill	0	35	1.0405	2.29156	3.27268	0	3.27268	3.6016	3.6016
28	0.102376	0.364785	-17.4985	Compacted Fill	0	35	1.02965	2.26766	3.23855	0	3.23855	3.56316	3.56316
29	0.102376	0.359661	-17.4547	Compacted Fill	0	35	1.01543	2.23635	3.19384	0	3.19384	3.51313	3.51313
30	0.102376	0.35335	-17.411	Compacted Fill	0	35	0.997857	2.19764	3.13856	0	3.13856	3.45148	3.45148
31	0.102376	0.345851	-17.3672	Compacted Fill	0	35	0.97692	2.15153	3.0727	0	3.0727	3.37823	3.37823
32	0.102376	0.337166	-17.3234	Compacted Fill	0	35	0.952614	2.098	2.99626	0	2.99626	3.29339	3.29339
33	0.102376	0.327296	-17.2797	Compacted Fill	0	35	0.924953	2.03708	2.90925	0	2.90925	3.19698	3.19698
34	0.102376	0.316241	-17.236	Compacted Fill	0	35	0.893927	1.96875	2.81167	0	2.81167	3.089	3.089
35	0.102376	0.304001	-17.1922	Compacted Fill	0	35	0.859537	1.89301	2.7035	0	2.7035	2.96944	2.96944
36	0.102376	0.290579	-17.1485	Compacted Fill	0	35	0.821787	1.80987	2.58476	0	2.58476	2.83834	2.83834
37	0.102376	0.275975	-17.1048	Compacted Fill	0	35	0.780672	1.71932	2.45545	0	2.45545	2.69569	2.69569
38	0.102376	0.260189	-17.0611	Compacted Fill	0	35	0.736197	1.62137	2.31555	0	2.31555	2.54149	2.54149
39	0.102376	0.243223	-17.0174	Compacted Fill	0	35	0.688357	1.51601	2.16508	0	2.16508	2.37576	2.37576
40	0.102376	0.225077	-16.9738	Compacted Fill	0	35	0.637153	1.40324	2.00404	0	2.00404	2.19852	2.19852
41	0.102376	0.205752	-16.9301	Compacted Fill	0	35	0.582589	1.28307	1.83242	0	1.83242	2.00976	2.00976
42	0.102376	0.185249	-16.8864	Compacted Fill	0	35	0.524664	1.1555	1.65022	0	1.65022	1.80949	1.80949
43	0.102376	0.163569	-16.8428	Compacted Fill	0	35	0.463371	1.02051	1.45744	0	1.45744	1.59772	1.59772
44	0.102376	0.141187	-16.7992	Compacted Fill	0	35	0.400063	0.881083	1.25832	0	1.25832	1.3791	1.3791
45	0.102376	0.121834	-16.7555	Compacted Fill	0	35	0.345309	0.760494	1.0861	0	1.0861	1.19006	1.19006
46	0.102376	0.102295	-16.7119	Compacted Fill	0	35	0.29	0.638685	0.912137	0	0.912137	0.999207	0.999207
47	0.102376	0.0815824	-16.6683	Compacted Fill	0	35	0.231336	0.509486	0.727621	0	0.727621	0.796886	0.796886

48	0.102376	0.0596964	-16.6247	Compacted Fill	0	35	0.169317	0.372896	0.532551	0		0.532551	0.583106	0.583106
49	0.102376	0.0366379	-16.5811	Compacted Fill	0	35	0.103941	0.228915	0.326925	0		0.326925	0.357874	0.357874
50	0.102376	0.0124078	-16.5376	Compacted Fill	0	35	0.0352092	0.0775434	0.110744	0		0.110744	0.121198	0.121198

Interslice Data

Short Term Upslope - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.24827

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	660.825	134.449	0	0	0
2	667.658	124.33	2473.3	234.09	5.40676
3	674.49	115.242	9805.38	928.048	5.40676
4	681.322	107	20651.3	1954.58	5.40676
5	688.447	99.1656	36591.1	3463.23	5.40676
6	695.572	92	56843.6	5380.07	5.40676
7	701.856	86.1682	71999.1	6814.49	5.40676
8	708.141	80.7475	87569.3	8288.16	5.40676
9	714.425	75.7015	103175	9765.18	5.40675
10	720.71	71	118484	11214.1	5.40674
11	727.999	65.9456	135465	12821.3	5.40674
12	735.288	61.2881	151412	14330.7	5.40677
13	742.577	57	166068	15717.8	5.40675
14	749.414	53.2927	191570	18131.5	5.40676
15	756.252	49.874	215675	20413	5.40677
16	763.089	46.73	238248	22549.4	5.40675
17	770.291	43.7024	260241	24631	5.40676
18	777.493	40.9541	280319	26531.3	5.40676
19	784.694	38.4746	298383	28241	5.40676
20	791.896	36.255	314325	29749.8	5.40675
21	799.098	34.2876	328069	31050.7	5.40676
22	806.299	32.5658	339559	32138.2	5.40676
23	813.501	31.0841	348754	33008.5	5.40676
24	820.703	29.8379	355622	33658.5	5.40676
25	827.904	28.8232	360145	34086.6	5.40676
26	835.106	28.0371	362319	34292.4	5.40677
27	842.308	27.4772	362174	34278.6	5.40675
28	849.509	27.142	359743	34048.5	5.40675
29	856.711	27.0303	355072	33606.4	5.40675
30	863.913	27.142	348216	32957.5	5.40675
31	871.114	27.4772	339238	32107.8	5.40676
32	878.316	28.0371	328217	31064.7	5.40676
33	885.518	28.8232	315250	29837.4	5.40676
34	892.719	29.8379	300453	28436.9	5.40675
35	899.921	31.0841	283978	26877.6	5.40675
36	907.123	32.5658	265988	25174.9	5.40675
37	914.324	34.2876	246657	23345.3	5.40676
38	921.526	36.255	226161	21405.4	5.40675
39	928.728	38.4746	204718	19375.9	5.40675
40	935.929	40.9541	182589	17281.4	5.40674
41	943.131	43.7024	160125	15155.4	5.40678
42	950.333	46.73	137558	13019.4	5.40675
43	957.17	49.874	116343	11011.5	5.40676
44	964.008	53.2927	96069.3	9092.66	5.40676
45	970.845	57	77317.6	7317.86	5.40675
46	978.134	61.2881	51349.6	4860.08	5.40676
47	985.423	65.9456	30306.6	2868.42	5.40675
48	992.712	71	14172.1	1341.35	5.40678
49	998.726	75.4917	4830.94	457.233	5.40676
50	1004.74	80.2977	-48.8024	-4.61899	5.40675
51	1006.31	81.6058	0	0	0

Short Term Upslope - Short Term Stability Downslope

Global Minimum Query (spencer) - Safety Factor: 2.20236

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	1042.7	79.4186	0	0	0
2	1042.8	79.3839	0.000281132	0	0
3	1042.9	79.3494	0.00107841	0	0
4	1043	79.315	0.00232513	0	0
5	1043.11	79.2806	0.00395746	0	0
6	1043.21	79.2463	0.00591437	0	0
7	1043.31	79.2121	0.00813765	0	0
8	1043.41	79.178	0.0105719	0	0
9	1043.52	79.144	0.0131646	0	0
10	1043.62	79.1101	0.015866	0	0
11	1043.72	79.0763	0.018629	0	0
12	1043.82	79.0425	0.0214096	0	0
13	1043.93	79.0089	0.0241664	0	0
14	1044.03	78.9753	0.0268607	0	0
15	1044.13	78.9418	0.0294433	0	0
16	1044.23	78.9084	0.0318744	0	0
17	1044.34	78.8751	0.0341284	0	0
18	1044.44	78.8419	0.036182	0	0
19	1044.54	78.8087	0.0380151	0	0
20	1044.64	78.7757	0.0396101	0	0
21	1044.74	78.7427	0.0409521	0	0
22	1044.85	78.7098	0.0420292	0	0
23	1044.95	78.677	0.0428321	0	0
24	1045.05	78.6443	0.0433542	0	0
25	1045.15	78.6117	0.0435918	0	0
26	1045.26	78.5792	0.0435438	0	0
27	1045.36	78.5467	0.0432119	0	0
28	1045.46	78.5144	0.0426005	0	0
29	1045.56	78.4821	0.0417168	0	0
30	1045.67	78.4499	0.0405707	0	0
31	1045.77	78.4178	0.0391747	0	0
32	1045.87	78.3858	0.0375441	0	0
33	1045.97	78.3538	0.0356969	0	0
34	1046.08	78.322	0.033654	0	0
35	1046.18	78.2902	0.0314386	0	0
36	1046.28	78.2586	0.029077	0	0
37	1046.38	78.227	0.0265979	0	0
38	1046.49	78.1955	0.0240329	0	0
39	1046.59	78.164	0.0214161	0	0
40	1046.69	78.1327	0.0187846	0	0
41	1046.79	78.1015	0.0161778	0	0
42	1046.89	78.0703	0.0136379	0	0
43	1047	78.0392	0.01121	0	0
44	1047.1	78.0082	0.00894166	0	0
45	1047.2	77.9773	0.00687614	0	0
46	1047.3	77.9465	0.00500096	0	0
47	1047.41	77.9158	0.00334862	0	0
48	1047.51	77.8851	0.00196875	0	0
49	1047.61	77.8545	0.00091362	0	0
50	1047.71	77.8241	0.000238169	0	0
51	1047.82	77.7937	0	0	0

Short Term Upslope - Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.69012

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	952.383	92.4777	0	0	0
2	952.85	92	-43.8172	-12.206	15.5661
3	953.539	91.3269	-31.9244	-8.89306	15.566
4	954.227	90.6876	0.74405	0.207267	15.566
5	954.915	90.0798	49.968	13.9194	15.566
6	955.604	89.5015	109.45	30.4891	15.5661
7	956.292	88.951	176.711	49.2258	15.5661
8	956.98	88.4266	249.759	69.5743	15.566
9	957.669	87.927	326.818	91.0403	15.566
10	958.357	87.451	406.311	113.184	15.566
11	959.045	86.9975	486.846	135.619	15.5661
12	959.734	86.5656	567.173	157.995	15.566
13	960.422	86.1543	646.174	180.002	15.566
14	961.11	85.763	722.855	201.363	15.566
15	961.799	85.3908	796.348	221.835	15.566
16	962.487	85.0371	865.887	241.207	15.566
17	963.175	84.7014	930.784	259.285	15.566
18	963.864	84.383	990.439	275.903	15.566
19	964.552	84.0816	1044.33	290.915	15.566
20	965.24	83.7966	1092	304.195	15.5661
21	965.929	83.5277	1133.1	315.642	15.566
22	966.617	83.2744	1167.3	325.17	15.566
23	967.305	83.0365	1194.38	332.714	15.566
24	967.994	82.8137	1214.17	338.226	15.566
25	968.682	82.6056	1226.54	341.673	15.5661
26	969.37	82.4119	1231.46	343.042	15.566
27	970.059	82.2326	1228.91	342.333	15.566
28	970.747	82.0673	1218.97	339.563	15.566
29	971.435	81.9158	1201.74	334.765	15.5661
30	972.124	81.778	1177.41	327.986	15.566
31	972.812	81.6537	1146.19	319.29	15.566
32	973.5	81.5428	1108.37	308.756	15.5661
33	974.188	81.4452	1064.3	296.479	15.5661
34	974.877	81.3607	1014.38	282.572	15.566
35	975.565	81.2893	959.064	267.163	15.5661
36	976.253	81.2309	898.883	250.398	15.566
37	976.942	81.1855	834.429	232.443	15.566
38	977.63	81.1529	766.365	213.483	15.566
39	978.318	81.1331	695.425	193.722	15.566
40	979.007	81.1262	622.412	173.383	15.566
41	979.695	81.1321	548.209	152.712	15.566
42	980.383	81.1508	473.742	131.968	15.566
43	981.072	81.1824	400.031	111.435	15.566
44	981.76	81.2268	328.215	91.4297	15.5661
45	982.448	81.2842	259.531	72.2966	15.566
46	983.137	81.3545	195.296	54.4029	15.566
47	983.825	81.4379	136.854	38.1229	15.566
48	984.513	81.5345	85.762	23.8904	15.566
49	985.202	81.6443	43.7231	12.1798	15.5661
50	985.89	81.7675	12.5893	3.50696	15.5661
51	986.933	81.9799	0	0	0

Short Term Upslope - Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.20236

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	1042.7	79.4186	0	0	0
2	1042.8	79.3839	0.000281132	0	0
3	1042.9	79.3494	0.00107841	0	0
4	1043	79.315	0.00232513	0	0
5	1043.11	79.2806	0.00395746	0	0
6	1043.21	79.2463	0.00591437	0	0
7	1043.31	79.2121	0.00813765	0	0
8	1043.41	79.178	0.0105719	0	0
9	1043.52	79.144	0.0131646	0	0
10	1043.62	79.1101	0.015866	0	0
11	1043.72	79.0763	0.018629	0	0
12	1043.82	79.0425	0.0214096	0	0
13	1043.93	79.0089	0.0241664	0	0
14	1044.03	78.9753	0.0268607	0	0
15	1044.13	78.9418	0.0294433	0	0
16	1044.23	78.9084	0.0318744	0	0
17	1044.34	78.8751	0.0341284	0	0
18	1044.44	78.8419	0.036182	0	0
19	1044.54	78.8087	0.0380151	0	0
20	1044.64	78.7757	0.0396101	0	0
21	1044.74	78.7427	0.0409521	0	0
22	1044.85	78.7098	0.0420292	0	0
23	1044.95	78.677	0.0428321	0	0
24	1045.05	78.6443	0.0433542	0	0
25	1045.15	78.6117	0.0435918	0	0
26	1045.26	78.5792	0.0435438	0	0
27	1045.36	78.5467	0.0432119	0	0
28	1045.46	78.5144	0.0426005	0	0
29	1045.56	78.4821	0.0417168	0	0
30	1045.67	78.4499	0.0405707	0	0
31	1045.77	78.4178	0.0391747	0	0
32	1045.87	78.3858	0.0375441	0	0
33	1045.97	78.3538	0.0356969	0	0
34	1046.08	78.322	0.033654	0	0
35	1046.18	78.2902	0.0314386	0	0
36	1046.28	78.2586	0.029077	0	0
37	1046.38	78.227	0.0265979	0	0
38	1046.49	78.1955	0.0240329	0	0
39	1046.59	78.164	0.0214161	0	0
40	1046.69	78.1327	0.0187846	0	0
41	1046.79	78.1015	0.0161778	0	0
42	1046.89	78.0703	0.0136379	0	0
43	1047	78.0392	0.01121	0	0
44	1047.1	78.0082	0.00894166	0	0
45	1047.2	77.9773	0.00687614	0	0
46	1047.3	77.9465	0.00500096	0	0
47	1047.41	77.9158	0.00334862	0	0
48	1047.51	77.8851	0.00196875	0	0
49	1047.61	77.8545	0.00091362	0	0
50	1047.71	77.8241	0.000238169	0	0
51	1047.82	77.7937	0	0	0

Discharge Sections

Entity Information

Short Term Upslope

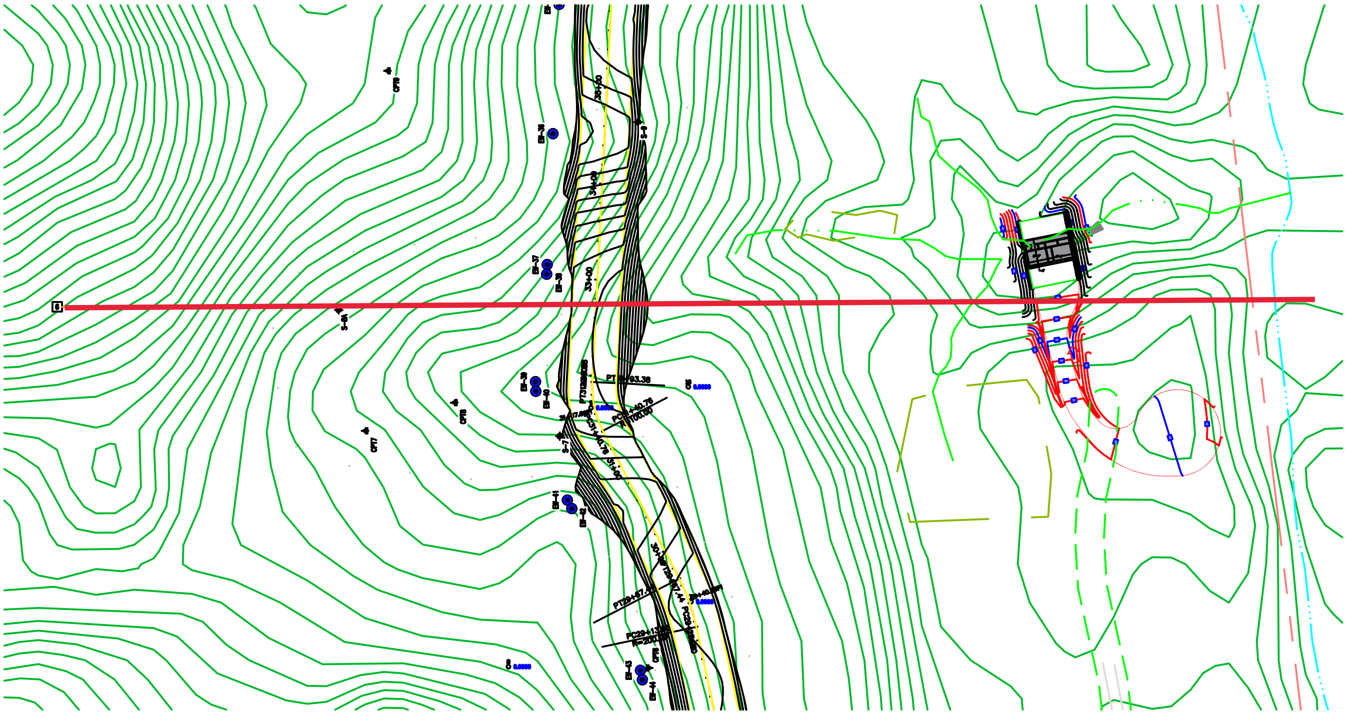
Shared Entities

Type	Coordinates (x,y)
External Boundary	360.46, 0
	1382.96, 0
	1382.96, 27
	1382.96, 57
	1382.96, 68
	1267.13, 70
	1209.04, 71
	1150.95, 72
	1080.09, 72
	1066.3, 72
	1063.07, 73
	1059.85, 74
	1056.67, 75
	1053.5, 76
	1050.34, 77
	1047.16, 78
	1044.02, 79
	1040.86, 80
	1037.68, 81
	985.89, 82
	982.71, 83
	979.6, 84
	976.53, 85
	973.45, 86
	970.37, 87
	967.3, 88
	964.23, 89
	961.15, 90
	958.09, 91
	955.04, 92
	954.52, 92.17
	941.81, 94
	932.55, 96
	921.45, 98
	910.31, 100
	900.27, 102
	890.3, 104
	878.64, 106
	872.66, 107
	866.68, 108
	854.68, 110
	843.79, 112
	832.88, 114
	822.58, 116

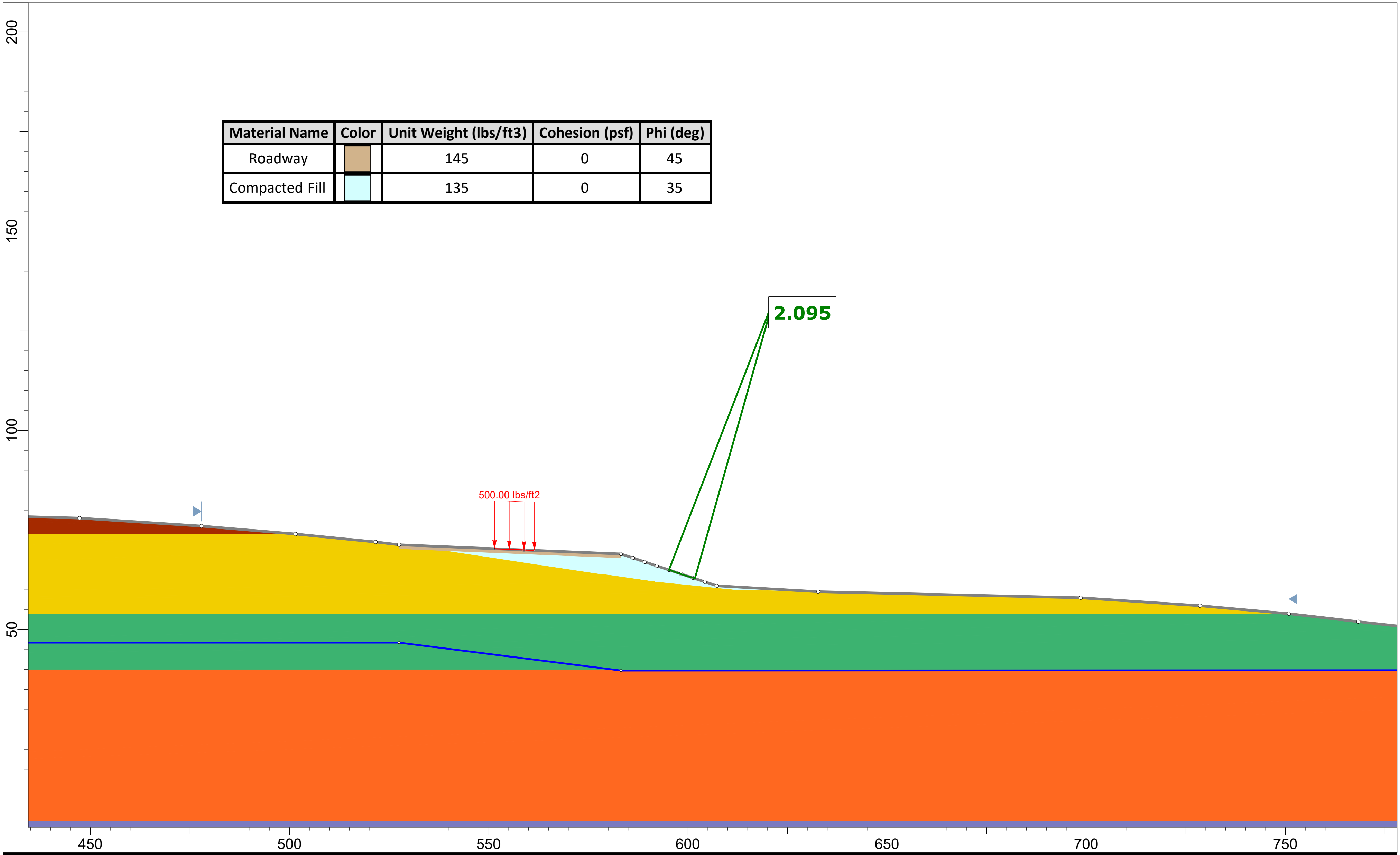
	810.45, 118 797.06, 120 783.1, 122 767.07, 124 753.03, 126 738.94, 128 724.62, 130 708.7, 132 680.98, 134 591.24, 136 360.46, 138 360.46, 107 360.46, 92 360.46, 71 360.46, 57 360.46, 27
Material Boundary	1013.56, 79.9691 1020.4, 78 1029.17, 76 1037.96, 74 1054.82, 72 1066.3, 72
Material Boundary	985.89, 82 985.89, 81 1013.56, 79.9691 1037.68, 80 1037.68, 81
Material Boundary	360.46, 71 1209.04, 71
Material Boundary	360.46, 92 955.04, 92
Material Boundary	360.46, 107 872.66, 107
Material Boundary	360.46, 57 1382.96, 57
Material Boundary	360.46, 27 1382.96, 27

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Short Term Stability Downslope	Long Term Upslope	Long Term Downslope
Piezoline	360.46, 46.73 1382.96, 46.73	Assigned to: 🟩 Black Creek Confining U 🟧 Black Creek Aquifer	Assigned to: 🟩 Black Creek Confining U 🟧 Black Creek Aquifer	Assigned to: ▨ Black Creek Confining U (Long Term 🟧 Black Creek Aquifer	Assigned to: ▨ Black Creek Confining U (Long Term 🟧 Black Creek Aquifer
Distributed Load	1006.3, 81.6059 1016.32, 81.4125	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No



Section: 6
Approximate Station: 32+78



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Roadway	🟫	145	0	45
Compacted Fill	🟦	135	0	35

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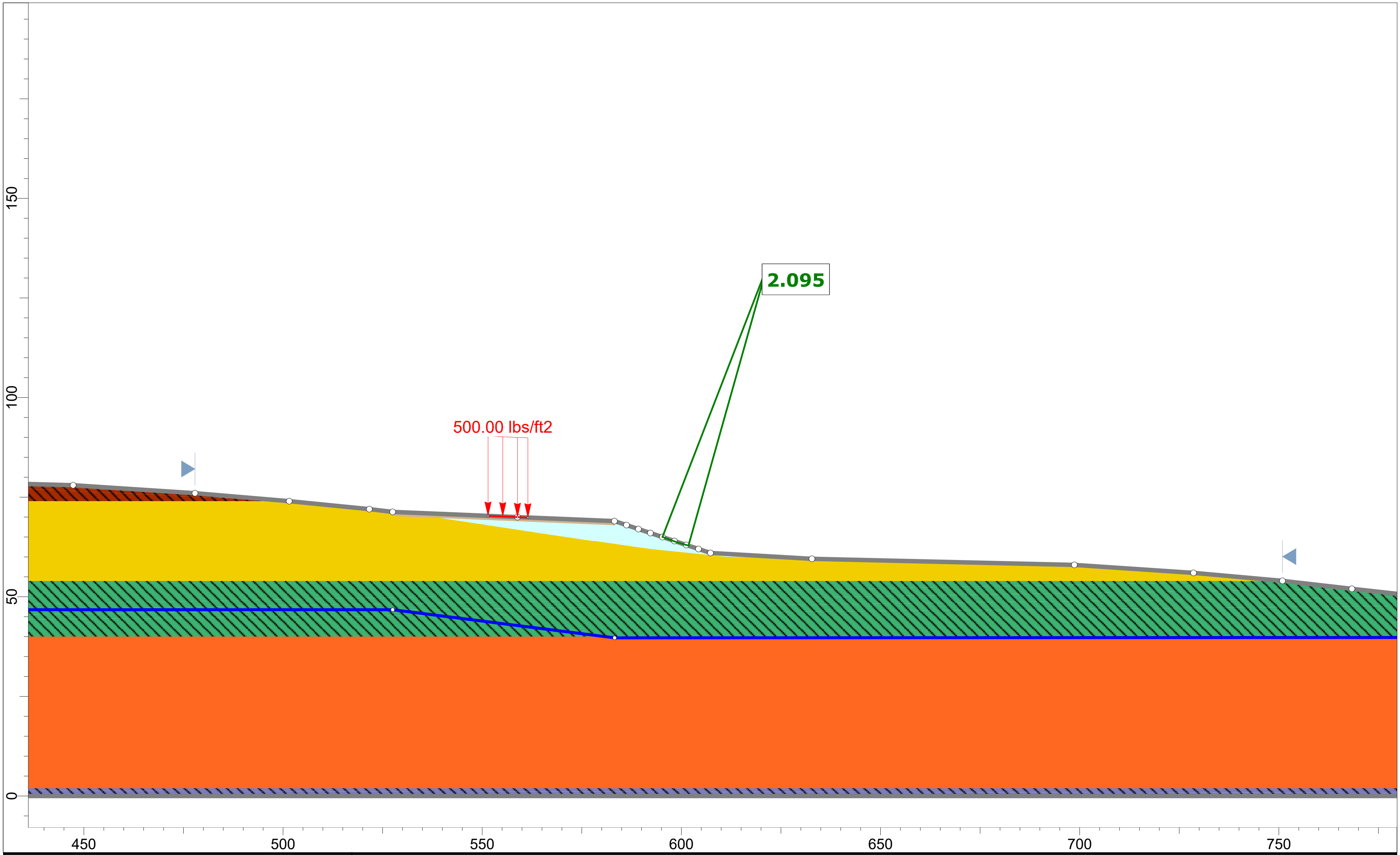
Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_32+78_section_6.slmd



Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway	Scenario	Long Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	section_32+78_section_6.slmd

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45-20803 Barrier Wall Road Interim Design and Repair
Downslope Unsupported Fill
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.016

Table of Contents

Slide Analysis Information

section_32+78_section_6

Project Summary

File Name:	section_32+78_section_6.slmd
Last saved with Slide version:	9.016
Project Title:	45-20803 Barrier Wall Road Interim Design and Repair
Analysis:	Roadway: Long Term Slope Stability
Company:	GeoServices LLC
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name	Scenario Name	Compute Time
Ground Profile ◆	Master Scenario Long Term	
Roadway ◆	Master Scenario Long Term	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

All Open Scenarios

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

All Open Scenarios

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

◆ **Roadway**

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Materials

Light Brown Sand	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay	
Color	⬛
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0
Light Gray Sand	
Color	⬜
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay	
Color	🟥
Strength Type	Undrained
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1100
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	200

Friction Angle [deg]	24
Water Surface	Assigned per scenario
Ru Value	0
Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Hu Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Hu Value	0
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Hu Value	1
Upper Cape Fear Confining Unit	
Color	🟪
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	2500
Cohesion Type	Constant
Water Surface	Assigned per scenario
Hu Value	0
Upper Cape Fear Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	250

Friction Angle [deg]	26
Water Surface	Assigned per scenario
Hu Value	1
Roadway	
Color	■
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	145
Cohesion [psf]	0
Friction Angle [deg]	45
Water Surface	Assigned per scenario
Ru Value	0
Compacted Fill	
Color	□
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	135
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material		Ground Profile	Long Term	Roadway	Long Term
Light Brown Sand	■	✓	✓	✓	✓
Dark Gray Clay	■	✓	✗	✓	✗
Dark Gray Clay (Long Term)	▨	✗	✓	✗	✓
Light Gray Sand	■	✓	✓	✓	✓
Perched Clay	■	✓	✗	✓	✗
Perched Clay (Long Term)	▨	✗	✓	✗	✓
Surficial Aquifer	■	✓	✓	✓	✓
Black Creek Confining Unit	■	✓	✗	✓	✗
Black Creek Confining Unit (Long Term)	▨	✗	✓	✗	✓
Black Creek Aquifer	■	✓	✓	✓	✓
Upper Cape Fear Confining Unit	■	✓	✗	✓	✗
Upper Cape Fear Confining Unit (Long Term)	▨	✗	✓	✗	✓
Roadway	■	✗	✗	✓	✓
Compacted Fill	□	✗	✗	✓	✓

Entity Information

Ground Profile

Shared Entities

Type	Coordinates (x,y)

External Boundary	0, 114.11
	0, 107
	0, 92
	0, 80
	0, 74
	0, 54
	0, 40
	0, 2
	0, 0
	1300.16, 0
	1300.16, 2
	1300.16, 34.63
	1252.38, 40
	1234.58, 42
	1216.79, 44
	1197.68, 46
	1134.65, 46
	1103.8, 44
	1077.44, 42
	1057.29, 40
	948.42, 40
	927.13, 42
	901.93, 44
	863.54, 46
	809.24, 48
	786.41, 50
	768.32, 52
	750.9, 54
	728.58, 56
	698.65, 58
	611.2, 60
	591.78, 62
	577.98, 64
	564.57, 66
	551.43, 68
	538.13, 70
	521.64, 72
	501.53, 74
	477.87, 76
	447.28, 78
	373.97, 80
	347.69, 82
	319.18, 84
	283.17, 86
	254.32, 88
	233.18, 90
	214.92, 92
	198.4, 94
	184.11, 96
	170.65, 98
	157.19, 100
	144.82, 102
	129.63, 104
	115.2, 106
	105.085, 107
	94.97, 108
	67.87, 110
	32.68, 112
	1.7, 114

Material Boundary	0, 74 501.53, 74
Material Boundary	0, 54 750.9, 54
Material Boundary	0, 40 948.42, 40
Material Boundary	1057.29, 40 1252.38, 40
Material Boundary	0, 2 1300.16, 2
Material Boundary	0, 80 373.97, 80
Material Boundary	0, 92 214.92, 92
Material Boundary	0, 107 105.085, 107

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Long Term
Piezoline	0, 46.73 527.51, 46.73 583.233, 39.7 1252.38, 40	Assigned to: 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	Assigned to: ▨ Black Creek Confining Unit (Long Term) 🟧 Black Creek Aquifer ▨ Upper Cape Fear Confining Unit (Long Term)

Roadway

Shared Entities

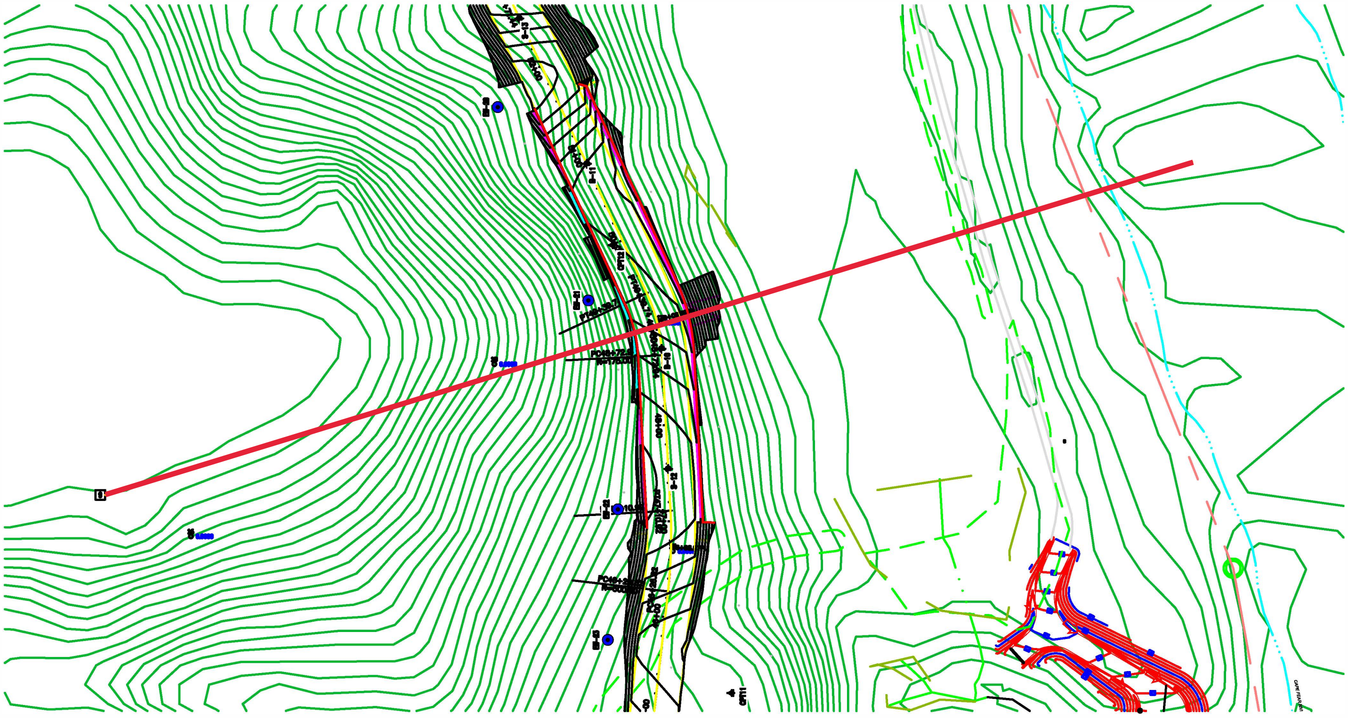
Type	Coordinates (x,y)
	0, 0 1300.16, 0 1300.16, 2 1300.16, 34.63 1252.38, 40 1234.58, 42 1216.79, 44 1197.68, 46 1134.65, 46 1103.8, 44 1077.44, 42 1057.29, 40 948.42, 40 927.13, 42 901.93, 44 863.54, 46 809.24, 48 786.41, 50 768.32, 52 750.9, 54 728.58, 56 698.65, 58

External Boundary	632.76, 59.51 607.28, 61 604.28, 62 601.23, 63 598.25, 64 595.25, 65 592.21, 66 589.21, 67 586.21, 68 583.19, 69 558.86, 70 527.51, 71.29 521.64, 72 501.53, 74 477.87, 76 447.28, 78 373.97, 80 347.69, 82 319.18, 84 283.17, 86 254.32, 88 233.18, 90 214.92, 92 198.4, 94 184.11, 96 170.65, 98 157.19, 100 144.82, 102 129.63, 104 115.2, 106 105.085, 107 94.97, 108 67.87, 110 32.68, 112 1.7, 114 0, 114.11 0, 107 0, 92 0, 80 0, 74 0, 54 0, 40 0, 2
Material Boundary	0, 74 501.53, 74
Material Boundary	0, 54 750.9, 54
Material Boundary	0, 40 948.42, 40
Material Boundary	1057.29, 40 1252.38, 40
Material Boundary	0, 2 1300.16, 2
Material Boundary	0, 80 373.97, 80
Material Boundary	0, 92 214.92, 92

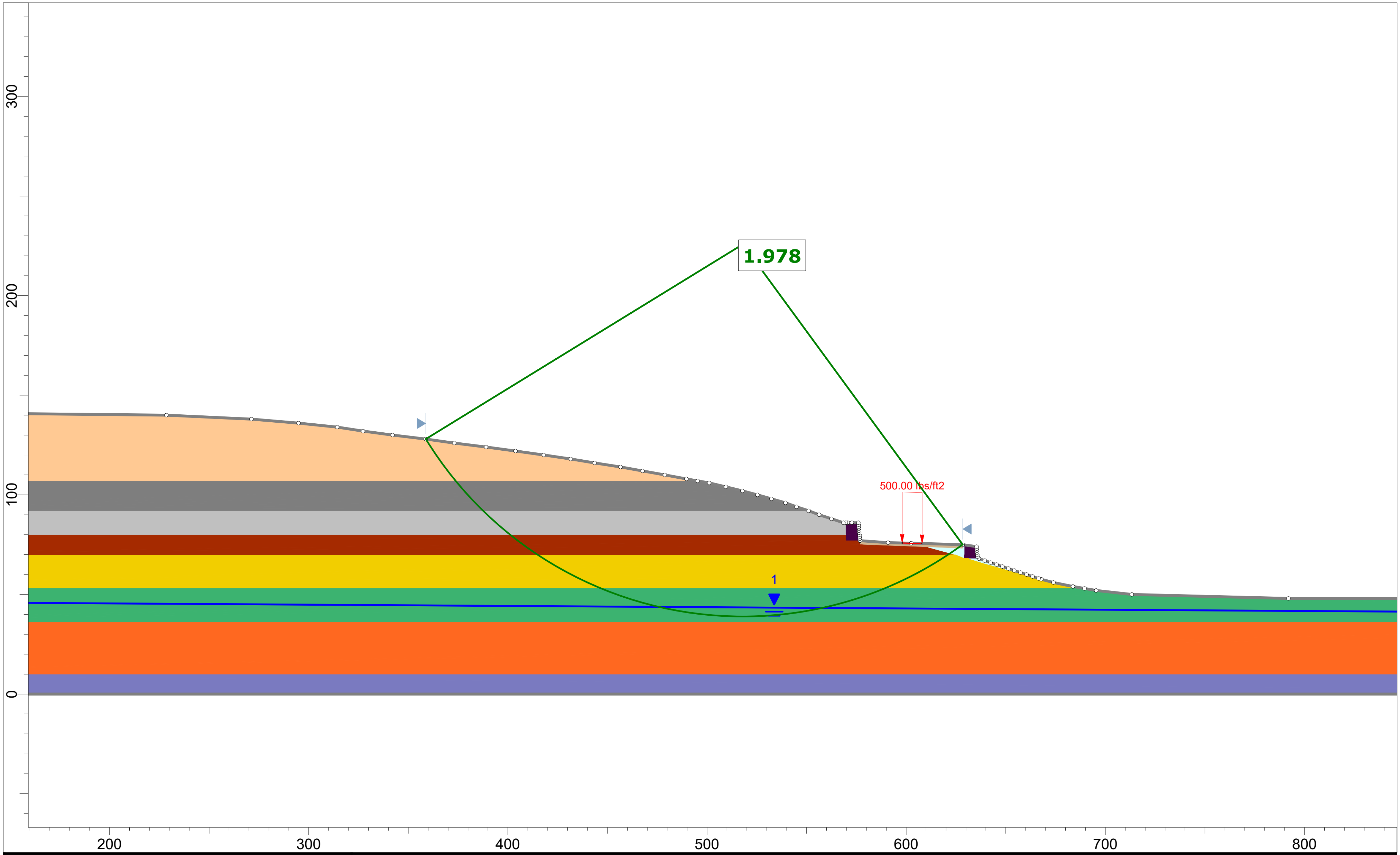
Material Boundary	0, 107 105.085, 107
Material Boundary	527.51, 71.29 538.13, 70 539.47, 69.7985 551.43, 68 564.57, 66 577.98, 64 591.78, 62 611.2, 60 632.76, 59.51
Material Boundary	527.51, 71.29 527.51, 70.29 539.47, 69.7985 583.233, 68 583.19, 69

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Long Term
Piezoline	0, 46.73 527.51, 46.73 583.233, 39.7 1252.38, 40	Assigned to: 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	Assigned to: ▨ Black Creek Confining Unit (Long Term) 🟧 Black Creek Aquifer ▨ Upper Cape Fear Confining Unit (Long Term)
Distributed Load	551.469, 70.3041 558.86, 70 561.469, 69.8928	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No



Section: 9, Retaining Wall Supported Cut and Fill
Approximate Station: 49+05



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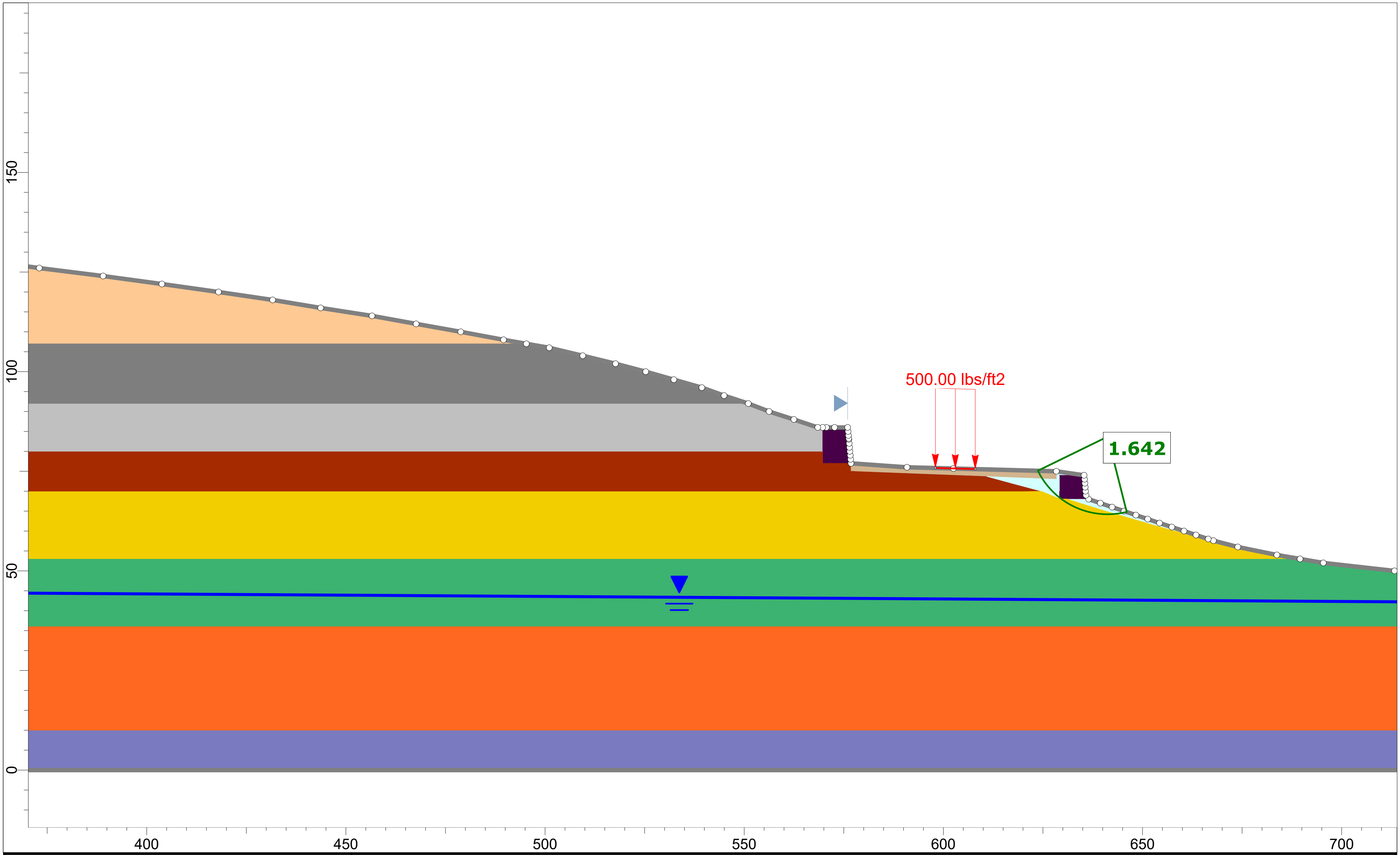
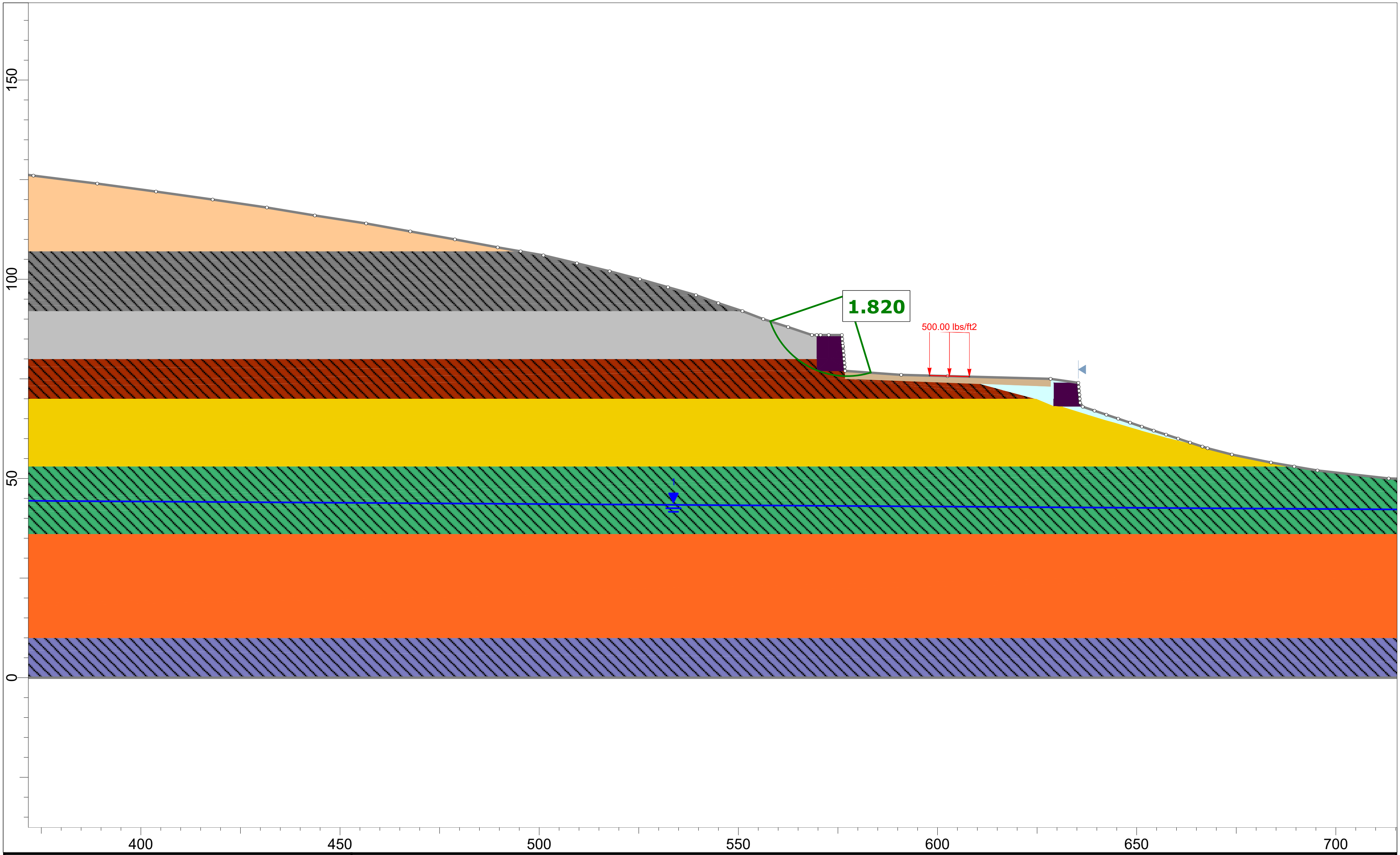
SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Upslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	chainage_49+05_section_9.slmd



SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	chainage_49+05_section_9.slmd



Project

45-20803 Barrier Wall Road Interim Design and Repair

Group	Roadway Upslope	Scenario	Long Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	chainage_49+05_section_9.slmd

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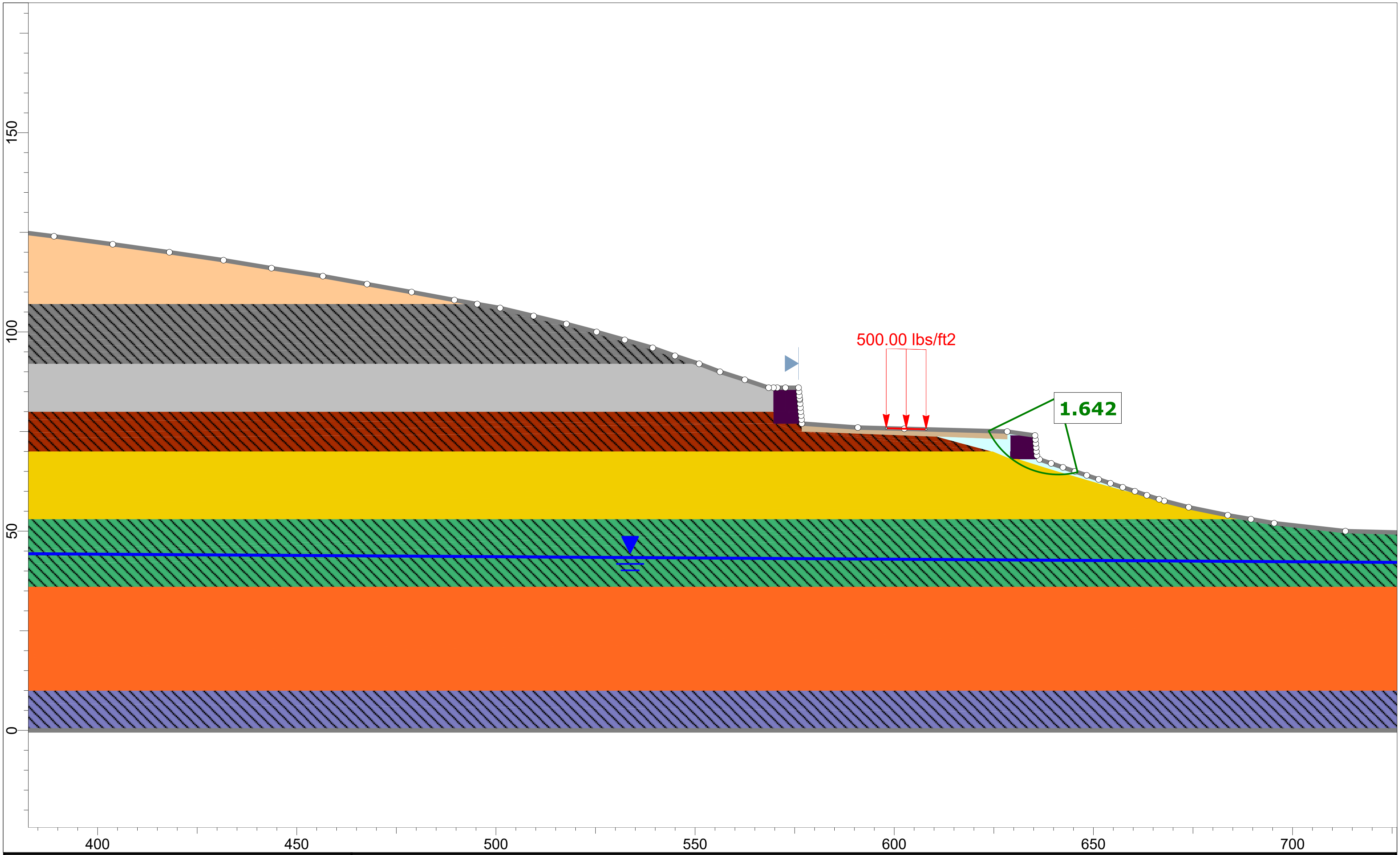

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	Scenario	Long Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	chainage_49+05_section_9.slmd

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45-20803 Barrier Wall Road Interim Design and Repair
Retaining Wall Supported Cut and Fill
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.016

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Slide Analysis Information

chainage_49+05_section_9

Project Summary

File Name:	chainage_49+05_section_9.slmd
Slide Modeler Version:	9.016
Project Title:	45-20803 Barrier Wall Road Interim Design and Repair
Analysis:	Section 49+05, Long Term Slope Stability
Company:	GeoServices LLC
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Slope Profile ◆	Master Scenario	Spencer: 1.655070	00h:00m:00.978s
	Slope Long Term	Spencer: 2.247220	00h:00m:00.841s
Roadway ◆	Master Scenario	Spencer: 1.978100	00h:00m:01.26s
	Short Term Downslope	Spencer: 1.642080	00h:00m:00.896s
	Roadway Long Term Upslope	Spencer: 1.819790	00h:00m:00.868s
	Roadway Long Term Downslope	Spencer: 1.642080	00h:00m:00.818s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Loading

Roadway - Master Scenario

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Roadway - Short Term Downslope

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Roadway - Roadway Long Term Upslope

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Roadway - Roadway Long Term Downslope

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Materials

Retaining Wall	
Color	🟪
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	135
Allow Sliding Along Boundary	Yes
Water Surface	Assigned per scenario
Ru Value	0
Light Brown Sand	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay	
Color	⬛
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0
Light Gray Sand	
Color	⬜
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay	
Color	🟥
Strength Type	Undrained
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1100
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Perched Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	200
Friction Angle [deg]	24
Water Surface	Assigned per scenario
Ru Value	0
Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Hu Value	1
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Hu Value	1
Upper Cape Fear Confining Unit	
Color	🟪
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	2500
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Hu Value	0
Roadway	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	145
Cohesion [psf]	0
Friction Angle [deg]	45
Water Surface	Assigned per scenario
Ru Value	0
Compacted Fill	
Color	🟦
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	135
Cohesion [psf]	0
Friction Angle [deg]	35
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material	Slope Profile	Slope Long Term	Roadway	Short Term Downslope	Roadway Long Term Upslope	Roadway Long Term Downslope
Retaining Wall	✗	✗	✓	✓	✓	✓
Light Brown Sand	✓	✓	✓	✓	✓	✓
Dark Gray Clay	✓	✗	✓	✓	✗	✗
Dark Gray Clay (Long Term)	✗	✓	✗	✗	✓	✓
Light Gray Sand	✓	✓	✓	✓	✓	✓
Perched Clay	✓	✗	✓	✓	✗	✗
Perched Clay (Long Term)	✗	✓	✗	✗	✓	✓
Surficial Aquifer	✓	✓	✓	✓	✓	✓
Black Creek Confining Unit	✓	✗	✓	✓	✗	✗
Black Creek Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Black Creek Aquifer	✓	✓	✓	✓	✓	✓
Upper Cape Fear Confining Unit	✓	✗	✓	✓	✗	✗
Upper Cape Fear Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Roadway	✗	✗	✓	✓	✓	✓
Compacted Fill	✗	✗	✓	✓	✓	✓

Global Minimums

◆ Slope Profile - Master Scenario

Method: spencer

FS	1.655070
Center:	563.317, 272.027
Radius:	236.065
Left Slip Surface Endpoint:	378.364, 125.333
Right Slip Surface Endpoint:	664.044, 58.530
Resisting Moment:	1.05782e+08 lb-ft
Driving Moment:	6.39141e+07 lb-ft
Resisting Horizontal Force:	408109 lb
Driving Horizontal Force:	246581 lb
Total Slice Area:	11642.5 ft2
Surface Horizontal Width:	285.68 ft
Surface Average Height:	40.7537 ft

◆ Slope Profile - Slope Long Term

Method: spencer

FS	2.247220
Center:	582.817, 193.647
Radius:	123.659
Left Slip Surface Endpoint:	494.439, 107.154
Right Slip Surface Endpoint:	611.808, 73.434
Resisting Moment:	1.2199e+07 lb-ft
Driving Moment:	5.42847e+06 lb-ft
Resisting Horizontal Force:	91899.2 lb
Driving Horizontal Force:	40894.6 lb
Total Slice Area:	1395.34 ft2
Surface Horizontal Width:	117.369 ft
Surface Average Height:	11.8885 ft

◆ Roadway - Master Scenario

Method: spencer

FS	1.978100
Center:	517.988, 225.771
Radius:	186.851
Left Slip Surface Endpoint:	358.759, 127.999
Right Slip Surface Endpoint:	628.358, 75.001
Resisting Moment:	8.57896e+07 lb-ft
Driving Moment:	4.33696e+07 lb-ft
Resisting Horizontal Force:	406720 lb
Driving Horizontal Force:	205611 lb
Total Slice Area:	11967.3 ft2
Surface Horizontal Width:	269.599 ft
Surface Average Height:	44.3892 ft

◆ Roadway - Short Term Downslope

Method: spencer

FS	1.642080
Center:	641.266, 83.688
Radius:	19.507
Left Slip Surface Endpoint:	623.740, 75.124
Right Slip Surface Endpoint:	646.041, 64.775
Resisting Moment:	171876 lb-ft
Driving Moment:	104670 lb-ft
Resisting Horizontal Force:	7739.28 lb
Driving Horizontal Force:	4713.09 lb
Total Slice Area:	94.2762 ft2
Surface Horizontal Width:	22.3011 ft
Surface Average Height:	4.22742 ft

◆ Roadway - Roadway Long Term Upslope

Method: spencer

FS	1.819790
Center:	577.295, 96.039
Radius:	20.391
Left Slip Surface Endpoint:	558.002, 89.438
Right Slip Surface Endpoint:	583.264, 76.541
Resisting Moment:	245179 lb-ft
Driving Moment:	134729 lb-ft
Resisting Horizontal Force:	10623.5 lb
Driving Horizontal Force:	5837.75 lb
Total Slice Area:	142.986 ft2
Surface Horizontal Width:	25.262 ft
Surface Average Height:	5.66012 ft

◆ Roadway - Roadway Long Term Downslope

Method: spencer

FS	1.642080
Center:	641.266, 83.688
Radius:	19.507
Left Slip Surface Endpoint:	623.740, 75.124
Right Slip Surface Endpoint:	646.041, 64.775
Resisting Moment:	171876 lb-ft
Driving Moment:	104670 lb-ft
Resisting Horizontal Force:	7739.28 lb
Driving Horizontal Force:	4713.09 lb
Total Slice Area:	94.2762 ft2
Surface Horizontal Width:	22.3011 ft
Surface Average Height:	4.22742 ft

Global Minimum Support Data

All Open Scenarios

No Supports Present

Valid and Invalid Surfaces

Slope Profile - Master Scenario

Method: spencer

Number of Valid Surfaces: 11641
Number of Invalid Surfaces: 0

Slope Profile - Slope Long Term

Method: spencer

Number of Valid Surfaces: 12017
Number of Invalid Surfaces: 0

Roadway - Master Scenario

Method: spencer

Number of Valid Surfaces: 10127
Number of Invalid Surfaces: 0

Roadway - Short Term Downslope

Method: spencer

Number of Valid Surfaces: 6959
Number of Invalid Surfaces: 0

Roadway - Roadway Long Term Upslope

Method: spencer

Number of Valid Surfaces: 7585
Number of Invalid Surfaces: 0

Roadway - Roadway Long Term Downslope

Method: spencer

Number of Valid Surfaces: 7152
Number of Invalid Surfaces: 0

Slice Data

Slope Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.65507

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	5.38499	1739.37	-50.5522	Light Brown Sand	75	32	110.517	182.913	172.697	0	172.697	307.014	307.014
2	5.38499	5084.76	-48.5366	Light Brown Sand	75	32	264.815	438.288	581.383	0	581.383	881.088	881.088
3	5.38499	8160.62	-46.5985	Light Brown Sand	75	32	414.427	685.906	977.654	0	977.654	1415.88	1415.88
4	5.36634	11094.7	-44.7306	Dark Gray Clay	1300	0	785.465	1300	1220.79	0	1220.79	1998.9	1998.9
5	5.36634	13983.6	-42.9245	Dark Gray Clay	1300	0	785.465	1300	1742.13	0	1742.13	2472.66	2472.66
6	5.36634	16660.4	-41.1699	Dark Gray Clay	1300	0	785.465	1300	2232.08	0	2232.08	2918.97	2918.97
7	5.1317	18208.3	-39.4977	Light Gray Sand	50	32	993.245	1643.89	2550.76	0	2550.76	3369.46	3369.46
8	5.1317	20225	-37.9013	Light Gray Sand	50	32	1120.3	1854.17	2887.27	0	2887.27	3759.44	3759.44
9	5.1317	22093.6	-36.3389	Light Gray Sand	50	32	1242.46	2056.35	3210.83	0	3210.83	4124.8	4124.8
10	5.06328	23461.2	-34.8173	Perched Clay	1100	0	664.624	1100	3850.15	0	3850.15	4312.38	4312.38
11	5.06328	24933.3	-33.3334	Perched Clay	1100	0	664.624	1100	4156.63	0	4156.63	4593.76	4593.76
12	5.06328	26269.7	-31.8743	Perched Clay	1100	0	664.624	1100	4439.74	0	4439.74	4853.02	4853.02
13	5.67624	30967.2	-30.3525	Surficial Aquifer	75	32	1681.23	2782.55	4332.98	0	4332.98	5317.48	5317.48
14	5.67624	32514.9	-28.7683	Surficial Aquifer	75	32	1791.19	2964.54	4624.22	0	4624.22	5607.64	5607.64
15	5.67624	33929.9	-27.2079	Surficial Aquifer	75	32	1896.1	3138.17	4902.09	0	4902.09	5876.88	5876.88
16	5.67624	35155.4	-25.669	Surficial Aquifer	75	32	1992.51	3297.75	5157.49	0	5157.49	6115.09	6115.09
17	5.67624	36237.6	-24.1498	Surficial Aquifer	75	32	2082.61	3446.87	5396.13	0	5396.13	6329.9	6329.9
18	5.67624	37206.6	-22.6484	Surficial Aquifer	75	32	2167.81	3587.88	5621.78	0	5621.78	6526.31	6526.31
19	5.73482	38490	-21.1557	Black Creek Confining Unit	933.284	0	563.894	933.284	6198.24	0	6198.24	6416.46	6416.46
20	5.73482	39291.1	-19.6704	Black Creek Confining Unit	997.324	0	602.587	997.324	6366.54	0	6366.54	6581.94	6581.94
21	5.73482	39977.7	-18.1986	Black Creek Confining Unit	1056.35	0	638.251	1056.35	6518.78	0	6518.78	6728.61	6728.61
22	5.73482	40577.6	-16.7392	Black Creek Confining Unit	1110.51	0	670.975	1110.51	6659.17	0	6659.17	6860.97	6860.97
23	5.73482	40999.4	-15.291	Black Creek Confining Unit	1159.9	0	700.816	1159.9	6772.01	0	6772.01	6963.62	6963.62

24	5.51236	39523.7	-13.8804	Black Creek Confining Unit	1203.85	0	727.371	1203.85	6835.08	0	6835.08	7014.82	7014.82
25	5.51236	39501.6	-12.506	Black Creek Confining Unit	1242.62	0	750.796	1242.62	6874.49	0	6874.49	7041.02	7041.02
26	5.51236	39368.4	-11.139	Black Creek Confining Unit	1277.24	0	771.714	1277.24	6895.22	0	6895.22	7047.17	7047.17
27	5.51236	39089.3	-9.77833	Black Creek Confining Unit	1307.77	0	790.16	1307.77	6890.74	0	6890.74	7026.92	7026.92
28	5.51236	38667.2	-8.42323	Black Creek Confining Unit	1334.27	0	806.171	1334.27	6861.22	0	6861.22	6980.6	6980.6
29	5.51236	38127.9	-7.07286	Black Creek Confining Unit	1356.77	0	819.766	1356.77	6810.83	0	6810.83	6912.54	6912.54
30	5.51236	37456	-5.72643	Black Creek Confining Unit	1375.32	0	830.974	1375.32	6736.49	0	6736.49	6819.82	6819.82
31	5.51236	36514.8	-4.38317	Black Creek Confining Unit	1389.95	0	839.813	1389.95	6613.37	0	6613.37	6677.74	6677.74
32	5.51236	35527	-3.04232	Black Creek Confining Unit	1400.68	0	846.297	1400.68	6480.85	0	6480.85	6525.83	6525.83
33	5.51236	34386.6	-1.70313	Black Creek Confining Unit	1407.54	0	850.441	1407.54	6319.6	0	6319.6	6344.89	6344.89
34	8.51884	50960.3	0	Black Creek Confining Unit	1409.99	0	851.922	1409.99	6119.46	0	6119.46	6119.46	6119.46
35	5.8042	33022.4	1.73858	Black Creek Confining Unit	1407.35	0	850.327	1407.35	5881.17	0	5881.17	5855.36	5855.36
36	5.8042	31491.9	3.14876	Black Creek Confining Unit	1399.92	0	845.837	1399.92	5658.92	0	5658.92	5612.39	5612.39
37	5.8042	29980.6	4.56084	Black Creek Confining Unit	1388.19	0	838.75	1388.19	5437.52	0	5437.52	5370.61	5370.61
38	5.8042	28458	5.97571	Black Creek Confining Unit	1372.13	0	829.047	1372.13	5211.52	0	5211.52	5124.74	5124.74
39	5.8042	26935.9	7.39425	Black Creek Confining Unit	1351.71	0	816.709	1351.71	4982.82	0	4982.82	4876.83	4876.83
40	5.8042	25379.9	8.81737	Black Creek Confining Unit	1326.91	0	801.724	1326.91	4745.08	0	4745.08	4620.72	4620.72
41	5.8042	23796.5	10.246	Black Creek Confining Unit	1297.67	0	784.057	1297.67	4499.19	0	4499.19	4357.47	4357.47
42	5.8042	22105.3	11.6811	Black Creek Confining Unit	1263.93	0	763.672	1263.93	4230.54	0	4230.54	4072.65	4072.65

43	5.8042	20221.2	13.1237	Black Creek Confining Unit	1225.63	0	740.531	1225.63	3923.36	0	3923.36	3750.71	3750.71
44	6.31197	19722.4	14.6387	Black Creek Confining Unit	1180.61	0	713.329	1180.61	3576.43	0	3576.43	3390.11	3390.11
45	6.31197	17111	16.2282	Black Creek Confining Unit	1128.32	0	681.736	1128.32	3167.68	0	3167.68	2969.25	2969.25
46	6.31197	14246.7	17.8307	Black Creek Confining Unit	1070.31	0	646.686	1070.31	2709.6	0	2709.6	2501.59	2501.59
47	6.31197	11208.6	19.4477	Black Creek Confining Unit	1006.42	0	608.083	1006.42	2214.21	0	2214.21	1999.51	1999.51
48	6.31197	8056.32	21.081	Black Creek Confining Unit	936.492	0	565.832	936.492	1690.39	0	1690.39	1472.27	1472.27
49	6.33487	4864.84	22.7356	Surficial Aquifer	75	32	464.427	768.659	1110.09	0	1110.09	915.474	915.474
50	6.33487	1620.28	24.4134	Surficial Aquifer	75	32	198.68	328.829	406.211	0	406.211	316.029	316.029

Slope Profile - Slope Long Term

Global Minimum Query (spencer) - Safety Factor: 2.24722

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.15119	1.06355	-45.5677	Light Brown Sand	75	32	29.8151	67.0011	-12.801	0	-12.801	17.6109	17.6109
2	2.22533	276.933	-44.7912	Dark Gray Clay (Long Term)	200	25	97.5542	219.226	41.2296	0	41.2296	138.075	138.075
3	2.22533	749.475	-43.3557	Dark Gray Clay (Long Term)	200	25	130.302	292.816	199.045	0	199.045	322.074	322.074
4	2.22533	1193.53	-41.9534	Dark Gray Clay (Long Term)	200	25	162.009	364.07	351.848	0	351.848	497.483	497.483
5	2.22533	1589.55	-40.5814	Dark Gray Clay (Long Term)	200	25	191.193	429.652	492.492	0	492.492	656.256	656.256
6	2.22533	1945.38	-39.2369	Dark Gray Clay (Long Term)	200	25	218.238	490.428	622.824	0	622.824	801.048	801.048
7	2.22533	2278.16	-37.9178	Dark Gray Clay (Long Term)	200	25	244.233	548.846	748.104	0	748.104	938.357	938.357
8	2.22533	2588.98	-36.6219	Dark Gray Clay (Long Term)	200	25	269.179	604.904	868.32	0	868.32	1068.39	1068.39
9	2.22533	2876.76	-35.3475	Dark Gray Clay (Long Term)	200	25	292.924	658.264	982.75	0	982.75	1190.52	1190.52
10	2.40883	3404.55	-34.042	Light Gray Sand	50	32	325.148	730.68	1089.32	0	1089.32	1308.98	1308.98
11	2.40883	3674.78	-32.7053	Light Gray Sand	50	32	354.07	795.674	1193.33	0	1193.33	1420.68	1420.68
12	2.40883	3918.7	-31.3884	Light Gray Sand	50	32	381.165	856.562	1290.77	0	1290.77	1523.33	1523.33
13	2.40883	4132.4	-30.0897	Light Gray Sand	50	32	405.967	912.298	1379.96	0	1379.96	1615.2	1615.2
14	2.40883	4325.73	-28.8078	Light Gray Sand	50	32	429.297	964.724	1463.86	0	1463.86	1699.95	1699.95
15	2.40883	4496.79	-27.5415	Light Gray Sand	50	32	450.901	1013.27	1541.56	0	1541.56	1776.7	1776.7
16	2.40883	4638.95	-26.2897	Light Gray Sand	50	32	470.061	1056.33	1610.47	0	1610.47	1842.68	1842.68
17	2.40883	4762.19	-25.0513	Light Gray Sand	50	32	487.66	1095.88	1673.76	0	1673.76	1901.69	1901.69
18	2.40883	4867.79	-23.8252	Light Gray Sand	50	32	503.765	1132.07	1731.67	0	1731.67	1954.12	1954.12
19	2.34903	4826.34	-22.6256	Perched Clay (Long Term)	200	24	444.075	997.934	1792.19	0	1792.19	1977.27	1977.27
20	2.34903	4883.69	-21.4513	Perched Clay (Long Term)	200	24	452.137	1016.05	1832.88	0	1832.88	2010.54	2010.54
21	2.34903	4913.29	-20.2864	Perched Clay (Long Term)	200	24	458.167	1029.6	1863.32	0	1863.32	2032.67	2032.67
22	2.34903	4895.41	-19.1302	Perched Clay (Long Term)	200	24	460.609	1035.09	1875.64	0	1875.64	2035.41	2035.41
23	2.34903	4863.55	-17.982	Perched Clay (Long Term)	200	24	461.942	1038.09	1882.37	0	1882.37	2032.31	2032.31
24	2.34903	4832.26	-16.8413	Perched Clay (Long Term)	200	24	463.272	1041.07	1889.08	0	1889.08	2029.32	2029.32
25	2.34903	4791.66	-15.7074	Perched Clay (Long Term)	200	24	463.83	1042.33	1891.9	0	1891.9	2022.34	2022.34

26	2.34903	4730.36	-14.5798	Perched Clay (Long Term)	200	24	462.701	1039.79	1886.2	0	1886.2	2006.55	2006.55
27	2.34903	4638.97	-13.4579	Perched Clay (Long Term)	200	24	459.097	1031.69	1868.01	0	1868.01	1977.87	1977.87
28	2.34903	4540.68	-12.3413	Perched Clay (Long Term)	200	24	454.821	1022.08	1846.43	0	1846.43	1945.94	1945.94
29	2.34903	4460.03	-11.2294	Perched Clay (Long Term)	200	24	451.856	1015.42	1831.46	0	1831.46	1921.17	1921.17
30	2.34903	4371.08	-10.1217	Perched Clay (Long Term)	200	24	448.116	1007.02	1812.59	0	1812.59	1892.58	1892.58
31	2.34903	4266.44	-9.01791	Perched Clay (Long Term)	200	24	442.978	995.469	1786.65	0	1786.65	1856.95	1856.95
32	2.34903	4144.62	-7.91745	Perched Clay (Long Term)	200	24	436.286	980.43	1752.87	0	1752.87	1813.55	1813.55
33	2.34903	4009.58	-6.81993	Perched Clay (Long Term)	200	24	428.336	962.565	1712.75	0	1712.75	1763.98	1763.98
34	2.34903	3847.71	-5.72492	Perched Clay (Long Term)	200	24	417.946	939.216	1660.31	0	1660.31	1702.21	1702.21
35	2.34903	3669.87	-4.63201	Perched Clay (Long Term)	200	24	405.987	912.341	1599.94	0	1599.94	1632.84	1632.84
36	2.34903	3493.67	-3.54078	Perched Clay (Long Term)	200	24	393.939	885.268	1539.14	0	1539.14	1563.51	1563.51
37	2.34903	3317.38	-2.45084	Perched Clay (Long Term)	200	24	381.657	857.667	1477.14	0	1477.14	1493.48	1493.48
38	2.34903	3130.92	-1.36178	Perched Clay (Long Term)	200	24	368.251	827.54	1409.48	0	1409.48	1418.23	1418.23
39	3.52832	4346.12	0	Perched Clay (Long Term)	200	24	350.76	788.236	1321.2	0	1321.2	1321.2	1321.2
40	2.47515	2780.22	1.39102	Perched Clay (Long Term)	200	24	331.363	744.645	1223.29	0	1223.29	1215.25	1215.25
41	2.47515	2557.83	2.53859	Perched Clay (Long Term)	200	24	314.947	707.756	1140.44	0	1140.44	1126.47	1126.47
42	2.47515	2329.45	3.68719	Perched Clay (Long Term)	200	24	297.694	668.984	1053.35	0	1053.35	1034.17	1034.17
43	2.47515	2088.44	4.83727	Perched Clay (Long Term)	200	24	278.994	626.961	958.97	0	958.97	935.359	935.359
44	2.47515	1844.62	5.98931	Perched Clay (Long Term)	200	24	259.677	583.551	861.469	0	861.469	834.225	834.225
45	2.47515	1590.16	7.14379	Perched Clay (Long Term)	200	24	239.022	537.134	757.213	0	757.213	727.256	727.256
46	2.47515	1322.59	8.30119	Perched Clay (Long Term)	200	24	216.761	487.11	644.857	0	644.857	613.231	613.231
47	2.47515	1053.79	9.46202	Perched Clay (Long Term)	200	24	193.93	435.804	529.624	0	529.624	497.303	497.303
48	2.47515	775.663	10.6268	Perched Clay (Long Term)	200	24	169.758	381.483	407.617	0	407.617	375.766	375.766
49	2.47515	483.321	11.796	Perched Clay (Long Term)	200	24	143.737	323.008	276.282	0	276.282	246.264	246.264
50	2.47515	168.283	12.9702	Perched Clay (Long Term)	200	24	114.944	258.304	130.952	0	130.952	104.478	104.478

Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.9781

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	4.99453	1923.7	-57.0409	Light Brown Sand	75	32	101.773	201.317	202.15	0	202.15	359.112	359.112
2	4.99453	5565.85	-54.3202	Light Brown Sand	75	32	252.096	498.672	678.016	0	678.016	1029.11	1029.11
3	4.99453	8834.06	-51.7696	Light Brown Sand	75	32	396.831	784.972	1136.19	0	1136.19	1639.93	1639.93
4	4.59668	10898.1	-49.448	Dark Gray Clay	1300	0	657.196	1300	1471.29	0	1471.29	2239.36	2239.36
5	4.59668	13464.8	-47.3242	Dark Gray Clay	1300	0	657.196	1300	2027.57	0	2027.57	2740.37	2740.37
6	4.59668	15830.2	-45.2827	Dark Gray Clay	1300	0	657.196	1300	2546.4	0	2546.4	3210.11	3210.11
7	6.78092	27148.9	-42.8625	Light Gray Sand	50	32	944.593	1868.5	2910.21	0	2910.21	3786.83	3786.83
8	6.78092	31143.8	-40.085	Light Gray Sand	50	32	1111.14	2197.94	3437.42	0	3437.42	4372.58	4372.58
9	6.85056	34984.6	-37.4037	Perched Clay	1100	0	556.089	1100	4344.57	0	4344.57	4769.79	4769.79
10	6.85056	38028.4	-34.8022	Perched Clay	1100	0	556.089	1100	4823.53	0	4823.53	5210.06	5210.06
11	5.33908	31577.5	-32.5518	Surficial Aquifer	75	32	1537.7	3041.72	4747.75	0	4747.75	5729.33	5729.33
12	5.33908	33136.8	-30.6292	Surficial Aquifer	75	32	1638.64	3241.4	5067.3	0	5067.3	6037.52	6037.52
13	5.33908	34545.2	-28.7442	Surficial Aquifer	75	32	1733.89	3429.81	5368.83	0	5368.83	6319.85	6319.85
14	5.33908	35793.1	-26.8926	Surficial Aquifer	75	32	1822.67	3605.43	5649.86	0	5649.86	6574.26	6574.26
15	5.33908	36871.5	-25.071	Surficial Aquifer	75	32	1904.21	3766.71	5907.97	0	5907.97	6798.79	6798.79
16	5.33908	37828.7	-23.2761	Surficial Aquifer	75	32	1980.67	3917.97	6150.03	0	6150.03	7002.06	7002.06
17	5.80736	42151.4	-21.4284	Black Creek Confining Unit	934.183	0	472.263	934.183	6804.03	0	6804.03	6989.38	6989.38
18	5.80736	43081.8	-19.5271	Black Creek Confining Unit	999.264	0	505.164	999.264	6997.41	0	6997.41	7176.56	7176.56
19	5.80736	43795.2	-17.6479	Black Creek Confining Unit	1057.87	0	534.791	1057.87	7157.81	0	7157.81	7327.94	7327.94
20	5.80736	44342.6	-15.7882	Black Creek Confining Unit	1110.22	0	561.256	1110.22	7293.01	0	7293.01	7451.7	7451.7
21	5.80736	44753.1	-13.9454	Black Creek Confining Unit	1156.48	0	584.642	1156.48	7407.32	0	7407.32	7552.5	7552.5
22	5.85308	45378.6	-12.1101	Black Creek Confining Unit	1196.95	0	605.101	1196.95	7499.99	0	7499.99	7629.83	7629.83
23	5.85308	45494.9	-10.2801	Black Creek Confining Unit	1231.71	0	622.673	1231.71	7567.88	0	7567.88	7680.82	7680.82

24	5.85308	45482.1	-8.46076	Black Creek Confining Unit	1260.69	0	637.324	1260.69	7615.01	0	7615.01	7709.81	7709.81
25	5.85308	45355.3	-6.64995	Black Creek Confining Unit	1283.99	0	649.103	1283.99	7643.54	0	7643.54	7719.22	7719.22
26	5.85308	44993.7	-4.84579	Black Creek Confining Unit	1301.67	0	658.041	1301.67	7632.65	0	7632.65	7688.44	7688.44
27	5.85308	44311.2	-3.04645	Black Creek Confining Unit	1313.78	0	664.163	1313.78	7567.21	0	7567.21	7602.56	7602.56
28	5.85308	43471.4	-1.2501	Black Creek Confining Unit	1320.37	0	667.494	1320.37	7474.32	0	7474.32	7488.88	7488.88
29	5.85308	42466.3	0.545007	Black Creek Confining Unit	1321.45	0	668.04	1321.45	7352.15	0	7352.15	7345.8	7345.8
30	5.85308	41267.5	2.34065	Black Creek Confining Unit	1317.03	0	665.806	1317.03	7195.43	0	7195.43	7168.21	7168.21
31	5.85308	39876.5	4.13861	Black Creek Confining Unit	1307.09	0	660.781	1307.09	7003.84	0	7003.84	6956.02	6956.02
32	5.85308	38341.6	5.94066	Black Creek Confining Unit	1291.6	0	652.95	1291.6	6785.21	0	6785.21	6717.26	6717.26
33	5.85308	36488.1	7.74863	Black Creek Confining Unit	1270.51	0	642.288	1270.51	6508.7	0	6508.7	6421.3	6421.3
34	5.85308	34469.4	9.56441	Black Creek Confining Unit	1243.77	0	628.77	1243.77	6200.19	0	6200.19	6094.25	6094.25
35	5.85308	32262.4	11.39	Black Creek Confining Unit	1211.29	0	612.35	1211.29	5855.04	0	5855.04	5731.68	5731.68
36	5.22261	26909.9	13.1277	Black Creek Confining Unit	1175.34	0	594.176	1175.34	5521.8	0	5521.8	5383.23	5383.23
37	5.22261	25065	14.7781	Black Creek Confining Unit	1136.4	0	574.491	1136.4	5189.03	0	5189.03	5037.48	5037.48
38	5.22261	24322.2	16.4411	Black Creek Confining Unit	1092.62	0	552.358	1092.62	5071.12	0	5071.12	4908.12	4908.12
39	5.22261	20914.6	18.1185	Black Creek Confining Unit	1043.87	0	527.713	1043.87	4419.11	0	4419.11	4246.44	4246.44
40	5.22261	16267.3	19.8122	Black Creek Confining Unit	990.011	0	500.486	990.011	3511.44	0	3511.44	3331.13	3331.13
41	5.22261	14788.2	21.5241	Black Creek Confining Unit	930.891	0	470.599	930.891	3230.94	0	3230.94	3045.34	3045.34
42	5.33908	13542.6	23.2761	Surficial Aquifer	75	32	1083.1	2142.49	3308.67	0	3308.67	2842.75	2842.75
43	5.33908	11989.5	25.071	Surficial Aquifer	75	32	1056.45	2089.76	3224.28	0	3224.28	2730.06	2730.06

44	5.33908	10319.9	26.8926	Surficial Aquifer	75	32	1087.54	2151.27	3322.72	0	3322.72	2771.15	2771.15
45	5.33908	8518.06	28.7442	Surficial Aquifer	75	32	863.839	1708.76	2614.57	0	2614.57	2140.77	2140.77
46	5.33908	6647.46	30.6292	Surficial Aquifer	75	32	609.919	1206.48	1810.74	0	1810.74	1449.62	1449.62
47	5.33908	4722.89	32.5518	Surficial Aquifer	75	32	460.689	911.288	1338.34	0	1338.34	1044.26	1044.26
48	0.978593	648.666	33.7033	Perched Clay	1100	0	556.089	1100	1200.35	0	1200.35	829.433	829.433
49	3.55936	1626.36	34.5462	Compacted Fill	0	35	256.63	507.639	724.985	0	724.985	548.303	548.303
50	2.63975	376.592	35.7072	Roadway	0	45	152.071	300.811	300.811	0	300.811	191.508	191.508

Roadway - Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.64208

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.373152	19.3402	-62.7602	Roadway	0	45	11.5479	18.9625	18.9626	0	18.9626	41.3939	41.3939
2	0.373152	56.2189	-60.4515	Roadway	0	45	35.8714	58.9037	58.9037	0	58.9037	122.181	122.181
3	0.373152	89.8319	-58.2973	Roadway	0	45	60.7456	99.7492	99.7492	0	99.7492	198.095	198.095
4	0.450902	148.018	-56.068	Compacted Fill	0	35	67.8323	111.386	159.076	0	159.076	259.899	259.899
5	0.450902	186.433	-53.7614	Compacted Fill	0	35	89.5651	147.073	210.041	0	210.041	332.244	332.244
6	0.450902	221.75	-51.5755	Compacted Fill	0	35	111.191	182.584	260.757	0	260.757	400.922	400.922
7	0.450902	254.405	-49.4904	Compacted Fill	0	35	132.681	217.872	311.154	0	311.154	466.45	466.45
8	0.450902	284.733	-47.4908	Compacted Fill	0	35	154.016	252.907	361.19	0	361.19	529.215	529.215
9	0.450902	312.994	-45.5649	Compacted Fill	0	35	175.186	287.67	410.836	0	410.836	589.511	589.511
10	0.450902	339.4	-43.7029	Compacted Fill	0	35	196.182	322.147	460.074	0	460.074	647.569	647.569
11	0.450902	362.322	-41.8972	Compacted Fill	0	35	215.929	354.572	506.381	0	506.381	700.104	700.104
12	0.450902	376.043	-40.1412	Compacted Fill	0	35	230.731	378.879	541.094	0	541.094	735.672	735.672
13	0.450902	394.567	-38.4296	Compacted Fill	0	35	248.952	408.799	583.826	0	583.826	781.352	781.352
14	0.450902	411.364	-36.7576	Surficial Aquifer	75	32	282.187	463.374	621.528	0	621.528	832.306	832.306
15	0.450902	424.855	-35.1214	Surficial Aquifer	75	32	296.736	487.265	659.763	0	659.763	868.479	868.479
16	0.450902	437.038	-33.5175	Surficial Aquifer	75	32	310.825	510.4	696.786	0	696.786	902.653	902.653
17	0.450902	448.287	-31.9428	Surficial Aquifer	75	32	324.647	533.096	733.108	0	733.108	935.519	935.519
18	0.450902	458.732	-30.3946	Surficial Aquifer	75	32	338.259	555.448	768.877	0	768.877	967.29	967.29
19	0.450902	469.158	-28.8707	Surficial Aquifer	75	32	352.156	578.268	805.397	0	805.397	999.562	999.562
20	0.450902	478.99	-27.3688	Surficial Aquifer	75	32	365.967	600.947	841.691	0	841.691	1031.14	1031.14
21	0.450902	488.05	-25.887	Surficial Aquifer	75	32	379.561	623.27	877.416	0	877.416	1061.61	1061.61
22	0.450902	496.367	-24.4236	Surficial Aquifer	75	32	392.941	645.241	912.577	0	912.577	1091.02	1091.02
23	0.450902	503.967	-22.977	Surficial Aquifer	75	32	406.111	666.866	947.183	0	947.183	1119.37	1119.37
24	0.450902	510.875	-21.5457	Surficial Aquifer	75	32	419.072	688.15	981.245	0	981.245	1146.71	1146.71
25	0.450902	517.11	-20.1284	Surficial Aquifer	75	32	431.829	709.098	1014.77	0	1014.77	1173.04	1173.04
26	0.450902	522.692	-18.7239	Surficial Aquifer	75	32	444.383	729.713	1047.76	0	1047.76	1198.38	1198.38
27	0.450902	448.982	-17.331	Surficial Aquifer	75	32	395.758	649.866	919.977	0	919.977	1043.48	1043.48
28	0.450902	233.314	-15.9485	Surficial Aquifer	75	32	232.679	382.077	491.427	0	491.427	557.92	557.92
29	0.450902	191.185	-14.5755	Surficial Aquifer	75	32	202.884	333.151	413.129	0	413.129	465.883	465.883

30	0.450902	179.499	-13.211	Surficial Aquifer	75	32	196.859	323.259	397.297	0	397.297	443.51	443.51
31	0.450902	176.634	-11.8542	Surficial Aquifer	75	32	197.931	325.018	400.113	0	400.113	441.658	441.658
32	0.450902	173.192	-10.504	Surficial Aquifer	75	32	198.49	325.937	401.584	0	401.584	438.386	438.386
33	0.450902	169.174	-9.15972	Surficial Aquifer	75	32	198.513	325.974	401.641	0	401.641	433.65	433.65
34	0.450902	164.589	-7.82051	Surficial Aquifer	75	32	197.98	325.099	400.244	0	400.244	427.436	427.436
35	0.450902	159.449	-6.48558	Surficial Aquifer	75	32	196.873	323.282	397.335	0	397.335	419.715	419.715
36	0.450902	153.774	-5.15418	Surficial Aquifer	75	32	195.181	320.503	392.887	0	392.887	410.493	410.493
37	0.450902	147.595	-3.82557	Surficial Aquifer	75	32	192.905	316.765	386.905	0	386.905	399.804	399.804
38	0.450902	140.875	-2.49901	Surficial Aquifer	75	32	189.974	311.953	379.205	0	379.205	387.496	387.496
39	0.450902	133.613	-1.1738	Surficial Aquifer	75	32	186.354	306.008	369.69	0	369.69	373.508	373.508
40	0.450902	125.81	0.150789	Surficial Aquifer	75	32	182.006	298.868	358.265	0	358.265	357.786	357.786
41	0.450902	117.466	1.47546	Surficial Aquifer	75	32	176.887	290.463	344.814	0	344.814	340.258	340.258
42	0.450902	108.582	2.80091	Surficial Aquifer	75	32	170.953	280.718	329.217	0	329.217	320.853	320.853
43	0.450902	99.2139	4.12787	Surficial Aquifer	75	32	164.21	269.646	311.499	0	311.499	299.648	299.648
44	0.450902	89.3345	5.45705	Surficial Aquifer	75	32	156.579	257.115	291.444	0	291.444	276.486	276.486
45	0.449109	77.7496	6.78653	Compacted Fill	0	35	102.51	168.329	240.399	0	240.399	228.2	228.2
46	0.449109	65.0808	8.11704	Compacted Fill	0	35	88.1139	144.69	206.639	0	206.639	194.072	194.072
47	0.449109	51.7656	9.45197	Compacted Fill	0	35	72.0276	118.275	168.914	0	168.914	156.923	156.923
48	0.449109	37.7971	10.7921	Compacted Fill	0	35	54.0939	88.8265	126.857	0	126.857	116.546	116.546
49	0.449109	23.1631	12.1382	Compacted Fill	0	35	34.1295	56.0433	80.0381	0	80.0381	72.6975	72.6975
50	0.449109	7.83506	13.4912	Compacted Fill	0	35	13.6923	22.4838	32.1102	0	32.1102	28.8252	28.8252

Roadway - Roadway Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 1.81979

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.515508	35.0858	-69.0845	Light Gray Sand	50	32	27.517	50.0752	0.120305	0	0.120305	72.1219	72.1219
2	0.515508	98.5276	-65.3204	Light Gray Sand	50	32	47.439	86.329	58.1386	0	58.1386	161.375	161.375
3	0.515508	150.774	-62.0406	Light Gray Sand	50	32	66.1629	120.403	112.668	0	112.668	237.315	237.315
4	0.515508	195.284	-59.0857	Light Gray Sand	50	32	83.9553	152.781	164.485	0	164.485	304.684	304.684
5	0.515508	233.977	-56.3681	Light Gray Sand	50	32	100.963	183.731	214.014	0	214.014	365.791	365.791
6	0.515508	268.057	-53.8329	Light Gray Sand	50	32	117.275	213.416	261.521	0	261.521	421.95	421.95
7	0.515508	298.337	-51.4434	Light Gray Sand	50	32	132.955	241.951	307.187	0	307.187	473.996	473.996
8	0.515508	325.399	-49.1735	Light Gray Sand	50	32	148.049	269.418	351.142	0	351.142	522.498	522.498
9	0.515508	349.66	-47.0035	Light Gray Sand	50	32	162.583	295.867	393.469	0	393.469	567.839	567.839
10	0.515508	371.17	-44.9185	Light Gray Sand	50	32	176.467	321.133	433.903	0	433.903	609.869	609.869
11	0.515508	390.389	-42.9068	Light Gray Sand	50	32	189.794	345.385	472.716	0	472.716	649.125	649.125
12	0.515508	407.635	-40.9588	Light Gray Sand	50	32	202.624	368.734	510.081	0	510.081	685.964	685.964
13	0.515508	423.081	-39.0668	Light Gray Sand	50	32	214.973	391.206	546.043	0	546.043	720.54	720.54
14	0.504425	426.867	-37.2436	Perched Clay (Long Term)	200	24	250.307	455.507	573.877	0	573.877	764.172	764.172
15	0.504425	437.695	-35.483	Perched Clay (Long Term)	200	24	258.263	469.984	606.394	0	606.394	790.495	790.495
16	0.504425	447.239	-33.7602	Perched Clay (Long Term)	200	24	265.86	483.81	637.446	0	637.446	815.157	815.157
17	0.504425	455.576	-32.0714	Perched Clay (Long Term)	200	24	273.111	497.004	667.082	0	667.082	838.214	838.214
18	0.504425	462.774	-30.4132	Perched Clay (Long Term)	200	24	280.022	509.582	695.331	0	695.331	859.706	859.706
19	0.504425	468.89	-28.7828	Perched Clay (Long Term)	200	24	286.602	521.556	722.226	0	722.226	879.674	879.674
20	0.504425	473.977	-27.1775	Perched Clay (Long Term)	200	24	292.856	532.937	747.788	0	747.788	898.151	898.151
21	0.504425	479.473	-25.595	Perched Clay (Long Term)	200	24	299.342	544.74	774.299	0	774.299	917.688	917.688
22	0.504425	491.353	-24.0332	Perched Clay (Long Term)	200	24	308.498	561.401	811.72	0	811.72	949.286	949.286
23	0.504425	514.551	-22.4901	Perched Clay (Long Term)	200	24	322.51	586.9	868.992	0	868.992	1002.51	1002.51
24	0.504425	612.605	-20.9641	Perched Clay (Long Term)	200	24	368.319	670.263	1056.23	0	1056.23	1197.35	1197.35
25	0.504425	623.211	-19.4535	Perched Clay (Long Term)	200	24	378.275	688.381	1096.92	0	1096.92	1230.53	1230.53
26	0.504425	632.689	-17.9569	Perched Clay (Long Term)	200	24	387.95	705.988	1136.47	0	1136.47	1262.2	1262.2

27	0.504425	641.363	-16.4729	Perched Clay (Long Term)	200	24	397.476	723.323	1175.4	0	1175.4	1292.94	1292.94
28	0.504425	649.251	-15.0001	Perched Clay (Long Term)	200	24	406.855	740.391	1213.74	0	1213.74	1322.76	1322.76
29	0.504425	656.37	-13.5374	Perched Clay (Long Term)	200	24	416.09	757.197	1251.48	0	1251.48	1351.67	1351.67
30	0.504425	662.735	-12.0837	Perched Clay (Long Term)	200	24	425.185	773.747	1288.66	0	1288.66	1379.68	1379.68
31	0.504425	668.36	-10.6378	Perched Clay (Long Term)	200	24	434.142	790.047	1325.27	0	1325.27	1406.81	1406.81
32	0.504425	673.255	-9.19876	Perched Clay (Long Term)	200	24	442.964	806.101	1361.33	0	1361.33	1433.06	1433.06
33	0.504425	677.43	-7.76554	Perched Clay (Long Term)	200	24	451.654	821.916	1396.85	0	1396.85	1458.44	1458.44
34	0.504425	680.892	-6.3372	Perched Clay (Long Term)	200	24	460.216	837.496	1431.84	0	1431.84	1482.95	1482.95
35	0.504425	683.649	-4.91281	Perched Clay (Long Term)	200	24	468.651	852.847	1466.32	0	1466.32	1506.6	1506.6
36	0.504425	615.094	-3.49145	Perched Clay (Long Term)	200	24	440.29	801.235	1350.39	0	1350.39	1377.26	1377.26
37	0.504425	270.329	-2.07225	Perched Clay (Long Term)	200	24	264.731	481.754	632.83	0	632.83	642.409	642.409
38	0.496474	95.8493	-0.665482	Roadway	0	45	136.663	248.698	248.697	0	248.697	250.285	250.285
39	0.496474	93.2891	0.729703	Roadway	0	45	137.015	249.338	249.338	0	249.338	247.593	247.593
40	0.496474	89.8581	2.12532	Roadway	0	45	136.043	247.57	247.571	0	247.571	242.522	242.522
41	0.496474	85.5548	3.5222	Roadway	0	45	133.626	243.171	243.172	0	243.172	234.947	234.947
42	0.496474	80.376	4.92119	Roadway	0	45	129.623	235.886	235.885	0	235.885	224.724	224.724
43	0.496474	74.3169	6.32312	Roadway	0	45	123.871	225.42	225.42	0	225.42	211.694	211.694
44	0.496474	67.3712	7.72887	Roadway	0	45	116.187	211.436	211.436	0	211.436	195.668	195.668
45	0.496474	59.5307	9.13931	Roadway	0	45	106.351	193.536	193.536	0	193.536	176.427	176.427
46	0.496474	50.7857	10.5554	Roadway	0	45	94.1098	171.26	171.26	0	171.26	153.723	153.723
47	0.496474	41.1243	11.978	Roadway	0	45	79.163	144.06	144.06	0	144.06	127.265	127.265
48	0.496474	30.5328	13.4081	Roadway	0	45	61.1543	111.288	111.288	0	111.288	96.7102	96.7102
49	0.496474	18.9955	14.8469	Roadway	0	45	39.6589	72.1708	72.1708	0	72.1708	61.6578	61.6578
50	0.496474	6.49412	16.2952	Roadway	0	45	12.5755	22.8848	22.8849	0	22.8849	19.2087	19.2087

Roadway - Roadway Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.64208

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.373152	19.3402	-62.7602	Roadway	0	45	11.5479	18.9625	18.9626	0	18.9626	41.3939	41.3939
2	0.373152	56.2189	-60.4515	Roadway	0	45	35.8714	58.9037	58.9037	0	58.9037	122.181	122.181
3	0.373152	89.8319	-58.2973	Roadway	0	45	60.7456	99.7492	99.7492	0	99.7492	198.095	198.095
4	0.450902	148.018	-56.068	Compacted Fill	0	35	67.8323	111.386	159.076	0	159.076	259.899	259.899
5	0.450902	186.433	-53.7614	Compacted Fill	0	35	89.5651	147.073	210.041	0	210.041	332.244	332.244
6	0.450902	221.75	-51.5755	Compacted Fill	0	35	111.191	182.584	260.757	0	260.757	400.922	400.922
7	0.450902	254.405	-49.4904	Compacted Fill	0	35	132.681	217.872	311.154	0	311.154	466.45	466.45
8	0.450902	284.733	-47.4908	Compacted Fill	0	35	154.016	252.907	361.19	0	361.19	529.215	529.215
9	0.450902	312.994	-45.5649	Compacted Fill	0	35	175.186	287.67	410.836	0	410.836	589.511	589.511
10	0.450902	339.4	-43.7029	Compacted Fill	0	35	196.182	322.147	460.074	0	460.074	647.569	647.569
11	0.450902	362.322	-41.8972	Compacted Fill	0	35	215.929	354.572	506.381	0	506.381	700.104	700.104
12	0.450902	376.043	-40.1412	Compacted Fill	0	35	230.731	378.879	541.094	0	541.094	735.672	735.672
13	0.450902	394.567	-38.4296	Compacted Fill	0	35	248.952	408.799	583.826	0	583.826	781.352	781.352
14	0.450902	411.364	-36.7576	Surficial Aquifer	75	32	282.187	463.374	621.528	0	621.528	832.306	832.306
15	0.450902	424.855	-35.1214	Surficial Aquifer	75	32	296.736	487.265	659.763	0	659.763	868.479	868.479
16	0.450902	437.038	-33.5175	Surficial Aquifer	75	32	310.825	510.4	696.786	0	696.786	902.653	902.653
17	0.450902	448.287	-31.9428	Surficial Aquifer	75	32	324.647	533.096	733.108	0	733.108	935.519	935.519
18	0.450902	458.732	-30.3946	Surficial Aquifer	75	32	338.259	555.448	768.877	0	768.877	967.29	967.29
19	0.450902	469.158	-28.8707	Surficial Aquifer	75	32	352.156	578.268	805.397	0	805.397	999.562	999.562
20	0.450902	478.99	-27.3688	Surficial Aquifer	75	32	365.967	600.947	841.691	0	841.691	1031.14	1031.14
21	0.450902	488.05	-25.887	Surficial Aquifer	75	32	379.561	623.27	877.416	0	877.416	1061.61	1061.61
22	0.450902	496.367	-24.4236	Surficial Aquifer	75	32	392.941	645.241	912.577	0	912.577	1091.02	1091.02
23	0.450902	503.967	-22.977	Surficial Aquifer	75	32	406.111	666.866	947.183	0	947.183	1119.37	1119.37
24	0.450902	510.875	-21.5457	Surficial Aquifer	75	32	419.072	688.15	981.245	0	981.245	1146.71	1146.71
25	0.450902	517.11	-20.1284	Surficial Aquifer	75	32	431.829	709.098	1014.77	0	1014.77	1173.04	1173.04
26	0.450902	522.692	-18.7239	Surficial Aquifer	75	32	444.383	729.713	1047.76	0	1047.76	1198.38	1198.38
27	0.450902	448.982	-17.331	Surficial Aquifer	75	32	395.758	649.866	919.977	0	919.977	1043.48	1043.48
28	0.450902	233.314	-15.9485	Surficial Aquifer	75	32	232.679	382.077	491.427	0	491.427	557.92	557.92
29	0.450902	191.185	-14.5755	Surficial Aquifer	75	32	202.884	333.151	413.129	0	413.129	465.883	465.883

30	0.450902	179.499	-13.211	Surficial Aquifer	75	32	196.859	323.259	397.297	0	397.297	443.51	443.51
31	0.450902	176.634	-11.8542	Surficial Aquifer	75	32	197.931	325.018	400.113	0	400.113	441.658	441.658
32	0.450902	173.192	-10.504	Surficial Aquifer	75	32	198.49	325.937	401.584	0	401.584	438.386	438.386
33	0.450902	169.174	-9.15972	Surficial Aquifer	75	32	198.513	325.974	401.641	0	401.641	433.65	433.65
34	0.450902	164.589	-7.82051	Surficial Aquifer	75	32	197.98	325.099	400.244	0	400.244	427.436	427.436
35	0.450902	159.449	-6.48558	Surficial Aquifer	75	32	196.873	323.282	397.335	0	397.335	419.715	419.715
36	0.450902	153.774	-5.15418	Surficial Aquifer	75	32	195.181	320.503	392.887	0	392.887	410.493	410.493
37	0.450902	147.595	-3.82557	Surficial Aquifer	75	32	192.905	316.765	386.905	0	386.905	399.804	399.804
38	0.450902	140.875	-2.49901	Surficial Aquifer	75	32	189.974	311.953	379.205	0	379.205	387.496	387.496
39	0.450902	133.613	-1.1738	Surficial Aquifer	75	32	186.354	306.008	369.69	0	369.69	373.508	373.508
40	0.450902	125.81	0.150789	Surficial Aquifer	75	32	182.006	298.868	358.265	0	358.265	357.786	357.786
41	0.450902	117.466	1.47546	Surficial Aquifer	75	32	176.887	290.463	344.814	0	344.814	340.258	340.258
42	0.450902	108.582	2.80091	Surficial Aquifer	75	32	170.953	280.718	329.217	0	329.217	320.853	320.853
43	0.450902	99.2139	4.12787	Surficial Aquifer	75	32	164.21	269.646	311.499	0	311.499	299.648	299.648
44	0.450902	89.3345	5.45705	Surficial Aquifer	75	32	156.579	257.115	291.444	0	291.444	276.486	276.486
45	0.449109	77.7496	6.78653	Compacted Fill	0	35	102.51	168.329	240.399	0	240.399	228.2	228.2
46	0.449109	65.0808	8.11704	Compacted Fill	0	35	88.1139	144.69	206.639	0	206.639	194.072	194.072
47	0.449109	51.7656	9.45197	Compacted Fill	0	35	72.0276	118.275	168.914	0	168.914	156.923	156.923
48	0.449109	37.7971	10.7921	Compacted Fill	0	35	54.0939	88.8265	126.857	0	126.857	116.546	116.546
49	0.449109	23.1631	12.1382	Compacted Fill	0	35	34.1295	56.0433	80.0381	0	80.0381	72.6975	72.6975
50	0.449109	7.83506	13.4912	Compacted Fill	0	35	13.6923	22.4838	32.1102	0	32.1102	28.8252	28.8252

Interslice Data

◆ Slope Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.65507

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	378.364	125.333	0	0	0
2	383.749	118.789	535.475	86.4169	9.16756
3	389.134	112.694	2653.53	428.237	9.16757
4	394.519	107	5990.13	966.71	9.16757
5	399.885	101.684	8267.49	1334.24	9.16757
6	405.252	96.6929	12750	2057.64	9.16755
7	410.618	92	19012.4	3068.3	9.16759
8	415.75	87.7701	24708	3987.46	9.16754
9	420.881	83.775	30497.5	4921.79	9.16754
10	426.013	80	36246.3	5849.56	9.16756
11	431.076	76.4787	46440.9	7494.8	9.16756
12	436.14	73.1485	56920.1	9185.97	9.16756
13	441.203	70	67535.3	10899.1	9.16756
14	446.879	66.6761	72400.6	11684.3	9.16758
15	452.555	63.5596	76650.8	12370.2	9.16757
16	458.232	60.6415	80199.9	12943	9.16759
17	463.908	57.9135	82966.5	13389.4	9.16753
18	469.584	55.3684	84885.6	13699.2	9.16759
19	475.26	53	85902.8	13863.3	9.16755
20	480.995	50.7807	96426.7	15561.7	9.16756
21	486.73	48.7307	106025	17110.6	9.16751
22	492.465	46.8453	114657	18503.7	9.16753
23	498.2	45.1205	122297	19736.8	9.16759
24	503.934	43.5526	128898	20802.1	9.16759
25	509.447	42.1904	134202	21658	9.16756
26	514.959	40.9678	138471	22346.9	9.16754
27	520.471	39.8824	141703	22868.6	9.16758
28	525.984	38.9324	143897	23222.6	9.16755
29	531.496	38.1161	145056	23409.7	9.16757
30	537.009	37.4322	145198	23432.7	9.1676
31	542.521	36.8794	144344	23294.8	9.16757
32	548.033	36.4569	142512	22999.1	9.16756
33	553.546	36.1639	139749	22553.1	9.16752
34	559.058	36	136099	21964.2	9.16758
35	567.577	36	128846	20793.7	9.16759
36	573.381	36.1762	122878	19830.5	9.16756
37	579.185	36.4955	116164	18747.1	9.16762
38	584.989	36.9585	108782	17555.6	9.16754
39	590.794	37.566	100806	16268.5	9.16759
40	596.598	38.3193	92315.6	14898.2	9.16754
41	602.402	39.2196	83392.9	13458.3	9.16759
42	608.206	40.2688	74124.5	11962.5	9.16757
43	614.01	41.4688	64618.1	10428.3	9.16755
44	619.815	42.822	55013.4	8878.27	9.16757
45	626.127	44.4707	44617.2	7200.5	9.16758
46	632.439	46.3078	34497.3	5567.3	9.16756
47	638.751	48.3381	24916.7	4021.14	9.16754
48	645.063	50.5668	16146	2605.69	9.16752
49	651.374	53	8463.61	1365.89	9.16757
50	657.709	55.6546	2576.54	415.812	9.16757
51	664.044	58.53	0	0	0

Slope Profile - Slope Long Term

Global Minimum Query (spencer) - Safety Factor: 2.24722

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	494.439	107.154	0	0	0
2	494.59	107	-6.48196	-1.653	14.3064
3	496.816	104.791	-132.493	-33.7878	14.3064
4	499.041	102.69	-4.24279	-1.08198	14.3064
5	501.266	100.689	339.073	86.4688	14.3064
6	503.492	98.7832	852.326	217.357	14.3064
7	505.717	96.9659	1498.54	382.151	14.3064
8	507.942	95.2324	2251.85	574.258	14.3064
9	510.168	93.5784	3089.03	787.75	14.3064
10	512.393	92	3988.33	1017.09	14.3064
11	514.802	90.3727	4977.78	1269.41	14.3064
12	517.211	88.8259	5970.66	1522.61	14.3064
13	519.619	87.3562	6949.51	1772.23	14.3064
14	522.028	85.9604	7897.7	2014.04	14.3064
15	524.437	84.6357	8802.75	2244.84	14.3064
16	526.846	83.3796	9653.06	2461.68	14.3064
17	529.255	82.1896	10437.2	2661.64	14.3063
18	531.664	81.0637	11146.9	2842.63	14.3064
19	534.072	80	11775.4	3002.9	14.3063
20	536.421	79.021	12486.8	3184.33	14.3064
21	538.77	78.098	13116.5	3344.9	14.3063
22	541.119	77.2297	13658.1	3483.03	14.3064
23	543.468	76.4148	14104.4	3596.84	14.3064
24	545.818	75.6524	14454.4	3686.11	14.3064
25	548.167	74.9414	14709.4	3751.14	14.3064
26	550.516	74.2807	14869.7	3792	14.3064
27	552.865	73.6698	14935.2	3808.71	14.3064
28	555.214	73.1076	14906.8	3801.47	14.3064
29	557.563	72.5937	14787.4	3771.01	14.3064
30	559.912	72.1273	14580.1	3718.14	14.3063
31	562.261	71.708	14287.5	3643.54	14.3064
32	564.61	71.3352	13913	3548.03	14.3064
33	566.959	71.0085	13460.7	3432.7	14.3064
34	569.308	70.7275	12935.7	3298.81	14.3064
35	571.657	70.4921	12344.9	3148.15	14.3064
36	574.006	70.3017	11695.7	2982.6	14.3065
37	576.355	70.1564	10994.1	2803.66	14.3064
38	578.704	70.0558	10246	2612.9	14.3064
39	581.053	70	9459.7	2412.37	14.3064
40	584.581	70	8222.08	2096.76	14.3064
41	587.056	70.0601	7328.37	1868.85	14.3064
42	589.532	70.1698	6423.66	1638.13	14.3064
43	592.007	70.3293	5518.79	1407.38	14.3064
44	594.482	70.5388	4627.36	1180.05	14.3064
45	596.957	70.7985	3760.89	959.087	14.3064
46	599.432	71.1087	2934.37	748.31	14.3064
47	601.907	71.4699	2164.96	552.098	14.3064
48	604.382	71.8824	1466.47	373.971	14.3063
49	606.858	72.3468	856.98	218.543	14.3064
50	609.333	72.8637	358.391	91.3953	14.3064
51	611.808	73.4338	0	0	0

Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.9781

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	358.759	127.999	0	0	0
2	363.754	120.296	1047.68	128.159	6.97414
3	368.748	113.34	4501.84	550.697	6.97418
4	373.743	107	9718.78	1188.87	6.97418
5	378.339	101.628	14594.9	1785.36	6.97421
6	382.936	96.6423	21675.8	2651.53	6.97416
7	387.533	92	30469	3727.18	6.97417
8	394.314	85.707	42362.9	5182.14	6.97419
9	401.095	80	54428.6	6658.1	6.97418
10	407.945	74.7616	73368.8	8974.99	6.97418
11	414.796	70	92518.5	11317.5	6.97417
12	420.135	66.5918	100471	12290.3	6.97416
13	425.474	63.4307	107721	13177.2	6.97418
14	430.813	60.5022	114164	13965.4	6.9742
15	436.152	57.7944	119709	14643.7	6.9742
16	441.491	55.2967	124276	15202.3	6.97417
17	446.83	53	127802	15633.6	6.97416
18	452.637	50.7208	140560	17194.4	6.97422
19	458.445	48.6612	152032	18597.6	6.97416
20	464.252	46.8137	162143	19834.5	6.97418
21	470.06	45.1716	170852	20899.8	6.97417
22	475.867	43.7296	178131	21790.2	6.97416
23	481.72	42.4737	184000	22508.2	6.97418
24	487.573	41.4121	188381	23044.1	6.97418
25	493.426	40.5415	191272	23397.8	6.97419
26	499.279	39.8591	192680	23570	6.97418
27	505.132	39.3629	192607	23561.1	6.97419
28	510.985	39.0514	191068	23372.8	6.97418
29	516.839	38.9236	188107	23010.6	6.97418
30	522.692	38.9793	183778	22481.1	6.9742
31	528.545	39.2186	178151	21792.7	6.97418
32	534.398	39.6421	171308	20955.7	6.97421
33	540.251	40.2511	163345	19981.6	6.9742
34	546.104	41.0476	154394	18886.5	6.97415
35	551.957	42.0338	144590	17687.3	6.97419
36	557.81	43.2129	134094	16403.3	6.97416
37	563.033	44.4309	124258	15200.1	6.97417
38	568.255	45.8087	114102	13957.7	6.97414
39	573.478	47.3498	103395	12648	6.97417
40	578.701	49.0587	93080.8	11386.3	6.97417
41	583.923	50.9402	83854.2	10257.6	6.97415
42	589.146	53	74735.7	9142.21	6.97418
43	594.485	55.2967	61340.6	7503.62	6.97418
44	599.824	57.7944	47633.9	5826.92	6.97418
45	605.163	60.5022	32816.9	4014.4	6.97418
46	610.502	63.4307	20537.7	2512.31	6.97416
47	615.841	66.5918	11549.7	1412.84	6.97417
48	621.18	70	4523.14	553.303	6.97418
49	622.159	70.6527	3194.22	390.739	6.97417
50	625.718	73.1032	502.106	61.4212	6.97418
51	628.358	75.0006	0	0	0

Roadway - Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.64208

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	623.74	75.1237	0	0	0
2	624.113	74.3989	9.43851	4.12111	23.5874
3	624.487	73.7406	34.835	15.2099	23.5874
4	624.86	73.1365	72.4435	31.6308	23.5874
5	625.311	72.4663	148.492	64.8354	23.5873
6	625.761	71.8511	237.353	103.635	23.5874
7	626.212	71.2827	335.464	146.473	23.5874
8	626.663	70.755	439.893	192.069	23.5874
9	627.114	70.263	548.168	239.345	23.5874
10	627.565	69.8032	658.164	287.372	23.5874
11	628.016	69.3722	768.027	335.341	23.5874
12	628.467	68.9677	875.577	382.3	23.5874
13	628.918	68.5874	977.36	426.742	23.5874
14	629.369	68.2297	1074.05	468.96	23.5874
15	629.82	67.8929	1156.23	504.84	23.5873
16	630.271	67.5757	1231.76	537.821	23.5874
17	630.721	67.2771	1299.8	567.526	23.5873
18	631.172	66.996	1359.61	593.642	23.5874
19	631.623	66.7315	1410.55	615.883	23.5873
20	632.074	66.4829	1452.1	634.024	23.5873
21	632.525	66.2495	1483.65	647.803	23.5874
22	632.976	66.0306	1504.62	656.957	23.5874
23	633.427	65.8259	1514.42	661.237	23.5874
24	633.878	65.6347	1512.51	660.404	23.5874
25	634.329	65.4567	1498.37	654.229	23.5874
26	634.78	65.2914	1471.49	642.492	23.5874
27	635.23	65.1386	1431.38	624.98	23.5874
28	635.681	64.9979	1382.5	603.638	23.5874
29	636.132	64.869	1340.98	585.508	23.5874
30	636.583	64.7518	1298	566.741	23.5873
31	637.034	64.6459	1251.35	546.372	23.5873
32	637.485	64.5513	1200.03	523.965	23.5874
33	637.936	64.4677	1144.16	499.572	23.5874
34	638.387	64.395	1083.91	473.266	23.5875
35	638.838	64.333	1019.49	445.137	23.5874
36	639.289	64.2818	951.147	415.296	23.5874
37	639.739	64.2411	879.178	383.873	23.5874
38	640.19	64.2109	803.921	351.013	23.5873
39	640.641	64.1913	725.781	316.895	23.5873
40	641.092	64.182	645.225	281.723	23.5874
41	641.543	64.1832	562.789	245.729	23.5874
42	641.994	64.1948	479.079	209.179	23.5874
43	642.445	64.2169	394.785	172.374	23.5874
44	642.896	64.2494	310.655	135.64	23.5873
45	643.347	64.2925	227.547	99.3531	23.5874
46	643.796	64.3459	168.691	73.6552	23.5874
47	644.245	64.41	115.909	50.609	23.5874
48	644.694	64.4848	70.9534	30.9802	23.5874
49	645.143	64.5704	35.8157	15.6381	23.5874
50	645.592	64.667	12.767	5.5744	23.5873
51	646.041	64.7747	0	0	0

Roadway - Roadway Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 1.81979

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	558.002	89.4384	0	0	0
2	558.518	88.0895	-14.0098	-6.16931	23.7666
3	559.033	86.9677	26.7804	11.7929	23.7666
4	559.549	85.9965	102.126	44.972	23.7667
5	560.064	85.1356	200.486	88.2852	23.7666
6	560.58	84.3606	314.34	138.422	23.7667
7	561.095	83.6554	438.365	193.037	23.7666
8	561.611	83.0087	568.568	250.373	23.7666
9	562.126	82.412	701.832	309.056	23.7666
10	562.642	81.8591	835.639	367.979	23.7666
11	563.157	81.3451	967.798	426.176	23.7666
12	563.673	80.8659	1096.55	482.874	23.7667
13	564.188	80.4184	1220.44	537.43	23.7667
14	564.704	80	1338.21	589.291	23.7667
15	565.208	79.6165	1432.14	630.654	23.7667
16	565.713	79.2569	1520.04	669.358	23.7666
17	566.217	78.9198	1600.98	705.004	23.7667
18	566.722	78.6037	1674.2	737.243	23.7666
19	567.226	78.3076	1738.96	765.765	23.7667
20	567.73	78.0305	1794.67	790.294	23.7666
21	568.235	77.7715	1840.75	810.586	23.7666
22	568.739	77.5299	1876.98	826.542	23.7666
23	569.244	77.3049	1904.1	838.482	23.7666
24	569.748	77.0961	1923.05	846.826	23.7666
25	570.252	76.9028	1941.56	854.981	23.7667
26	570.757	76.7247	1946.36	857.094	23.7666
27	571.261	76.5612	1936.64	852.813	23.7666
28	571.766	76.412	1911.65	841.808	23.7666
29	572.27	76.2769	1870.66	823.759	23.7666
30	572.775	76.1554	1812.97	798.351	23.7665
31	573.279	76.0474	1737.85	765.275	23.7666
32	573.783	75.9527	1644.63	724.222	23.7666
33	574.288	75.871	1532.59	674.888	23.7667
34	574.792	75.8022	1401.07	616.969	23.7666
35	575.297	75.7462	1249.35	550.16	23.7666
36	575.801	75.7028	1076.75	474.153	23.7666
37	576.306	75.672	896.421	394.745	23.7666
38	576.81	75.6538	774.559	341.082	23.7666
39	577.306	75.648	708.206	311.863	23.7666
40	577.803	75.6543	638.668	281.242	23.7666
41	578.299	75.6728	566.628	249.518	23.7666
42	578.796	75.7033	492.917	217.059	23.7666
43	579.292	75.7461	418.538	184.306	23.7666
44	579.789	75.8011	344.695	151.789	23.7666
45	580.285	75.8685	272.818	120.137	23.7666
46	580.782	75.9483	204.609	90.1008	23.7666
47	581.278	76.0409	142.085	62.5682	23.7667
48	581.775	76.1462	87.6458	38.5954	23.7666
49	582.271	76.2645	44.1412	19.4379	23.7666
50	582.768	76.3961	14.9716	6.59284	23.7666
51	583.264	76.5413	0	0	0

◆ Roadway - Roadway Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.64208

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	623.74	75.1237	0	0	0
2	624.113	74.3989	9.43851	4.12111	23.5874
3	624.487	73.7406	34.835	15.2099	23.5874
4	624.86	73.1365	72.4435	31.6308	23.5874
5	625.311	72.4663	148.492	64.8354	23.5873
6	625.761	71.8511	237.353	103.635	23.5874
7	626.212	71.2827	335.464	146.473	23.5874
8	626.663	70.755	439.893	192.069	23.5874
9	627.114	70.263	548.168	239.345	23.5874
10	627.565	69.8032	658.164	287.372	23.5874
11	628.016	69.3722	768.027	335.341	23.5874
12	628.467	68.9677	875.577	382.3	23.5874
13	628.918	68.5874	977.36	426.742	23.5874
14	629.369	68.2297	1074.05	468.96	23.5874
15	629.82	67.8929	1156.23	504.84	23.5873
16	630.271	67.5757	1231.76	537.821	23.5874
17	630.721	67.2771	1299.8	567.526	23.5873
18	631.172	66.996	1359.61	593.642	23.5874
19	631.623	66.7315	1410.55	615.883	23.5873
20	632.074	66.4829	1452.1	634.024	23.5873
21	632.525	66.2495	1483.65	647.803	23.5874
22	632.976	66.0306	1504.62	656.957	23.5874
23	633.427	65.8259	1514.42	661.237	23.5874
24	633.878	65.6347	1512.51	660.404	23.5874
25	634.329	65.4567	1498.37	654.229	23.5874
26	634.78	65.2914	1471.49	642.492	23.5874
27	635.23	65.1386	1431.38	624.98	23.5874
28	635.681	64.9979	1382.5	603.638	23.5874
29	636.132	64.869	1340.98	585.508	23.5874
30	636.583	64.7518	1298	566.741	23.5873
31	637.034	64.6459	1251.35	546.372	23.5873
32	637.485	64.5513	1200.03	523.965	23.5874
33	637.936	64.4677	1144.16	499.572	23.5874
34	638.387	64.395	1083.91	473.266	23.5875
35	638.838	64.333	1019.49	445.137	23.5874
36	639.289	64.2818	951.147	415.296	23.5874
37	639.739	64.2411	879.178	383.873	23.5874
38	640.19	64.2109	803.921	351.013	23.5873
39	640.641	64.1913	725.781	316.895	23.5873
40	641.092	64.182	645.225	281.723	23.5874
41	641.543	64.1832	562.789	245.729	23.5874
42	641.994	64.1948	479.079	209.179	23.5874
43	642.445	64.2169	394.785	172.374	23.5874
44	642.896	64.2494	310.655	135.64	23.5873
45	643.347	64.2925	227.547	99.3531	23.5874
46	643.796	64.3459	168.691	73.6552	23.5874
47	644.245	64.41	115.909	50.609	23.5874
48	644.694	64.4848	70.9534	30.9802	23.5874
49	645.143	64.5704	35.8157	15.6381	23.5874
50	645.592	64.667	12.767	5.5744	23.5873
51	646.041	64.7747	0	0	0

Discharge Sections

Entity Information

Slope Profile

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 142
	0, 107
	0, 92
	0, 80
	0, 70
	0, 53
	0, 36
	0, 10
	0, 0
	1183.51, 0
	1183.51, 10
	1183.51, 27.78
	1122.45, 34
	1102.83, 36
	1085.74, 38
	1067.38, 40
	1015.58, 42
	1000.24, 44
	988.29, 46
	976.05, 48
	947.3, 50
	939.34, 50
	872.7, 48
	791.94, 48
	713.29, 50
	695.4, 52
	689.565, 53
	683.73, 54
	673.91, 56
	666.18, 58
	658.12, 60
	651, 62
	644.29, 64
	637.84, 66
	631.45, 68
	624.6, 70
	617.12, 72
	609.71, 74
	601.22, 76
	593.6, 78
	586.57, 80
	580.02, 82
	573.92, 84
	568.47, 86

	562.49, 88 556.25, 90 551.04, 92 544.96, 94 539.37, 96 532.34, 98 525.29, 100 517.7, 102 509.48, 104 501.07, 106 495.325, 107 489.58, 108 478.83, 110 467.64, 112 456.55, 114 443.68, 116 431.63, 118 418.03, 120 403.81, 122 389.05, 124 373.02, 126 358.75, 128 342.14, 130 327.29, 132 314.25, 134 294.87, 136 271.2, 138 228.51, 140 32.88, 142 12.96, 142
Material Boundary	0, 70 624.6, 70
Material Boundary	0, 53 689.565, 53
Material Boundary	0, 36 1102.83, 36
Material Boundary	0, 10 1183.51, 10
Material Boundary	0, 80 586.57, 80
Material Boundary	0, 92 551.04, 92
Material Boundary	0, 107 495.325, 107

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Slope Long Term
Piezoline	0, 46.73 1067.38, 40	Assigned to: 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	Assigned to: ▨ Black Creek Confining Unit (Long Term) 🟧 Black Creek Aquifer ▨ Upper Cape Fear Confining Unit (Long Term)

Roadway

Shared Entities

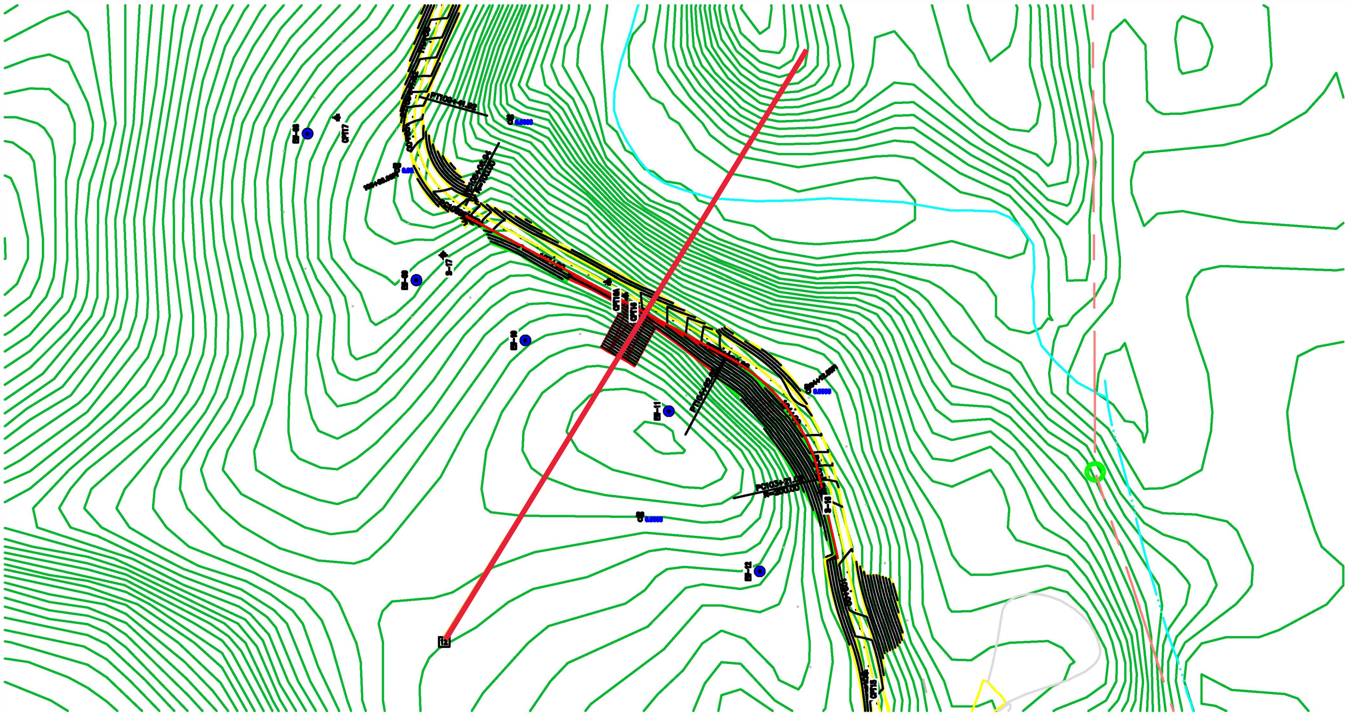
Type	Coordinates (x,y)
	0, 142 0, 107 0, 92 0, 80 0, 70 0, 53 0, 36 0, 10 0, 0 1183.51, 0 1183.51, 10 1183.51, 27.78 1122.45, 34 1102.83, 36 1085.74, 38 1067.38, 40 1015.58, 42 1000.24, 44 988.29, 46 976.05, 48 947.3, 50 939.34, 50 872.7, 48 791.94, 48 713.29, 50 695.4, 52 689.565, 53 683.73, 54 673.91, 56 667.8, 57.58 666.51, 58 663.43, 59 660.42, 60 657.38, 61 654.29, 62 651.3, 63 648.35, 64 645.37, 65 642.38, 66 639.42, 67 636.48, 68 635.81, 69

External Boundary	635.71, 70 635.63, 71 635.54, 72 635.44, 73 635.35, 74 628.38, 75 602.54, 75.6891 590.88, 76 576.81, 77 576.73, 78 576.64, 79 576.54, 80 576.46, 81 576.37, 82 576.27, 83 576.249, 83.2365 576.18, 84 576.09, 85 575.99, 86 572.7, 86 570.647, 86 569.69, 86 568.47, 86 562.49, 88 556.25, 90 551.04, 92 544.96, 94 539.37, 96 532.34, 98 525.29, 100 517.7, 102 509.48, 104 501.07, 106 495.325, 107 489.58, 108 478.83, 110 467.64, 112 456.55, 114 443.68, 116 431.63, 118 418.03, 120 403.81, 122 389.05, 124 373.02, 126 358.75, 128 342.14, 130 327.29, 132 314.25, 134 294.87, 136 271.2, 138 228.51, 140 32.88, 142 12.96, 142
Material Boundary	0, 70 624.6, 70 629.15, 70 634, 70 635.71, 70

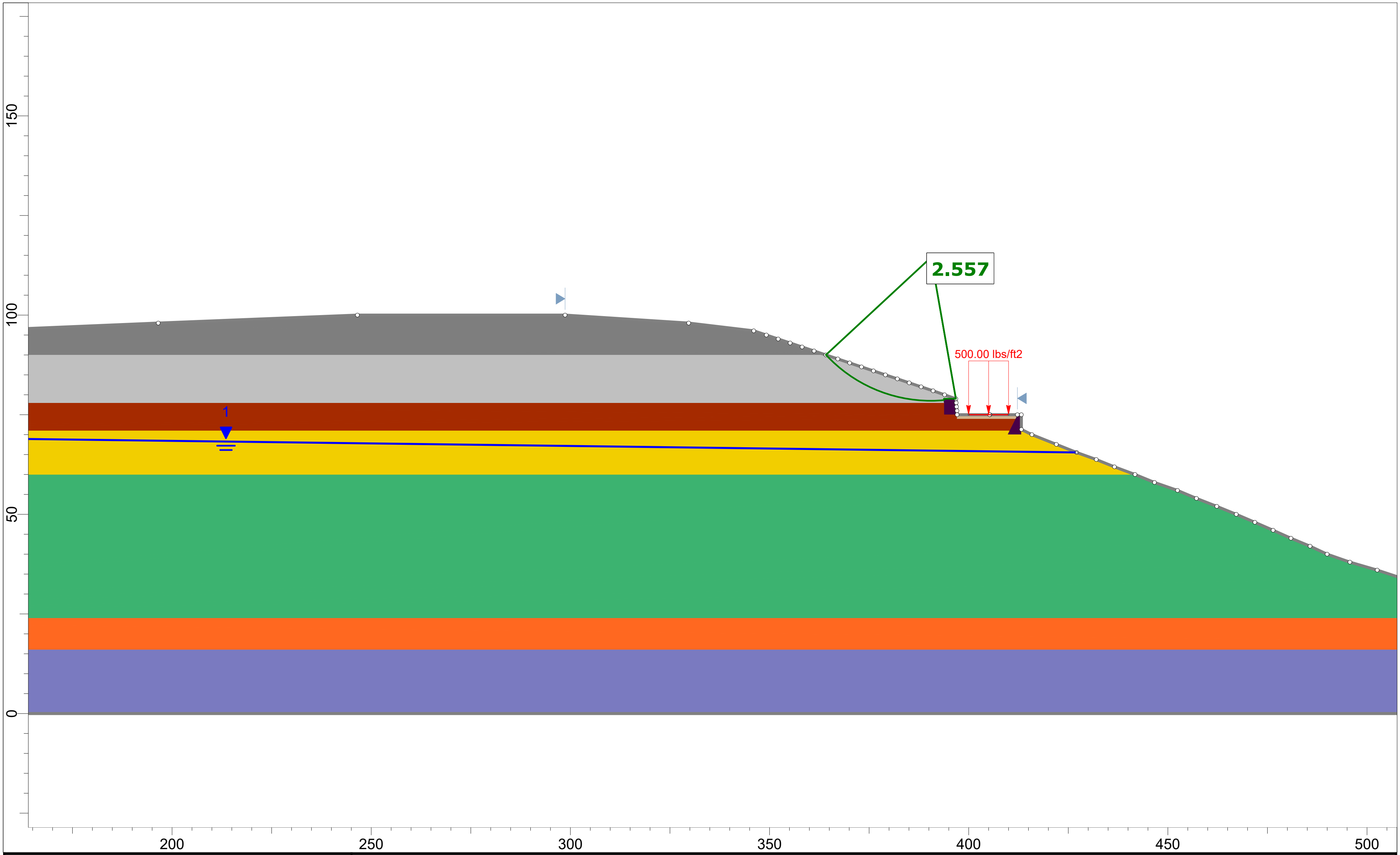
Material Boundary	0, 53 689.565, 53
Material Boundary	0, 10 1183.51, 10
Material Boundary	0, 36 1102.83, 36
Material Boundary	0, 80 569.69, 80 572.7, 80 576.54, 80
Material Boundary	0, 92 551.04, 92
Material Boundary	0, 107 495.325, 107
Material Boundary	635.35, 74 629.15, 74 629.15, 70 629.15, 68.0876 631.15, 68 631.45, 68 636.48, 68
Material Boundary	569.69, 86 569.69, 80 569.69, 77 576.81, 77
Material Boundary	576.81, 77 576.81, 75 610.904, 73.6778 628.38, 73 628.38, 75
Material Boundary	602.54, 75.6891 609.71, 74 610.904, 73.6778 617.12, 72 624.6, 70 629.15, 68.0876 631.45, 68 637.84, 66 644.29, 64 651, 62 658.12, 60 666.18, 58 667.8, 57.58

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Short Term Downslope	Roadway Long Term Upslope	Roadway Long Term Downslope
Piezoline	0, 46.73 1067.38, 40	Assigned to: 🟧 Black Creek Aquifer	Assigned to: 🟧 Black Creek Aquifer	Assigned to: 🟩 Black Creek Confining U (Long Term 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confin Unit (Long Term)	Assigned to: 🟩 Black Creek Confining U (Long Term 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confin Unit (Long Term)
Distributed Load	607.997, 75.5435 597.995, 75.8103	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No
Distributed Load	597.995, 75.8103 607.997, 75.5435			Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No

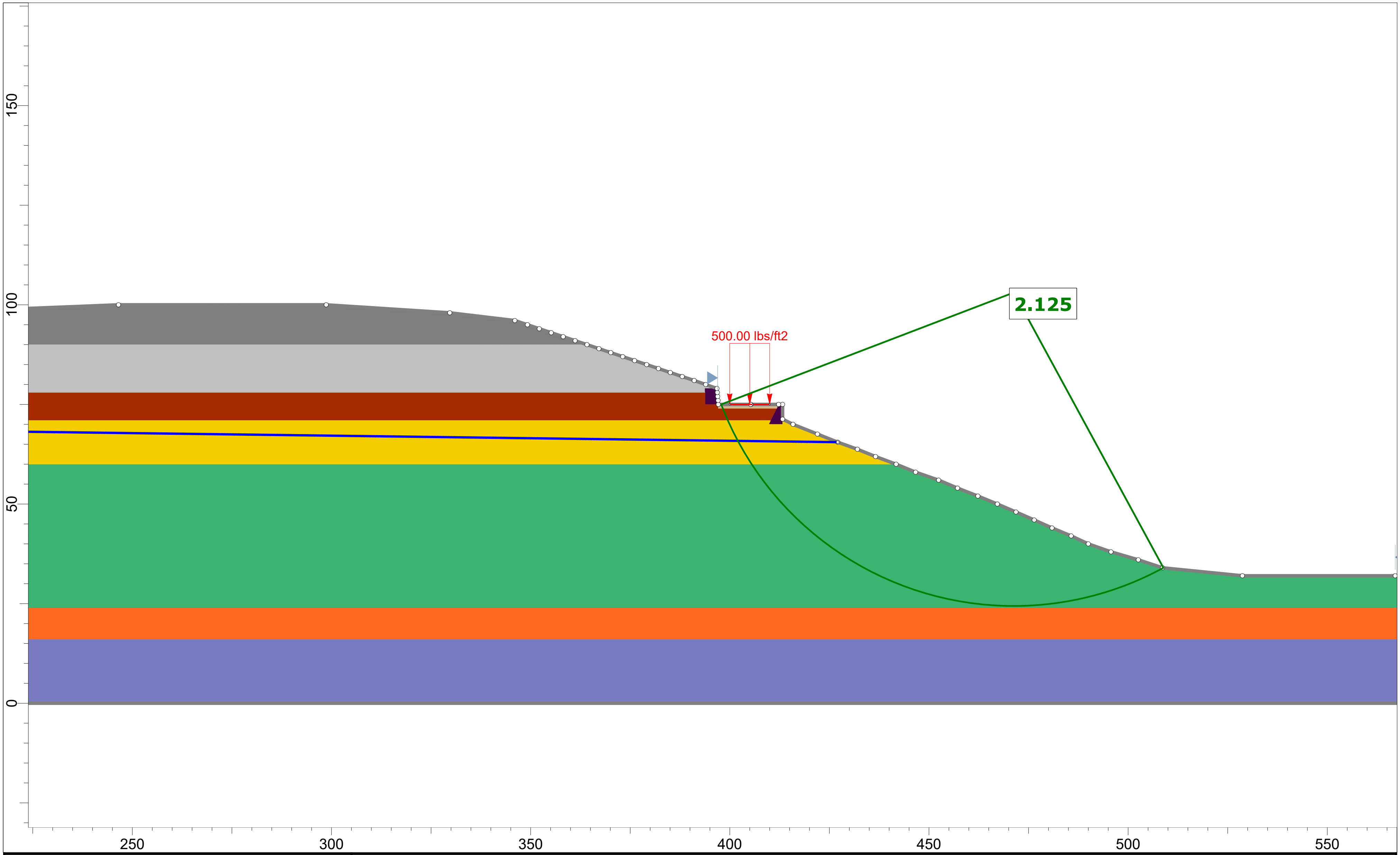


Section: 12, Steep Natural Grade with Retaining Wall Supported Cut and Fill
Approximate Station: 105+90



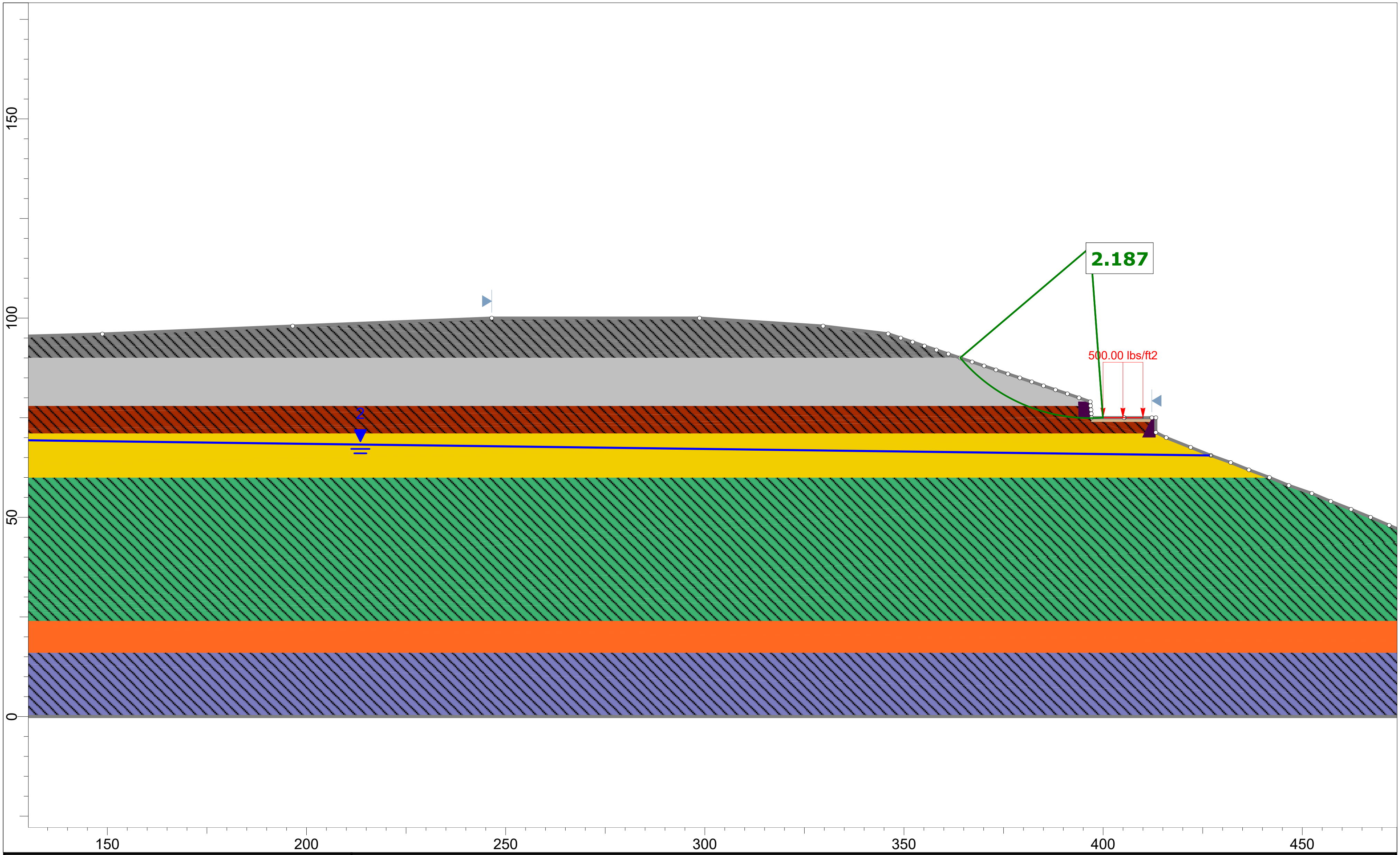
GEOS
Geotechnical, Environmental and Materials Engineers
SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Upslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_105+90_section_12.slmd



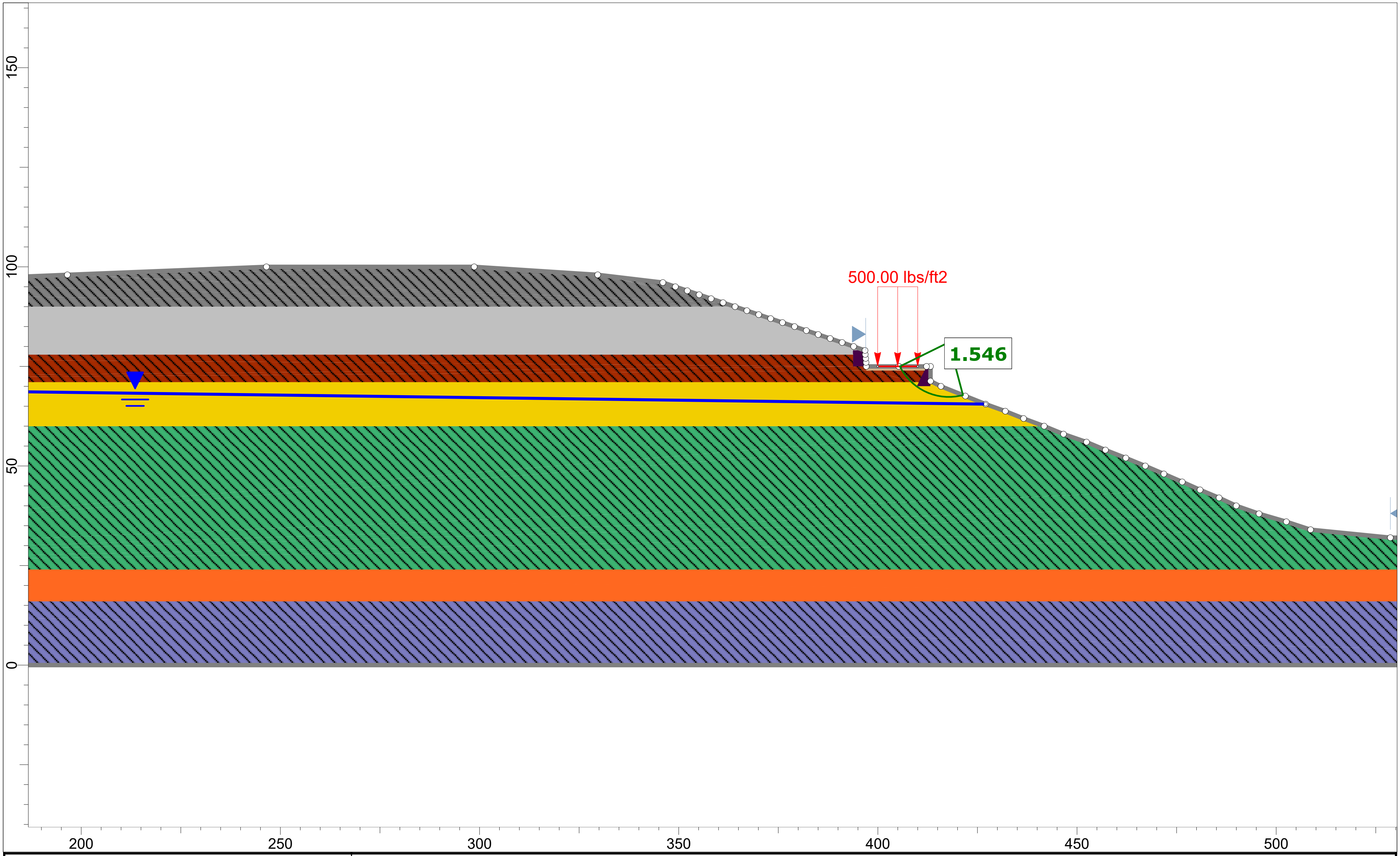
Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_105+90_section_12.slmd

GEOS
Geotechnical, Environmental and Materials Engineers
SLIDEINTERPRET 9.016



Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Upslope	*Scenario*	Long Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_105+90_section_12.slmd

GEOS
Geotechnical, Environmental and Materials Engineers
SLIDEINTERPRET 9.016



Project	
	45-20803 Barrier Wall Road Interim Design and Repair

Group	Roadway Downslope	Scenario	Long Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	section_105+90_section_12.slmd

GEOS
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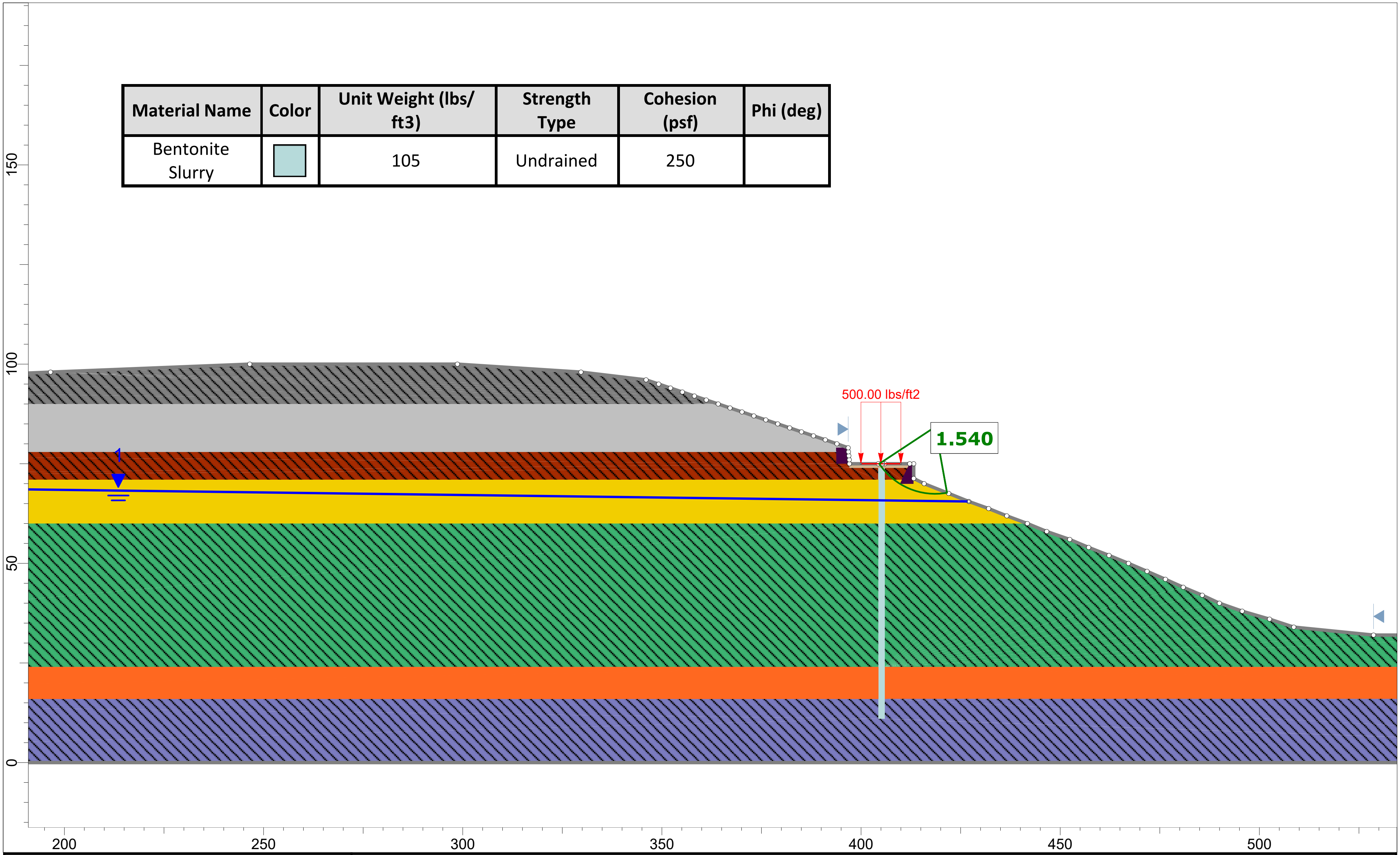
SLIDEINTERPRET 9.016



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bentonite Slurry	🟦	105	Undrained	250	

GEOS Geotechnical, Environmental and Materials Engineers

SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair
Group	Roadway with 0.5m Barrier Wall
Scenario	Long Term Slope Stability Analysis
Drawn By	
Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM
File Name	section_105+90_section_12_with_BarrierWall.slmd

rocscience

GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Steep Natural Grade with Retaining Walls Supported Cut and Fill
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.016

Table of Contents

Slide Analysis Information

section_105+90_section_12

Project Summary

File Name:	section_105+90_section_12.slmd
Slide Modeler Version:	9.016
Project Title:	45-20803 Barrier Wall Road Interim Design and Repair
Analysis:	Roadway: Long Term Slope Stability
Company:	GeoServices LLC
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Ground Profile ◆	Master Scenario	Spencer: 2.125130	00h:00m:04.128s
	Long Term	Spencer: 1.899780	00h:00m:08.284s
Roadway ◆	Master Scenario	Spencer: 2.557330	00h:00m:11.222s
	Short Term Downslope	Spencer: 2.125270	00h:00m:03.473s
	Long Term Upslope	Spencer: 2.186900	00h:00m:05.637s
	Long Term Downslope	Spencer: 1.545810	00h:00m:06.459s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Surface Options

◆ Ground Profile

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

◆ Roadway

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Enabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Loading

◆ Roadway

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Materials

Retaining Wall	
Color	🟪
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	135
Allow Sliding Along Boundary	Yes
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay	
Color	■
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0
Light Gray Sand	
Color	□
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay	
Color	🟥
Strength Type	Undrained
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1100
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	200
Friction Angle [deg]	24

Water Surface	Assigned per scenario
Ru Value	0
Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit	
Color	🟪
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	2500
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	26

Water Surface	Assigned per scenario
Ru Value	0
Roadway	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	145
Cohesion [psf]	0
Friction Angle [deg]	45
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material	Ground Profile	Long Term	Roadway	Short Term Downslope	Long Term Upslope	Long Term Downslope
Retaining Wall	✗	✗	✓	✓	✓	✓
Dark Gray Clay	✓	✗	✓	✓	✓	✓
Dark Gray Clay (Long Term)	✗	✓	✗	✗	✓	✓
Light Gray Sand	✓	✓	✓	✓	✓	✓
Perched Clay	✓	✗	✓	✓	✗	✗
Perched Clay (Long Term)	✗	✓	✗	✗	✓	✓
Surficial Aquifer	✓	✓	✓	✓	✓	✓
Black Creek Confining Unit	✓	✗	✓	✓	✗	✗
Black Creek Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Black Creek Aquifer	✓	✓	✓	✓	✓	✓
Upper Cape Fear Confining Unit	✓	✗	✓	✓	✗	✗
Upper Cape Fear Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Roadway	✗	✗	✓	✓	✓	✓

Global Minimums

Ground Profile - Master Scenario

Method: spencer

FS	2.125130
Center:	396.008, 111.763
Radius:	33.585
Left Slip Surface Endpoint:	370.430, 90.000
Right Slip Surface Endpoint:	398.493, 78.271
Resisting Moment:	240451 lb-ft
Driving Moment:	113147 lb-ft
Resisting Horizontal Force:	6518.76 lb
Driving Horizontal Force:	3067.47 lb
Total Slice Area:	81.425 ft2
Surface Horizontal Width:	28.0631 ft
Surface Average Height:	2.9015 ft

Ground Profile - Long Term

Method: spencer

FS	1.899780
Center:	412.696, 136.609
Radius:	67.539
Left Slip Surface Endpoint:	361.262, 92.836
Right Slip Surface Endpoint:	417.720, 69.257
Resisting Moment:	1.883e+06 lb-ft
Driving Moment:	991165 lb-ft
Resisting Horizontal Force:	25284.2 lb
Driving Horizontal Force:	13309 lb
Total Slice Area:	352.87 ft2
Surface Horizontal Width:	56.4576 ft
Surface Average Height:	6.25019 ft

Roadway - Master Scenario

Method: spencer

FS	2.557330
Center:	390.557, 114.505
Radius:	36.041
Left Slip Surface Endpoint:	364.124, 90.005
Right Slip Surface Endpoint:	396.770, 79.004
Resisting Moment:	324677 lb-ft
Driving Moment:	126959 lb-ft
Resisting Horizontal Force:	8342.1 lb
Driving Horizontal Force:	3262.03 lb
Total Slice Area:	102.181 ft2
Surface Horizontal Width:	32.6462 ft
Surface Average Height:	3.12995 ft

Roadway - Short Term Downslope

Method: spencer

FS	2.125270
Center:	471.296, 103.080
Radius:	78.652
Left Slip Surface Endpoint:	397.828, 75.000
Right Slip Surface Endpoint:	508.860, 33.978
Resisting Moment:	1.41403e+07 lb-ft
Driving Moment:	6.65344e+06 lb-ft
Resisting Horizontal Force:	156541 lb
Driving Horizontal Force:	73657.1 lb
Total Slice Area:	2298.63 ft2
Surface Horizontal Width:	111.033 ft
Surface Average Height:	20.7023 ft

Roadway - Long Term Upslope

Method: spencer

FS	2.186900
Center:	396.822, 117.809
Radius:	42.924
Left Slip Surface Endpoint:	364.118, 90.007
Right Slip Surface Endpoint:	399.960, 75.000
Resisting Moment:	596864 lb-ft
Driving Moment:	272927 lb-ft
Resisting Horizontal Force:	12814.7 lb
Driving Horizontal Force:	5859.75 lb
Total Slice Area:	164.913 ft2
Surface Horizontal Width:	35.8416 ft
Surface Average Height:	4.60118 ft

Roadway - Long Term Downslope

Method: spencer

FS	1.545810
Center:	417.839, 81.067
Radius:	13.725
Left Slip Surface Endpoint:	405.528, 75.000
Right Slip Surface Endpoint:	421.377, 67.805
Resisting Moment:	87718.1 lb-ft
Driving Moment:	56745.7 lb-ft
Resisting Horizontal Force:	5297.55 lb
Driving Horizontal Force:	3427.04 lb
Total Slice Area:	48.9127 ft2
Surface Horizontal Width:	15.8493 ft
Surface Average Height:	3.08612 ft

Global Minimum Support Data

All Open Scenarios

No Supports Present

Valid and Invalid Surfaces

Ground Profile - Master Scenario

Method: spencer

Number of Valid Surfaces:	9845
Number of Invalid Surfaces:	0

Ground Profile - Long Term

Method: spencer

Number of Valid Surfaces:	9189
Number of Invalid Surfaces:	0

Roadway - Master Scenario

Method: spencer

Number of Valid Surfaces:	8137
Number of Invalid Surfaces:	0

Roadway - Short Term Downslope

Method: spencer

Number of Valid Surfaces:	4862
Number of Invalid Surfaces:	0

Roadway - Long Term Upslope

Method: spencer

Number of Valid Surfaces:	8679
Number of Invalid Surfaces:	0

Roadway - Long Term Downslope

Method: spencer

Number of Valid Surfaces:	7240
Number of Invalid Surfaces:	0

Slice Data

Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.12513

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.561262	13.7468	-48.9425	Light Gray Sand	50	32	24.4888	52.0418	3.2676	0	3.2676	31.3816	31.3816
2	0.561262	40.1721	-47.441	Light Gray Sand	50	32	33.4588	71.1044	33.774	0	33.774	70.2126	70.2126
3	0.561262	64.588	-46.0434	Light Gray Sand	50	32	42.082	89.4297	63.1008	0	63.1008	106.744	106.744
4	0.561262	87.1897	-44.6803	Light Gray Sand	50	32	50.3866	107.078	91.344	0	91.344	141.171	141.171
5	0.561262	108.104	-43.3485	Light Gray Sand	50	32	58.3729	124.05	118.505	0	118.505	173.606	173.606
6	0.561262	127.442	-42.0455	Light Gray Sand	50	32	66.0416	140.347	144.586	0	144.586	204.145	204.145
7	0.561262	145.299	-40.7686	Light Gray Sand	50	32	73.3932	155.97	169.587	0	169.587	232.868	232.868
8	0.561262	161.761	-39.5158	Light Gray Sand	50	32	80.428	170.92	193.513	0	193.513	259.85	259.85
9	0.561262	176.902	-38.2852	Light Gray Sand	50	32	87.1471	185.199	216.363	0	216.363	285.152	285.152
10	0.561262	191.165	-37.0752	Light Gray Sand	50	32	93.6922	199.108	238.622	0	238.622	309.417	309.417
11	0.561262	204.905	-35.8842	Light Gray Sand	50	32	100.183	212.901	260.696	0	260.696	333.174	333.174
12	0.561262	217.518	-34.7109	Light Gray Sand	50	32	106.375	226.061	281.756	0	281.756	355.444	355.444
13	0.561262	229.041	-33.554	Light Gray Sand	50	32	112.264	238.575	301.782	0	301.782	376.24	376.24
14	0.561262	239.517	-32.4123	Light Gray Sand	50	32	117.849	250.444	320.777	0	320.777	395.602	395.602
15	0.561262	248.985	-31.285	Light Gray Sand	50	32	123.129	261.665	338.735	0	338.735	413.554	413.554
16	0.561262	257.484	-30.171	Light Gray Sand	50	32	128.104	272.238	355.656	0	355.656	430.128	430.128
17	0.561262	265.044	-29.0694	Light Gray Sand	50	32	132.774	282.161	371.534	0	371.534	445.342	445.342
18	0.561262	271.698	-27.9795	Light Gray Sand	50	32	137.135	291.43	386.369	0	386.369	459.222	459.222
19	0.561262	277.472	-26.9005	Light Gray Sand	50	32	141.188	300.042	400.152	0	400.152	471.782	471.782
20	0.561262	282.392	-25.8317	Light Gray Sand	50	32	144.93	307.995	412.878	0	412.878	483.039	483.039
21	0.561262	285.156	-24.7725	Light Gray Sand	50	32	147.78	314.051	422.571	0	422.571	490.769	490.769
22	0.561262	285.42	-23.7223	Light Gray Sand	50	32	149.551	317.815	428.593	0	428.593	494.31	494.31
23	0.561262	284.887	-22.6804	Light Gray Sand	50	32	150.97	320.83	433.418	0	433.418	496.509	496.509
24	0.561262	283.584	-21.6464	Light Gray Sand	50	32	152.036	323.096	437.044	0	437.044	497.382	497.382
25	0.561262	281.527	-20.6198	Light Gray Sand	50	32	152.746	324.606	439.462	0	439.462	496.936	496.936
26	0.561262	278.731	-19.6001	Light Gray Sand	50	32	153.097	325.352	440.655	0	440.655	495.171	495.171
27	0.561262	275.21	-18.5867	Light Gray Sand	50	32	153.085	325.326	440.613	0	440.613	492.093	492.093
28	0.561262	270.979	-17.5794	Light Gray Sand	50	32	152.705	324.519	439.322	0	439.322	487.702	487.702
29	0.561262	265.999	-16.5776	Light Gray Sand	50	32	151.93	322.87	436.683	0	436.683	481.91	481.91

30	0.561262	260.075	-15.5811	Light Gray Sand	50	32	150.651	320.152	432.334	0	432.334	474.342	474.342
31	0.561262	253.438	-14.5893	Light Gray Sand	50	32	148.967	316.575	426.609	0	426.609	465.382	465.382
32	0.561262	246.132	-13.602	Light Gray Sand	50	32	146.89	312.161	419.545	0	419.545	455.087	455.087
33	0.561262	238.167	-12.6188	Light Gray Sand	50	32	144.413	306.897	411.12	0	411.12	443.45	443.45
34	0.561262	229.55	-11.6394	Light Gray Sand	50	32	141.529	300.767	401.31	0	401.31	430.463	430.463
35	0.561262	220.288	-10.6634	Light Gray Sand	50	32	138.229	293.754	390.088	0	390.088	416.115	416.115
36	0.561262	210.389	-9.69052	Light Gray Sand	50	32	134.505	285.841	377.425	0	377.425	400.394	400.394
37	0.561262	199.861	-8.72046	Light Gray Sand	50	32	130.351	277.013	363.298	0	363.298	383.292	383.292
38	0.561262	188.958	-7.75291	Light Gray Sand	50	32	125.889	267.53	348.122	0	348.122	365.261	365.261
39	0.561262	177.582	-6.78758	Light Gray Sand	50	32	121.057	257.262	331.688	0	331.688	346.097	346.097
40	0.561262	165.587	-5.82419	Light Gray Sand	50	32	115.766	246.018	313.695	0	313.695	325.504	325.504
41	0.561262	152.978	-4.86244	Light Gray Sand	50	32	110.004	233.773	294.099	0	294.099	303.457	303.457
42	0.561262	139.756	-3.90206	Light Gray Sand	50	32	103.758	220.499	272.855	0	272.855	279.932	279.932
43	0.561262	125.925	-2.94279	Light Gray Sand	50	32	97.0134	206.166	249.918	0	249.918	254.906	254.906
44	0.561262	111.35	-1.98433	Light Gray Sand	50	32	89.6787	190.579	224.974	0	224.974	228.081	228.081
45	0.561262	95.8818	-1.02644	Light Gray Sand	50	32	81.6472	173.511	197.658	0	197.658	199.121	199.121
46	0.561262	79.7987	-0.0688274	Light Gray Sand	50	32	73.0581	155.258	168.448	0	168.448	168.535	168.535
47	0.561262	63.1101	0.888763	Light Gray Sand	50	32	63.8977	135.791	137.294	0	137.294	136.303	136.303
48	0.561262	45.8157	1.8466	Light Gray Sand	50	32	54.1461	115.067	104.13	0	104.13	102.384	102.384
49	0.561262	27.9149	2.80496	Light Gray Sand	50	32	43.7811	93.0406	68.8794	0	68.8794	66.7344	66.7344
50	0.561262	9.40638	3.7641	Light Gray Sand	50	32	32.7407	69.5782	31.3317	0	31.3317	29.1776	29.1776

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.89978

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.27765	90.729	-48.7778	Dark Gray Clay (Long Term)	200	25	103.01	195.697	-9.22812	0	-9.22812	108.348	108.348
2	1.27765	266.01	-47.1584	Dark Gray Clay (Long Term)	200	25	125.795	238.983	83.6003	0	83.6003	219.249	219.249
3	1.09396	355.226	-45.697	Light Gray Sand	50	32	90.0357	171.048	193.718	0	193.718	285.971	285.971
4	1.09396	455.004	-44.3833	Light Gray Sand	50	32	110.857	210.603	257.019	0	257.019	365.515	365.515
5	1.09396	532.902	-43.0985	Light Gray Sand	50	32	128.051	243.269	309.295	0	309.295	429.117	429.117
6	1.09396	604.508	-41.8401	Light Gray Sand	50	32	144.497	274.513	359.296	0	359.296	488.674	488.674
7	1.09396	670.715	-40.6061	Light Gray Sand	50	32	160.301	304.537	407.345	0	407.345	544.769	544.769
8	1.09396	731.822	-39.3944	Light Gray Sand	50	32	175.462	333.339	453.437	0	453.437	597.534	597.534
9	1.09396	788.48	-38.2034	Light Gray Sand	50	32	190.059	361.071	497.818	0	497.818	647.398	647.398
10	1.09396	840.999	-37.0316	Light Gray Sand	50	32	204.112	387.768	540.542	0	540.542	694.528	694.528
11	1.09396	889.133	-35.8777	Light Gray Sand	50	32	217.524	413.248	581.318	0	581.318	738.65	738.65
12	1.09396	933.074	-34.7403	Light Gray Sand	50	32	230.293	437.506	620.139	0	620.139	779.841	779.841
13	1.09396	973.126	-33.6184	Light Gray Sand	50	32	242.448	460.597	657.092	0	657.092	818.286	818.286
14	1.09396	1012.09	-32.5109	Light Gray Sand	50	32	254.587	483.66	694.001	0	694.001	856.259	856.259
15	1.09396	1048.45	-31.4169	Light Gray Sand	50	32	266.352	506.011	729.77	0	729.77	892.46	892.46
16	1.09396	1081.22	-30.3355	Light Gray Sand	50	32	277.492	527.173	763.637	0	763.637	926.021	926.021
17	1.16891	1185.63	-29.2297	Perched Clay (Long Term)	200	24	291.553	553.886	794.839	0	794.839	957.98	957.98
18	1.16891	1211.26	-28.0994	Perched Clay (Long Term)	200	24	298.532	567.145	824.618	0	824.618	984.015	984.015
19	1.16891	1228.77	-26.9809	Perched Clay (Long Term)	200	24	304.264	578.034	849.08	0	849.08	1003.98	1003.98
20	1.16891	1234.04	-25.8735	Perched Clay (Long Term)	200	24	308.017	585.165	865.097	0	865.097	1014.49	1014.49
21	1.16891	1235.51	-24.7763	Perched Clay (Long Term)	200	24	311.143	591.103	878.433	0	878.433	1022.05	1022.05
22	1.16891	1233.5	-23.6888	Perched Clay (Long Term)	200	24	313.677	595.917	889.245	0	889.245	1026.87	1026.87
23	1.16891	1227.66	-22.6102	Perched Clay (Long Term)	200	24	315.54	599.457	897.197	0	897.197	1028.61	1028.61
24	1.16891	1217.5	-21.5401	Perched Clay (Long Term)	200	24	316.632	601.531	901.855	0	901.855	1026.84	1026.84
25	1.16891	1204.08	-20.4778	Perched Clay (Long Term)	200	24	317.111	602.442	903.9	0	903.9	1022.32	1022.32
26	1.16891	1187.5	-19.4227	Perched Clay (Long Term)	200	24	316.981	602.195	903.346	0	903.346	1015.11	1015.11

27	1.16891	1168.3	-18.3745	Perched Clay (Long Term)	200	24	316.325	600.947	900.546	0	900.546	1005.62	1005.62
28	1.16891	1147.27	-17.3327	Perched Clay (Long Term)	200	24	315.27	598.944	896.044	0	896.044	994.437	994.437
29	1.16891	1123.3	-16.2967	Perched Clay (Long Term)	200	24	313.606	595.782	888.941	0	888.941	980.626	980.626
30	1.16891	1095.94	-15.2661	Perched Clay (Long Term)	200	24	311.23	591.268	878.805	0	878.805	963.75	963.75
31	1.16891	1064.34	-14.2406	Perched Clay (Long Term)	200	24	307.967	585.07	864.881	0	864.881	943.041	943.041
32	1.10806	977.843	-13.2462	Surficial Aquifer	75	32	319.445	606.876	851.179	0	851.179	926.376	926.376
33	1.10806	945.797	-12.2823	Surficial Aquifer	75	32	313.785	596.123	833.972	0	833.972	902.287	902.287
34	1.10806	911.67	-11.322	Surficial Aquifer	75	32	307.341	583.881	814.38	0	814.38	875.916	875.916
35	1.10806	875.879	-10.3648	Surficial Aquifer	75	32	300.214	570.34	792.709	0	792.709	847.618	847.618
36	1.10806	837.674	-9.41059	Surficial Aquifer	75	32	292.159	555.038	768.221	0	768.221	816.644	816.644
37	1.10806	797.057	-8.45898	Surficial Aquifer	75	32	283.151	537.924	740.833	0	740.833	782.943	782.943
38	1.10806	756.423	-7.50972	Surficial Aquifer	75	32	273.891	520.333	712.681	0	712.681	748.787	748.787
39	1.10806	716.489	-6.56253	Surficial Aquifer	75	32	264.599	502.68	684.43	0	684.43	714.87	714.87
40	1.10806	674.205	-5.61714	Surficial Aquifer	75	32	254.322	483.156	653.185	0	653.185	678.199	678.199
41	1.10806	629.57	-4.67328	Surficial Aquifer	75	32	243.029	461.702	618.852	0	618.852	638.719	638.719
42	1.10806	579.002	-3.73069	Surficial Aquifer	75	32	229.537	436.069	577.832	0	577.832	592.799	592.799
43	1.10806	515.019	-2.78911	Surficial Aquifer	75	32	211.337	401.494	522.499	0	522.499	532.795	532.795
44	1.10806	447.929	-1.84828	Surficial Aquifer	75	32	191.647	364.088	462.638	0	462.638	468.822	468.822
45	1.10806	378.85	-0.90795	Surficial Aquifer	75	32	170.789	324.462	399.222	0	399.222	401.929	401.929
46	1.10806	311.748	0.032134	Surficial Aquifer	75	32	150.059	285.08	336.199	0	336.199	336.115	336.115
47	1.10806	243.254	0.972227	Surficial Aquifer	75	32	128.315	243.771	270.09	0	270.09	267.912	267.912
48	1.10806	170.163	1.91258	Surficial Aquifer	75	32	104.409	198.355	197.41	0	197.41	193.923	193.923
49	1.10806	97.6578	2.85345	Surficial Aquifer	75	32	80.0769	152.129	123.431	0	123.431	119.44	119.44
50	1.10806	32.7157	3.79509	Surficial Aquifer	75	32	57.6915	109.601	55.3733	0	55.3733	51.5464	51.5464

Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.55733

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.65903	17.8592	-46.4146	Light Gray Sand	50	32	21.1818	54.1688	6.67143	0	6.67143	28.9258	28.9258
2	0.65903	52.2359	-44.915	Light Gray Sand	50	32	30.8924	79.002	46.4129	0	46.4129	77.2137	77.2137
3	0.65903	84.0352	-43.4536	Light Gray Sand	50	32	40.1371	102.644	84.2477	0	84.2477	122.275	122.275
4	0.65903	113.442	-42.0267	Light Gray Sand	50	32	48.924	125.115	120.209	0	120.209	164.302	164.302
5	0.65903	140.623	-40.6313	Light Gray Sand	50	32	57.2629	146.44	154.336	0	154.336	203.471	203.471
6	0.65903	165.753	-39.2644	Light Gray Sand	50	32	65.1727	166.668	186.707	0	186.707	239.983	239.983
7	0.65903	188.921	-37.9237	Light Gray Sand	50	32	72.6512	185.793	217.314	0	217.314	273.92	273.92
8	0.65903	210.226	-36.607	Light Gray Sand	50	32	79.7038	203.829	246.178	0	246.178	305.386	305.386
9	0.65903	229.763	-35.3125	Light Gray Sand	50	32	86.3377	220.794	273.328	0	273.328	334.487	334.487
10	0.65903	247.595	-34.0383	Light Gray Sand	50	32	92.5524	236.687	298.761	0	298.761	361.279	361.279
11	0.65903	263.787	-32.783	Light Gray Sand	50	32	98.3506	251.515	322.491	0	322.491	385.833	385.833
12	0.65903	278.441	-31.5453	Light Gray Sand	50	32	103.748	265.318	344.581	0	344.581	408.271	408.271
13	0.65903	291.619	-30.3237	Light Gray Sand	50	32	108.75	278.109	365.051	0	365.051	428.659	428.659
14	0.65903	303.379	-29.1172	Light Gray Sand	50	32	113.362	289.904	383.927	0	383.927	447.068	447.068
15	0.65903	313.811	-27.9247	Light Gray Sand	50	32	117.601	300.744	401.275	0	401.275	463.606	463.606
16	0.65903	322.928	-26.7452	Light Gray Sand	50	32	121.46	310.614	417.07	0	417.07	478.278	478.278
17	0.65903	330.761	-25.5778	Light Gray Sand	50	32	124.94	319.514	431.313	0	431.313	491.115	491.115
18	0.65903	337.35	-24.4217	Light Gray Sand	50	32	128.044	327.452	444.016	0	444.016	502.158	502.158
19	0.65903	342.769	-23.2761	Light Gray Sand	50	32	130.788	334.468	455.244	0	455.244	511.505	511.505
20	0.65903	347.078	-22.1403	Light Gray Sand	50	32	133.183	340.592	465.045	0	465.045	519.233	519.233
21	0.65903	350.239	-21.0135	Light Gray Sand	50	32	135.208	345.772	473.334	0	473.334	525.272	525.272
22	0.65903	352.276	-19.8953	Light Gray Sand	50	32	136.865	350.009	480.116	0	480.116	529.647	529.647
23	0.65903	353.21	-18.7848	Light Gray Sand	50	32	138.153	353.304	485.387	0	485.387	532.377	532.377
24	0.65903	352.989	-17.6817	Light Gray Sand	50	32	139.048	355.591	489.048	0	489.048	533.374	533.374
25	0.65903	351.683	-16.5853	Light Gray Sand	50	32	139.565	356.914	491.165	0	491.165	532.732	532.732
26	0.65903	349.34	-15.4951	Light Gray Sand	50	32	139.714	357.296	491.777	0	491.777	530.51	530.51
27	0.65903	345.976	-14.4106	Light Gray Sand	50	32	139.495	356.736	490.88	0	490.88	526.724	526.724
28	0.65903	341.574	-13.3314	Light Gray Sand	50	32	138.895	355.201	488.425	0	488.425	521.339	521.339
29	0.65903	336.104	-12.2569	Light Gray Sand	50	32	137.897	352.647	484.336	0	484.336	514.294	514.294
30	0.65903	329.651	-11.1869	Light Gray Sand	50	32	136.523	349.135	478.715	0	478.715	505.714	505.714
31	0.65903	322.231	-10.1207	Light Gray Sand	50	32	134.773	344.66	471.555	0	471.555	495.612	495.612
32	0.65903	313.858	-9.05814	Light Gray Sand	50	32	132.646	339.22	462.85	0	462.85	483.997	483.997

33	0.65903	304.652	-7.99867	Light Gray Sand	50	32	130.179	332.911	452.752	0	452.752	471.045	471.045
34	0.65903	294.553	-6.94196	Light Gray Sand	50	32	127.344	325.66	441.149	0	441.149	456.654	456.654
35	0.65903	283.52	-5.88761	Light Gray Sand	50	32	124.119	317.414	427.952	0	427.952	440.751	440.751
36	0.65903	271.559	-4.83526	Light Gray Sand	50	32	120.501	308.16	413.143	0	413.143	423.336	423.336
37	0.65903	258.661	-3.78454	Light Gray Sand	50	32	116.478	297.872	396.678	0	396.678	404.383	404.383
38	0.65903	244.804	-2.73509	Light Gray Sand	50	32	112.034	286.509	378.493	0	378.493	383.845	383.845
39	0.65903	230.027	-1.68657	Light Gray Sand	50	32	107.179	274.091	358.62	0	358.62	361.776	361.776
40	0.65903	214.336	-0.638603	Light Gray Sand	50	32	101.904	260.601	337.032	0	337.032	338.168	338.168
41	0.65903	197.725	0.409145	Light Gray Sand	50	32	96.1992	246.013	313.686	0	313.686	312.999	312.999
42	0.65903	179.873	1.45703	Light Gray Sand	50	32	89.9329	229.988	288.041	0	288.041	285.753	285.753
43	0.65903	160.922	2.5054	Light Gray Sand	50	32	83.1484	212.638	260.276	0	260.276	256.638	256.638
44	0.65903	141.054	3.55462	Light Gray Sand	50	32	75.9069	194.119	230.637	0	230.637	225.922	225.922
45	0.65903	105.431	34.007	Light Gray Sand	50	32	79.5247	203.371	245.445	0	245.445	191.791	191.791
46	0.742345	79.0111	0	Light Gray Sand	50	32	47.0745	120.385	112.639	0	112.639	112.639	112.639
47	0.742345	56.7072	0	Light Gray Sand	50	32	39.4888	100.986	81.5943	0	81.5943	81.5943	81.5943
48	0.742345	34.3925	0	Light Gray Sand	50	32	31.8994	81.5773	50.5342	0	50.5342	50.5342	50.5342
49	0.742345	12.0778	0	Light Gray Sand	50	32	24.31	62.1688	19.4741	0	19.4741	19.4741	19.4741
50	0.0204668	0.012689	9.90987	Light Gray Sand	50	32	20.8694	53.3701	5.39323	0	5.39323	1.74723	1.74723

Roadway - Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.12527

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.390041	28.278	-68.6922	Roadway	0	45	12.3415	26.2291	26.2291	0	26.2291	57.8707	57.8707
2	1.26632	392.559	-67.1151	Perched Clay	1100	0	517.581	1100	-747.017	0	-747.017	479.169	479.169
3	2.5298	1950.79	-63.8385	Surficial Aquifer	75	32	194.939	414.298	542.99	0	542.99	939.832	939.832
4	1.73892	2162.72	-60.4633	Surficial Aquifer	75	32	274.636	583.675	909.101	95.0492	814.052	1393.79	1298.74
5	1.73892	2747.65	-57.9836	Surficial Aquifer	75	32	300.561	638.773	1178.4	276.18	902.224	1659.1	1382.92
6	2.29709	4454.46	-55.3183	Black Creek Confining Unit	949.792	0	446.904	949.792	1415.35	0	1415.35	2061.2	2061.2
7	2.29709	5326.74	-52.474	Black Creek Confining Unit	1044.45	0	491.443	1044.45	1730.24	0	1730.24	2370.1	2370.1
8	2.29709	6257.82	-49.8038	Black Creek Confining Unit	1130.09	0	531.739	1130.09	1714.47	0	1714.47	2343.78	2343.78
9	2.29709	6201.51	-47.2741	Black Creek Confining Unit	1208.18	0	568.483	1208.18	1740.79	0	1740.79	2356.29	2356.29
10	2.29709	6141.1	-44.8604	Black Creek Confining Unit	1279.77	0	602.168	1279.77	1766.34	0	1766.34	2365.58	2365.58
11	2.29709	6498.05	-42.5442	Black Creek Confining Unit	1345.68	0	633.181	1345.68	1938.88	0	1938.88	2519.98	2519.98
12	2.29709	6816.26	-40.3112	Black Creek Confining Unit	1406.54	0	661.817	1406.54	2101.01	0	2101.01	2662.49	2662.49
13	2.29709	7092.02	-38.1499	Black Creek Confining Unit	1462.83	0	688.303	1462.83	2250.63	0	2250.63	2791.29	2791.29
14	2.29709	7328.49	-36.051	Black Creek Confining Unit	1514.98	0	712.841	1514.98	2388.17	0	2388.17	2907.05	2907.05
15	2.29709	7534.37	-34.0067	Black Creek Confining Unit	1563.31	0	735.582	1563.31	2516.25	0	2516.25	3012.53	3012.53
16	2.29709	7725.99	-32.0106	Black Creek Confining Unit	1608.09	0	756.652	1608.09	2640.5	0	2640.5	3113.5	3113.5
17	2.29709	7886.54	-30.0571	Black Creek Confining Unit	1649.57	0	776.17	1649.57	2754.39	0	2754.39	3203.55	3203.55
18	2.29709	7999.33	-28.1415	Black Creek Confining Unit	1687.94	0	794.224	1687.94	2851.23	0	2851.23	3276.04	3276.04
19	2.29709	8083.15	-26.2596	Black Creek Confining Unit	1723.37	0	810.895	1723.37	2937.67	0	2937.67	3337.73	3337.73

20	2.29709	8154.92	-24.4077	Black Creek Confining Unit	1756.01	0	826.253	1756.01	3019.98	0	3019.98	3394.92	3394.92
21	2.29709	8204	-22.5827	Black Creek Confining Unit	1785.97	0	840.35	1785.97	3093.89	0	3093.89	3443.39	3443.39
22	2.29709	8206.79	-20.7816	Black Creek Confining Unit	1793.17	0	843.738	1793.17	3150.82	0	3150.82	3471.01	3471.01
23	2.29709	8176.62	-19.0017	Black Creek Confining Unit	1789.87	0	842.185	1789.87	3194.33	0	3194.33	3484.35	3484.35
24	2.29709	8147.88	-17.2407	Black Creek Confining Unit	1786.76	0	840.721	1786.76	3237.41	0	3237.41	3498.31	3498.31
25	2.29709	8114.43	-15.4963	Black Creek Confining Unit	1783.12	0	839.009	1783.12	3277.77	0	3277.77	3510.39	3510.39
26	2.29709	8052.4	-13.7666	Black Creek Confining Unit	1776.82	0	836.044	1776.82	3305.72	0	3305.72	3510.56	3510.56
27	2.29709	7935.11	-12.0495	Black Creek Confining Unit	1763.6	0	829.824	1763.6	3309.95	0	3309.95	3487.08	3487.08
28	2.29709	7796.32	-10.3434	Black Creek Confining Unit	1748.25	0	822.601	1748.25	3303.91	0	3303.91	3454.04	3454.04
29	2.29709	7652.18	-8.64658	Black Creek Confining Unit	1732.81	0	815.336	1732.81	3294.28	0	3294.28	3418.26	3418.26
30	2.29709	7490.68	-6.95732	Black Creek Confining Unit	1715.28	0	807.088	1715.28	3275.93	0	3275.93	3374.41	3374.41
31	2.29709	7302.4	-5.27413	Black Creek Confining Unit	1694.74	0	797.423	1694.74	3244.63	0	3244.63	3318.24	3318.24
32	2.29709	7092.39	-3.5955	Black Creek Confining Unit	1671.9	0	786.677	1671.9	3202.31	0	3202.31	3251.74	3251.74
33	2.29709	6856.05	-1.91996	Black Creek Confining Unit	1646.17	0	774.57	1646.17	3146.69	0	3146.69	3172.65	3172.65
34	2.29709	6596.82	-0.246054	Black Creek Confining Unit	1617.96	0	761.296	1617.96	3078.99	0	3078.99	3082.26	3082.26
35	2.29709	6316.56	1.42764	Black Creek Confining Unit	1587.45	0	746.94	1587.45	2999.79	0	2999.79	2981.17	2981.17
36	2.29709	6016.15	3.10255	Black Creek Confining Unit	1554.76	0	731.559	1554.76	2909.2	0	2909.2	2869.55	2869.55
37	2.29709	5692.29	4.78012	Black Creek Confining Unit	1519.51	0	714.973	1519.51	2805.42	0	2805.42	2745.64	2745.64
38	2.29709	5346.95	6.46182	Black Creek Confining Unit	1481.89	0	697.271	1481.89	2689.02	0	2689.02	2610.04	2610.04

39	2.29709	4994.96	8.14913	Black Creek Confining Unit	1443.62	0	679.264	1443.62	2566.72	0	2566.72	2469.45	2469.45
40	2.29709	4630.18	9.84359	Black Creek Confining Unit	1403.93	0	660.589	1403.93	2435.43	0	2435.43	2320.81	2320.81
41	2.29709	4228.5	11.5468	Black Creek Confining Unit	1360.2	0	640.013	1360.2	2283.12	0	2283.12	2152.37	2152.37
42	2.29709	3796.46	13.2604	Black Creek Confining Unit	1312.99	0	617.799	1312.99	2112.25	0	2112.25	1966.66	1966.66
43	2.29709	3393.42	14.9862	Black Creek Confining Unit	1269.31	0	597.246	1269.31	1952.05	0	1952.05	1792.17	1792.17
44	2.29709	2992.13	16.7261	Black Creek Confining Unit	1225.64	0	576.698	1225.64	1788.97	0	1788.97	1615.66	1615.66
45	2.29709	2579.56	18.482	Black Creek Confining Unit	1180.59	0	555.501	1180.59	1616.2	0	1616.2	1430.52	1430.52
46	2.29709	2170.95	20.2561	Black Creek Confining Unit	1136.27	0	534.647	1136.27	1441.45	0	1441.45	1244.14	1244.14
47	2.29709	1741.27	22.0507	Black Creek Confining Unit	1089.51	0	512.645	1089.51	1251.17	0	1251.17	1043.52	1043.52
48	2.29709	1281.8	23.8684	Black Creek Confining Unit	1039.59	0	489.157	1039.59	1039.99	0	1039.99	823.551	823.551
49	2.29709	781.764	25.7121	Black Creek Confining Unit	985.079	0	463.508	985.079	800.769	0	800.769	577.577	577.577
50	2.29709	256.29	27.5848	Black Creek Confining Unit	927.817	0	436.564	927.817	533.308	0	533.308	305.225	305.225

Roadway - Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.1869

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.723936	24.4303	-48.8969	Light Gray Sand	50	32	25.5473	55.8693	9.3929	0	9.3929	38.6751	38.6751
2	0.723936	71.5714	-47.4474	Light Gray Sand	50	32	37.5393	82.0946	51.3621	0	51.3621	92.2536	92.2536
3	0.723936	115.418	-46.0369	Light Gray Sand	50	32	49.1568	107.501	92.0207	0	92.0207	142.99	142.99
4	0.723936	156.22	-44.6616	Light Gray Sand	50	32	60.3993	132.087	131.367	0	131.367	191.057	191.057
5	0.723936	194.217	-43.3182	Light Gray Sand	50	32	71.2735	155.868	169.424	0	169.424	236.631	236.631
6	0.723936	229.612	-42.0038	Light Gray Sand	50	32	81.7843	178.854	206.209	0	206.209	279.858	279.858
7	0.723936	262.526	-40.7162	Light Gray Sand	50	32	91.921	201.022	241.686	0	241.686	320.796	320.796
8	0.723936	293.104	-39.4529	Light Gray Sand	50	32	101.685	222.375	275.857	0	275.857	359.539	359.539
9	0.723936	321.453	-38.2122	Light Gray Sand	50	32	111.07	242.9	308.706	0	308.706	396.148	396.148
10	0.723936	347.657	-36.9924	Light Gray Sand	50	32	120.07	262.581	340.2	0	340.2	430.655	430.655
11	0.723936	371.861	-35.7918	Light Gray Sand	50	32	128.695	281.444	370.387	0	370.387	463.177	463.177
12	0.723936	394.159	-34.609	Light Gray Sand	50	32	136.947	299.49	399.268	0	399.268	493.773	493.773
13	0.723936	414.645	-33.443	Light Gray Sand	50	32	144.83	316.728	426.855	0	426.855	522.508	522.508
14	0.723936	433.431	-32.2923	Light Gray Sand	50	32	152.354	333.182	453.186	0	453.186	549.471	549.471
15	0.723936	450.537	-31.1562	Light Gray Sand	50	32	159.505	348.822	478.215	0	478.215	574.648	574.648
16	0.723936	466.021	-30.0334	Light Gray Sand	50	32	166.282	363.642	501.932	0	501.932	598.065	598.065
17	0.723936	479.952	-28.9233	Light Gray Sand	50	32	172.687	377.65	524.349	0	524.349	619.769	619.769
18	0.723936	492.467	-27.8249	Light Gray Sand	50	32	178.748	390.903	545.558	0	545.558	639.901	639.901
19	0.723936	503.529	-26.7376	Light Gray Sand	50	32	184.436	403.342	565.465	0	565.465	658.378	658.378
20	0.723936	513.165	-25.6605	Light Gray Sand	50	32	189.743	414.949	584.041	0	584.041	675.198	675.198
21	0.723936	521.404	-24.5931	Light Gray Sand	50	32	194.666	425.716	601.271	0	601.271	690.368	690.368
22	0.723936	528.196	-23.5347	Light Gray Sand	50	32	199.172	435.57	617.041	0	617.041	703.787	703.787
23	0.723936	533.636	-22.4848	Light Gray Sand	50	32	203.279	444.55	631.412	0	631.412	715.55	715.55
24	0.709627	526.636	-21.453	Perched Clay (Long Term)	200	24	222.42	486.41	643.287	0	643.287	730.69	730.69
25	0.709627	528.471	-20.4387	Perched Clay (Long Term)	200	24	224.553	491.074	653.764	0	653.764	737.447	737.447
26	0.709627	529.111	-19.431	Perched Clay (Long Term)	200	24	226.393	495.099	662.802	0	662.802	742.666	742.666
27	0.709627	528.612	-18.4296	Perched Clay (Long Term)	200	24	227.947	498.498	670.437	0	670.437	746.396	746.396
28	0.709627	527.041	-17.4339	Perched Clay (Long Term)	200	24	229.225	501.293	676.715	0	676.715	748.699	748.699
29	0.709627	524.414	-16.4437	Perched Clay (Long Term)	200	24	230.225	503.48	681.626	0	681.626	749.575	749.575

30	0.709627	520.84	-15.4585	Perched Clay (Long Term)	200	24	230.968	505.105	685.277	0	685.277	749.15	749.15
31	0.709627	516.347	-14.4779	Perched Clay (Long Term)	200	24	231.457	506.173	687.675	0	687.675	747.439	747.439
32	0.709627	510.845	-13.5017	Perched Clay (Long Term)	200	24	231.66	506.617	688.673	0	688.673	744.296	744.296
33	0.709627	504.347	-12.5294	Perched Clay (Long Term)	200	24	231.574	506.429	688.251	0	688.251	739.715	739.715
34	0.709627	496.847	-11.5608	Perched Clay (Long Term)	200	24	231.191	505.592	686.372	0	686.372	733.664	733.664
35	0.709627	488.327	-10.5956	Perched Clay (Long Term)	200	24	230.5	504.08	682.974	0	682.974	726.092	726.092
36	0.709627	478.841	-9.63333	Perched Clay (Long Term)	200	24	229.507	501.908	678.096	0	678.096	717.052	717.052
37	0.709627	468.399	-8.67384	Perched Clay (Long Term)	200	24	228.208	499.068	671.718	0	671.718	706.532	706.532
38	0.709627	456.926	-7.71679	Perched Clay (Long Term)	200	24	226.575	495.497	663.696	0	663.696	694.398	694.398
39	0.709627	444.062	-6.76191	Perched Clay (Long Term)	200	24	224.495	490.948	653.481	0	653.481	680.099	680.099
40	0.709627	430.194	-5.80891	Perched Clay (Long Term)	200	24	222.071	485.646	641.572	0	641.572	664.164	664.164
41	0.709627	415.396	-4.85752	Perched Clay (Long Term)	200	24	219.314	479.618	628.033	0	628.033	646.671	646.671
42	0.709627	444.424	-3.90747	Perched Clay (Long Term)	200	24	229.538	501.977	678.251	0	678.251	693.93	693.93
43	0.709627	450.045	-2.95849	Perched Clay (Long Term)	200	24	232.922	509.378	694.876	0	694.876	706.914	706.914
44	0.709627	432.058	-2.01033	Perched Clay (Long Term)	200	24	229.201	501.239	676.594	0	676.594	684.639	684.639
45	0.709627	413.152	-1.06272	Perched Clay (Long Term)	200	24	225.117	492.308	656.533	0	656.533	660.709	660.709
46	0.709627	317.652	-0.115396	Perched Clay (Long Term)	200	24	197.218	431.297	519.501	0	519.501	519.898	519.898
47	0.717408	11.3155	0.837088	Roadway	0	45	8.76734	19.1733	19.1734	0	19.1734	19.0453	19.0453
48	0.717408	9.60089	1.795	Roadway	0	45	7.56139	16.536	16.536	0	16.536	16.2991	16.2991
49	0.717408	6.63698	2.75341	Roadway	0	45	5.31451	11.6223	11.6223	0	11.6223	11.3667	11.3667
50	0.717408	2.42122	3.7126	Roadway	0	45	1.81863	3.97716	3.97715	0	3.97715	3.85914	3.85914

Roadway - Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.54581

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.272747	10.3745	-62.5318	Roadway	0	45	123.705	191.224	191.224	0	191.224	429.181	429.181
2	0.272747	30.1487	-60.1536	Roadway	0	45	150.585	232.776	232.775	0	232.775	495.218	495.218
3	0.304581	52.2716	-57.816	Perched Clay (Long Term)	200	24	203.802	315.039	258.381	0	258.381	582.214	582.214
4	0.304581	67.8029	-55.4999	Perched Clay (Long Term)	200	24	217.677	336.488	306.558	0	306.558	623.279	623.279
5	0.304581	82.0755	-53.3133	Perched Clay (Long Term)	200	24	231.004	357.089	352.826	0	352.826	662.893	662.893
6	0.304581	95.2778	-51.2338	Perched Clay (Long Term)	200	24	243.889	377.006	397.562	0	397.562	701.266	701.266
7	0.304581	107.552	-49.2446	Perched Clay (Long Term)	200	24	256.407	396.357	441.024	0	441.024	738.544	738.544
8	0.304581	119.008	-47.3328	Perched Clay (Long Term)	200	24	268.613	415.225	483.403	0	483.403	774.831	774.831
9	0.304581	129.734	-45.4879	Perched Clay (Long Term)	200	24	280.548	433.674	524.84	0	524.84	810.207	810.207
10	0.304581	139.8	-43.7016	Perched Clay (Long Term)	200	24	292.245	451.756	565.453	0	565.453	844.745	844.745
11	0.321678	158.139	-41.9199	Surficial Aquifer	75	32	294.807	455.715	609.271	0	609.271	873.971	873.971
12	0.321678	168.499	-40.1392	Surficial Aquifer	75	32	311.362	481.307	650.226	0	650.226	912.782	912.782
13	0.321678	178.233	-38.4041	Surficial Aquifer	75	32	327.766	506.664	690.806	0	690.806	950.628	950.628
14	0.321678	187.474	-36.7098	Surficial Aquifer	75	32	344.11	531.929	731.238	0	731.238	987.821	987.821
15	0.321678	198.923	-35.0521	Surficial Aquifer	75	32	312.928	483.728	654.102	0	654.102	873.641	873.641
16	0.321678	211.383	-33.4274	Surficial Aquifer	75	32	237.102	366.515	466.523	0	466.523	623.025	623.025
17	0.321678	224.116	-31.8326	Surficial Aquifer	75	32	254.283	393.073	509.022	0	509.022	666.885	666.885
18	0.321678	236.456	-30.2649	Surficial Aquifer	75	32	271.67	419.95	552.036	0	552.036	710.564	710.564
19	0.321678	248.362	-28.7219	Surficial Aquifer	75	32	289.211	447.066	595.43	0	595.43	753.912	753.912
20	0.321678	259.854	-27.2013	Surficial Aquifer	75	32	306.914	474.43	639.222	0	639.222	796.963	796.963
21	0.321678	267.403	-25.7013	Surficial Aquifer	75	32	321.162	496.455	674.469	0	674.469	829.042	829.042
22	0.321678	271.07	-24.2199	Surficial Aquifer	75	32	331.764	512.844	700.695	0	700.695	849.934	849.934
23	0.321678	275.912	-22.7556	Surficial Aquifer	75	32	343.862	531.546	730.626	0	730.626	874.859	874.859
24	0.321678	280.728	-21.3068	Surficial Aquifer	75	32	356.248	550.692	761.267	0	761.267	900.211	900.211
25	0.321678	229.655	-19.8722	Surficial Aquifer	75	32	306.594	473.936	638.433	0	638.433	749.25	749.25
26	0.321678	115.315	-18.4504	Surficial Aquifer	75	32	182.372	281.912	331.13	0	331.13	391.975	391.975
27	0.321678	113.232	-17.0404	Surficial Aquifer	75	32	183.383	283.476	333.632	0	333.632	389.839	389.839
28	0.321678	110.831	-15.6409	Surficial Aquifer	75	32	183.974	284.389	335.093	0	335.093	386.601	386.601
29	0.321678	108.117	-14.2509	Surficial Aquifer	75	32	184.13	284.63	335.478	0	335.478	382.244	382.244

30	0.321678	105.096	-12.8694	Surficial Aquifer	75	32	183.838	284.178	334.755	0	334.755	376.756	376.756
31	0.321678	101.775	-11.4955	Surficial Aquifer	75	32	183.081	283.009	332.886	0	332.886	370.119	370.119
32	0.321678	98.1568	-10.1283	Surficial Aquifer	75	32	181.844	281.097	329.822	0	329.822	362.306	362.306
33	0.321678	94.2655	-8.76689	Surficial Aquifer	75	32	180.132	278.45	325.586	0	325.586	353.366	353.366
34	0.321678	90.8415	-7.41046	Surficial Aquifer	75	32	178.926	276.585	322.605	0	322.605	345.877	345.877
35	0.321678	87.5218	-6.05818	Surficial Aquifer	75	32	177.764	274.789	319.728	0	319.728	338.594	338.594
36	0.321678	83.9183	-4.70929	Surficial Aquifer	75	32	176.104	272.223	315.624	0	315.624	330.131	330.131
37	0.321678	80.033	-3.36301	Surficial Aquifer	75	32	173.92	268.848	310.222	0	310.222	320.442	320.442
38	0.321678	75.8673	-2.01859	Surficial Aquifer	75	32	171.186	264.621	303.457	0	303.457	309.491	309.491
39	0.321678	71.4221	-0.675285	Surficial Aquifer	75	32	167.869	259.493	295.25	0	295.25	297.229	297.229
40	0.321678	66.6978	0.667653	Surficial Aquifer	75	32	163.932	253.408	285.513	0	285.513	283.603	283.603
41	0.321678	61.6945	2.01096	Surficial Aquifer	75	32	159.338	246.307	274.148	0	274.148	268.553	268.553
42	0.321678	56.4117	3.35537	Surficial Aquifer	75	32	154.042	238.119	261.045	0	261.045	252.013	252.013
43	0.321678	50.8484	4.70164	Surficial Aquifer	75	32	147.992	228.767	246.079	0	246.079	233.908	233.908
44	0.321678	45.0033	6.05051	Surficial Aquifer	75	32	141.132	218.164	229.11	0	229.11	214.151	214.151
45	0.321678	38.8746	7.40276	Surficial Aquifer	75	32	133.399	206.21	209.98	0	209.98	192.648	192.648
46	0.321678	32.4597	8.75917	Surficial Aquifer	75	32	124.718	192.791	188.505	0	188.505	169.289	169.289
47	0.321678	25.7558	10.1206	Surficial Aquifer	75	32	115.006	177.778	164.479	0	164.479	143.951	143.951
48	0.321678	18.7595	11.4877	Surficial Aquifer	75	32	104.166	161.021	137.662	0	137.662	116.493	116.493
49	0.321678	11.4667	12.8616	Surficial Aquifer	75	32	92.0866	142.348	107.78	0	107.78	86.7544	86.7544
50	0.321678	3.87284	14.243	Surficial Aquifer	75	32	78.7579	121.745	74.8073	0	74.8073	54.8155	54.8155

Interslice Data

Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.12513

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	370.43	90	0	0	0
2	370.991	89.3556	-11.6308	-4.23748	20.0183
3	371.553	88.7444	-9.75437	-3.55383	20.0183
4	372.114	88.1623	3.37093	1.22814	20.0183
5	372.675	87.6073	25.8069	9.40229	20.0183
6	373.236	87.0775	55.8488	20.3475	20.0183
7	373.798	86.5713	91.9893	33.5147	20.0183
8	374.359	86.0874	132.89	48.4162	20.0183
9	374.92	85.6244	177.359	64.6175	20.0183
10	375.481	85.1814	224.33	81.7307	20.0183
11	376.043	84.7573	272.975	99.4538	20.0184
12	376.604	84.3513	322.637	117.547	20.0183
13	377.165	83.9625	372.514	135.719	20.0183
14	377.726	83.5902	421.882	153.705	20.0183
15	378.288	83.2339	470.089	171.269	20.0184
16	378.849	82.8928	516.549	188.196	20.0184
17	379.41	82.5665	560.737	204.294	20.0183
18	379.971	82.2545	602.181	219.394	20.0183
19	380.533	81.9564	640.462	233.341	20.0183
20	381.094	81.6716	675.211	246.001	20.0183
21	381.655	81.3999	706.099	257.254	20.0183
22	382.217	81.1409	732.657	266.93	20.0183
23	382.778	80.8943	754.477	274.88	20.0183
24	383.339	80.6597	771.456	281.066	20.0183
25	383.9	80.437	783.526	285.464	20.0183
26	384.462	80.2258	790.655	288.061	20.0183
27	385.023	80.0259	792.847	288.86	20.0183
28	385.584	79.8372	790.14	287.874	20.0183
29	386.145	79.6594	782.605	285.128	20.0183
30	386.707	79.4923	770.346	280.662	20.0183
31	387.268	79.3358	753.506	274.527	20.0183
32	387.829	79.1897	732.269	266.789	20.0183
33	388.39	79.0539	706.851	257.529	20.0183
34	388.952	78.9282	677.504	246.837	20.0183
35	389.513	78.8126	644.514	234.817	20.0183
36	390.074	78.7069	608.203	221.588	20.0183
37	390.635	78.6111	568.929	207.279	20.0183
38	391.197	78.525	527.089	192.035	20.0183
39	391.758	78.4486	483.076	176	20.0183
40	392.319	78.3818	437.33	159.334	20.0184
41	392.88	78.3245	390.354	142.218	20.0182
42	393.442	78.2768	342.692	124.854	20.0184
43	394.003	78.2385	294.938	107.455	20.0182
44	394.564	78.2096	247.731	90.2565	20.0183
45	395.126	78.1902	201.803	73.5235	20.0184
46	395.687	78.1801	157.993	57.5621	20.0184
47	396.248	78.1795	117.127	42.6732	20.0183
48	396.809	78.1882	80.0899	29.1793	20.0183
49	397.371	78.2063	47.8339	17.4274	20.0183
50	397.932	78.2338	21.3819	7.79013	20.0183
51	398.493	78.2707	0	0	0

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.89978

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	361.262	92.836	0	0	0
2	362.54	91.3777	-145.191	-53.3418	20.1729
3	363.818	90	-190.884	-70.1292	20.1729
4	364.912	88.8791	-72.3323	-26.5743	20.1729
5	366.006	87.8084	81.462	29.9285	20.1729
6	367.1	86.7848	257.861	94.7359	20.1729
7	368.194	85.8053	451.567	165.902	20.1729
8	369.288	84.8675	658.063	241.767	20.1729
9	370.382	83.9691	873.308	320.846	20.1729
10	371.475	83.1081	1093.8	401.854	20.173
11	372.569	82.2828	1316.42	483.64	20.1728
12	373.663	81.4915	1538.2	565.121	20.1729
13	374.757	80.7329	1756.49	645.319	20.1729
14	375.851	80.0056	1968.94	723.371	20.1729
15	376.945	79.3084	2174.04	798.725	20.1729
16	378.039	78.6402	2370.02	870.727	20.1729
17	379.133	78	2555.03	938.697	20.1729
18	380.302	77.3459	2733.8	1004.38	20.173
19	381.471	76.7218	2899.19	1065.14	20.1729
20	382.64	76.1267	3048.48	1119.99	20.173
21	383.809	75.5598	3178.55	1167.77	20.1729
22	384.978	75.0202	3288.45	1208.15	20.1729
23	386.147	74.5074	3377.49	1240.86	20.1729
24	387.316	74.0206	3445.08	1265.69	20.1729
25	388.484	73.5592	3490.73	1282.47	20.173
26	389.653	73.1227	3514.28	1291.12	20.173
27	390.822	72.7105	3515.74	1291.65	20.1729
28	391.991	72.3222	3495.29	1284.14	20.1729
29	393.16	71.9574	3453.3	1268.72	20.173
30	394.329	71.6157	3390.17	1245.52	20.1729
31	395.498	71.2967	3306.4	1214.75	20.173
32	396.667	71	3202.66	1176.63	20.1729
33	397.775	70.7392	3070.39	1128.03	20.1728
34	398.883	70.4979	2923.56	1074.09	20.1729
35	399.991	70.2761	2763.36	1015.24	20.173
36	401.099	70.0734	2591.05	951.93	20.1729
37	402.207	69.8898	2408.1	884.717	20.1729
38	403.315	69.725	2216.14	814.193	20.1729
39	404.423	69.5789	2016.47	740.836	20.173
40	405.531	69.4514	1810.26	665.073	20.1729
41	406.639	69.3424	1599.37	587.597	20.173
42	407.747	69.2519	1385.89	509.164	20.1729
43	408.856	69.1796	1173.06	430.973	20.1729
44	409.964	69.1256	966.874	355.222	20.1729
45	411.072	69.0899	770.862	283.208	20.1729
46	412.18	69.0723	588.452	216.192	20.1729
47	413.288	69.0729	421.813	154.971	20.173
48	414.396	69.0917	274.421	100.82	20.1729
49	415.504	69.1287	151.317	55.5925	20.1729
50	416.612	69.184	55.687	20.4589	20.1729
51	417.72	69.2575	0	0	0

◆ Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.55733

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	364.124	90.0055	0	0	0
2	364.783	89.3131	-9.35058	-1.23181	7.50471
3	365.442	88.656	0.77197	0.101697	7.50476
4	366.101	88.0316	26.9034	3.54416	7.50473
5	366.76	87.4377	66.035	8.69922	7.50473
6	367.419	86.8722	115.543	15.2213	7.50476
7	368.078	86.3335	173.144	22.8094	7.50474
8	368.737	85.82	236.815	31.1972	7.50474
9	369.396	85.3304	304.768	40.1492	7.50476
10	370.055	84.8636	375.425	49.4573	7.50475
11	370.714	84.4184	447.382	58.9366	7.50474
12	371.373	83.994	519.396	68.4235	7.50474
13	372.032	83.5894	590.379	77.7745	7.50473
14	372.691	83.2039	659.373	86.8635	7.50473
15	373.35	82.8369	725.536	95.5797	7.50474
16	374.009	82.4876	788.142	103.827	7.50473
17	374.668	82.1554	846.548	111.521	7.50471
18	375.327	81.84	900.2	118.589	7.50472
19	375.986	81.5408	948.624	124.968	7.50471
20	376.645	81.2573	991.426	130.607	7.50473
21	377.304	80.9891	1028.29	135.463	7.50471
22	377.963	80.736	1058.94	139.501	7.50473
23	378.622	80.4975	1083.19	142.695	7.5047
24	379.281	80.2733	1100.87	145.025	7.50474
25	379.94	80.0632	1111.91	146.48	7.50477
26	380.599	79.8669	1116.27	147.054	7.50476
27	381.258	79.6842	1113.98	146.752	7.50474
28	381.917	79.5149	1105.1	145.582	7.50473
29	382.576	79.3587	1089.77	143.563	7.50476
30	383.236	79.2155	1068.17	140.717	7.50473
31	383.895	79.0852	1040.53	137.075	7.50469
32	384.554	78.9676	1007.11	132.673	7.50472
33	385.213	78.8625	968.257	127.555	7.50474
34	385.872	78.7699	924.328	121.768	7.50475
35	386.531	78.6897	875.74	115.367	7.50474
36	387.19	78.6217	822.964	108.414	7.5047
37	387.849	78.5659	766.523	100.979	7.50473
38	388.508	78.5224	706.996	93.1372	7.50473
39	389.167	78.4909	645.023	84.9731	7.50473
40	389.826	78.4715	581.295	76.5778	7.50473
41	390.485	78.4641	516.563	68.0502	7.50473
42	391.144	78.4688	451.641	59.4976	7.50473
43	391.803	78.4856	387.5	51.0479	7.50473
44	392.462	78.5144	325.156	42.8349	7.50473
45	393.121	78.5554	265.651	34.996	7.50475
46	393.78	79	104.068	13.7096	7.50476
47	394.522	79	69.0965	9.10253	7.50473
48	395.265	79	39.7602	5.23787	7.50473
49	396.007	79	16.0621	2.11597	7.50475
50	396.749	79	-1.99786	-0.263191	7.50473
51	396.77	79.0036	0	0	0

Roadway - Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.12527

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	397.828	75	0	0	0
2	398.218	74	21.4262	6.03571	15.7324
3	399.484	71	-2873.58	-809.481	15.7324
4	402.014	65.85	-569.236	-160.353	15.7325
5	403.753	62.7811	1744.24	491.348	15.7324
6	405.492	60	4500	1267.64	15.7324
7	407.789	56.6803	8174.23	2302.67	15.7325
8	410.086	53.6895	12222.7	3443.11	15.7324
9	412.383	50.9709	15664.9	4412.78	15.7325
10	414.68	48.4839	18691.5	5265.35	15.7324
11	416.977	46.1979	21349	6013.99	15.7325
12	419.274	44.0898	23985.3	6756.61	15.7324
13	421.571	42.1409	26563	7482.74	15.7324
14	423.868	40.3366	29046.4	8182.32	15.7324
15	426.165	38.6645	31405.8	8846.95	15.7324
16	428.463	37.1147	33619.5	9470.56	15.7324
17	430.76	35.6788	35677	10050.2	15.7325
18	433.057	34.3495	37559.4	10580.4	15.7324
19	435.354	33.1208	39242.3	11054.5	15.7325
20	437.651	31.9875	40713	11468.8	15.7325
21	439.948	30.9452	41967.2	11822.1	15.7325
22	442.245	29.9898	42997	12112.2	15.7325
23	444.542	29.1181	43809.9	12341.2	15.7325
24	446.839	28.327	44406.5	12509.2	15.7324
25	449.136	27.6142	44787.4	12616.5	15.7324
26	451.433	26.9773	44952	12662.9	15.7324
27	453.73	26.4145	44896.3	12647.2	15.7324
28	456.028	25.9242	44617.4	12568.6	15.7324
29	458.325	25.5049	44117.2	12427.7	15.7324
30	460.622	25.1556	43399.2	12225.5	15.7325
31	462.919	24.8753	42467.7	11963.1	15.7325
32	465.216	24.6632	41328.1	11642	15.7324
33	467.513	24.5189	39987.3	11264.3	15.7324
34	469.81	24.4419	38454.3	10832.5	15.7324
35	472.107	24.432	36739.9	10349.6	15.7325
36	474.404	24.4893	34856.2	9818.93	15.7324
37	476.701	24.6138	32817.3	9244.57	15.7324
38	478.998	24.8059	30639.7	8631.16	15.7325
39	481.295	25.066	28342	7983.9	15.7325
40	483.593	25.395	25940.9	7307.51	15.7324
41	485.89	25.7936	23456.2	6607.57	15.7324
42	488.187	26.2629	20917.9	5892.52	15.7324
43	490.484	26.8042	18358.5	5171.55	15.7324
44	492.781	27.4191	15789.3	4447.81	15.7324
45	495.078	28.1094	13232.6	3727.6	15.7324
46	497.375	28.8772	10718.5	3019.39	15.7325
47	499.672	29.7249	8271.21	2329.99	15.7325
48	501.969	30.6554	5932.12	1671.07	15.7325
49	504.266	31.6718	3753.95	1057.48	15.7324
50	506.563	32.7779	1805.88	508.714	15.7325
51	508.86	33.978	0	0	0

Roadway - Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.1869

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	364.118	90.0073	0	0	0
2	364.842	89.1776	-10.6617	-3.94525	20.3065
3	365.566	88.389	2.72268	1.0075	20.3065
4	366.29	87.6384	36.2842	13.4266	20.3065
5	367.014	86.9229	86.6355	32.0585	20.3064
6	367.738	86.2403	150.801	55.8023	20.3065
7	368.462	85.5884	226.152	83.6849	20.3064
8	369.186	84.9653	310.327	114.833	20.3064
9	369.91	84.3696	401.215	148.465	20.3064
10	370.633	83.7996	496.917	183.878	20.3064
11	371.357	83.2543	595.713	220.437	20.3064
12	372.081	82.7323	696.07	257.573	20.3064
13	372.805	82.2327	796.603	294.774	20.3064
14	373.529	81.7546	896.066	331.579	20.3064
15	374.253	81.2971	993.345	367.576	20.3064
16	374.977	80.8594	1087.42	402.387	20.3064
17	375.701	80.4409	1177.37	435.671	20.3064
18	376.425	80.0409	1262.36	467.124	20.3065
19	377.149	79.6588	1341.69	496.476	20.3064
20	377.873	79.2941	1414.67	523.484	20.3065
21	378.597	78.9463	1480.72	547.925	20.3065
22	379.321	78.6149	1539.32	569.608	20.3064
23	380.045	78.2996	1589.99	588.357	20.3064
24	380.769	78	1632.33	604.026	20.3064
25	381.478	77.7211	1654.21	612.123	20.3065
26	382.188	77.4567	1668.09	617.258	20.3064
27	382.897	77.2064	1673.69	619.331	20.3065
28	383.607	76.9699	1670.81	618.266	20.3065
29	384.317	76.747	1659.29	614.003	20.3065
30	385.026	76.5376	1639.03	606.503	20.3064
31	385.736	76.3414	1609.95	595.743	20.3064
32	386.446	76.1581	1572.05	581.719	20.3064
33	387.155	75.9877	1525.35	564.437	20.3064
34	387.865	75.83	1469.9	543.919	20.3064
35	388.574	75.6849	1405.82	520.207	20.3064
36	389.284	75.5521	1333.26	493.356	20.3064
37	389.994	75.4317	1252.41	463.44	20.3064
38	390.703	75.3234	1163.53	430.55	20.3064
39	391.413	75.2273	1066.9	394.794	20.3064
40	392.123	75.1431	962.911	356.314	20.3064
41	392.832	75.0709	851.972	315.263	20.3064
42	393.542	75.0106	734.543	271.809	20.3064
43	394.251	74.9622	604.874	223.827	20.3064
44	394.961	74.9255	465.417	172.222	20.3064
45	395.671	74.9006	319.966	118.4	20.3065
46	396.38	74.8874	169.195	62.6088	20.3065
47	397.09	74.886	30.2806	11.205	20.3064
48	397.807	74.8965	23.8031	8.80805	20.3064
49	398.525	74.9189	18.0181	6.66739	20.3064
50	399.242	74.9534	13.8124	5.11114	20.3065
51	399.96	75	0	0	0

Roadway - Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.54581

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	405.528	75	0	0	0
2	405.8	74.4753	66.564	30.8437	24.8615
3	406.073	74	136.115	63.0716	24.8616
4	406.378	73.516	199.048	92.2328	24.8616
5	406.682	73.0729	268.56	124.443	24.8617
6	406.987	72.664	342.399	158.657	24.8615
7	407.292	72.2848	418.854	194.084	24.8615
8	407.596	71.9313	496.572	230.096	24.8615
9	407.901	71.6009	574.444	266.18	24.8616
10	408.205	71.2911	651.541	301.904	24.8616
11	408.51	71	727.063	336.899	24.8616
12	408.832	70.7112	808.141	374.468	24.8616
13	409.153	70.4399	884.294	409.755	24.8616
14	409.475	70.1849	954.943	442.492	24.8616
15	409.797	69.9451	1019.57	472.438	24.8616
16	410.118	69.7194	1066.46	494.164	24.8615
17	410.44	69.5071	1089.19	504.699	24.8616
18	410.762	69.3074	1109	513.875	24.8615
19	411.083	69.1196	1125.17	521.37	24.8616
20	411.405	68.9434	1137.03	526.867	24.8616
21	411.727	68.778	1143.92	530.06	24.8617
22	412.048	68.6232	1144.97	530.544	24.8616
23	412.37	68.4785	1139.57	528.042	24.8616
24	412.692	68.3436	1127.47	522.434	24.8615
25	413.013	68.2181	1108.3	513.554	24.8616
26	413.335	68.1019	1083.84	502.22	24.8616
27	413.657	67.9945	1060.68	491.486	24.8615
28	413.978	67.8959	1034.54	479.376	24.8616
29	414.3	67.8059	1005.5	465.919	24.8616
30	414.622	67.7242	973.642	451.156	24.8616
31	414.943	67.6507	939.069	435.136	24.8616
32	415.265	67.5853	901.915	417.92	24.8616
33	415.587	67.5278	862.334	399.579	24.8616
34	415.908	67.4782	820.503	380.196	24.8616
35	416.23	67.4364	776.406	359.763	24.8616
36	416.552	67.4022	730.102	338.307	24.8616
37	416.873	67.3757	681.78	315.916	24.8616
38	417.195	67.3568	631.661	292.692	24.8615
39	417.517	67.3455	579.998	268.754	24.8616
40	417.839	67.3417	527.083	244.234	24.8616
41	418.16	67.3454	473.244	219.287	24.8616
42	418.482	67.3567	418.859	194.086	24.8615
43	418.804	67.3756	364.351	168.829	24.8615
44	419.125	67.402	310.204	143.739	24.8616
45	419.447	67.4361	256.963	119.069	24.8616
46	419.769	67.4779	205.247	95.1054	24.8616
47	420.09	67.5275	155.759	72.1739	24.8615
48	420.412	67.5849	109.295	50.6442	24.8617
49	420.734	67.6503	66.7659	30.9373	24.8616
50	421.055	67.7237	29.2081	13.5342	24.8617
51	421.377	67.8054	0	0	0

Discharge Sections

Entity Information

Ground Profile

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 0
	714.83, 0
	714.83, 16
	714.83, 24
	714.83, 59.4
	690.54, 56
	676.23, 54
	666.21, 52
	657.41, 50
	649.68, 48
	642, 46
	634.22, 44
	626.17, 42
	618.51, 40
	610.34, 38
	600.78, 36
	588.35, 34
	567.06, 32
	528.68, 32
	508.64, 34
	502.56, 36
	495.7, 38
	489.98, 40
	485.68, 42
	480.89, 44
	476.42, 46
	471.82, 48
	467.15, 50
	462.26, 52
	457.15, 54
	452.4, 56
	446.63, 58
	441.75, 60
	436.588, 61.918
	432.023, 63.751
	427.073, 65.529
	421.995, 67.56
	415.85, 70
	413.83, 71
	411.81, 72
	408.1, 74
	403.39, 76
	399.09, 78
	394.68, 80

	391.118, 81.573 386.405, 83.707 381.691, 85.797 375.57, 88 370.43, 90 365.15, 92 355.85, 94 346.54, 96 329.69, 98 298.67, 100 246.52, 100 196.53, 98 148.77, 96 78.63, 94 0, 91.76 0, 90 0, 78 0, 71 0, 60 0, 24 0, 16
Material Boundary	0, 71 413.83, 71
Material Boundary	0, 78 399.09, 78
Material Boundary	0, 60 441.75, 60
Material Boundary	0, 24 714.83, 24
Material Boundary	0, 16 714.83, 16
Material Boundary	0, 90 370.43, 90

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Long Term
Piezoline	0, 71 421.995, 67.56	Assigned to: 🟨 Surficial Aquifer 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	Assigned to: 🟨 Surficial Aquifer ▨ Black Creek Confining Unit (Long Term) 🟧 Black Creek Aquifer ▨ Upper Cape Fear Confining Unit (Long Term)

Roadway

Shared Entities

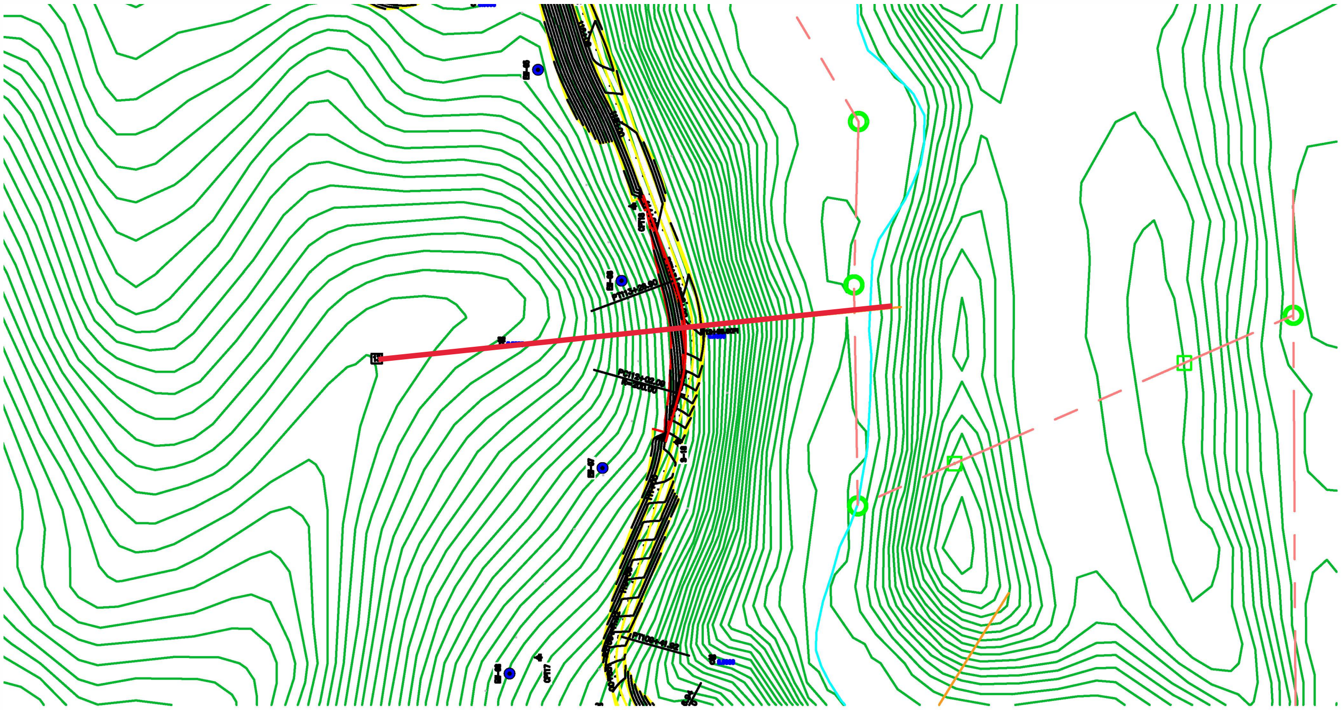
Type	Coordinates (x,y)
	405.305, 75 405.256, 75 397.09, 75

External Boundary	397.05, 76 396.95, 77 396.85, 78 396.78, 79 393.94, 80 391.04, 81 388.05, 82 385.05, 83 382.08, 84 379.09, 85 376.08, 86 373.09, 87 370.11, 88 367.12, 89 364.14, 90 361.15, 91 358.16, 92 355.15, 93 352.17, 94 349.19, 95 346.032, 96.0603 329.69, 98 298.67, 100 246.52, 100 196.53, 98 148.77, 96 78.63, 94 0, 91.76 0, 90 0, 78 0, 71 0, 60 0, 24 0, 16 0, 0 714.83, 0 714.83, 16 714.83, 24 714.83, 59.4 690.54, 56 676.23, 54 666.21, 52 657.41, 50 649.68, 48 642, 46 634.22, 44 626.17, 42 618.51, 40 610.34, 38 600.78, 36 588.35, 34 567.06, 32 528.68, 32 508.64, 34 502.56, 36 495.7, 38 489.98, 40 485.68, 42 480.89, 44

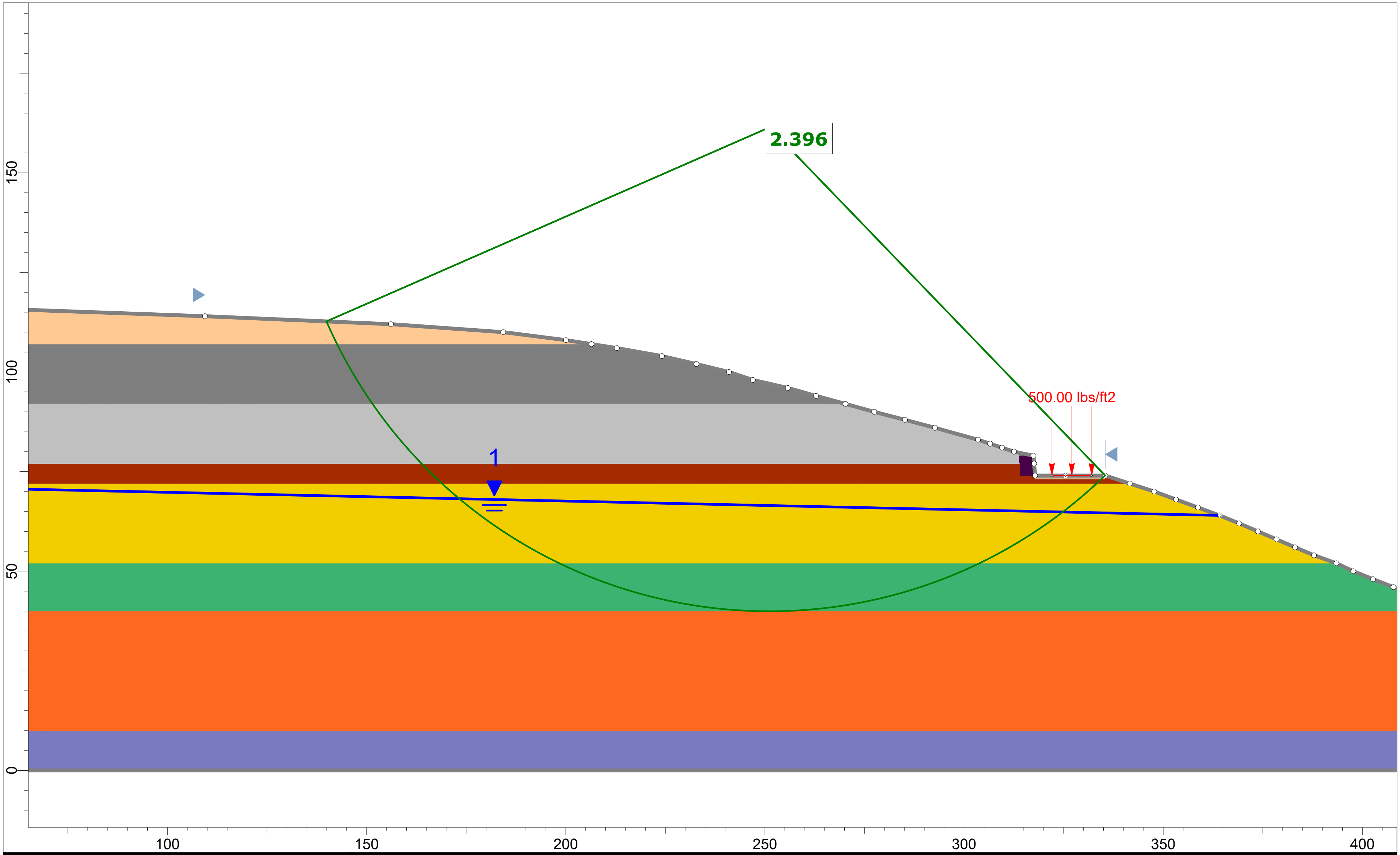
	476.42, 46 471.82, 48 467.15, 50 462.26, 52 457.15, 54 452.4, 56 446.63, 58 441.75, 60 436.588, 61.918 432.023, 63.751 427.073, 65.529 421.995, 67.56 415.85, 70 413.23, 71.297 413.23, 75 412.23, 75
Material Boundary	0, 71 410.23, 71
Material Boundary	0, 78 393.78, 78 396.85, 78
Material Boundary	0, 60 441.75, 60
Material Boundary	0, 24 714.83, 24
Material Boundary	0, 16 714.83, 16
Material Boundary	0, 90 364.14, 90
Material Boundary	346.032, 96.0603 346.21, 96 349.19, 95
Material Boundary	412.23, 75 411.73, 74 410.23, 71 409.73, 70 413.23, 70 413.23, 71.297
Material Boundary	396.78, 79 393.78, 79 393.78, 78 393.78, 75 397.09, 75
Material Boundary	397.09, 75 397.09, 74 411.73, 74

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Short Term Downslope	Long Term Upslope	Long Term Downslope
Piezoline	0, 71 427.073, 65.529	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer	Not assigned to any materials	Not assigned to any materials
Distributed Load	399.969, 75 405.745, 75 410.005, 75	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No



Section: 13, Steep Downslope
Approximate Station: 112+73

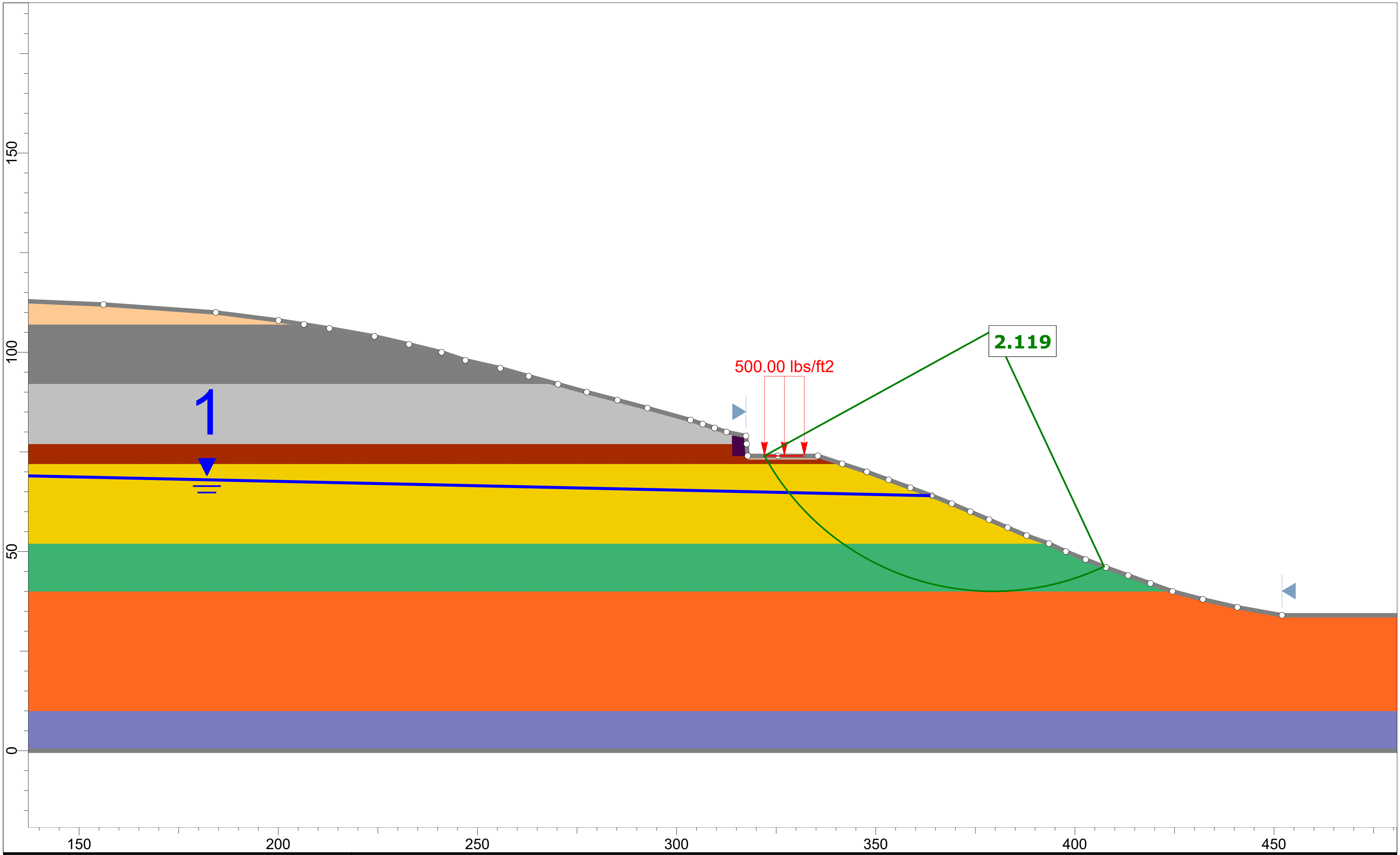


GEOS

Geotechnical, Environmental and Materials Engineers

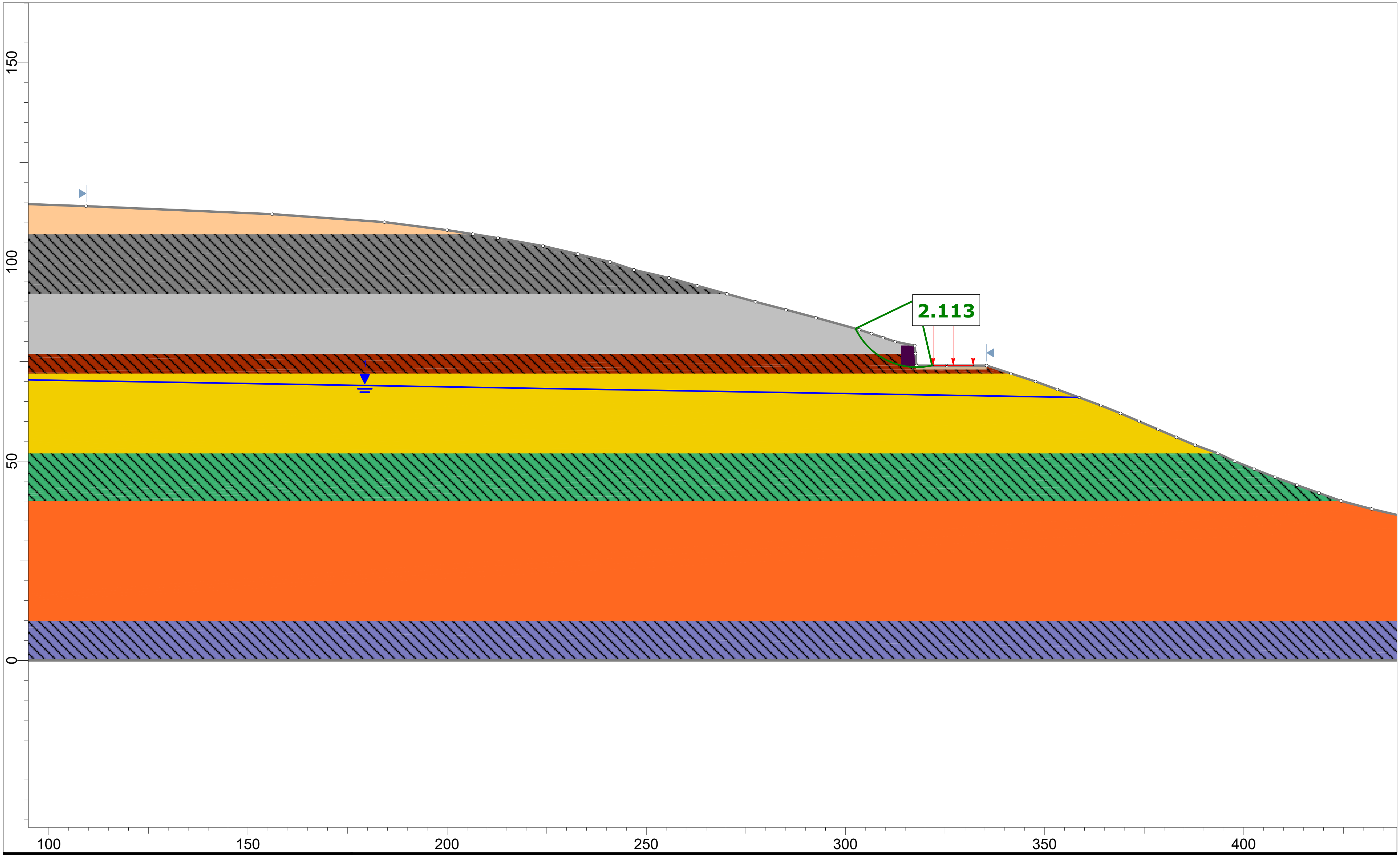
SLIDEINTERPRET 9.016

Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Upslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_112+73_section_13.slmd



GEOS
Geotechnical, Environmental and Materials Engineers
SLIDEINTERPRET 9.016

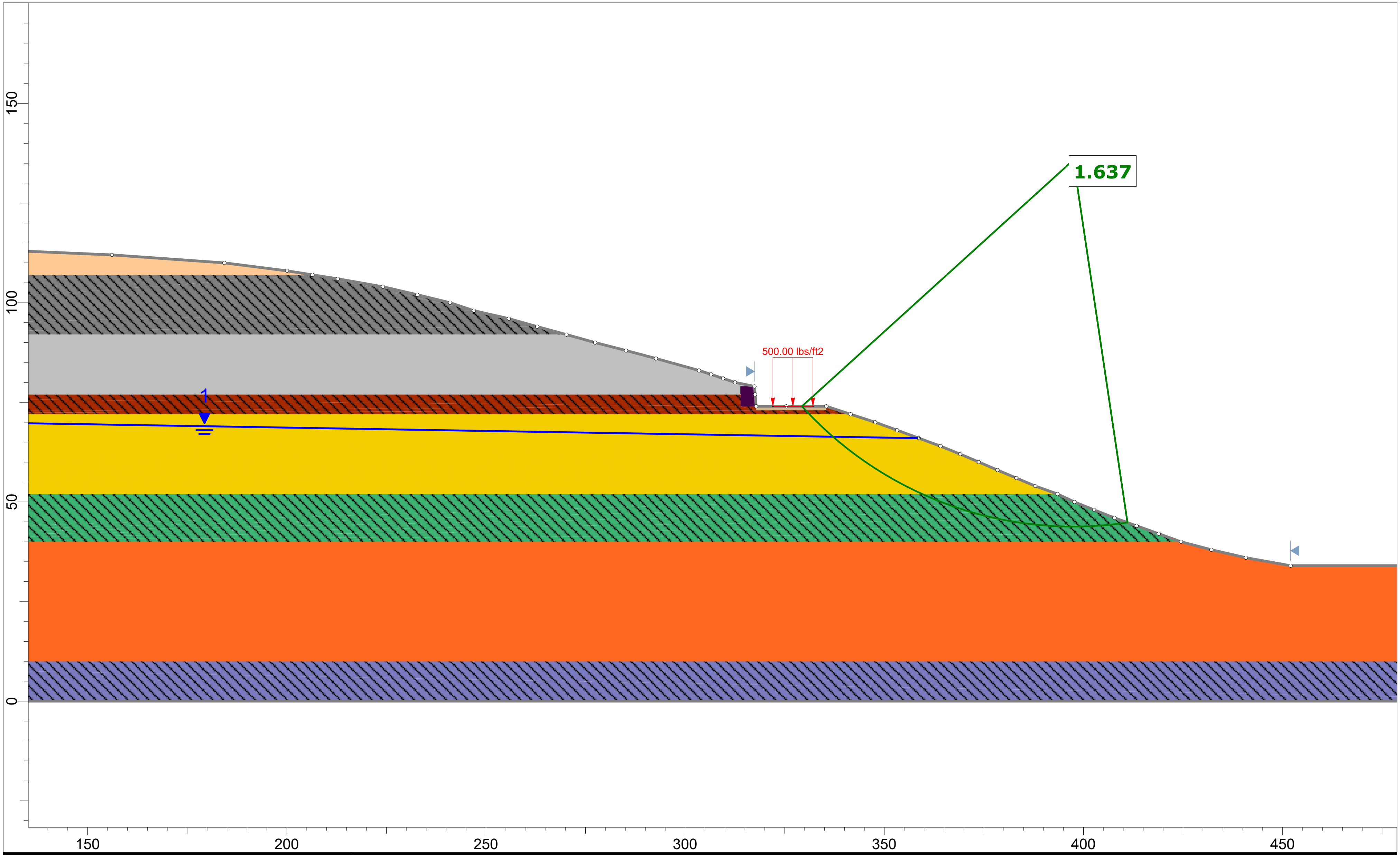
Project	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	*Scenario*	Short Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_112+73_section_13.slmd



Project
45-20803 Barrier Wall Road Interim Design and Repair

Group	Roadway Upslope	*Scenario*	Long Term Slope Stability Analysis
Drawn By		*Company*	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	*File Name*	section_112+73_section_13.slmd

GEOS
Geotechnical, Environmental and Materials Engineers
SLIDEINTERPRET 9.016



	Project		
	45-20803 Barrier Wall Road Interim Design and Repair		
Group	Roadway Downslope	Scenario	Long Term Slope Stability Analysis
Drawn By		Company	GeoServices LLC
Date	4/9/2021, 11:24:47 AM	File Name	section_112+73_section_13.slmd

Geotechnical, Environmental and Materials Engineers

SLIDEINTERPRET 9.016

rocscience

GEOS

Geotechnical, Environmental and Materials Engineers

45-20803 Barrier Wall Road Interim Design and Repair
Steep Downslope
Slope Stability Analysis
Date Created: 4/9/2021, 11:24:47 AM
Software Version: 9.016

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Slide Analysis Information

section_112+73_section_13

Project Summary

File Name:	section_112+73_section_13.slmd
Slide Modeler Version:	9.016
Project Title:	45-20803 Barrier Wall Road Interim Design and Repair
Analysis:	Roadway: Long Term Slope Stability
Company:	GeoServices LLC
Date Created:	4/9/2021, 11:24:47 AM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Ground Profile 🔷	Master Scenario	Spencer: 1.996250	00h:00m:00.975s
	Long Term	Spencer: 1.660280	00h:00m:00.650s
Roadway 🟩	Master Scenario	Spencer: 2.396180	00h:00m:11.173s
	Roadway Short Term Downslope	Spencer: 2.118780	00h:00m:01.115s
	Roadway Long Term Upslope	Spencer: 2.112950	00h:00m:00.981s
	Roadway Long Term Downslope	Spencer: 1.636560	00h:00m:00.538s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Loading

◆ Roadway

Distribution:	Constant
Magnitude [psf]:	500
Orientation:	Vertical

Materials

Retaining Wall	
Color	🟪
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	135
Allow Sliding Along Boundary	Yes
Water Surface	Assigned per scenario
Ru Value	0
Light Brown Sand	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay	
Color	⬛
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	1300
Cohesion Type	Constant
Water Surface	Assigned per scenario
Ru Value	0
Dark Gray Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	25
Water Surface	Assigned per scenario
Ru Value	0
Light Gray Sand	
Color	⬜
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	50
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Ru Value	0
Perched Clay	
Color	🟥
Strength Type	Undrained
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1100
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Perched Clay (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	200
Friction Angle [deg]	24
Water Surface	Assigned per scenario
Ru Value	0
Surficial Aquifer	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	115
Cohesion [psf]	75
Friction Angle [deg]	32
Water Surface	Assigned per scenario
Hu Value	1
Black Creek Confining Unit	
Color	🟩
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	900
Cohesion Type	F(Depth from Top of Layer)
Cohesion Change [psf/ft]	30
Cutoff [psf]	2000
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	125
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Ru Value	0
Black Creek Aquifer	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	33
Water Surface	Assigned per scenario
Hu Value	1
Upper Cape Fear Confining Unit	
Color	🟪
Strength Type	Undrained
Unit Weight [lbs/ft3]	120
Cohesion [psf]	2500
Cohesion Type	Constant

Water Surface	Assigned per scenario
Ru Value	0
Upper Cape Fear Confining Unit (Long Term)	
Color	▨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	200
Friction Angle [deg]	26
Water Surface	Assigned per scenario
Ru Value	0
Roadway	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	145
Cohesion [psf]	0
Friction Angle [deg]	45
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material	Ground Profile	Long Term	Roadway	Roadway Short Term Downslope	Roadway Long Term Upslope	Roadway Long Term Downslope
Infinite Strength Wall	✗	✗	✓	✓	✓	✓
Light Brown Sand	✓	✓	✓	✓	✓	✓
Dark Gray Clay	✓	✗	✓	✓	✗	✗
Dark Gray Clay (Long Term)	✗	✓	✗	✗	✓	✓
Light Gray Sand	✓	✓	✓	✓	✓	✓
Perched Clay	✓	✗	✓	✓	✗	✗
Perched Clay (Long Term)	✗	✓	✗	✗	✓	✓
Surficial Aquifer	✓	✓	✓	✓	✓	✓
Black Creek Confining Unit	✓	✗	✓	✓	✗	✗
Black Creek Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Black Creek Aquifer	✓	✓	✓	✓	✓	✓
Upper Cape Fear Confining Unit	✓	✗	✓	✓	✗	✗
Upper Cape Fear Confining Unit (Long Term)	✗	✓	✗	✗	✓	✓
Roadway	✗	✗	✓	✓	✓	✓

Global Minimums

Ground Profile - Master Scenario

Method: spencer

FS	1.996250
Center:	273.865, 189.827
Radius:	149.855
Left Slip Surface Endpoint:	145.530, 112.453
Right Slip Surface Endpoint:	358.407, 66.096
Resisting Moment:	5.00722e+07 lb-ft
Driving Moment:	2.50832e+07 lb-ft
Resisting Horizontal Force:	292106 lb
Driving Horizontal Force:	146328 lb
Total Slice Area:	8208.12 ft2
Surface Horizontal Width:	212.877 ft
Surface Average Height:	38.5581 ft

Ground Profile - Long Term

Method: spencer

FS	1.660280
Center:	404.723, 145.835
Radius:	104.124
Left Slip Surface Endpoint:	326.857, 76.706
Right Slip Surface Endpoint:	417.526, 42.500
Resisting Moment:	5.61625e+06 lb-ft
Driving Moment:	3.38272e+06 lb-ft
Resisting Horizontal Force:	49786.9 lb
Driving Horizontal Force:	29987.1 lb
Total Slice Area:	836.961 ft2
Surface Horizontal Width:	90.6688 ft
Surface Average Height:	9.23097 ft

Roadway - Master Scenario

Method: spencer

FS	2.396180
Center:	251.131, 161.388
Radius:	121.424
Left Slip Surface Endpoint:	139.898, 112.694
Right Slip Surface Endpoint:	335.436, 74.000
Resisting Moment:	4.11655e+07 lb-ft
Driving Moment:	1.71796e+07 lb-ft
Resisting Horizontal Force:	284341 lb
Driving Horizontal Force:	118664 lb
Total Slice Area:	8141.67 ft2
Surface Horizontal Width:	195.538 ft
Surface Average Height:	41.6374 ft

Roadway - Roadway Short Term Downslope

Method: spencer

FS	2.118780
Center:	379.514, 105.565
Radius:	65.575
Left Slip Surface Endpoint:	322.036, 74.000
Right Slip Surface Endpoint:	407.328, 46.181
Resisting Moment:	6.40791e+06 lb-ft
Driving Moment:	3.02435e+06 lb-ft
Resisting Horizontal Force:	87921.6 lb
Driving Horizontal Force:	41496.4 lb
Total Slice Area:	1320.19 ft2
Surface Horizontal Width:	85.2915 ft
Surface Average Height:	15.4786 ft

Roadway - Roadway Long Term Upslope

Method: spencer

FS	2.112950
Center:	317.968, 90.683
Radius:	17.110
Left Slip Surface Endpoint:	302.551, 83.263
Right Slip Surface Endpoint:	321.763, 74.000
Resisting Moment:	111675 lb-ft
Driving Moment:	52852.3 lb-ft
Resisting Horizontal Force:	5801.19 lb
Driving Horizontal Force:	2745.53 lb
Total Slice Area:	69.6183 ft2
Surface Horizontal Width:	19.2113 ft
Surface Average Height:	3.62383 ft

Roadway - Roadway Long Term Downslope

Method: spencer

FS	1.636560
Center:	397.472, 135.815
Radius:	92.002
Left Slip Surface Endpoint:	329.330, 74.000
Right Slip Surface Endpoint:	411.064, 44.822
Resisting Moment:	4.51968e+06 lb-ft
Driving Moment:	2.7617e+06 lb-ft
Resisting Horizontal Force:	45361.7 lb
Driving Horizontal Force:	27717.8 lb
Total Slice Area:	763.436 ft2
Surface Horizontal Width:	81.7345 ft
Surface Average Height:	9.34044 ft

Global Minimum Support Data

All Open Scenarios

No Supports Present

Valid and Invalid Surfaces

Ground Profile - Master Scenario

Method: spencer

Number of Valid Surfaces:	10405
Number of Invalid Surfaces:	0

Ground Profile - Long Term

Method: spencer

Number of Valid Surfaces:	5905
Number of Invalid Surfaces:	0

Roadway - Master Scenario

Method: spencer

Number of Valid Surfaces:	9781
Number of Invalid Surfaces:	0

Roadway - Roadway Short Term Downslope

Method: spencer

Number of Valid Surfaces:	4142
Number of Invalid Surfaces:	0

Roadway - Roadway Long Term Upslope

Method: spencer

Number of Valid Surfaces:	10418
Number of Invalid Surfaces:	0

Roadway - Roadway Long Term Downslope

Method: spencer

Number of Valid Surfaces:	3544
Number of Invalid Surfaces:	0

Slice Data

Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.99625

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.44986	1006.64	-57.6804	Light Brown Sand	75	32	82.4933	164.677	143.514	0	143.514	273.906	273.906
2	3.78881	3415.53	-55.1782	Dark Gray Clay	1300	0	651.221	1300	38.8068	0	38.8068	975.03	975.03
3	3.78881	5717.05	-52.7139	Dark Gray Clay	1300	0	651.221	1300	631.295	0	631.295	1486.58	1486.58
4	3.78881	7793.98	-50.3822	Dark Gray Clay	1300	0	651.221	1300	1175.05	0	1175.05	1961.75	1961.75
5	3.72368	9464.47	-48.1787	Light Gray Sand	50	32	568.656	1135.18	1736.65	0	1736.65	2372.18	2372.18
6	3.72368	11075.4	-46.0847	Light Gray Sand	50	32	678.066	1353.59	2086.18	0	2086.18	2790.42	2790.42
7	3.72368	12566.9	-44.0675	Light Gray Sand	50	32	783.614	1564.29	2423.38	0	2423.38	3181.9	3181.9
8	3.72368	13951.3	-42.117	Light Gray Sand	50	32	885.4	1767.48	2748.54	0	2748.54	3549.03	3549.03
9	6.03121	25193.3	-39.6594	Perched Clay	1100	0	551.033	1100	3436.65	0	3436.65	3893.47	3893.47
10	5.47384	25397.6	-36.8537	Surficial Aquifer	75	32	1158.96	2313.58	3582.48	0	3582.48	4451.19	4451.19
11	4.04204	20108.4	-34.607	Surficial Aquifer	75	32	1242.99	2481.31	3935.15	84.2453	3850.91	4792.85	4708.61
12	4.04204	21132.7	-32.7493	Surficial Aquifer	75	32	1283.02	2561.23	4225.64	246.84	3978.8	5050.89	4804.05
13	4.04204	22071.6	-30.9296	Surficial Aquifer	75	32	1321.27	2637.58	4498.97	397.979	4100.99	5290.66	4892.68
14	4.04204	22916.7	-29.144	Surficial Aquifer	75	32	1356.89	2708.7	4753.13	538.322	4214.81	5509.73	4971.41
15	4.04204	23647.6	-27.3889	Surficial Aquifer	75	32	1388.3	2771.4	4983.58	668.439	4315.14	5702.86	5034.42
16	4.04204	24288.1	-25.6613	Surficial Aquifer	75	32	1416.74	2828.17	5194.83	788.825	4406	5875.48	5086.65
17	4.04204	24843.6	-23.9584	Surficial Aquifer	75	32	1442.34	2879.28	5387.7	899.911	4487.79	6028.62	5128.71
18	4.30095	26956.5	-22.2246	Black Creek Confining Unit	926.358	0	464.049	926.358	5840.96	1005.06	4835.9	6030.57	5025.51
19	4.30095	27431.8	-20.4587	Black Creek Confining Unit	976.786	0	489.31	976.786	5980.81	1104.05	4876.76	6163.35	5059.3
20	4.30095	27782.1	-18.713	Black Creek Confining Unit	1022.71	0	512.316	1022.71	6094.65	1193.67	4900.98	6268.19	5074.52
21	4.30095	27984.6	-16.9851	Black Creek Confining Unit	1064.27	0	533.135	1064.27	6176.9	1274.22	4902.68	6339.74	5065.52
22	4.30095	28102.6	-15.273	Black Creek Confining Unit	1101.59	0	551.83	1101.59	6241.27	1345.95	4895.32	6391.96	5046.01
23	4.30095	28132.5	-13.5748	Black Creek Confining Unit	1134.78	0	568.456	1134.78	6286.67	1409.1	4877.57	6423.93	5014.83

24	4.30095	27998.4	-11.8886	Black Creek Confining Unit	1163.94	0	583.063	1163.94	6295.53	1463.86	4831.67	6418.28	4954.42
25	4.30095	27729.3	-10.2129	Black Creek Confining Unit	1189.15	0	595.692	1189.15	6273.98	1510.38	4763.6	6381.3	4870.92
26	4.30095	27569.4	-8.54591	Black Creek Confining Unit	1210.46	0	606.367	1210.46	6277.35	1548.83	4728.52	6368.47	4819.64
27	4.30095	27347.6	-6.88622	Black Creek Confining Unit	1227.95	0	615.128	1227.95	6266.67	1579.3	4687.37	6340.96	4761.66
28	4.30095	26972.4	-5.23231	Black Creek Confining Unit	1241.65	0	621.991	1241.65	6220.66	1601.9	4618.76	6277.62	4675.72
29	4.30095	26527.5	-3.58277	Black Creek Confining Unit	1251.6	0	626.976	1251.6	6158.25	1616.69	4541.56	6197.5	4580.81
30	4.30095	26030.6	-1.9362	Black Creek Confining Unit	1257.82	0	630.091	1257.82	6083.22	1623.74	4459.48	6104.52	4480.78
31	5.82419	34354.4	0	Black Creek Confining Unit	1260	0	631.183	1260	5976.28	1621.33	4354.95	5976.28	4354.95
32	4.30095	24652.3	1.9362	Black Creek Confining Unit	1257.82	0	630.091	1257.82	5855.1	1609.86	4245.24	5833.8	4223.94
33	4.30095	23994.4	3.58277	Black Creek Confining Unit	1251.6	0	626.976	1251.6	5739.6	1591.02	4148.58	5700.35	4109.33
34	4.30095	23264	5.23231	Black Creek Confining Unit	1241.65	0	621.991	1241.65	5605.85	1564.43	4041.42	5548.9	3984.47
35	4.30095	22462.3	6.88622	Black Creek Confining Unit	1227.95	0	615.128	1227.95	5453.83	1530.04	3923.79	5379.54	3849.5
36	4.30095	21602.8	8.54591	Black Creek Confining Unit	1210.46	0	606.367	1210.46	5286.48	1487.78	3798.7	5195.37	3707.59
37	4.30095	20677.1	10.2129	Black Creek Confining Unit	1189.15	0	595.692	1189.15	5101.51	1437.54	3663.97	4994.19	3556.65
38	4.30095	19669.3	11.8886	Black Creek Confining Unit	1163.94	0	583.063	1163.94	4894.78	1379.22	3515.56	4772.03	3392.81
39	4.30095	18592.1	13.5748	Black Creek Confining Unit	1134.78	0	568.456	1134.78	4668.99	1312.67	3356.32	4531.73	3219.06
40	4.30095	17447.6	15.273	Black Creek Confining Unit	1101.59	0	551.83	1101.59	4424.22	1237.73	3186.49	4273.53	3035.8
41	4.30095	16230.8	16.9851	Black Creek Confining Unit	1064.27	0	533.135	1064.27	4158.8	1154.2	3004.6	3995.96	2841.76
42	4.30095	14936.2	18.713	Black Creek Confining Unit	1022.71	0	512.316	1022.71	3871	1061.86	2809.14	3697.46	2635.6

43	4.30095	13529.3	20.4587	Black Creek Confining Unit	976.786	0	489.31	976.786	3551.75	960.45	2591.3	3369.2	2408.75
44	4.30095	12038.4	22.2246	Black Creek Confining Unit	926.358	0	464.049	926.358	3207.26	849.663	2357.59	3017.65	2167.99
45	4.571	11059.4	24.0699	Surficial Aquifer	75	32	754.465	1506.1	3015.28	725.047	2290.23	2678.26	1953.22
46	4.571	9187.12	25.9993	Surficial Aquifer	75	32	657.338	1312.21	2565.48	585.519	1979.96	2244.89	1659.37
47	4.571	7195.65	27.961	Surficial Aquifer	75	32	549.215	1096.37	2068.54	433.991	1634.55	1777	1343
48	4.571	5060.91	29.959	Surficial Aquifer	75	32	426.708	851.815	1512.98	269.817	1243.16	1267.03	997.211
49	4.571	2744.48	31.9981	Surficial Aquifer	75	32	284.421	567.776	880.844	92.2376	788.606	703.13	610.893
50	2.86239	486.599	33.6862	Surficial Aquifer	75	32	133.416	266.331	306.194	0	306.194	217.263	217.263

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.66028

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.22364	215.805	-47.4961	Perched Clay (Long Term)	200	24	120.734	200.452	1.0142	0	1.0142	132.754	132.754
2	2.22364	623.95	-45.7144	Perched Clay (Long Term)	200	24	154.795	257.004	128.032	0	128.032	286.736	286.736
3	2.05063	911.725	-44.0531	Surficial Aquifer	75	32	145.751	241.987	267.235	0	267.235	408.246	408.246
4	2.05063	1218.74	-42.5027	Surficial Aquifer	75	32	185.783	308.451	373.601	0	373.601	543.855	543.855
5	2.05063	1500.56	-40.99	Surficial Aquifer	75	32	224.254	372.324	475.817	0	475.817	670.689	670.689
6	1.84455	1571.16	-39.584	Surficial Aquifer	75	32	244.137	405.336	575.264	46.6146	528.649	777.117	730.502
7	1.84455	1764.79	-38.279	Surficial Aquifer	75	32	245.98	408.395	671.229	137.688	533.541	865.346	727.658
8	1.84455	1942.74	-36.9971	Surficial Aquifer	75	32	247.33	410.637	761.672	224.54	537.132	948.029	723.489
9	1.84455	2104	-35.7364	Surficial Aquifer	75	32	247.893	411.571	846.011	307.387	538.624	1024.38	716.992
10	1.84455	2252.16	-34.4954	Surficial Aquifer	75	32	248.057	411.844	925.478	386.417	539.061	1095.93	709.517
11	1.84455	2386.47	-33.2726	Surficial Aquifer	75	32	247.591	411.07	999.626	461.801	537.825	1162.09	700.292
12	1.84455	2497.17	-32.0667	Surficial Aquifer	75	32	244.864	406.542	1064.27	533.694	530.58	1217.68	683.985
13	1.84455	2593.91	-30.8765	Surficial Aquifer	75	32	241.213	400.481	1123.11	602.234	520.878	1267.34	665.107
14	1.84455	2679.62	-29.701	Surficial Aquifer	75	32	236.998	393.483	1177.23	667.547	509.68	1312.41	644.866
15	1.84455	2754.37	-28.539	Surficial Aquifer	75	32	232.141	385.419	1226.52	729.746	496.776	1352.77	623.023
16	1.84455	2818.8	-27.3897	Surficial Aquifer	75	32	226.669	376.334	1271.17	788.937	482.236	1388.62	599.679
17	1.84455	2873.29	-26.2523	Surficial Aquifer	75	32	220.567	366.203	1311.24	845.213	466.022	1420.02	574.805
18	1.75561	2780.08	-25.1528	Black Creek Confining Unit (Long Term)	125	26	461.779	766.683	1315.65	0	1315.65	1532.48	1532.48
19	1.75561	2819.53	-24.0901	Black Creek Confining Unit (Long Term)	125	26	472.32	784.183	1351.53	0	1351.53	1562.71	1562.71
20	1.75561	2849.61	-23.0361	Black Creek Confining Unit (Long Term)	125	26	481.642	799.661	1383.26	0	1383.26	1588.06	1588.06
21	1.75561	2861.92	-21.9903	Black Creek Confining Unit (Long Term)	125	26	488.487	811.026	1406.56	0	1406.56	1603.83	1603.83
22	1.75561	2864.2	-20.9521	Black Creek Confining Unit (Long Term)	125	26	493.908	820.025	1425.01	0	1425.01	1614.13	1614.13
23	1.75561	2857.27	-19.9211	Black Creek Confining Unit (Long Term)	125	26	497.98	826.786	1438.87	0	1438.87	1619.35	1619.35

24	1.75561	2836.48	-18.8968	Black Creek Confining Unit (Long Term)	125	26	499.967	830.086	1445.64	0	1445.64	1616.79	1616.79
25	1.75561	2807.64	-17.8787	Black Creek Confining Unit (Long Term)	125	26	500.685	831.278	1448.09	0	1448.09	1609.6	1609.6
26	1.75561	2771.71	-16.8664	Black Creek Confining Unit (Long Term)	125	26	500.246	830.548	1446.59	0	1446.59	1598.26	1598.26
27	1.75561	2728.84	-15.8595	Black Creek Confining Unit (Long Term)	125	26	498.64	827.882	1441.12	0	1441.12	1582.78	1582.78
28	1.75561	2678.97	-14.8577	Black Creek Confining Unit (Long Term)	125	26	495.826	823.21	1431.54	0	1431.54	1563.08	1563.08
29	1.75561	2622.18	-13.8604	Black Creek Confining Unit (Long Term)	125	26	491.787	816.504	1417.79	0	1417.79	1539.14	1539.14
30	1.75561	2558.58	-12.8674	Black Creek Confining Unit (Long Term)	125	26	486.505	807.735	1399.82	0	1399.82	1510.95	1510.95
31	1.75561	2488.67	-11.8783	Black Creek Confining Unit (Long Term)	125	26	480.027	796.98	1377.76	0	1377.76	1478.73	1478.73
32	1.75561	2413.74	-10.8929	Black Creek Confining Unit (Long Term)	125	26	472.536	784.542	1352.26	0	1352.26	1443.2	1443.2
33	1.75561	2332.4	-9.91062	Black Creek Confining Unit (Long Term)	125	26	463.772	769.992	1322.43	0	1322.43	1403.46	1403.46
34	1.75561	2253.92	-8.93131	Black Creek Confining Unit (Long Term)	125	26	455.252	755.846	1293.43	0	1293.43	1364.97	1364.97
35	1.75561	2182.46	-7.95463	Black Creek Confining Unit (Long Term)	125	26	447.693	743.296	1267.7	0	1267.7	1330.25	1330.25
36	1.75561	2104.69	-6.98028	Black Creek Confining Unit (Long Term)	125	26	438.856	728.624	1237.61	0	1237.61	1291.35	1291.35
37	1.75561	2008.61	-6.00795	Black Creek Confining Unit (Long Term)	125	26	426.635	708.334	1196.01	0	1196.01	1240.91	1240.91
38	1.75561	1872.2	-5.03735	Black Creek Confining Unit (Long Term)	125	26	407.089	675.882	1129.47	0	1129.47	1165.36	1165.36

39	1.75561	1728.45	-4.0682	Black Creek Confining Unit (Long Term)	125	26	385.795	640.527	1056.99	0	1056.99	1084.43	1084.43
40	1.75561	1596.32	-3.10021	Black Creek Confining Unit (Long Term)	125	26	366.081	607.797	989.881	0	989.881	1009.71	1009.71
41	1.75561	1464.39	-2.13311	Black Creek Confining Unit (Long Term)	125	26	345.947	574.369	921.344	0	921.344	934.23	934.23
42	1.75561	1326.63	-1.16662	Black Creek Confining Unit (Long Term)	125	26	324.287	538.407	847.611	0	847.611	854.215	854.215
43	1.75561	1185.68	-0.200462	Black Creek Confining Unit (Long Term)	125	26	301.539	500.64	770.173	0	770.173	771.228	771.228
44	1.75561	1039.1	0.765641	Black Creek Confining Unit (Long Term)	125	26	277.215	460.254	687.37	0	687.37	683.666	683.666
45	1.75561	888.024	1.73196	Black Creek Confining Unit (Long Term)	125	26	251.477	417.523	599.758	0	599.758	592.154	592.154
46	1.75561	739.464	2.69878	Black Creek Confining Unit (Long Term)	125	26	225.617	374.587	511.73	0	511.73	501.095	501.095
47	1.75561	585.854	3.66636	Black Creek Confining Unit (Long Term)	125	26	198.171	329.019	418.301	0	418.301	405.603	405.603
48	1.75561	425.986	4.63499	Black Creek Confining Unit (Long Term)	125	26	168.846	280.332	318.479	0	318.479	304.79	304.79
49	1.75561	259.995	5.60495	Black Creek Confining Unit (Long Term)	125	26	137.601	228.457	212.119	0	212.119	198.615	198.615
50	1.75561	87.7222	6.57653	Black Creek Confining Unit (Long Term)	125	26	108.817	180.667	114.134	0	114.134	101.589	101.589

Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.39618

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	2.67049	819.546	-64.874	Light Brown Sand	75	32	67.823	162.516	140.055	0	140.055	284.671	284.671
2	4.4586	4859.88	-61.2056	Dark Gray Clay	1300	0	542.53	1300	130.561	0	130.561	1117.65	1117.65
3	4.4586	8779	-57.0849	Dark Gray Clay	1300	0	542.53	1300	1029.56	0	1029.56	1867.7	1867.7
4	4.11268	11029.7	-53.5166	Light Gray Sand	50	32	496.173	1188.92	1822.65	0	1822.65	2493.6	2493.6
5	4.11268	13419.2	-50.3632	Light Gray Sand	50	32	622.032	1490.5	2305.28	0	2305.28	3056.2	3056.2
6	4.11268	15519.7	-47.4081	Light Gray Sand	50	32	739.014	1770.81	2753.87	0	2753.87	3557.77	3557.77
7	5.12648	21889	-44.2844	Perched Clay	1100	0	459.064	1100	3536.96	0	3536.96	3984.7	3984.7
8	4.34433	20534.6	-41.2316	Surficial Aquifer	75	32	983.766	2357.28	3652.42	0	3652.42	4514.6	4514.6
9	4.18801	21378.4	-38.6041	Surficial Aquifer	75	32	1060.92	2542.16	4049.73	101.449	3948.28	4896.78	4795.33
10	4.18801	22782.6	-36.1164	Surficial Aquifer	75	32	1108.95	2657.24	4427.81	295.372	4132.44	5236.96	4941.58
11	4.18801	24046.8	-33.7053	Surficial Aquifer	75	32	1154.05	2765.32	4777.53	472.132	4305.4	5547.35	5075.21
12	4.18801	25110.5	-31.3603	Surficial Aquifer	75	32	1192.62	2857.74	5086.5	633.185	4453.31	5813.34	5180.16
13	4.18801	26040.8	-29.0725	Surficial Aquifer	75	32	1227.65	2941.68	5367.36	779.724	4587.64	6049.9	5270.17
14	4.18801	26866.7	-26.8345	Surficial Aquifer	75	32	1260.36	3020.05	5625.79	912.73	4713.06	6263.4	5350.67
15	3.82521	25187.8	-24.7334	Black Creek Confining Unit	926.429	0	386.627	926.429	6172.89	0	6172.89	6350.99	6350.99
16	3.82521	25712.6	-22.761	Black Creek Confining Unit	976.934	0	407.705	976.934	6336.72	0	6336.72	6507.78	6507.78
17	3.82521	26153	-20.8167	Black Creek Confining Unit	1022.82	0	426.854	1022.82	6480.94	0	6480.94	6643.23	6643.23
18	3.82521	26511.3	-18.8972	Black Creek Confining Unit	1064.28	0	444.157	1064.28	6605.75	0	6605.75	6757.79	6757.79
19	3.82521	26780.1	-16.9994	Black Creek Confining Unit	1101.46	0	459.673	1101.46	6709.01	0	6709.01	6849.54	6849.54
20	3.82521	26975.5	-15.1208	Black Creek Confining Unit	1134.51	0	473.466	1134.51	6794.45	0	6794.45	6922.38	6922.38
21	3.82521	27105.6	-13.2586	Black Creek Confining Unit	1163.53	0	485.577	1163.53	6863.93	0	6863.93	6978.34	6978.34
22	3.82521	27108.6	-11.4107	Black Creek Confining Unit	1188.63	0	496.052	1188.63	6901.34	0	6901.34	7001.46	7001.46
23	3.82521	27027.9	-9.57466	Black Creek Confining Unit	1209.89	0	504.925	1209.89	6917.52	0	6917.52	7002.69	7002.69

24	3.82521	26877.9	-7.74853	Black Creek Confining Unit	1227.38	0	512.224	1227.38	6915.96	0	6915.96	6985.66	6985.66
25	3.82521	26660.3	-5.93031	Black Creek Confining Unit	1241.15	0	517.97	1241.15	6896.86	0	6896.86	6950.66	6950.66
26	3.82521	26325.7	-4.11806	Black Creek Confining Unit	1251.24	0	522.181	1251.24	6847.23	0	6847.23	6884.82	6884.82
27	3.82521	25847.4	-2.30994	Black Creek Confining Unit	1257.68	0	524.869	1257.68	6759.83	0	6759.83	6781	6781
28	5.96161	39471.7	0	Black Creek Confining Unit	1260	0	525.837	1260	6670.9	0	6670.9	6670.9	6670.9
29	3.82521	24764.2	2.30994	Black Creek Confining Unit	1257.68	0	524.869	1257.68	6570.16	0	6570.16	6548.99	6548.99
30	3.82521	24180.8	4.11806	Black Creek Confining Unit	1251.24	0	522.181	1251.24	6452.79	0	6452.79	6415.2	6415.2
31	3.82521	23537.1	5.93031	Black Creek Confining Unit	1241.15	0	517.97	1241.15	6318.57	0	6318.57	6264.76	6264.76
32	3.82521	22848	7.74853	Black Creek Confining Unit	1227.38	0	512.224	1227.38	6171.21	0	6171.21	6101.51	6101.51
33	3.82521	22106.4	9.57466	Black Creek Confining Unit	1209.89	0	504.925	1209.89	6008.63	0	6008.63	5923.46	5923.46
34	3.82521	21314.7	11.4107	Black Creek Confining Unit	1188.63	0	496.052	1188.63	5831.32	0	5831.32	5731.2	5731.2
35	3.82521	20477.1	13.2586	Black Creek Confining Unit	1163.53	0	485.577	1163.53	5640.1	0	5640.1	5525.68	5525.68
36	3.82521	19597.5	15.1208	Black Creek Confining Unit	1134.51	0	473.466	1134.51	5435.82	0	5435.82	5307.89	5307.89
37	3.82521	18651.5	16.9994	Black Creek Confining Unit	1101.46	0	459.673	1101.46	5211.65	0	5211.65	5071.12	5071.12
38	3.82521	17634.5	18.8972	Black Creek Confining Unit	1064.28	0	444.157	1064.28	4965.98	0	4965.98	4813.93	4813.93
39	3.82521	16544.5	20.8167	Black Creek Confining Unit	1022.82	0	426.854	1022.82	4697.81	0	4697.81	4535.52	4535.52
40	3.82521	15376.3	22.761	Black Creek Confining Unit	976.934	0	407.705	976.934	4405.28	0	4405.28	4234.22	4234.22
41	3.82521	14137	24.7334	Black Creek Confining Unit	926.429	0	386.627	926.429	4089.76	0	4089.76	3911.66	3911.66
42	4.19195	13940.3	26.8356	Surficial Aquifer	75	32	890.163	2132.99	4055.87	762.396	3293.47	3605.52	2843.12
43	4.19195	12193.7	29.0757	Surficial Aquifer	75	32	817.793	1959.58	3633.72	617.758	3015.97	3179	2561.24

44	4.19195	10742.2	31.3658	Surficial Aquifer	75	32	771.382	1848.37	3297.55	459.56	2837.99	2827.33	2367.77
45	4.19195	7436.96	33.7132	Surficial Aquifer	75	32	571.96	1370.52	2360.08	286.818	2073.26	1978.44	1691.62
46	4.19195	5246.61	36.1268	Surficial Aquifer	75	32	583.253	1397.58	2214.9	98.3351	2116.57	1789.17	1690.83
47	4.2563	3745.63	38.6371	Surficial Aquifer	75	32	562.95	1348.93	2038.71	0	2038.71	1588.71	1588.71
48	4.2563	1999.16	41.2587	Surficial Aquifer	75	32	366.265	877.636	1284.49	0	1284.49	963.182	963.182
49	1.07459	214.917	42.941	Perched Clay	1100	0	459.064	1100	736.548	0	736.548	309.347	309.347
50	1.04903	76.0547	43.6293	Roadway	0	45	77.9449	186.77	186.77	0	186.77	112.468	112.468

Roadway - Roadway Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.11878

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.560602	40.6436	-60.7249	Roadway	0	45	121.403	257.227	257.226	0	257.226	473.785	473.785
2	0.583927	116.785	-59.7182	Perched Clay	1100	0	519.167	1100	-93.5516	0	-93.5516	795.543	795.543
3	1.65903	674.859	-57.8501	Surficial Aquifer	75	32	176.262	373.46	477.636	0	477.636	758.078	758.078
4	1.65903	1154.52	-55.2173	Surficial Aquifer	75	32	233.41	494.544	671.412	0	671.412	1007.46	1007.46
5	1.65903	1590.5	-52.7492	Surficial Aquifer	75	32	289.146	612.636	860.398	0	860.398	1240.63	1240.63
6	1.69122	2032.26	-50.3927	Surficial Aquifer	75	32	328.79	696.634	1057.43	62.6023	994.824	1454.76	1392.16
7	1.69122	2414.48	-48.1267	Surficial Aquifer	75	32	352.868	747.65	1259.38	182.914	1076.47	1653.03	1470.11
8	1.69122	2768	-45.9569	Surficial Aquifer	75	32	308.117	652.832	1218.74	294.018	924.726	1537.33	1243.31
9	1.69122	3096.14	-43.8691	Surficial Aquifer	75	32	300.067	635.775	1294.41	396.981	897.43	1582.86	1185.88
10	1.69122	3337.21	-41.8523	Surficial Aquifer	75	32	313.687	664.634	1436.26	492.651	943.609	1717.24	1224.59
11	1.69122	3505.43	-39.8972	Surficial Aquifer	75	32	320.386	678.827	1548.04	581.712	966.324	1815.89	1234.18
12	1.69122	3668.41	-37.9965	Surficial Aquifer	75	32	328.145	695.268	1657.36	664.728	992.635	1913.71	1248.98
13	1.69122	3814.02	-36.1439	Surficial Aquifer	75	32	335.286	710.398	1759.02	742.169	1016.85	2003.91	1261.74
14	1.74728	4079.07	-34.3048	Black Creek Confining Unit	917.879	0	433.211	917.879	1827.14	0	1827.14	2122.71	2122.71
15	1.74728	4206.65	-32.4758	Black Creek Confining Unit	952.443	0	449.524	952.443	1919.37	0	1919.37	2205.48	2205.48
16	1.74728	4317.94	-30.6833	Black Creek Confining Unit	984.676	0	464.737	984.676	2004.92	0	2004.92	2280.68	2280.68
17	1.74728	4411.78	-28.9235	Black Creek Confining Unit	1014.71	0	478.912	1014.71	2082.94	0	2082.94	2347.57	2347.57
18	1.74728	4480.46	-27.1931	Black Creek Confining Unit	1042.66	0	492.104	1042.66	2149.23	0	2149.23	2402.06	2402.06
19	1.74728	4533.77	-25.4892	Black Creek Confining Unit	1068.62	0	504.356	1068.62	2208.43	0	2208.43	2448.88	2448.88
20	1.74728	4573.75	-23.8092	Black Creek Confining Unit	1092.68	0	515.712	1092.68	2261.38	0	2261.38	2488.93	2488.93
21	1.74728	4600.62	-22.1506	Black Creek Confining Unit	1114.91	0	526.204	1114.91	2308.01	0	2308.01	2522.22	2522.22
22	1.74728	4615.12	-20.5114	Black Creek Confining Unit	1135.39	0	535.87	1135.39	2348.55	0	2348.55	2549.02	2549.02
23	1.74728	4617.71	-18.8895	Black Creek Confining Unit	1154.16	0	544.729	1154.16	2383.08	0	2383.08	2569.47	2569.47

24	1.74728	4608.6	-17.2832	Black Creek Confining Unit	1171.28	0	552.809	1171.28	2411.59	0	2411.59	2583.59	2583.59
25	1.74728	4588.21	-15.6909	Black Creek Confining Unit	1186.8	0	560.134	1186.8	2434.15	0	2434.15	2591.5	2591.5
26	1.74728	4556.71	-14.1108	Black Creek Confining Unit	1200.75	0	566.718	1200.75	2450.75	0	2450.75	2593.22	2593.22
27	1.74728	4506.23	-12.5417	Black Creek Confining Unit	1213.17	0	572.58	1213.17	2457.02	0	2457.02	2584.39	2584.39
28	1.74728	4440.67	-10.9821	Black Creek Confining Unit	1224.09	0	577.733	1224.09	2454.85	0	2454.85	2566.96	2566.96
29	1.74728	4364.33	-9.43065	Black Creek Confining Unit	1233.53	0	582.189	1233.53	2446.46	0	2446.46	2543.16	2543.16
30	1.74728	4271.68	-7.88618	Black Creek Confining Unit	1241.51	0	585.955	1241.51	2428.68	0	2428.68	2509.84	2509.84
31	1.74728	4167.07	-6.34746	Black Creek Confining Unit	1248.06	0	589.047	1248.06	2403.74	0	2403.74	2469.26	2469.26
32	1.74728	4052.58	-4.81332	Black Creek Confining Unit	1253.18	0	591.463	1253.18	2372.67	0	2372.67	2422.48	2422.48
33	1.74728	3928.45	-3.28264	Black Creek Confining Unit	1256.89	0	593.214	1256.89	2335.5	0	2335.5	2369.53	2369.53
34	1.74728	3794.53	-1.75431	Black Creek Confining Unit	1259.19	0	594.3	1259.19	2292.03	0	2292.03	2310.23	2310.23
35	2.26734	4707.54	0	Black Creek Confining Unit	1260	0	594.682	1260	2233.68	0	2233.68	2233.68	2233.68
36	1.77866	3510.23	1.76803	Black Creek Confining Unit	1259.17	0	594.29	1259.17	2167.09	0	2167.09	2148.74	2148.74
37	1.77866	3338.31	3.32386	Black Creek Confining Unit	1256.8	0	593.172	1256.8	2100.96	0	2100.96	2066.51	2066.51
38	1.77866	3157.73	4.88214	Black Creek Confining Unit	1252.97	0	591.364	1252.97	2028.68	0	2028.68	1978.16	1978.16
39	1.77866	2966.89	6.44406	Black Creek Confining Unit	1247.68	0	588.867	1247.68	1949.19	0	1949.19	1882.68	1882.68
40	1.77866	2776.21	8.01081	Black Creek Confining Unit	1240.91	0	585.672	1240.91	1868.42	0	1868.42	1785.99	1785.99
41	1.77866	2587.83	9.58361	Black Creek Confining Unit	1232.65	0	581.773	1232.65	1787.56	0	1787.56	1689.33	1689.33
42	1.77866	2388.73	11.1637	Black Creek Confining Unit	1222.88	0	577.162	1222.88	1698.89	0	1698.89	1584.99	1584.99

43	1.77866	2163.2	12.7525	Black Creek Confining Unit	1204.19	0	568.341	1204.19	1590.98	0	1590.98	1462.35	1462.35
44	1.77866	1893.86	14.3514	Black Creek Confining Unit	1166.19	0	550.406	1166.19	1449.75	0	1449.75	1308.92	1308.92
45	1.77866	1614.3	15.9617	Black Creek Confining Unit	1126.59	0	531.716	1126.59	1298.91	0	1298.91	1146.82	1146.82
46	1.77866	1342.49	17.5851	Black Creek Confining Unit	1088.69	0	513.829	1088.69	1150.12	0	1150.12	987.267	987.267
47	1.77866	1063.37	19.2232	Black Creek Confining Unit	1049.46	0	495.313	1049.46	993.177	0	993.177	820.466	820.466
48	1.77866	772.797	20.8779	Black Creek Confining Unit	1008.57	0	476.014	1008.57	825.04	0	825.04	643.478	643.478
49	1.77866	472.673	22.551	Black Creek Confining Unit	966.434	0	456.128	966.434	646.553	0	646.553	457.143	457.143
50	1.77866	159.779	24.2446	Black Creek Confining Unit	922.455	0	435.371	922.455	457.572	0	457.572	261.5	261.5

Roadway - Roadway Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.11295

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.395785	15.0643	-62.8443	Light Gray Sand	50	32	24.2543	51.2481	1.99735	0	1.99735	49.281	49.281
2	0.395785	43.2748	-60.0641	Light Gray Sand	50	32	34.4248	72.7379	36.3883	0	36.3883	96.1682	96.1682
3	0.395785	67.8916	-57.5025	Light Gray Sand	50	32	44.5796	94.1944	70.7259	0	70.7259	140.708	140.708
4	0.395785	89.0775	-55.1103	Light Gray Sand	50	32	54.338	114.813	103.723	0	103.723	181.645	181.645
5	0.395785	107.938	-52.8541	Light Gray Sand	50	32	63.8295	134.869	135.818	0	135.818	220.075	220.075
6	0.395785	124.891	-50.71	Light Gray Sand	50	32	73.041	154.332	166.967	0	166.967	256.237	256.237
7	0.395785	140.193	-48.6601	Light Gray Sand	50	32	81.9532	173.163	197.102	0	197.102	290.256	290.256
8	0.395785	154.04	-46.6906	Light Gray Sand	50	32	90.5563	191.341	226.193	0	226.193	322.258	322.258
9	0.395785	166.592	-44.7906	Light Gray Sand	50	32	98.8485	208.862	254.233	0	254.233	352.361	352.361
10	0.395785	177.973	-42.9514	Light Gray Sand	50	32	106.829	225.725	281.219	0	281.219	380.669	380.669
11	0.395785	188.252	-41.1656	Light Gray Sand	50	32	114.484	241.9	307.104	0	307.104	407.207	407.207
12	0.395785	197.509	-39.4273	Light Gray Sand	50	32	121.812	257.382	331.881	0	331.881	432.035	432.035
13	0.395785	205.859	-37.7314	Light Gray Sand	50	32	128.836	272.223	355.63	0	355.63	455.318	455.318
14	0.375419	201.965	-36.1153	Perched Clay (Long Term)	200	24	172.483	364.447	369.353	0	369.353	495.2	495.2
15	0.375419	207.542	-34.5737	Perched Clay (Long Term)	200	24	176.905	373.792	390.344	0	390.344	512.263	512.263
16	0.375419	212.51	-33.0602	Perched Clay (Long Term)	200	24	181.12	382.697	410.344	0	410.344	528.235	528.235
17	0.375419	216.898	-31.5723	Perched Clay (Long Term)	200	24	185.13	391.171	429.377	0	429.377	543.147	543.147
18	0.375419	220.736	-30.1079	Perched Clay (Long Term)	200	24	188.94	399.22	447.456	0	447.456	557.015	557.015
19	0.375419	224.059	-28.6648	Perched Clay (Long Term)	200	24	192.556	406.862	464.621	0	464.621	569.889	569.889
20	0.375419	226.885	-27.2414	Perched Clay (Long Term)	200	24	195.981	414.099	480.874	0	480.874	581.773	581.773
21	0.375419	229.227	-25.8359	Perched Clay (Long Term)	200	24	199.213	420.928	496.214	0	496.214	592.671	592.671
22	0.375419	231.101	-24.447	Perched Clay (Long Term)	200	24	202.255	427.355	510.648	0	510.648	602.595	602.595
23	0.375419	232.525	-23.0732	Perched Clay (Long Term)	200	24	205.107	433.381	524.183	0	524.183	611.555	611.555
24	0.375419	233.511	-21.7133	Perched Clay (Long Term)	200	24	207.771	439.01	536.826	0	536.826	619.564	619.564
25	0.375419	234.073	-20.3662	Perched Clay (Long Term)	200	24	210.248	444.243	548.58	0	548.58	626.629	626.629
26	0.375419	234.246	-19.0307	Perched Clay (Long Term)	200	24	212.549	449.106	559.503	0	559.503	632.817	632.817

27	0.375419	235.332	-17.7059	Perched Clay (Long Term)	200	24	215.327	454.975	572.684	0	572.684	641.428	641.428
28	0.375419	236.777	-16.3908	Perched Clay (Long Term)	200	24	218.321	461.302	586.895	0	586.895	651.112	651.112
29	0.375419	237.837	-15.0845	Perched Clay (Long Term)	200	24	221.16	467.299	600.363	0	600.363	659.973	659.973
30	0.375419	256.958	-13.7862	Perched Clay (Long Term)	200	24	233.542	493.463	659.128	0	659.128	716.432	716.432
31	0.375419	281.975	-12.4951	Perched Clay (Long Term)	200	24	249.399	526.968	734.381	0	734.381	789.649	789.649
32	0.375419	281.946	-11.2104	Perched Clay (Long Term)	200	24	252.118	532.713	747.286	0	747.286	797.254	797.254
33	0.375419	281.53	-9.93137	Perched Clay (Long Term)	200	24	254.669	538.102	759.389	0	759.389	803.98	803.98
34	0.375419	280.758	-8.65734	Perched Clay (Long Term)	200	24	257.063	543.162	770.756	0	770.756	809.896	809.896
35	0.375419	279.633	-7.38762	Perched Clay (Long Term)	200	24	259.301	547.89	781.374	0	781.374	814.995	814.995
36	0.375419	278.16	-6.12154	Perched Clay (Long Term)	200	24	261.381	552.284	791.243	0	791.243	819.276	819.276
37	0.375419	276.34	-4.85845	Perched Clay (Long Term)	200	24	263.299	556.338	800.348	0	800.348	822.728	822.728
38	0.375419	274.177	-3.59773	Perched Clay (Long Term)	200	24	265.055	560.049	808.682	0	808.682	825.348	825.348
39	0.375419	270.354	-2.33875	Perched Clay (Long Term)	200	24	265.854	561.737	812.473	0	812.473	823.331	823.331
40	0.375419	131.773	-1.0809	Perched Clay (Long Term)	200	24	184.356	389.535	425.702	0	425.702	429.18	429.18
41	0.392975	24.2104	0.205831	Roadway	0	45	36.9958	78.1702	78.1701	0	78.1701	78.0372	78.0372
42	0.392975	23.8727	1.52208	Roadway	0	45	37.4653	79.1624	79.1624	0	79.1624	78.1669	78.1669
43	0.392975	23.02	2.83913	Roadway	0	45	37.1292	78.4522	78.4521	0	78.4521	76.6108	76.6108
44	0.392975	21.6508	4.15768	Roadway	0	45	35.9175	75.8918	75.8919	0	75.8919	73.2809	73.2809
45	0.392975	19.7632	5.47845	Roadway	0	45	33.7503	71.3128	71.3127	0	71.3127	68.0757	68.0757
46	0.392975	17.3539	6.80214	Roadway	0	45	30.5364	64.5219	64.5218	0	64.5218	60.8794	60.8794
47	0.392975	14.4191	8.1295	Roadway	0	45	26.1704	55.2967	55.2967	0	55.2967	51.5584	51.5584
48	0.392975	10.9539	9.46126	Roadway	0	45	20.5301	43.3791	43.3791	0	43.3791	39.9578	39.9578
49	0.392975	6.95271	10.7982	Roadway	0	45	13.4732	28.4683	28.4683	0	28.4683	25.8986	25.8986
50	0.392975	2.40865	12.1411	Roadway	0	45	3.24418	6.85479	6.85479	0	6.85479	6.15686	6.15686

Roadway - Roadway Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.63656

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.920703	66.751	-47.3641	Roadway	0	45	191.833	313.947	313.947	0	313.947	522.303	522.303
2	0.948577	189.715	-46.5117	Perched Clay (Long Term)	200	24	229.905	376.254	395.872	0	395.872	638.241	638.241
3	1.48411	506.985	-45.424	Surficial Aquifer	75	32	190.729	312.139	379.501	0	379.501	573.074	573.074
4	1.48411	758.346	-44.1218	Surficial Aquifer	75	32	163.262	267.188	307.565	0	307.565	465.898	465.898
5	1.48411	991.287	-42.8477	Surficial Aquifer	75	32	205.065	335.601	417.049	0	417.049	607.259	607.259
6	1.48411	1126.74	-41.5994	Surficial Aquifer	75	32	231.613	379.049	486.58	0	486.58	692.211	692.211
7	1.72275	1483.58	-40.2783	Surficial Aquifer	75	32	247.273	404.677	572.238	44.6438	527.594	781.779	737.135
8	1.72275	1658.96	-38.8859	Surficial Aquifer	75	32	249.72	408.682	665.746	131.742	534.004	867.144	735.402
9	1.72275	1820.42	-37.5204	Surficial Aquifer	75	32	251.841	412.153	754.124	214.567	539.557	947.51	732.943
10	1.72275	1966.1	-36.1794	Surficial Aquifer	75	32	253.188	414.357	836.438	293.352	543.086	1021.6	728.251
11	1.72275	2098.97	-34.8611	Surficial Aquifer	75	32	254.073	415.805	913.709	368.305	545.404	1090.7	722.391
12	1.72275	2220.26	-33.5635	Surficial Aquifer	75	32	254.568	416.616	986.313	439.611	546.702	1155.21	715.603
13	1.72275	2325.52	-32.2852	Surficial Aquifer	75	32	253.815	415.384	1052.16	507.434	544.729	1212.53	705.093
14	1.72275	2411.57	-31.0246	Surficial Aquifer	75	32	251.126	410.982	1109.61	571.923	537.682	1260.64	688.721
15	1.72275	2487.3	-29.7806	Surficial Aquifer	75	32	247.865	405.646	1162.35	633.211	529.143	1304.2	670.985
16	1.72275	2553.14	-28.5518	Surficial Aquifer	75	32	244.019	399.352	1210.49	691.418	519.07	1343.26	651.847
17	1.72275	2609.23	-27.3372	Surficial Aquifer	75	32	239.523	391.994	1253.95	746.653	507.297	1377.77	631.121
18	1.72275	2656.16	-26.1357	Surficial Aquifer	75	32	234.405	383.618	1292.91	799.014	493.892	1407.92	608.907
19	1.72275	2694.23	-24.9466	Surficial Aquifer	75	32	228.642	374.186	1327.39	848.592	478.796	1433.75	585.153
20	1.66236	2630.76	-23.7892	Black Creek Confining Unit (Long Term)	125	26	474.101	775.895	1334.53	0	1334.53	1543.53	1543.53
21	1.66236	2656.46	-22.6626	Black Creek Confining Unit (Long Term)	125	26	483.55	791.358	1366.24	0	1366.24	1568.14	1568.14
22	1.66236	2674.19	-21.5451	Black Creek Confining Unit (Long Term)	125	26	491.861	804.96	1394.12	0	1394.12	1588.32	1588.32
23	1.66236	2676.44	-20.4362	Black Creek Confining Unit (Long Term)	125	26	497.809	814.694	1414.09	0	1414.09	1599.58	1599.58
24	1.66236	2668	-19.3352	Black Creek Confining Unit (Long Term)	125	26	502.076	821.678	1428.4	0	1428.4	1604.58	1604.58

25	1.66236	2652.16	-18.2416	Black Creek Confining Unit (Long Term)	125	26	505.139	826.69	1438.68	0	1438.68	1605.16	1605.16
26	1.66236	2623.99	-17.1548	Black Creek Confining Unit (Long Term)	125	26	506.152	828.348	1442.08	0	1442.08	1598.32	1598.32
27	1.66236	2586.85	-16.0744	Black Creek Confining Unit (Long Term)	125	26	505.604	827.452	1440.24	0	1440.24	1585.93	1585.93
28	1.66236	2542.98	-14.9998	Black Creek Confining Unit (Long Term)	125	26	503.824	824.539	1434.27	0	1434.27	1569.27	1569.27
29	1.66236	2492.68	-13.9306	Black Creek Confining Unit (Long Term)	125	26	500.826	819.631	1424.21	0	1424.21	1548.43	1548.43
30	1.66236	2435.87	-12.8663	Black Creek Confining Unit (Long Term)	125	26	496.559	812.648	1409.89	0	1409.89	1523.31	1523.31
31	1.66236	2372.59	-11.8065	Black Creek Confining Unit (Long Term)	125	26	490.995	803.542	1391.22	0	1391.22	1493.85	1493.85
32	1.66236	2302.92	-10.7508	Black Creek Confining Unit (Long Term)	125	26	484.109	792.274	1368.11	0	1368.11	1460.03	1460.03
33	1.66236	2226.93	-9.69873	Black Creek Confining Unit (Long Term)	125	26	475.876	778.8	1340.49	0	1340.49	1421.82	1421.82
34	1.66236	2145.36	-8.65	Black Creek Confining Unit (Long Term)	125	26	466.389	763.273	1308.66	0	1308.66	1379.61	1379.61
35	1.66236	2058.88	-7.60418	Black Creek Confining Unit (Long Term)	125	26	455.733	745.834	1272.9	0	1272.9	1333.74	1333.74
36	1.66236	1966.27	-6.5609	Black Creek Confining Unit (Long Term)	125	26	443.651	726.061	1232.36	0	1232.36	1283.38	1283.38
37	1.66236	1877.15	-5.5198	Black Creek Confining Unit (Long Term)	125	26	431.889	706.813	1192.89	0	1192.89	1234.63	1234.63
38	1.66236	1792.96	-4.48053	Black Creek Confining Unit (Long Term)	125	26	420.742	688.569	1155.49	0	1155.49	1188.46	1188.46
39	1.66236	1702.73	-3.44273	Black Creek Confining Unit (Long Term)	125	26	408.143	667.951	1113.22	0	1113.22	1137.77	1137.77

40	1.66236	1599.06	-2.40607	Black Creek Confining Unit (Long Term)	125	26	392.616	642.54	1061.12	0	1061.12	1077.61	1077.61
41	1.66236	1457.43	-1.37019	Black Creek Confining Unit (Long Term)	125	26	369.257	604.312	982.734	0	982.734	991.566	991.566
42	1.66236	1306.14	-0.33476	Black Creek Confining Unit (Long Term)	125	26	343.388	561.975	895.93	0	895.93	897.936	897.936
43	1.66236	1160.99	0.70056	Black Creek Confining Unit (Long Term)	125	26	318.088	520.57	811.041	0	811.041	807.152	807.152
44	1.66236	1020.49	1.73611	Black Creek Confining Unit (Long Term)	125	26	293.083	479.648	727.134	0	727.134	718.25	718.25
45	1.66236	873.997	2.77223	Black Creek Confining Unit (Long Term)	125	26	266.196	435.645	636.915	0	636.915	624.025	624.025
46	1.66236	723.468	3.80925	Black Creek Confining Unit (Long Term)	125	26	237.765	389.116	541.518	0	541.518	525.687	525.687
47	1.66236	568.577	4.84753	Black Creek Confining Unit (Long Term)	125	26	207.66	339.848	440.503	0	440.503	422.892	422.892
48	1.66236	407.629	5.88741	Black Creek Confining Unit (Long Term)	125	26	175.451	287.136	332.429	0	332.429	314.337	314.337
49	1.66236	245.53	6.92923	Black Creek Confining Unit (Long Term)	125	26	142.116	232.581	220.573	0	220.573	203.302	203.302
50	1.66236	82.8662	7.97337	Black Creek Confining Unit (Long Term)	125	26	113.1	185.095	123.213	0	123.213	107.372	107.372

Interslice Data

◆ Ground Profile - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 1.99625

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	145.53	112.453	0	0	0
2	148.98	107	497.827	61.3213	7.0222
3	152.769	101.553	-1759.55	-216.738	7.02221
4	156.558	96.577	-1086.97	-133.89	7.02217
5	160.346	92	1822.48	224.49	7.02222
6	164.07	87.8384	6931	853.746	7.0222
7	167.794	83.971	12472.7	1536.36	7.0222
8	171.518	80.3666	18288	2252.67	7.02218
9	175.241	77	24242.4	2986.13	7.02221
10	181.272	72	38100.4	4693.12	7.02219
11	186.746	67.897	46451.6	5721.81	7.0222
12	190.788	65.1079	52400.2	6454.54	7.02219
13	194.83	62.508	58197.3	7168.61	7.02219
14	198.872	60.0861	63749.9	7852.57	7.02219
15	202.914	57.8323	68974.9	8496.18	7.0222
16	206.956	55.7381	73796.8	9090.13	7.0222
17	210.998	53.7961	78155	9626.97	7.0222
18	215.041	52	81998.6	10100.4	7.02219
19	219.341	50.2427	90266.2	11118.8	7.0222
20	223.642	48.6381	97756.9	12041.5	7.02221
21	227.943	47.1813	104431	12863.6	7.02221
22	232.244	45.8675	110252	13580.6	7.0222
23	236.545	44.6931	115207	14190.9	7.02217
24	240.846	43.6546	119289	14693.8	7.02222
25	245.147	42.7491	122481	15086.9	7.02218
26	249.448	41.9743	124778	15369.9	7.0222
27	253.749	41.328	126226	15548.3	7.02222
28	258.05	40.8086	126834	15623.1	7.02218
29	262.351	40.4147	126607	15595.2	7.02221
30	266.652	40.1454	125568	15467.2	7.0222
31	270.953	40	123741	15242.1	7.02218
32	276.777	40	120062	14789	7.02221
33	281.078	40.1454	116500	14350.2	7.02219
34	285.379	40.4147	112256	13827.4	7.02217
35	289.68	40.8086	107371	13225.8	7.02224
36	293.981	41.328	101891	12550.7	7.02219
37	298.282	41.9743	95865.1	11808.5	7.02222
38	302.583	42.7491	89348.7	11005.8	7.02221
39	306.884	43.6546	82407.5	10150.8	7.02221
40	311.185	44.6931	75112.4	9252.18	7.0222
41	315.486	45.8675	67541.7	8319.65	7.02221
42	319.787	47.1813	59784	7364.06	7.02219
43	324.088	48.6381	51939.7	6397.82	7.0222
44	328.389	50.2427	44135.1	5436.47	7.0222
45	332.689	52	36501.9	4496.22	7.02219
46	337.26	54.0418	26894.6	3312.82	7.0222
47	341.831	56.2712	18168.8	2238	7.02222
48	346.402	58.6976	10637.8	1310.34	7.02219
49	350.973	61.3323	4699.9	578.923	7.02219
50	355.544	64.1884	883.318	108.805	7.02218
51	358.407	66.0964	0	0	0

Ground Profile - Long Term

Global Minimum Query (spencer) - Safety Factor: 1.66028

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	326.857	76.7061	0	0	0
2	329.081	74.2798	-266.374	-85.9395	17.8811
3	331.305	72	-319.167	-102.972	17.8811
4	333.355	70.0161	-88.2773	-28.4806	17.8811
5	335.406	68.1368	232.313	74.9504	17.8811
6	337.457	66.3549	619.708	199.935	17.8811
7	339.301	64.8298	1046.09	337.497	17.8811
8	341.146	63.3742	1568.82	506.144	17.8811
9	342.99	61.9843	2170.57	700.285	17.8811
10	344.835	60.6571	2835.54	914.822	17.8811
11	346.679	59.3896	3550.41	1145.46	17.8811
12	348.524	58.1792	4303.02	1388.27	17.8811
13	350.368	57.0236	5080.61	1639.14	17.8811
14	352.213	55.9207	5873.77	1895.04	17.8811
15	354.057	54.8686	6674.64	2153.42	17.8811
16	355.902	53.8654	7476.23	2412.03	17.8811
17	357.747	52.9097	8272.42	2668.91	17.8811
18	359.591	52	9057.88	2922.32	17.8811
19	361.347	51.1756	9330.63	3010.31	17.8811
20	363.102	50.3907	9561.18	3084.7	17.8811
21	364.858	49.6442	9747.07	3144.67	17.8811
22	366.614	48.9352	9885.51	3189.33	17.8811
23	368.369	48.263	9975.16	3218.26	17.8811
24	370.125	47.6267	10015.2	3231.17	17.8811
25	371.88	47.0258	10005	3227.89	17.8811
26	373.636	46.4594	9944.91	3208.5	17.8811
27	375.392	45.9272	9835.45	3173.18	17.8811
28	377.147	45.4284	9677.61	3122.26	17.8811
29	378.903	44.9627	9472.67	3056.14	17.8811
30	380.658	44.5295	9222.27	2975.35	17.8811
31	382.414	44.1284	8928.37	2880.53	17.8811
32	384.17	43.7592	8593.24	2772.41	17.8811
33	385.925	43.4213	8219.38	2651.8	17.8811
34	387.681	43.1146	7809.71	2519.62	17.8811
35	389.436	42.8387	7366.23	2376.55	17.8811
36	391.192	42.5934	6890.17	2222.96	17.8811
37	392.948	42.3784	6384.69	2059.87	17.8811
38	394.703	42.1936	5855.64	1889.19	17.8811
39	396.459	42.0389	5314.76	1714.69	17.8812
40	398.214	41.914	4768.51	1538.45	17.8811
41	399.97	41.8189	4219.07	1361.18	17.881
42	401.726	41.7536	3671.14	1184.41	17.8811
43	403.481	41.7178	3131.34	1010.26	17.8812
44	405.237	41.7117	2605.96	840.754	17.8811
45	406.993	41.7351	2102.49	678.321	17.8811
46	408.748	41.7882	1628.55	525.416	17.8812
47	410.504	41.871	1189.57	383.788	17.8811
48	412.259	41.9835	794.128	256.207	17.8811
49	414.015	42.1258	451.965	145.816	17.8811
50	415.771	42.2981	173.514	55.9804	17.8811
51	417.526	42.5005	0	0	0

Roadway - Master Scenario

Global Minimum Query (spencer) - Safety Factor: 2.39618

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	139.898	112.694	0	0	0
2	142.568	107	616.07	58.5076	5.42506
3	147.027	98.888	-747.818	-71.0195	5.42505
4	151.486	92	3920.75	372.35	5.42506
5	155.598	86.4387	12013.1	1140.87	5.42504
6	159.711	81.4738	20896	1984.47	5.42505
7	163.824	77	30171.7	2865.38	5.42506
8	168.95	72	45499.2	4321.02	5.42506
9	173.294	68.1926	55124.5	5235.12	5.42505
10	177.482	64.8489	64215.1	6098.44	5.42505
11	181.67	61.7931	73093.4	6941.61	5.42505
12	185.858	58.9995	81598.7	7749.35	5.42505
13	190.046	56.4471	89578.2	8507.16	5.42506
14	194.234	54.1187	96925.4	9204.92	5.42506
15	198.422	52	103557	9834.75	5.42508
16	202.248	50.2379	112953	10727.1	5.42509
17	206.073	48.633	121561	11544.5	5.42504
18	209.898	47.1787	129351	12284.3	5.42504
19	213.723	45.8692	136299	12944.2	5.42506
20	217.549	44.6998	142383	13522	5.42506
21	221.374	43.6661	147592	14016.7	5.42507
22	225.199	42.7648	151918	14427.5	5.42505
23	229.024	41.9928	155345	14753	5.42507
24	232.849	41.3475	157874	14993.2	5.42508
25	236.675	40.827	159511	15148.6	5.42505
26	240.5	40.4297	160267	15220.4	5.42505
27	244.325	40.1543	160152	15209.5	5.42506
28	248.15	40	159184	15117.5	5.42504
29	254.112	40	156044	14819.3	5.42504
30	257.937	40.1543	153019	14532.1	5.42507
31	261.762	40.4297	149241	14173.3	5.42506
32	265.587	40.827	144746	13746.4	5.42506
33	269.413	41.3475	139571	13254.9	5.42504
34	273.238	41.9928	133759	12703	5.42507
35	277.063	42.7648	127356	12094.9	5.42506
36	280.888	43.6661	120412	11435.4	5.42505
37	284.714	44.6998	112980	10729.6	5.42505
38	288.539	45.8692	105124	9983.48	5.42503
39	292.364	47.1787	96918.9	9204.3	5.42506
40	296.189	48.633	88451.2	8400.13	5.42506
41	300.014	50.2379	79818.9	7580.33	5.42506
42	303.84	52	71130.9	6755.24	5.42506
43	308.032	54.1208	58791.5	5583.38	5.42506
44	312.223	56.4517	46887.8	4452.89	5.42506
45	316.415	59.007	35222.4	3345.04	5.42506
46	320.607	61.8041	26219.4	2490.03	5.42505
47	324.799	64.8639	16993.1	1613.82	5.42506
48	329.056	68.2662	7656.72	727.151	5.42505
49	333.312	72	1299.11	123.375	5.42504
50	334.387	73	68.4256	6.49831	5.42505
51	335.436	74	0	0	0

Roadway - Roadway Short Term Downslope

Global Minimum Query (spencer) - Safety Factor: 2.11878

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	322.036	74	0	0	0
2	322.597	73	189.135	50.1947	14.8632
3	323.181	72	-207.72	-55.127	14.8632
4	324.84	69.3604	760.49	201.828	14.8632
5	326.499	66.9718	1976.78	524.622	14.8632
6	328.158	64.7901	3373.96	895.421	14.8632
7	329.849	62.7463	4978.8	1321.33	14.8632
8	331.54	60.8597	6757.76	1793.45	14.8632
9	333.231	59.111	8367.59	2220.69	14.8632
10	334.923	57.4852	9964.24	2644.43	14.8632
11	336.614	55.9703	11609.3	3081	14.8631
12	338.305	54.5564	13256	3518.03	14.8632
13	339.996	53.2352	14890.4	3951.78	14.8632
14	341.687	52	16495.9	4377.87	14.8632
15	343.435	50.8079	17916.8	4754.96	14.8632
16	345.182	49.6958	19265.5	5112.9	14.8632
17	346.929	48.659	20531.7	5448.94	14.8632
18	348.676	47.6935	21705.6	5760.47	14.8632
19	350.424	46.7958	22774.7	6044.21	14.8632
20	352.171	45.9628	23732.6	6298.44	14.8632
21	353.918	45.1918	24574.6	6521.89	14.8632
22	355.666	44.4805	25296.4	6713.45	14.8632
23	357.413	43.8268	25894.8	6872.26	14.8632
24	359.16	43.229	26367.3	6997.66	14.8632
25	360.907	42.6853	26712	7089.14	14.8632
26	362.655	42.1945	26927.6	7146.36	14.8632
27	364.402	41.7552	27013.4	7169.12	14.8632
28	366.149	41.3665	26967.5	7156.93	14.8632
29	367.897	41.0275	26789.9	7109.81	14.8632
30	369.644	40.7373	26482.1	7028.14	14.8632
31	371.391	40.4952	26045.6	6912.29	14.8632
32	373.138	40.3009	25483.1	6763	14.8632
33	374.886	40.1537	24798.2	6581.25	14.8632
34	376.633	40.0535	23995.3	6368.15	14.8632
35	378.38	40	23079	6124.98	14.8632
36	380.648	40	21730	5766.97	14.8632
37	382.426	40.0549	20553.5	5454.72	14.8632
38	384.205	40.1582	19280.9	5116.99	14.8632
39	385.984	40.3101	17920.3	4755.91	14.8632
40	387.762	40.511	16480.8	4373.88	14.8632
41	389.541	40.7613	14970.9	3973.16	14.8632
42	391.32	41.0617	13398.8	3555.93	14.8632
43	393.098	41.4127	11775.4	3125.09	14.8632
44	394.877	41.8152	10123.6	2686.71	14.8631
45	396.656	42.2703	8484.36	2251.68	14.8632
46	398.434	42.779	6877.36	1825.19	14.8632
47	400.213	43.3428	5314.64	1410.46	14.8632
48	401.992	43.963	3817.25	1013.07	14.8632
49	403.77	44.6414	2410.44	639.71	14.8632
50	405.549	45.38	1121.2	297.557	14.8632
51	407.328	46.181	0	0	0

Roadway - Roadway Long Term Upslope

Global Minimum Query (spencer) - Safety Factor: 2.11295

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	302.551	83.2627	0	0	0
2	302.947	82.4912	-8.07683	-3.57271	23.8618
3	303.343	81.8039	3.28156	1.45157	23.8618
4	303.739	81.1826	29.5468	13.0698	23.8618
5	304.135	80.615	66.8686	29.5787	23.8618
6	304.53	80.0925	112.515	49.7702	23.8619
7	304.926	79.6088	164.318	72.6844	23.8617
8	305.322	79.1589	220.492	97.5324	23.8617
9	305.718	78.7391	279.551	123.657	23.8618
10	306.114	78.3462	340.242	150.503	23.8618
11	306.509	77.9777	401.493	177.597	23.8618
12	306.905	77.6317	462.372	204.526	23.8618
13	307.301	77.3062	522.068	230.932	23.8618
14	307.697	77	579.888	256.508	23.8618
15	308.072	76.7261	616.182	272.562	23.8617
16	308.448	76.4674	650.634	287.802	23.8618
17	308.823	76.223	682.779	302.021	23.8618
18	309.198	75.9923	712.206	315.037	23.8617
19	309.574	75.7746	738.545	326.688	23.8617
20	309.949	75.5694	761.474	336.831	23.8618
21	310.325	75.3761	780.701	345.336	23.8618
22	310.7	75.1943	795.968	352.089	23.8618
23	311.075	75.0236	807.043	356.988	23.8618
24	311.451	74.8637	813.722	359.942	23.8617
25	311.826	74.7142	815.825	360.873	23.8618
26	312.202	74.5748	813.195	359.709	23.8617
27	312.577	74.4454	805.697	356.393	23.8618
28	312.953	74.3255	793.342	350.928	23.8618
29	313.328	74.2151	776.031	343.27	23.8618
30	313.703	74.1139	753.593	333.345	23.8618
31	314.079	74.0218	726.464	321.344	23.8617
32	314.454	73.9386	693.751	306.874	23.8617
33	314.83	73.8642	654.521	289.521	23.8617
34	315.205	73.7984	608.647	269.229	23.8617
35	315.58	73.7413	556.012	245.947	23.8618
36	315.956	73.6926	496.512	219.628	23.8618
37	316.331	73.6523	430.055	190.231	23.8618
38	316.707	73.6204	356.557	157.719	23.8617
39	317.082	73.5968	275.947	122.062	23.8617
40	317.458	73.5815	188.406	83.3394	23.8617
41	317.833	73.5744	122.077	53.9996	23.8617
42	318.226	73.5758	107.4	47.5075	23.8618
43	318.619	73.5863	91.8225	40.6168	23.8617
44	319.012	73.6058	75.6746	33.474	23.8618
45	319.405	73.6343	59.3649	26.2595	23.8617
46	319.798	73.672	43.3885	19.1925	23.8618
47	320.191	73.7189	28.341	12.5364	23.8618
48	320.584	73.775	14.9328	6.60539	23.8618
49	320.977	73.8405	4.00866	1.77319	23.8617
50	321.37	73.9155	-3.4299	-1.51718	23.8617
51	321.763	74	0	0	0

Roadway - Roadway Long Term Downslope

Global Minimum Query (spencer) - Safety Factor: 1.63656

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	329.33	74	0	0	0
2	330.25	73	137.185	45.8157	18.4678
3	331.199	72	314.8	105.134	18.4678
4	332.683	70.4938	603.133	201.429	18.4678
5	334.167	69.0545	803.319	268.285	18.4678
6	335.651	67.6779	1072.85	358.299	18.4677
7	337.135	66.3602	1369.96	457.527	18.4678
8	338.858	64.9004	1779.03	594.143	18.4678
9	340.581	63.511	2273.46	759.268	18.4678
10	342.304	62.1881	2836.87	947.432	18.4678
11	344.026	60.9282	3454.19	1153.6	18.4678
12	345.749	59.7281	4112.64	1373.5	18.4678
13	347.472	58.5851	4801.1	1603.43	18.4678
14	349.195	57.4967	5508.72	1839.75	18.4678
15	350.917	56.4605	6225.46	2079.12	18.4678
16	352.64	55.4747	6944.02	2319.1	18.4678
17	354.363	54.5373	7658.01	2557.55	18.4678
18	356.086	53.6467	8361.8	2792.59	18.4678
19	357.808	52.8014	9050.55	3022.62	18.4678
20	359.531	52	9720.08	3246.22	18.4678
21	361.194	51.2672	9909.29	3309.41	18.4678
22	362.856	50.5731	10053.1	3357.45	18.4679
23	364.518	49.9168	10149.8	3389.74	18.4678
24	366.181	49.2973	10197.5	3405.68	18.4679
25	367.843	48.714	10195.4	3404.97	18.4678
26	369.505	48.1661	10143.3	3387.56	18.4678
27	371.168	47.653	10041.2	3353.47	18.4678
28	372.83	47.174	9889.93	3302.94	18.4678
29	374.492	46.7286	9690.58	3236.37	18.4678
30	376.155	46.3162	9444.61	3154.22	18.4678
31	377.817	45.9365	9153.83	3057.11	18.4678
32	379.479	45.5891	8820.39	2945.75	18.4678
33	381.142	45.2734	8446.81	2820.98	18.4678
34	382.804	44.9893	8035.95	2683.77	18.4678
35	384.467	44.7364	7590.98	2535.16	18.4678
36	386.129	44.5145	7115.28	2376.29	18.4678
37	387.791	44.3233	6612.8	2208.48	18.4678
38	389.454	44.1627	6085.91	2032.52	18.4678
39	391.116	44.0324	5536.45	1849.01	18.4678
40	392.778	43.9324	4968.76	1659.42	18.4678
41	394.441	43.8625	4389.69	1466.03	18.4678
42	396.103	43.8228	3814.44	1273.91	18.4678
43	397.765	43.8131	3251.85	1086.02	18.4678
44	399.428	43.8334	2706.17	903.781	18.4678
45	401.09	43.8838	2181.94	728.702	18.4678
46	402.752	43.9643	1687.8	563.676	18.4678
47	404.415	44.075	1232.3	411.553	18.4678
48	406.077	44.2159	824.72	275.432	18.4678
49	407.74	44.3874	475.841	158.917	18.4678
50	409.402	44.5894	194.845	65.0723	18.4678
51	411.064	44.8222	0	0	0

Discharge Sections

Entity Information

Ground Profile

Shared Entities

Type	Coordinates (x,y)

External Boundary	0, 0 542.04, 0 542.04, 10 542.04, 38 533.92, 36 522.72, 34 452, 34 440.77, 36 432.1, 38 424.5, 40 418.92, 42 413.35, 44 407.79, 46 402.68, 48 397.71, 50 393.465, 52 387.85, 54 383.1, 56 378.42, 58 373.74, 60 369.07, 62 364.12, 64 358.67, 66 353.21, 68 347.73, 70 341.57, 72 335.46, 74 329.23, 76 325.87, 77 322.51, 78 315.12, 80 307.7, 82 300.32, 84 292.67, 86 285.16, 88 277.43, 90 270.21, 92 262.86, 94 255.74, 96 246.96, 98 240.98, 100 232.78, 102 224.13, 104 212.81, 106 206.43, 107 200.05, 108 184.3, 110 156.11, 112 109.4, 114 53.42, 116 0, 117.9 0, 107 0, 92 0, 77 0, 72 0, 52 0, 40 0, 10

Material Boundary	0, 10 542.04, 10
Material Boundary	0, 40 424.5, 40
Material Boundary	0, 52 393.465, 52
Material Boundary	0, 92 270.21, 92
Material Boundary	0, 107 206.43, 107
Material Boundary	0, 72 341.57, 72
Material Boundary	0, 77 325.87, 77

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Long Term
Piezoline	0, 72 364.12, 64	Assigned to: 🟨 Surficial Aquifer 🟩 Black Creek Confining Unit 🟧 Black Creek Aquifer 🟪 Upper Cape Fear Confining Unit	✗
Piezoline	0, 72 358.67, 66	✗	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer

Roadway

Shared Entities

Type	Coordinates (x,y)
	0, 0 542.04, 0 542.04, 10 542.04, 38 533.92, 36 522.72, 34 452, 34 440.77, 36 432.1, 38 424.5, 40 418.92, 42 413.35, 44 407.79, 46 402.68, 48 397.71, 50 393.465, 52 387.85, 54 383.1, 56

External Boundary	378.42, 58 373.74, 60 369.07, 62 364.12, 64 358.67, 66 353.21, 68 347.73, 70 341.57, 72 335.46, 74 325.45, 74 317.833, 74 317.583, 77 317.417, 79 312.52, 80 309.52, 81 306.53, 82 303.5, 83 292.67, 86 285.16, 88 277.43, 90 270.21, 92 262.86, 94 255.74, 96 246.96, 98 240.98, 100 232.78, 102 224.13, 104 212.81, 106 206.43, 107 200.05, 108 184.3, 110 156.11, 112 109.4, 114 53.42, 116 0, 117.9 0, 107 0, 92 0, 77 0, 72 0, 52 0, 40 0, 10
Material Boundary	0, 10 542.04, 10
Material Boundary	0, 40 424.5, 40
Material Boundary	0, 52 393.465, 52
Material Boundary	0, 92 270.21, 92
Material Boundary	0, 107 206.43, 107
Material Boundary	0, 72 341.57, 72
Material Boundary	0, 77 313.917, 77 317.583, 77

Material Boundary	317.833, 74 317.833, 73 335.46, 73 335.46, 74
Material Boundary	317.417, 79 313.917, 79 313.917, 77 313.917, 74 317.833, 74

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Roadway Short Term Downslope	Roadway Long Term Upslope	Roadway Long Term Downslope
Piezoline	0, 72 364.12, 64	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer	✗	✗
Distributed Load	322.048, 74 325.45, 74 332.047, 74	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No		
Piezoline	0, 72 358.67, 66	✗	✗	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer	Assigned to: 🟨 Surficial Aquifer 🟧 Black Creek Aquifer
Distributed Load	322.032, 74 325.45, 74 332.078, 74			Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: VerticalMagnitude: 500 lbs/ft2Creates Excess Pore Pressure: No

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

Appendix D

Groundwater Extraction and Conveyance System Design Report

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Groundwater Extraction and Conveyance System 60% Engineering Design Report

Chemours Fayetteville Works

Prepared for

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List of Abbreviations

3D	three-dimensional
COA	Consent Order Addendum
ETM	Elapsed Time Meter
ft	feet
fps	feet per second
gal	gallon
gpm	gallon per minute
GWEC	Groundwater Extraction and Conveyance
GWTP	Groundwater Treatment Plant
HDPE	High Density Polyethylene
HMI	Human Machine Interface
kV	kilovolt
MCP	Main Control Panel
NAVD88	North American Vertical Datum of 1988
NCDEQ	North Carolina Department of Environmental Quality
O&M	Operation and Maintenance
PDI	Pre-Design Investigation
PFAS	Per- and Polyfluoroalkyl Substances
PLC	Programmable Logic Controller
PVC	Polyvinyl Chloride
P&ID	Piping and Instrumentation Diagram
V	volt
VFD	Variable Frequency Drive
TOC	Top of Casing

1 Introduction

1.1 Overview and Background

Geosyntec Consultants of NC, P.C. (Geosyntec) has prepared for The Chemours Company, FC, LLC (Chemours) this 60% Engineering Design Report (report) for the Groundwater Extraction and Conveyance (GWEC) System planned to be installed at the Chemours Fayetteville Works facility in Bladen County, North Carolina (the Site; Figure 1-1). This report has been prepared pursuant to the Consent Order Addendum (COA) Paragraph 3 (North Carolina Department of Environmental Quality [NCDEQ], 2019) which requires a 60% design report for the Barrier Wall and Groundwater Extraction and Treatment System be submitted by August 15, 2021 to NCDEQ for approval. This report describes the basis of design for the GWEC System and presents a 60% level of design for the GWEC System and its constituent components.

The design concepts presented in this report have been developed based on the current understanding of Site conditions and are expected to generally remain consistent between this design stage and construction, although details of specific elements may be adjusted as the design of the other related components such as the barrier wall and the Groundwater Treatment Plant (GWTP) are advanced towards the 90% design stage. Specifically, between the 60% and 90% design submittals Chemours will be selecting a barrier wall installation contractor. The contractors have different access requirements for barrier wall installation, and therefore selection of this contractor will enable the finalization of the barrier wall roadway, wall alignment, and positioning of the groundwater extraction and conveyance components. Finalization of the barrier wall and roadway details will also allow the location of the GWEC system components to be finalized. Additionally, GWEC System details such as hydraulic modeling, calculation packages, technical specifications, and 90% design drawings are not provided here, but will be provided as part of the 90% design report, which will be submitted to the NCDEQ by March 31, 2022.

1.2 GWEC System and Report Objectives

The extraction and conveyance components of the GWEC System are being designed such that in conjunction with the barrier wall and the GWTP, the per- and polyfluoroalkyl substance (PFAS) loading from groundwater flow under the facility to the Cape Fear River and Willis Creek is reduced, pursuant to COA Paragraph 3(b)(ii) (COA; NCDEQ, 2019). The objectives of this report are to:

- Describe the rationale and basis of design for the GWEC System components including, but not limited to, wells, the conveyance system, pumps, instrumentation, and electrical components.
- Provide 60% level engineering drawings consistent with the rationale and basis of design.

The design basis is formed in significant part based on the analysis and conclusions presented in the Groundwater Modeling report (Appendix B of the Groundwater and Seeps Remedy 60% Design: Geosyntec, 2021b).

1.3 Design Report Organization

The remainder of this report is divided into the following sections:

- **Section 2** – Key project drivers and constraints
- **Section 3 –** Groundwater Containment System Design Basis, including extraction system design flow rates
- **Section 4** – GWEC System infrastructure overview, including a description of the main system components, their design basis and rationale, and their anticipated operational conditions
- **Section 5** – GWEC System functional checkout and startup checklist
- **Section 6** – List of references cited in this report

2 Key Project Drivers and Constraints

This section details the key project drivers and constraints for the GWEC System.

Paragraph 3(b)(ii) of the COA states:

> *"Chemours shall construct an extraction system consisting of an adequate number of wells and/or interceptor trenches to pump groundwater at a rate and depth sufficient to prevent groundwater migration around, above, or under the barrier wall. The system shall be designed so that extracted groundwater shall be treated through a treatment system that removes PFAS compounds (as measured by concentrations of indicator parameters GenX, PMPA, and PFMOAA) at a minimum removal efficiency of 99%."*

Furthermore, the COA states that the complete installation and commencement of the operations of the barrier wall, the GWEC system, and the GWTP shall be completed by March 15, 2023.

Inherent in this requirement is the inclusion of an appropriately sized GWEC System to meet the remedial objectives stated in the COA. The design of a system to extract and convey groundwater to a GWTP on Site must account for several physical and logistical constraints and considerations.

- **Geographic/Geologic:** The Site geography, particularly the extremely steep and unstable slopes along certain parts of the remedy alignment, and the need for extensive clearing, slope stabilization, and erosion control present design and construction challenges that need to be considered. Further, the highly heterogenous nature of the hydrostratigraphy necessitates the inclusion of sufficient contingency into the 60% design to account for uncertainties in anticipated groundwater capture.

- **Schedule:** The COA schedule requires that the complete installation and commencement of the operations of the entire groundwater remedy be completed by March 15, 2023. However, for the entire remedial system to be installed effectively the extraction and conveyance system must be operable in advance of the barrier wall installation to reduce hydraulic head in the upgradient aquifer and thus avoid large hydraulic gradients across the wall during construction. Therefore, the design and construction of the extraction and conveyance system must progress with a schedule offset from the COA completion date. Project execution in accordance with the schedule is challenged further by the well-documented global shipping delays which are increasing lead time volatility and resulting in an uncertain climate for system procurement.
- **Technical:** Considerations for the design must include an understanding of existing site utilities and additional power requirements. The design must be technically compatible with other remedy components, including the GWTP, barrier wall, and seeps capture and conveyance. As such, the design must include contingency in the event that additional capacity is needed in the future. Operation and maintenance (O&M) requirements must be considered in the design in order to minimize effort and mitigate potential down time. System automation and remote monitoring capabilities are included in the design to to aide in minimizing O&M efforts.

3 Groundwater Containment System Design Basis

To aid in designing the barrier wall and groundwater extraction system, a three-dimensional (3D) numerical model was developed in FEFLOW version 7.2 (DHI-WASY). The model was used to evaluate the hydraulic response under various barrier wall and extraction well configurations, as well as expected changes to the hydraulic gradients after the barrier wall and extraction system is implemented. The model was updated and calibrated prior to the design simulations. Detailed information regarding the model construction, calibrations, and design simulations is presented in Appendix B of the Groundwater and Seeps Remedy 60% Design (Geosyntec, 2021b).

3.1 Extraction System Design Flow Rates

Numerical model simulations to assess well locations and associated pumping rate ranges were performed using flow data obtained from aquifer pumping tests (Groundwater Modeling report Appendix B of the Groundwater and Seeps Remedy 60% Design: Geosyntec, 2021b). Details of the lithological borings and pumping tests are included in the Pre-Design Investigation (PDI) Summary report (Geosyntec, 2021a). The PDI investigation identified areas of increased transmissivity near Seep A, Seep B, and Seep D, and this information was incorporated into calibration and remedy design; details are presented in Appendix B of the Groundwater and Seeps Remedy 60% Design (Geosyntec, 2021b). The 3D numerical model simulations indicate that to provide hydraulic containment in accordance with the requirements set forth in the COA

(Paragraph 3 of the COA), 64 extraction wells (10 wells in the Surficial aquifer and 54 wells in the Black Creek aquifer) would need to be installed in conjunction with the vertical barrier wall.

The modeled range of extraction well flow rates are provided in Table 3-1. The estimated operating flow rates for the extraction well network is 980 gallons per minute (gpm) and the maximum flowrate that the aquifers can yield is 1,225 gpm.

3.2 Material Compatibility

Material compatibility for components of the GWEC System directly in contact with the groundwater matrix at the Site is important to ensure long-term reliability during operation and has been incorporated into the design of the various components. Details of the groundwater chemistry at the Site have been previously presented in the 2020 Annual Onsite and Offsite Groundwater Monitoring Report (Geosyntec, 2021c) and the Final RCRA Facility Investigation Report (Parsons, 2014).

4 GWEC System Design

Figure 4-1 provides a plan view of the GWEC System layout, which is comprised of the following key components:

- **Groundwater Extraction System**: The groundwater extraction system, described in **Section 4.1.1**, consists of 64 extraction wells (i.e., EW-01 through EW-64) installed upgradient of the barrier wall. Associated appurtenances include well enclosures, well head fixtures, submersible pumps, and instrumentation.
- **Groundwater Conveyance System**: The groundwater conveyance system, described in **Section 4.1.2**, consists of two groundwater conveyance pipelines (i.e., North Forcemain and South Forcemain) that convey extracted groundwater to the GWTP.

This section provides a description of the groundwater extraction system and the groundwater conveyance system, summarizes their design basis and rationale, and describes the overall operational logic of the system.

4.1 System Description and Rationale

The GWEC System design consists of 64 extraction wells screened at different depths within the transmissive zones of the Surficial and Black Creek aquifers. Submersible pumps installed in each well can extract and then convey groundwater though individual lateral pipes into a single header pipe (i.e., North Forcemain and South Forcemain) that conveys extracted groundwater to the GWTP' equalization tank.

Each well is designed to include flow, pressure, and water level measuring instrumentation for monitoring operations and for system control. Individual panels, with remote control access capabilities, are designed to control operation of a specific set of extraction wells. These remote-control panels communicate with a primary Programmable Logic Controller (PLC) and Human Machine Interface (HMI) located at the GWTP that controls the GWEC. A Supervisory Control and Data Acquisition system collects and logs all the operational data from the entire system.

4.1.1 Groundwater Extraction System

The main components of the groundwater extraction system are shown on Drawings C-01 through C-08 and M-01 through M-03 in Attachment A; the Piping and Instrumentation Diagrams (P&IDs) for the GWEC System are shown on Drawings D-01 through D-03. Extraction wells and their associated components were sized based on the estimated extraction flow rates for each well. Current design elements have been conservatively estimated and/or sized to accommodate potential changes as the design is refined and for contingent capacity, should it be needed during operation.

The groundwater extraction system design consists of the following components:

- **Extraction Wells:** The GWEC System consists of 64 groundwater extraction wells with expected individual well flow rates ranging from 10 to 35 gpm, as shown on Figure 4-1. Well construction schematics for the 64 extraction wells are shown on Drawings M-01 through M-03 in Attachment A.
- Each extraction well design includes construction using 6-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and be equipped with 6-inch diameter stainless steel wire-wrapped, well screens. Grain size sample data (Stations 5+00, 15+00, 20+00, 33+50, and 67+50) near the proposed extraction wells were evaluated to select an appropriately size filter pack and well screen slot size. Based on the analysis using methods presented by Driscoll (2008), approximately 60% of the material in the Black Creek Aquifer at each location is coarser than 0.020 in, and 90% retention is achieved when using 20-40 sand and a 0.020 slot screen or equivalent. Approximately 60% of the material in the Surficial at each location is coarser than 0.010 in in the southern half of the barrier wall alignment, and 90% retention is achieved when using 20-40 sand and a 0.010 slot screen or equivalent. Both Schedule 40 PVC and stainless steel are compatible with the groundwater and aquifer matrix at the Site. Based on existing hydrostratigraphic data from the PDI Work Plan (Geosyntec, 2020a), the screen intervals are expected to range between 20 and 40 feet (ft) in length within the transmissive zone of the aquifer. Consistent with best practices for extraction well design, each extraction well design includes a 5-ft sump below the bottom of the screened interval to allow for collection of silt or sediment that may accumulate over time (EPA, 2018).
- Ten of the proposed extraction wells are designed to be screened in the Surficial aquifer, while the remaining 54 wells are designed to be screened in the Black Creek aquifer. Based on previous sieve analyses (Geosyntec, 2020a), a 20-40 graded clean silica sand will be used for the filter pack material and extended approximately 2-3 ft above the top of the screen unless the well design process described above indicates otherwise.

- The extraction wells will be installed using sonic drilling to allow casing off the overlying aquifer to prevent vertical migration of groundwater between aquifers during construction. A combination of 8-inch and 10-inch rods will be used to advance a minimum 10-inch borehole within which the extraction well casing, screen, and filter pack will be installed using centralizers. During well development, measures such as continuous water level gauging to avoid drawdown below the top of the screen interval will be taken to minimize aeration of the groundwater to prevent iron fouling.
- **Well Enclosures:** The extraction wells and their associated wellhead fixtures are designed to be housed in lockable fiberglass hot box enclosures of appropriate dimensions, as shown on Drawings M-01 through M-03 (Attachment A). Each enclosure design is set atop a 4-inch-thick concrete pad to allow water that enters the enclosure to drain through the opening at the bottom side to prevent submergence of equipment. Each well enclosure will be equipped with an entry sensor to alert the operator if the enclosure door is unintentionally left open or in the case of unauthorized entry. If opened, the sensor will be activated, and a signal will be sent to the local well control panel and the operator will be notified with an alarm. The sensor alarm will not affect system operations; it is a notification alarm only.
- **Wellhead Fixtures:** As mentioned previously, each extraction well will consist of a 6-inch diameter Schedule 40 PVC riser casing set above ground surface. Each riser well casing will terminate in a 6-inch well seal with five adequately sized holes bored through the seal plate to accommodate installation of the following: (i) high-density polyethylene (HDPE) submersible well pump discharge pipe (i.e., riser pipe); (ii) 1-inch Schedule 40 PVC stilling tube (i.e., transducer housing); (iii) pump power cable; (iv) steel pump support cable; and (v) the air release valve discharge tubing. The discharge piping from the pump within each enclosure will sequentially comprise of the following components:
- Magnetic Flow Meter and Transmitter – A magnetic flow meter and transmitter will be installed on the vertical pipe segment after the HDPE pipe transitions to PVC at the flange. The magnetic flow meter will be situated to provide a minimum of 4 pipe diameters of straight pipe upstream and 2.5 pipe diameters of straight pipe downstream of the flow sensor to avoid turbulence effects and provide accurate flow readings.
- Air Relief Valve – An isolation ball valve and an air relief valve will be installed in the discharge piping within the well enclosure to prevent air entrainment or blocks due to air bubbles in the discharge line.
- Pressure Transmitter and Sample Port Assembly – A pressure transmitter will be installed as illustrated on Drawings M-01 through M-03. The pressure transmitter can be isolated from the pressurized line for maintenance via a 0.5-inch bronze isolation ball valve; the sample port will be comprised of a 0.5-inch bronze ball valve.

- Check Valve – After the pressure transmitter, a check valve will be installed to prevent backflow through the piping system into the extraction well.
- Ball Valve – After the check valve, a ball valve will be installed to provide isolation of the preceding valves and instrumentation from the remainder of the system.
- Before exiting the enclosure, the Schedule 40 PVC pipe will transition to an HDPE pipe lateral that will connect to the conveyance forcemain. For collocated wells, the individual laterals will combine into a common lateral prior to connecting to the conveyance forcemain, as illustrated on Detail 34 on Drawing M-09.
- **Submersible Pumps:** An electrical stainless-steel submersible pump will be installed in each extraction well. Preliminary pump specifications are provided in Table 4-1. The pump impellers will be constructed of stainless-steel which is compatible with Site groundwater. The selection of the final design elements will be based on hydraulic modeling using WaterGEMS (SELECT Series 3), a water distribution system modeling and design software developed by Bentley Systems. Based on the capture analysis presented in the Groundwater Modeling report (Appendix B of Groundwater and Seeps Remedy 60% Design), the anticipated range of flow rates for the extraction wells can be found in Table 4-1. Each extraction well motor will be selected for compatibility with a Variable Frequency Drive (VFD) for controlling flow rates.
- **Water-Level Monitoring and Control:** Each extraction well will be equipped with a pressure transducer to monitor water levels in the well during operation to ensure that the extraction pump does not cavitate and to minimize fouling by drawing down water to the screen interval. The water level in the well will be used to control extraction pump operation. Flow rate control of the extraction wells is discussed further in Section 4.1.5.

4.1.2 Groundwater Conveyance System

Figure 4-1 presents the general layout of the GWEC System conveyance piping. Drawings C-01 through C-08 present the plans and profiles of the forcemains. The groundwater conveyance system will consist of the following components:

- Two conveyance pipes (i.e., North Forcemain and South Forcemain) that connect the extraction wells to the GWTP:
    - The North Forcemain consists of a telescoping forcemain transitioning from 3-inch SDR-11 HDPE to 10-inch SDR-11 HDPE and conveys groundwater from EW-01 through EW-49 to the GWTP.
    - The South Forcemain consists of a telescoping forcemain transitioning from 3-inch SDR-11 HDPE to 8-inch SDR-11 HDPE and conveys groundwater from EW-50 through EW-64 to the GWTP.
- Both forcemains will discharge into an equalization tank located at the GWTP.

- The basis for the pipe specifications, including diameters and wall thickness, will be confirmed in the 90% Design as part of the design calculations.
- Pipe cleanouts
- Air release/vacuum breaker valves
- Associated fittings

The key design criteria used for the groundwater conveyance piping include: (i) structural integrity for subsurface use; (ii) pipe flow velocity generally targeted in the range of 2 – 8 feet per second (fps); (iv) the design flow rate for the North Forcemain of 855 gpm; and (v) the design flow rate for the South Forcemain of 370 gpm.

The conveyance pipeline will be constructed using SDR-11 HDPE pipe that is compatible with the Site groundwater, aquifer, and subsurface matrix. In addition, the pipeline will be designed to accommodate vehicle loadings at locations where the pipeline will cross beneath or installed within the barrier wall road and other access roads. The pipeline will also be designed to accommodate culvert crossings (as applicable) and accommodate stresses due to overburden materials. In areas of high utility density, conveyance pipeline will be installed via directional drilling to avoid potential utility strikes. Directional drilling technology is typically accompanied with tracking mechanisms that allow tracking of the drill head as it advances in the subsurface. Different types of directional drill rigs have limitations on angle of entry and setback requirements which will be determined as details on the conveyance layout are finalized with further design progress.

The conveyance piping will be installed a minimum of 36 inches below grade with 4 inches of pipe bedding material below the conveyance piping as shown on Drawing M-08 in Attachment A. Native soil or imported clean fill will be used as backfill material, as appropriate. Surface completion of the trench will be made consistent with the surface of the surrounding roadway.

Typically, a target flow velocity greater than 2 fps is selected to minimize particulate settling in pressurized pipes. For several sections of the GWEC System conveyance piping, nominal piping diameters 2 inches or less would be necessary to maintain flow velocities in excess of 2 fps. Conveyance piping less than 3 inches in diameter can be difficult to clean out should it become clogged due to particulate settling, biofouling, and/or chemical precipitation (e.g., scaling). Given the presence of dissolved iron in the extracted groundwater, scaling is considered to be a greater risk than settling of particulates. To facilitate conveyance piping cleaning should scaling occur, 3-inch conveyance piping was specified even where the 2 fps settling criterion was not satisfied. Both forcemains were designed to accommodate additional flow rates while maintaining the velocity constraints mentioned previously.

Butt-fusion welding will be used to assemble the HDPE conveyance piping to the extent possible. Alternative methods may include the use of compression fittings where butt-fusion welding may not be feasible. Transition from PVC piping to HDPE piping in the well enclosures will be facilitated using flanged connections. Prior to GWEC System startup, pressure testing of all conveyance piping will be conducted following approved methods (ASTM, F 2164), to confirm the integrity of the conveyance piping and the integrity of the mechanical joints (i.e., there is no leakage).

4.1.3 Electrical & Process Control Infrastructure

The power to the GWEC System will be distributed using an underground 13.2 kilovolt (kV) distribution feeder sourced from the power drop at the GWTP location. There will be 14 remote control panels installed along the barrier wall alignment to supply power and process control to the 64 extraction wells. At each of the 14 control panel locations, the 13.2 kV distribution feeder will be tapped to supply a 75-kilovolt ampere secondary transformer that will convert the power to single phase 120/240 volt (V). The secondary transformer will supply a fused disconnect switch to allow each location to be isolated for maintenance. The fused disconnect switch will feed a distribution panel that will feed the remote-control panel, the area lighting, a convenience outlet, and a security camera.

The system will be controlled by a PLC located in the main control panel (MCP). The MCP will be installed in the control room of the GWTP building. The PLC will be accessible/programmable via an HMI. The HMI will be a computer running the system software. The HMI will also be accessible remotely via a secure internet connection. The full range of GWEC System operations will be controllable both on- and off-Site.

The MCP will communicate with each of the 14 remote control panels via a fiber optic line network. The remote-control panels will contain input and output cards to relay the data from extraction wells to the PLC for processing. Data transmitted from each well will include the extraction flow rate, well water level elevation, and discharge pressure at the well. Each remote-control panel will be equipped with a touch-screen HMI to facilitate operations and maintenance activities at the remote well locations.

In addition, the remote-control panels are designed to allow control of up to six extraction wells. Each panel is designed to have at least one spare position to facilitate control of additional extraction wells should they be needed to achieve groundwater containment objectives. The aquifer is most transmissive near Seeps A and B due localized gravelly sands; therefore, a junction box will be installed between Seeps A and B to allow installation of an additional control panel and up to another six extraction wells, should they be needed. The remote-control panels near Seeps C and D are designed to have two spare positions (i.e., only four wells per panel initially).

Each well pump will be controlled by appropriately rated VFDs that will convert the 240V single phase input to 240V three phase output. The VFDs will allow for finer control of extraction well flow rates without the need for mechanical control using valves. The VFDs will supply the wells in buried conduits to a local disconnect switch near each well to allow service of the well pumps.

A low voltage junction box will also be installed near the wells to allow termination of the instrumentation (i.e., flow meter, level transmitter, pressure transmitter, and intrusion alarm).

4.1.4 Process Control/Functional Description

The flow rates from individual extraction wells will be controlled by both localized setpoints (i.e., well level, enclosure pipeline flowrate/pressure) and level controls at the equalization tank at the GWTP that will shut off or prevent the extraction well pumps from operating if the level setpoint has been reached.

The system interlocks for the GWEC System operation are shown on the P&IDs (Drawing D-02 in Attachment A). The PLC will be programmed to execute the system operation logic depicted on Drawing D-02 in Attachment A. Overviews of the operation protocols and controls for the groundwater extraction well system are provided below.

4.1.4.1 Groundwater Extraction Well System Operation and Control

The HMI will include a general control interface window that displays and provides operational access to each of the 64 extraction wells. The general control interface window will display a graphical representation of the groundwater extraction well and conveyance systems. The well icons will display key well design details, including top of casing (ft North American Vertical Datum of 1988 [NAVD88]), transducer elevation (ft NAVD88), and pump elevation (ft NAVD88). Operational parameters and alarm status for the individual extraction wells will be displayed adjacent to the extraction well icons in a table. The operational parameters indicated on the HMI interface will include the following:

- **Well Status –** Indicates whether the extraction well is in OFF, HAND, or AUTO mode. In OFF, the pump will not be allowed to operate. In HAND, the pump will be turned on regardless of control interlocks. In AUTO, the pump will operate when required by the control system.
- **Pump Status –** Indicates whether the pump is ON or OFF.
- **Flow Rate –** Indicates the instantaneous flow of water pumped from well in gpm.
- **Total (gal) –** Indicates the total volume of flow in gallons (gal) pumped from the well since the totalizer was last reset. The total volume will be estimated by the PLC using the instantaneous flow rate from the flow meter and the reporting time steps. The total volume of flow as measured by the flow meter will be accessible at the device installed in the well enclosure.
- **Pressure –** Indicates the line pressures at the extraction well enclosures.
- **Well Level –** Indicates: (i) the height of the water column (in ft) above the well level transmitter; and (ii) the elevation of the water column with respect to ft NAVD88.

- **Flow Setpoint –** Indicates the flow to which the pump will attempt to maintain. The **Flow Setpoint** will be referenced in gpm.
- **Pump Speed (or Speed) –** Indicates the pump motor speed as a percentage.
- **Motor Current –** Indicates the motor current of the pump motor in amps.
- **Pump Starts (Daily) –** Indicates the number of pump starts at the well during the current calendar day.
- **Elapsed Time Meter (ETM) (Hours) –** Indicates the total elapsed time that the pump has operated since the meter was last reset.
- **Enclosure Status –** Indicates the extraction well enclosure door status (i.e., open or closed).

The alarm status for the extraction wells is displayed. The alarms listed include:

- **Panel Intrusion –** the well control panel is open; warning only.
- **Communication Failure –** there is a failure in communication between the well control panel and the MCP; this will shut down the pump(s) controlled through the well control panel.
- **High Motor Current –** the pump motor current exceeded the maximum allowable value; the pump will be shut down.
- **Low Level –** the water level in the well dropped below the Well Level set point; the pump will be shut down for a minimum of 5 minutes[1] to allow the well to recharge.
- **Low Flow –** the pump flow rate dropped below the minimum level; the pump will be shut down.
- **Pump Failure –** a pump failure occurred; pump is shut down.
- **Low Pressure –** the conveyance pipeline pressure is less than the minimum pressure setpoint within the well enclosure piping; the pump will shut off.
- **High Pressure –** the conveyance pipeline pressure is greater than the maximum pressure setpoint within the well enclosure piping; the pump will shut off.
- **Running in Hand at Well –** the pump is operating in Hand mode; control interlocks for pump are disabled.
- **Enclosure Intrusion –** the well enclosure door is open, warning only.

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[1] A minimum shut down period of 5 minutes will be specified to prevent the number of pump motor starts per hour from exceeding manufacturer recommendations.

In addition to the alarm status icons described for individual wells, the system will monitor the flow rates and pressures at each extraction well. The summation of the flows from the extraction well network will be compared to the total incoming flow rate as measured at the inlet manifold. Accounting for accuracy range of the flowmeters, a predetermined setpoint for the discrepancy between the individual flow rates and the total flow rate will be used to trigger an alarm indicating a potential leak. Similarly, pressure readings outside of anticipated range and the accuracy of the instrument will trigger a pressure alarm and shut down the system. The system operator will be notified via text message or email when an alarm is triggered by an exceedance of the specified operational parameters.

The control interface window for an extraction well will be accessible by clicking on the extraction well information box on the HMI interface. The individual control interface window for an extraction well will provide the means to control pump extraction rate and other operational parameters. The operational variables[2] and their functionality are described below:

- **Flow Setpoint –** Sets the flow rate that the pump will attempt to maintain during routine operation.
- **Maximum Flow** – Sets the maximum flow at which the PLC will operate the extraction well pump. Given its function as one of the second-tier governing controls, the **Maximum Flow** set point can be used to set the operating flow rate of the extraction well. For example, if the **Maximum Flow** for EW-15 is set at 20 gpm and the **Target Water Level** is set at an elevation below which the water level in the well will not reach, the PLC will maintain the flow rate at 20 gpm (i.e., at the specified extraction rate, the water level in the well will not decrease to the **Target Well Level**). Therefore, the **Maximum Flow** set point acts as the operating flow rate control point.
- **Target Water Level** – Sets the level to which the pump will attempt to maintain the groundwater level in the well. The **Target Water Level** will be referenced to NAVD88 to the level at which the pressure transducer is installed. The **Target Water Level** will be the first-tier[3] governing control that is used to set the well extraction rate. The second-tier[3] governing control will be the **Minimum Flow** and **Maximum Flow** set points (see below) for the pump. Operationally, the PLC will attempt to maintain the **Target Water Level** by adjusting the pump rate within the specified flow range. The PLC will keep increasing flow up to the **Maximum Flow** set point in an attempt to draw the well water level down to the **Target Water Level**. If the well yield is less than the **Minimum Flow** set point the PLC will operate the well at **Minimum Flow** until the water level in the well drops to **Low Level (Pump Stop)**, as defined below, at which point the pump will be turned off.

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[2] Set points for the operational variables will be determined in the field during system installation, including functional checkout and startup activities.

[3] First- and second-tier governing controls are used for programming purposes only. The system can be operated either way depending on operator preference.

- **Low Level (Pump Stop)** - Sets the low-level interlock that shuts down the well pump should the water level in the well decrease to the specified level. The level set point will be referenced to NAVD88.
- **High Level (Pump Start)** – Sets the high-level interlock that starts the well pump should the water level in the well be above to the specified level. The level set point will be referenced to NAVD88.
- **Minimum Flow** – Sets the minimum flow at which the PLC will operate the extraction well pump. The minimum flow values for a well will be set no lower than the manufacturer’s recommended flow rate.
- **Level Transmitter Depth from TOC** – Sets the depth below the top of casing (TOC) at which the level transmitter is installed in the well.
- **Low Pressure Alarm** – Sets the low pressure set point in the extraction well enclosure at which the PLC will transmit a signal to shut down the extraction well. The pressure transmitter is installed on the enclosure piping and a low-pressure alarm could be indicative of a potential pipe failure or leak within the enclosure.
- **High Pressure Alarm** – Sets the high pressure set point in the extraction well enclosure at which the PLC will transmit a signal to shut down the extraction well. The pressure transmitter is installed on the enclosure piping and a high-pressure alarm could be indicative of a potential pipe blockage or clogging within the enclosure.
- **Pump Motor High Current Alarm** – Sets the maximum allowable current (amps) set point for the pump motor. If exceeded, the PLC will transmit a signal to shut down the extraction well pump, thus protecting the motor from damage.
- **VFD Set Points** – These are set points that control the operation of the VFD controlling the extraction well pump motor. In general, after system start up, these set points will not be changed except by an operator with specialized training in VFD control optimization.
- **Total (gal) and ETM (hours) Resets** – These two control icons, if clicked, will reset the PLC estimated flow volume total and the elapsed time meter. The **Total (gal) Reset** does not reset the totalizer associated with the local device.
- **Communication Failure** – Sets whether a communication failure between the MCP and the well control panel shuts down the well (Enabled) or allows it to operate (Disabled). **Communication Failure** will only be set in the Disabled mode if maintenance is being performed at the well.
- **Panel Door Status** – Indicates whether the local well control panel is open or closed.

The control infrastructure and programming for the extraction wells provides an appropriate degree of operational flexibility to achieve the groundwater containment objectives.

4.1.4.2 Groundwater Treatment System Operation and Control

Extracted groundwater will be conveyed to an equalization tank at the GWTP (designed by others). The equalization tank shall be equipped with a level transmitter and a high-high level switch. Overviews of the minimum operation protocols and controls are described below:

- **Equalization Tank Level High –** Sets the maximum water level setpoint for the level transmitter in the equalization tank at which the extraction well pumps will be shut off. The run permissive condition for the extraction wells is that the level in the tank is below the **Equalization Tank Level High**.
- **Equalization Tank Level High-High –** Sets the maximum water level setpoint for the high-high level switch in the equalization tank at which the extraction well pumps will be shut off. The **Equalization Tank Level High-High** setpoint shall be higher than the **Equalization Tank Level High** setpoint and acts as a redundant control in the event of level transmitter failure/malfunction.

4.2 Design Drawings

The design drawings incorporate the design elements of the groundwater extraction and conveyance components of the GWEC System as detailed in the preceding sections. The different design elements are presented in a manner that facilitates review of the principal design concepts. The drawings have been grouped into five categories, including:

- General (e.g., project notes, existing site conditions, etc.)
- Civil (e.g., site development plan, grading plan, piping plans and profiles, piping details, extraction well details, etc.)
- Process (e.g., piping & instrumentation diagrams)
- Mechanical (e.g., extraction well enclosure and piping plans, pipeline appurtenances, etc.)
- Electrical (e.g., electrical service drop, system architecture, control panels, conduit diagrams, PLC modules, well grounding, cable lists)

The 60% Design Drawings are provided in Attachment A.

4.3 Design Calculations

The hydraulic design, including pipe sizing and pump selections, presented herein are preliminary and based on current Site conditions, the tentative barrier wall alignment and is subject to change as the design of related components progresses. Current design elements have been conservatively estimated and/or sized to accommodate potential changes. The selection of the final design elements will be based on hydraulic modeling using WaterGEMS (SELECT Series 3) and presented in conjunction with the 90% engineering design report.

5 System Operations

The GWEC System will undergo functional checkout and startup processes after construction is complete. Functional checkout and startup activities will be documented and reported in a Construction Completion report. Performance monitoring of the GWEC System, not detailed herein, will be performed to confirm that the system is providing hydraulic containment in accordance with COA Paragraph 3 (COA; NCDEQ, 2019). GWEC System optimization will be performed to achieve hydraulic containment objectives. This section addresses these topics.

5.1 System Integration, Functional Checkout, and Startup

The mechanical, electrical, and instrumentation components comprising the GWEC System will be integrated into the process control network architecture to provide a fully functional and automated system. The system software that controls functionality of the individual extraction wells via the 14 remote control panels, the main control panel, and associated instrumentation, communication, and power distribution subsystems will be programmed by the system integrator and executed by the PLC.

Functional checkout activities will be performed prior to startup of the GWEC System. The purpose of the functional checkout is to verify that key system components have been installed correctly and are functioning in accordance with the design. Functional checkout activities will proceed according to the following sequence for each system:

- Verify correct installation and operation of electrical, mechanical, and instrumentation components
- Verify hydraulic performance (i.e., pipe filling and purging)
- Verify system interlocks by limited operation of the GWEC System
- Verify flow adjustments of the extraction well pumps
- Verify full system operation to confirm each system is operating consisted with design criteria

Once the system is confirmed to be fully functional, startup activities will commence. The startup of the GWEC System extraction wells will be performed in a phased manner to minimize the volume of water generated initially so operating parameters can be optimized prior to running the system at higher capacities. Startup of the GWEC System will be considered substantially complete when the system is confirmed to be operating consistent with the range of operational flow rates.

5.2 Operations and Maintenance Plan

The components of the GWEC system will require routine O&M to ensure reliable operation as designed. Prior to startup, a draft O&M Plan will be prepared and then refined based on lessons learned from system stabilization. The O&M Plan will describe routine preventative maintenance activities for the various components of the GWEC system and the conditions that may prompt additional non-routine action. The O&M Plan will also include a compilation of operating manuals and specifications on all the installed components for operator reference during O&M activities. The O&M Plan will include checklists to support the routine inspection and logging of GWEC components and maintenance activities.

The expected O&M activities for the primary components of the GWEC system are described herein and will be refined as the design is advanced further and subsequently during startup. Flow, pressure, and water level data from each well and the overall flow rate for the GWEC system will be routinely evaluated the determine the need for well or conveyance line maintenance. Well maintenance activities will include retrieving the submersible well pumps and cleaning or replacement, as necessary. Well maintenance activities will include redevelopment to remove scaling/fouling and to maintain hydraulic connectivity of the screen interval with the aquifer. Depending on the level of scaling, additional well maintenance using chemical treatment may also be necessary. Over time, fouling or scaling of the groundwater conveyance pipes may also occur. To address this, the conveyance pipe will be designed to allow for routine pipe cleaning (both physical and chemical), as necessary. Other O&M activities will include routine calibration of measuring instrumentation and systems alarms and interlocks to confirm operation as designed. In addition, thermal evaluation of the control panels will also be performed routinely to mitigate potential health and safety hazards.

6 References

AECOM, 2021. Fayetteville Consent Order Activities Waste Management Plan. May 2021.

Driscoll, F.G., 2008. Groundwater and Wells. New Brighton, MN. Johnson Screens

EPA, 2018. Design and Installation of Monitoring Wells. SESDGUID-101-R2. January 16, 2018.

Geosyntec, 2019a. Corrective Action Plan. Chemours Fayetteville Works. December 31, 2019.

Geosyntec, 2020a. Pre-Design Investigation Work Plan. Chemours Fayetteville Works. July 2020.

Geosyntec, 2021a. Pre-Design Investigation Summary. Chemours Fayetteville Works. June 29, 2021.

Geosyntec, 2021b. Groundwater and Seeps Remedy 60% Design. Chemours Fayetteville Works. August 13, 2021.

Geosyntec, 2021c. 2020 Annual Onsite and Offsite Groundwater Monitoring Report. Chemours Fayetteville Works. February 2021.

NCDEQ, 2019. Addendum to Consent Order Paragraph 12. General Court of Justice Superior Court Division. State of North Carolina. County of Bladen. February 25, 2019.

Parsons, 2014. Final RCRA Facility Investigation Report (Rev. 1). DuPont Fayetteville Works. February 2014.

Tables

TABLE 3-1
EXTRACTION WELL SYSTEM DESIGN FLOW RATES
Chemours Fayetteville Works, North Carolina

Extraction Well	Design Flow Rate Range (gpm)
EW-01	5 - 10
EW-02	5 - 10
EW-03	5 - 10
EW-04	10 - 15
EW-05	10 - 20
EW-06	10 - 20
EW-07	10 - 20
EW-08	10 - 20
EW-09	5 - 15
EW-10	5 - 15
EW-11	10 - 15
EW-12	10 - 15
EW-13	10 - 15
EW-14	10 - 20
EW-15	10 - 20
EW-16	5 - 15
EW-17	10 - 20
EW-18	5 - 10
EW-19	10 - 15
EW-20	15 - 15
EW-21	15 - 20
EW-22	15 - 30
EW-23	15 - 20
EW-24	20 - 20
EW-25	20 - 20
EW-26	10 - 20
EW-27	20 - 20
EW-28	10 - 20
EW-29	20 - 20
EW-30	10 - 20
EW-31	20 - 20
EW-32	10 - 20
EW-33	10 - 15
EW-34	10 - 20

TABLE 3-1
EXTRACTION WELL SYSTEM DESIGN FLOW RATES
Chemours Fayetteville Works, North Carolina

Extraction Well	Design Flow Rate Range (gpm)
EW-35	10 - 15
EW-36	10 - 15
EW-37	10 - 15
EW-38	10 - 15
EW-39	10 - 20
EW-40	10 - 15
EW-41	10 - 20
EW-42	10 - 15
EW-43	10 - 20
EW-44	10 - 15
EW-45	10 - 20
EW-46	10 - 15
EW-47	10 - 20
EW-48	10 - 20
EW-49	10 - 15
EW-50	10 - 15
EW-51	10 - 20
EW-52	10 - 20
EW-53	10 - 15
EW-54	10 - 20
EW-55	10 - 20
EW-56	10 - 20
EW-57	10 - 20
EW-58	15 - 25
EW-59	15 - 30
EW-60	20 - 30
EW-61	20 - 30
EW-62	20 - 35
EW-63	15 - 35
EW-64	15 - 35

Notes:

gpm - gallons per minute

TABLE 4-1
PUMP SPECIFICATIONS
Chemours Fayetteville Works, North Carolina

Extraction Well	Design Flow Rate Range (gpm)	Grundfos SP Series Pump Model	Pump Flow Range (gpm)	Nominal Head (ft)	Motor Horsepower (hp)
EW-01	5 - 10	16S15-14	2 - 20.6	284	1.5
EW-02	5 - 10	16S15-14	2 - 20.6	284	1.5
EW-03	5 - 10	16S15-14	2 - 20.6	284	1.5
EW-04	10 - 15	25S30-15	3.3 - 34.3	298	3
EW-05	10 - 20	25S30-15	3.3 - 34.3	298	3
EW-06	10 - 20	25S30-15	3.3 - 34.3	298	3
EW-07	10 - 20	25S30-15	3.3 - 34.3	298	3
EW-08	10 - 20	25S30-15	3.3 - 34.3	298	3
EW-09	5 - 15	16S20-18	2 - 20.6	366	2
EW-10	5 - 15	16S15-14	2 - 20.6	284	1.5
EW-11	10 - 15	16S15-14	2 - 20.6	284	1.5
EW-12	10 - 15	16S15-14	2 - 20.6	284	1.5
EW-13	10 - 15	16S15-14	2 - 20.6	284	1.5
EW-14	10 - 20	16S15-14	2 - 20.6	284	1.5
EW-15	10 - 20	16S15-14	2 - 20.6	284	1.5
EW-16	5 - 15	16S15-14	2 - 20.6	284	1.5
EW-17	10 - 20	16S15-14	2 - 20.6	284	1.5
EW-18	5 - 10	16S15-14	2 - 20.6	284	1.5
EW-19	10 - 15	16S15-14	2 - 20.6	284	1.5
EW-20	15 - 15	16S15-14	2 - 20.6	284	1.5
EW-21	15 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-22	15 - 30	35S30-11	3.5 - 45.5	242	3
EW-23	15 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-24	20 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-25	20 - 20	25S10-7	3.3 - 34.3	139	1
EW-26	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-27	20 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-28	10 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-29	20 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-30	10 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-31	20 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-32	10 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-33	10 - 15	25S15-9	3.3 - 34.3	179	1.5
EW-34	10 - 20	25S15-9	3.3 - 34.3	179	1.5
EW-35	10 - 15	25S15-9	3.3 - 34.3	179	1.5

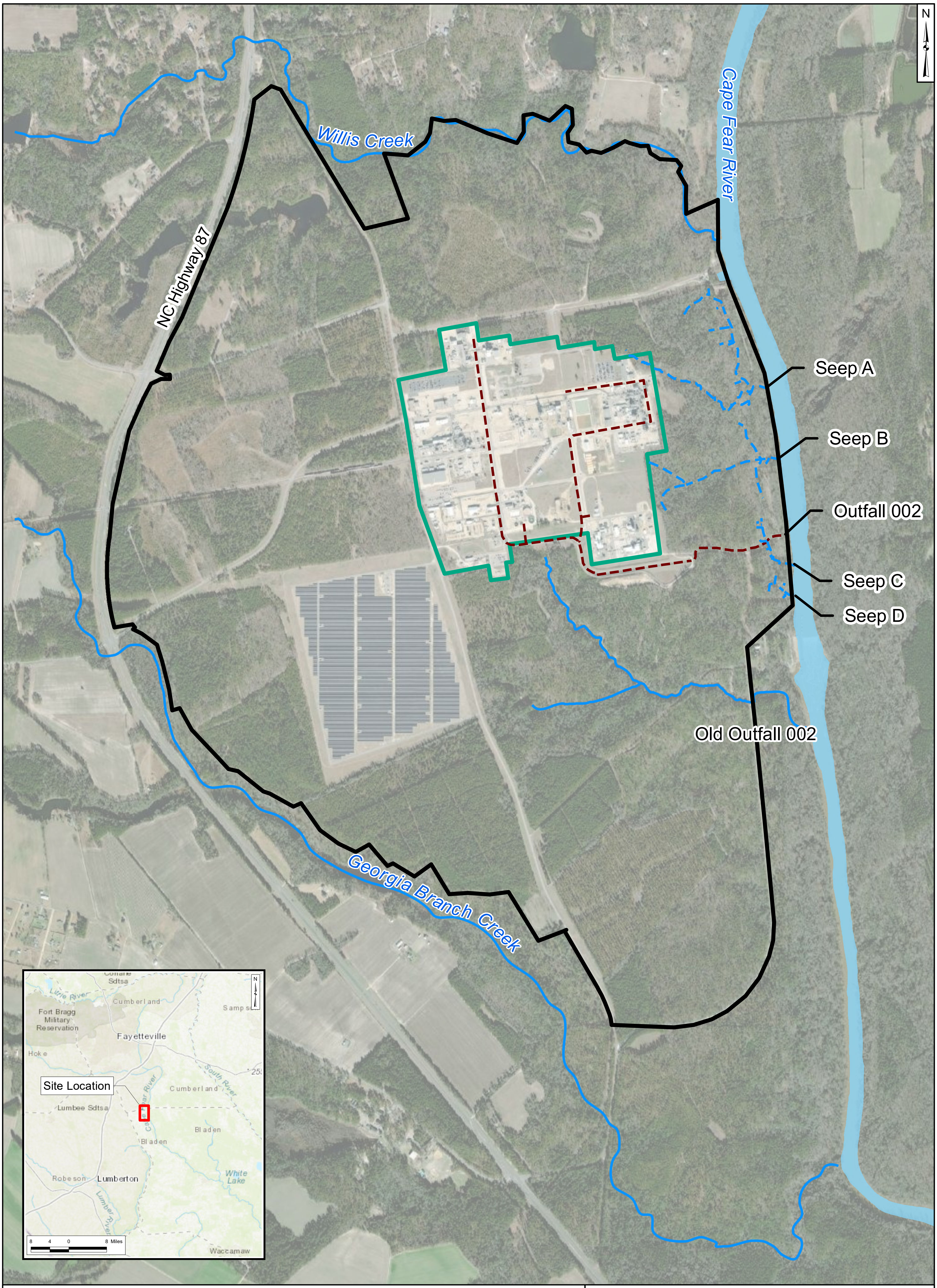
TABLE 4-1
PUMP SPECIFICATIONS
Chemours Fayetteville Works, North Carolina

Extraction Well	Design Flow Rate Range (gpm)	Grundfos SP Series Pump Model	Pump Flow Range (gpm)	Nominal Head (ft)	Motor Horsepower (hp)
EW-36	10 - 15	16S10-10	2 - 20.6	203	1
EW-37	10 - 15	16S10-10	2 - 20.6	203	1
EW-38	10 - 15	16S10-10	2 - 20.6	203	1
EW-39	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-40	10 - 15	16S10-10	2 - 20.6	203	1
EW-41	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-42	10 - 15	16S10-10	2 - 20.6	203	1
EW-43	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-44	10 - 15	16S10-10	2 - 20.6	203	1
EW-45	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-46	10 - 15	16S10-10	2 - 20.6	203	1
EW-47	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-48	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-49	10 - 15	16S07-8	2 - 20.6	162	0.75
EW-50	10 - 15	16S07-8	2 - 20.6	162	0.75
EW-51	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-52	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-53	10 - 15	16S07-8	2 - 20.6	162	0.75
EW-54	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-55	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-56	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-57	10 - 20	25S10-7	3.3 - 34.3	139	1
EW-58	15 - 25	35S20-8	3.5 - 45.5	175	2
EW-59	15 - 30	35S20-8	3.5 - 45.5	175	2
EW-60	20 - 30	35S20-8	3.5 - 45.5	175	2
EW-61	20 - 30	35S20-8	3.5 - 45.5	175	2
EW-62	20 - 35	35S30-11	3.5 - 45.5	242	3
EW-63	15 - 35	35S30-11	3.5 - 45.5	242	3
EW-64	15 - 35	35S30-11	3.5 - 45.5	242	3

Notes:

gpm - gallons per minute
ft - feet
hp - horsepower

Figures



Legend

🟩 Chemours Facility

▬ Site Boundary

▬ Nearby Tributary

- - - Seep

- - - Site Conveyance Network

Notes:
1. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
2. Basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1,000 500 0 1,000 Feet

Site Location Map

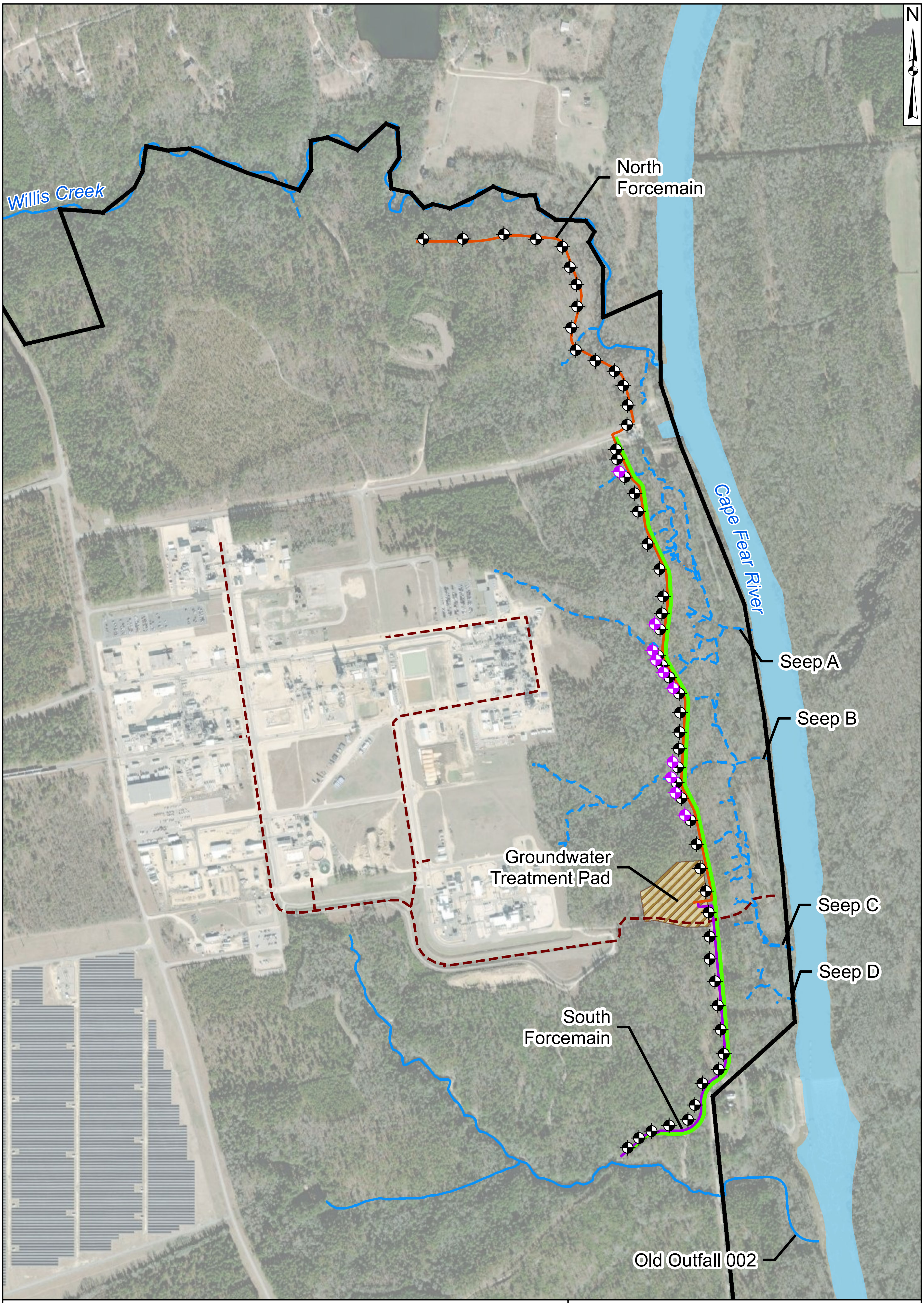
Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Raleigh | August 2021

Figure
1-1



Legend

- ⊕ Surficial Aquifer Extraction Well
- ⊕ Black Creek Aquifer Extraction Well
- — North Forcemain
- — South Forcemain
- — Barrier Wall; approximate surface elevation at 72 feet mean sea level
- - - Site Conveyance Network
- — Site Boundary
- - - Seep
- — Nearby Tributary to River

Notes:

1. Surficial Aquifer extraction wells have been offset for visibility. Therefore, the placement of these wells on this map do not reflect their true geographic coordinates.
2. Conveyance forcemain alignment is preliminary and is subject to change in future submittals.
3. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
4. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

800 400 0 800 Feet

Groundwater Extraction and Conveyance System Layout

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

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NC License No.: C 3500 and C 295

Figure

4-1

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Geosyntec
consultants

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Attachment A
60% Design Drawings

60% DESIGN - NOT FOR CONSTRUCTION

THE CHEMOURS COMPANY
FAYETTEVILLE WORKS PROJECT
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM
60% DESIGN DRAWINGS

WILLIS CREEK AND CAPE FEAR RIVER CORRIDOR
FAYETTEVILLE, BLADEN AND CUMBERLAND COUNTIES
STATE OF NORTH CAROLINA
AUGUST 2021

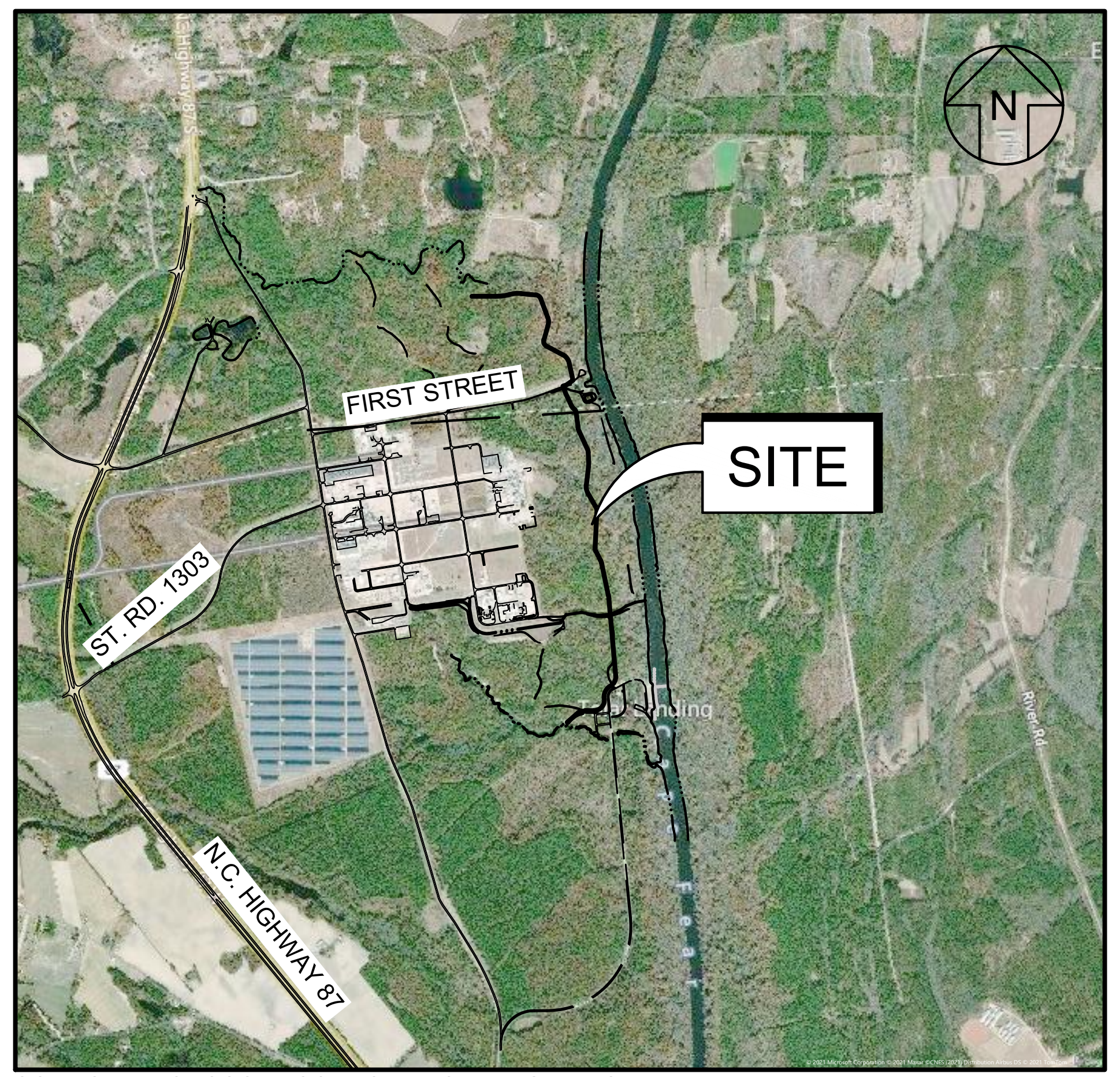
SOURCE: MICROSOFT CORPORATION BING MAPS 2021

VICINITY MAP

SCALE: 1" = 30 MILES

LIST OF DRAWINGS	
DRAWING NO.	DRAWING TITLE
GENERAL	
G-01	TITLE SHEET
G-02	GENERAL NOTES AND SYMBOLS
CIVIL	
C-01	SITE DEVELOPMENT PLAN
C-02	GROUNDWATER EXTRACTION SITE PLAN I
C-03	GROUNDWATER EXTRACTION SITE PLAN II
C-04	GROUNDWATER EXTRACTION SITE PLAN III
C-05	GROUNDWATER EXTRACTION SITE PLAN IV
C-06	GROUNDWATER EXTRACTION SITE PLAN V
C-07	GROUNDWATER EXTRACTION SITE PLAN VI
C-08	GROUNDWATER CONVEYANCE FORCEMAIN PROFILES
PROCESS	
D-01	PIPING AND INSTRUMENTATION DIAGRAM I
D-02	PIPING AND INSTRUMENTATION DIAGRAM II
D-03	EXTRACTION WELL P&ID SCHEDULES I
D-04	EXTRACTION WELL P&ID SCHEDULES II
MECHANICAL	
M-01	EXTRACTION WELL DETAILS I
M-02	EXTRACTION WELL DETAILS II
M-03	EXTRACTION WELL DETAILS III
M-04	EXTRACTION WELL DETAILS IV
M-05	EXTRACTION WELL DETAILS V
M-06	MECHANICAL DETAILS I
M-07	MECHANICAL DETAILS II
M-08	MECHANICAL DETAILS III
M-09	MECHANICAL DETAILS IV
ELECTRICAL	
E-01	OVERALL ELECTRICAL SITE PLAN
E-02 *	ELECTRICAL SITE PLAN I
E-03 *	ELECTRICAL SITE PLAN II
E-04 *	ELECTRICAL SITE PLAN III
E-05 *	ELECTRICAL SITE PLAN IV
E-06 *	ELECTRICAL SITE PLAN V
E-07 *	ELECTRICAL SITE PLAN VI
E-08	ELECTRICAL DETAILS I
E-09	ELECTRICAL DETAILS II
E-10	NETWORK ARCHITECTURE
E-11	SINGLE LINE DIAGRAM I
E-12	SINGLE LINE DIAGRAM II
E-13	SINGLE LINE DIAGRAM III
E-14	SINGLE LINE DIAGRAM IV
E-15	SINGLE LINE DIAGRAM V
E-16	SINGLE LINE DIAGRAM VI
E-17	SINGLE LINE DIAGRAM VII
E-18	CONTROL PANEL POWER DISTRIBUTION I
E-19	CONTROL PANEL POWER DISTRIBUTION II
E-20	PANELBOARD SCHEDULES AND JUNCTION BOX

* DRAWINGS NOT INCLUDED IN THIS SUBMITTAL



SOURCE: MICROSOFT CORPORATION BING MAPS 2021

LOCATION MAP

SCALE: 1" = 3,000'

0 3,000
SCALE IN FEET

PREPARED FOR:

Chemours™

22828 NC-87
FAYETTEVILLE, NC 28306
910.483.4681

PREPARED BY:

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE: TITLE SHEET

PROJECT: THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE: FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

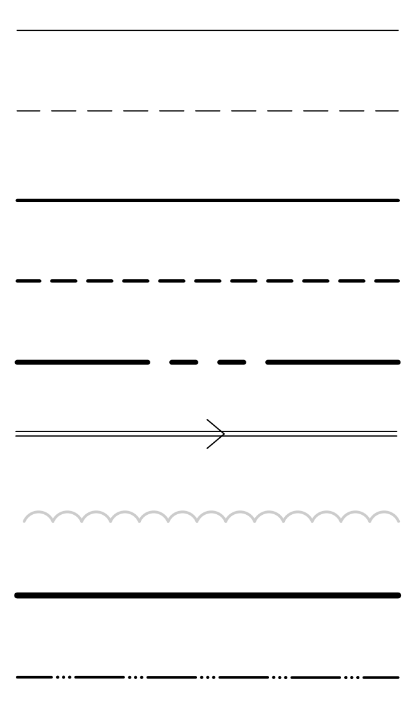
SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-G01.DWG
REVIEWED BY:	SV	DRAWING NO.:	G-01
APPROVED BY:	JJD		

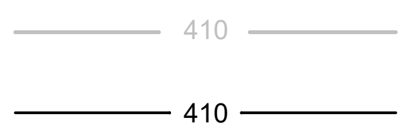
60% DESIGN - NOT FOR CONSTRUCTION

LINETYPE LEGEND



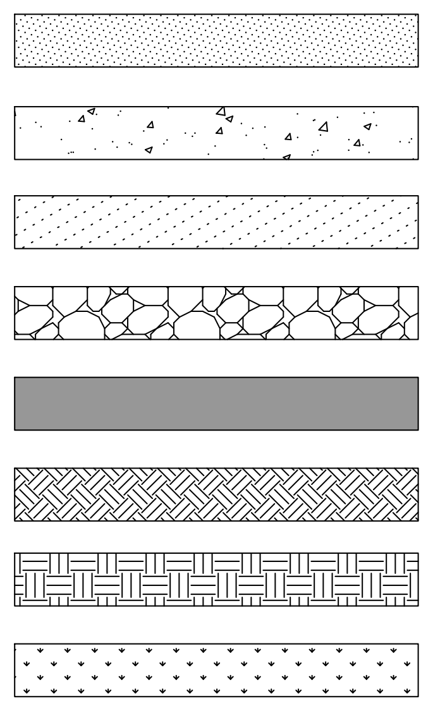
- EDGE OF ROAD / EXISTING BUILDINGS
- EXISTING GROUND (NOTE 1)
- GROUNDWATER CONVEYANCE FORCEMAIN
- NON-WOVEN GEOTEXTILE SEPARATOR
- PROPERTY BOUNDARY (NOTE 2)
- STORMWATER PIPE AND FLOW DIRECTION
- TREELINE
- BARRIER WALL
- STREAM / RIVER

CONTOUR LEGEND



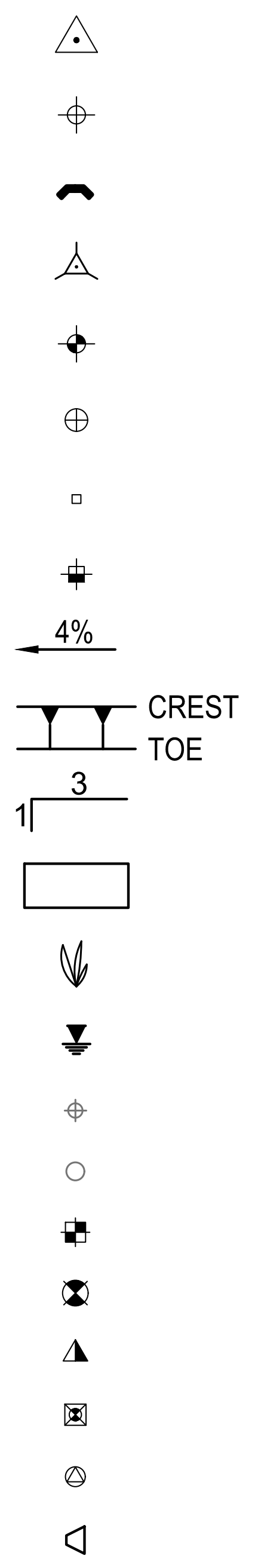
- EXISTING GROUND ELEVATION (FEET) (NOTE 1)
- FINISHED GRADE SURFACE ELEVATION (FEET)

HATCH LEGEND



- ACCESS ROAD (EXISTING AND PROPOSED)
- CONCRETE
- PIPE EMBEDMENT FILL
- RIPRAP
- STREAM (NOTE 1)
- SUBGRADE
- TRENCH BACKFILL / EARTHEN FILL
- WETLANDS (NOTE 1)

SYMBOL LEGEND



- CONTROL MARKER (NOTE 2)
- GROUNDWATER PIEZOMETER
- HEADWALL
- HISTORICAL WELL / PIEZOMETER
- MONITORING NETWORK WELL
- POWER POLE
- PRINCIPAL SPILLWAY RISER
- RELIEF WELL
- SLOPE GRADE
- SLOPE INDICATOR
- SLOPE LABEL
- TRAILER OR BUILDING
- VEGETATION
- WATER SURFACE
- EXISTING INJECTION WELL
- EXISTING EXTRACTION WELL
- SURFICIAL AND BLACK CREEK AQUIFER EXTRACTION WELL
- BLACK CREEK AQUIFER EXTRACTION WELL
- SURFICIAL AQUIFER EXTRACTION WELL
- FORCEMAIN CLEANOUT
- AIR RELEASE VALVE
- REDUCER

ABBREVIATIONS

AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
APP	APPROVED BY
ARV	AIR RELEASE VALVE
℄	CENTER LINE
DRN	DRAWN BY
DWG	DRAWING
E	EAST OR EASTING
EL	ELEVATION
EW	EXTRACTION WELL
FCO	FORCEMAIN CLEANOUT
FT	FEET
GWTP	GROUNDWATER TREATMENT PLANT
HDPE	HIGH DENSITY POLYETHYLENE
H:V	HORIZONTAL TO VERTICAL LENGTH RATIO FOR A SLOPE
HWY	HIGHWAY
IN	INCH
INV	INVERT
MAX	MAXIMUM
MIN	MINIMUM
MSL	MEAN SEA LEVEL
N	NORTH OR NORTHING
NAD	NORTH AMERICAN DATUM
NAVD88	NORTH AMERICAN VERTICAL DATUM OF 1988
NCDEQ	NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
NO.	NUMBER
NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
N.S.A.	NATIONAL STONE ASSOCIATION
NTS	NOT TO SCALE
OC	ON CENTER
OZ	OUNCE
PFAS	PER- AND POLYFLUOROALKYL SUBSTANCES
PROJ	PROJECT
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
REV	REVISION
S	SOUTH
SCH	SCHEDULE
SDR	STANDARD DIMENSIONAL RATIO
STA	STATION
SWP	STORMWATER PIPE
TYP	TYPICAL
U.S.	UNITED STATES
USEPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
W	WEST
W.S.	WATER SURFACE
%	PERCENT OR PERCENTILE

REFERENCE NOTES

1. THE BASIS OF BEARINGS FOR THIS SURVEY IS NAD83 NORTH CAROLINA STATE PLANES, US FOOT. THE BASIS OF ELEVATIONS FOR THIS SURVEY IS NAVD88 BASED ON AN OPUS SESSION PERFORMED ON NOVEMBER 16, 2019. THE TOPOGRAPHY OF THIS SURVEY HAS A CONTOUR INTERVAL OF ONE FOOT AND WAS PRODUCED FROM TWO LIDAR SCANS OF THE AREA. THE SCANS WERE PERFORMED ON DECEMBER 1, 2019 AND DECEMBER 19, 2019 BY SPECTRAL DATA CONSULTANTS, INC. PROJECT NO. 19085. THIS SURVEY WAS MADE IN ACCORDANCE WITH LAWS AND/OR MINIMUM STANDARDS OF THE STATE OF NORTH CAROLINA.
2. PROPERTY IS LOCATED WITHIN AN AREA HAVING A ZONE DESIGNATION "X" & "AE" BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), ON FLOOD INSURANCE RATE MAP NO. 3720035900J, WITH A DATE OF IDENTIFICATION OF JANUARY 5, 2007, IN BLADEN COUNTY, STATE OF NORTH CAROLINA AND ON FLOOD INSURANCE RATE MAP NO. 3720044000J, WITH A DATE OF IDENTIFICATION OF JANUARY 5, 2007, IN CUMBERLAND COUNTY, STATE OF NORTH CAROLINA, WHICH ARE THE CURRENT FLOOD INSURANCE RATE MAP FOR THE COMMUNITY IN WHICH SAID PREMISES IS SITUATED. THE BASE FLOOD ELEVATION FOR THE AREA IS 68' MSL.
3. TOPOGRAPHIC, ROADS, BUILDINGS, AND PROPERTY LINE INFORMATION OBTAINED FROM FREELAND-CLINK SCALES & ASSOCIATES, INC. OF NC. SURVEY OF THE CHEMOURS FAYETTEVILLE WORKS SITE DATE 7 JANUARY 2019.
4. COORDINATE SYSTEM CORRESPONDS TO NAD83, NORTH CAROLINA. ELEVATIONS PRESENTED ARE IN FEET, NAVD 88.

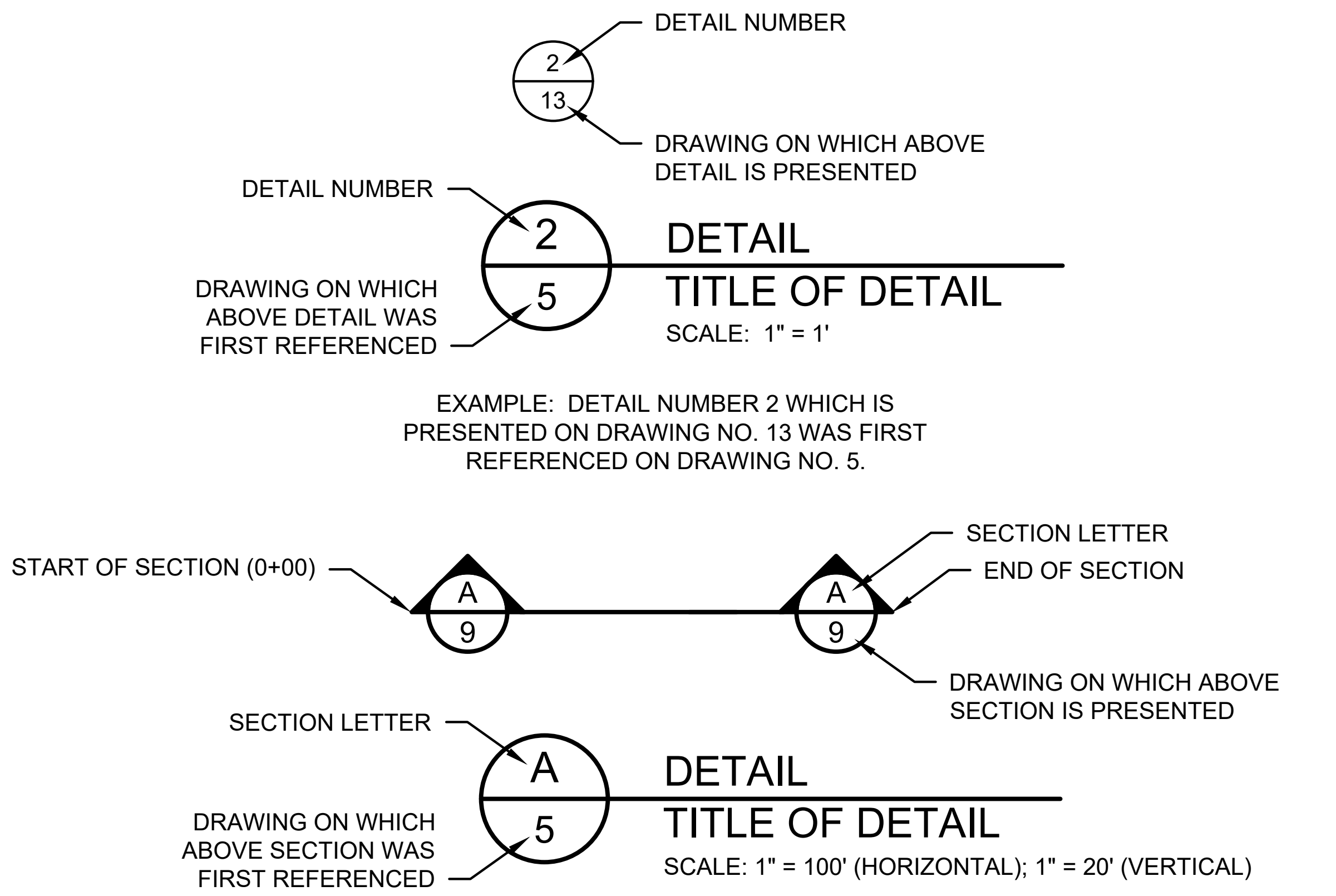
GENERAL EROSION AND SEDIMENT CONTROL (E&SC) NOTES

1. ALL EROSION CONTROL MEASURES SHALL BE IN CONFORMANCE WITH THE CURRENT EDITION OF THE “NC EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.” STORMWATER CONTROLS AND BEST MANAGEMENT PRACTICES SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THE APPLICABLE NPDES CONSTRUCTION STORMWATER DISCHARGE GENERAL PERMIT, NPDES INDUSTRIAL STORMWATER DISCHARGE GENERAL PERMIT, AND/OR THE FACILITY'S NPDES INDUSTRIAL WASTEWATER DISCHARGE INDIVIDUAL PERMIT.
2. STATE WATERS BUFFERS SHALL REMAIN UNDISTURBED, EXCEPT WHERE ENCROACHMENT IS REQUIRED TO FACILITATE PFAS REMEDIAL ACTIVITIES. UNLESS OTHERWISE EXEMPTED BY THE APPROPRIATE NPDES CONSTRUCTION STORMWATER GENERAL PERMIT, A STATE WATERS BUFFER VARIANCE SHALL BE OBTAINED FROM NORTH CAROLINA DEQ'S DIVISION OF WATER RESOURCES PRIOR TO BUFFER ENCROACHMENT.
3. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES FOR THIS PROJECT, THE LIMITS OF DISTURBANCE AND ALL WETLANDS AND STATE WATERS BUFFERS WITHIN 200 FEET OF THE LIMITS OF DISTURBANCE OR WITHIN THE PROPERTY BOUNDARY (WHICHEVER IS CLOSER) SHALL BE CLEARLY FLAGGED AND STAKED. THESE MARKINGS SHALL BE MAINTAINED UNTIL COMPLETION OF CONSTRUCTION / CLOSURE ACTIVITIES. SHOULD ANY OF THE MARKINGS BE DISTURBED, THE CONTRACTOR SHALL NOTIFY THE CHEMOURS COMPANY IMMEDIATELY. ALL CONSTRUCTION PERSONNEL SHALL BE SHOWN THE LOCATION OF THE LIMITS OF DISTURBANCE, STATE WATER BUFFERS, STATE WATERS AND WETLANDS OUTSIDE THE LIMITS OF DISTURBANCE TO PREVENT HEAVY EQUIPMENT ENCROACHMENT INTO THESE AREAS.

STEEL REINFORCING NOTES

1. CONTRACTOR SHALL FURNISH EMBEDMENT MATERIALS SUCH AS BOLTS AND FASTENERS FOR SECURING PIPE HANGERS, PIPE STANDS, AND OTHER EQUIPMENT THAT REQUIRES BOLTING TO CONCRETE.
2. CONTRACTOR SHALL FURNISH EPOXY RESIN FOR ANCHORING BOLTS AND FASTENERS TO CONCRETE. EPOXY RESIN SHALL CONFORM TO THE REQUIREMENTS OF ASTM C881.

DETAIL AND SECTION IDENTIFICATION LEGEND



EXAMPLE: DETAIL NUMBER 2 WHICH IS PRESENTED ON DRAWING NO. 13 WAS FIRST REFERENCED ON DRAWING NO. 5.

EXAMPLE: SECTION LETTER "A" WHICH IS PRESENTED ON DRAWING NO. 9 WAS FIRST REFERENCED ON DRAWING NO. 5.

CONCRETE NOTES

1. ALL CONCRETE WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION AND/OR ADDENDUM REFERENCED IN DESIGN STANDARDS ACI 318 AND ACI 301.
2. ADDITION OF WATER TO THE BATCH FOR MATERIAL WITH INSUFFICIENT SLUMP WILL NOT BE PERMITTED, UNLESS THE SUPPLIER HAS SPECIFICALLY WITHHELD WATER FROM THE BATCH AT THE PLANT. IN SUCH CASE, THE MIX DESIGN AND TRUCK TICKET MUST CLEARLY STATE THE MAXIMUM AMOUNT OF WATER THAT CAN BE ADDED TO THE BATCH ON SITE. IN NO CASE SHALL THE DESIGN WATER TO CEMENTITIOUS MATERIAL RATIO BE EXCEEDED.
3. MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED.
4. CHAMFER ALL EXPOSED EXTERNAL CORNERS OF CONCRETE WITH 3/4" X 45 DEGREE CHAMFER, UNLESS NOTED OTHERWISE.
5. CONTRACTOR TO REFER TO DRAWINGS OF OTHER TRADES AND VENDOR DRAWINGS FOR EMBEDDED ITEMS AND RECESSES NOT SHOWN ON THE STRUCTURAL DRAWINGS.
6. ALL CEMENT SHALL BE TYPE I/II, EXCEPT TYPE III MAY BE USED TO PROVIDE HIGH-EARLY STRENGTH FOR 4,000 PSI AT 14 DAYS. COMPLY WITH ACI 318 TESTING REQUIREMENTS FOR 14-DAY STRENGTH IN ACCORDANCE WITH ACI 318 CHAPTER 19.
7. THE STRUCTURAL DRAWINGS SHALL BE COORDINATED WITH MECHANICAL, ELECTRICAL, AND CIVIL DRAWINGS FOR THE SIZE AND LOCATION OF EMBEDDED ITEMS, OPENINGS, SLEEVES, INSERTS, DOWELS, DEPRESSIONS, ETC. DO NOT CUT REINFORCEMENT UNLESS INDICATED BY SECTION OR DETAIL. AT LOCATIONS OF CONFLICT, SPREAD THE REINFORCEMENT TO ACCOMMODATE PLACEMENT. ADD ADDITIONAL BARS IF NECESSARY, TO MAINTAIN SPACING REQUIREMENTS.
8. CONCRETE CONTAINING SUPERPLASTICIZING ADMIXTURE SHALL HAVE A SLUMP OF 4” ± 1”, TO BE FIELD VERIFIED, PRIOR TO ADDING ADMIXTURE, AND NOT EXCEEDING 8” AT PLACEMENT.
9. STRUCTURAL CONCRETE TO MEET THE REQUIREMENTS SHOWN IN THE FOLLOWING TABLE:

CONCRETE PROPERTIES

CONCRETE USE	MIN 28 DAY COMPRESSIVE STRENGTH	SLUMP AT PLACEMENT	MAX W/C RATIO	REMARKS
ALL CONCRETE SHALL BE	4,000 PSI	4” ± 1”	0.45	AIR ENTRAINED TO 5% ± 1%

10. ALL AGGREGATES SHALL CONFORM TO ASTM C33.
11. FLY ASH WILL NOT BE PERMITTED.
12. CONCRETE MIX DESIGNS MUST COMPLY WITH THE REQUIREMENTS OF ACI 318 CHAPTER 9. FOLLOW SECTION 19.2 FOR AVERAGE COMPRESSIVE STRENGTHS WHEN TEST DATA ARE NOT AVAILABLE.
13. ADMIXTURES SHALL NOT CONTAIN MORE THAN 0.1% CHLORIDE IONS AND CONFORM TO THE FOLLOWING:
    - A. AIR-ENTRAINING ADMIXTURES: ASTM C260
    - B. WATER REDUCING ADMIXTURES: ASTM C494, TYPE A
    - C. RETARDING ADMIXTURES: ASTM C494, TYPE D
14. CURE CONCRETE IN ACCORDANCE WITH ACI 301 USING WET CURE OR LIQUID CURING COMPOUND.
15. CURING COMPOUND SHALL CONFORM TO REQUIREMENTS OF ASTM C309 AND NOT IMPAIR NATURAL BONDING CHARACTERISTICS OF SUBSEQUENT COATINGS.
16. CONCRETE FORMWORK FOR VERTICAL LOADS AND LATERAL PRESSURES SHALL BE IN ACCORDANCE WITH ACI 347.
17. NONSHRINK GROUT SHALL BE USED FOR PIPE PENETRATIONS. MIX AND PLACE AS RECOMMENDED BY THE MANUFACTURER AND IN ACCORDANCE WITH ASTM C1107.
18. CONCRETE SLAB SURFACES SHALL BE COATED USING CARBOLINE PLASITE 9029, OR APPROVED EQUAL AS A PRIMER LAYER, AND PLASITE 9060, OR APPROVED EQUAL, AS A TOP COAT. THE PLASITE 9060 SHALL BE APPLIED IN A MINIMUM OF THREE COATINGS. EXTEND COATING TO THE TOP OF CHAMFERED EDGE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GENERAL NOTES AND SYMBOLS

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-G02.DWG
REVIEWED BY:	SV	DRAWING NO.:	G-02
APPROVED BY:	JJD		

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NOTES:

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3. APPROXIMATE EXTENT OF IMPACTED WETLANDS DELINEATED BY PARSONS (AUGUST 2020 WOTUS REPORT, CHEMOURS FAYETTEVILLE WORKS, FLOW THROUGH CELLS, SEEP C PILOT STUDY). APPROXIMATE EXTENT OF UNIMPACTED WETLANDS IN UPLAND LOCATIONS DELINEATED BY GEOSYNTEC, SEPTEMBER 2020 (WOTUS REPORT PENDING FOR SEEPS A, B, AND D PERMIT MODIFICATION).
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5. CONTRACTOR SHALL VERIFY HIGH POINTS ALONG VERTICAL ALIGNMENT PRIOR TO FINALIZING AIR RELEASE VALVE LOCATIONS.
6. CONTRACTOR SHALL FIELD-VERIFY BENDS ALONG FORCEMAIN.
7. CONTRACTOR SHALL INSTALL THE FORCEMAIN PIPE CROSSING FROM STA 30+71 TO STA 31+65 VIA HORIZONTAL DIRECTIONAL DRILLING.

LEGEND

——355——	EXISTING GROUND MAJOR CONTOUR (5')	▨	WETLANDS
———	EXISTING GROUND MINOR CONTOUR (1')	⊕	EXISTING INJECTION WELL
— — —	PROPERTY BOUNDARY	○	EXISTING EXTRACTION WELL
———	BARRIER WALL ALIGNMENT	◩	SURFICIAL AND BLACK CREEK AQUIFER EXTRACTION WELL
—x—x—	EXISTING FENCE	⧗	BLACK CREEK AQUIFER EXTRACTION WELL
= = =	EXISTING GRAVEL ROAD	▣	FORCEMAIN CLEANOUT
═══	EXISTING PAVED ROAD	◎	AIR RELEASE VALVE
———	GROUND WATER CONVEYANCE FORCEMAIN	◁	REDUCER
—·—·—	STREAM		
o——o	RELOCATED OUTFALL 002		

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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RALEIGH, NC 27607
919.870.0576

TITLE:

SITE DEVELOPMENT PLAN

PROJECT:

THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:

FAYETTEVILLE WORKS SITE

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DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
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REVIEWED BY:	SV	DRAWING NO.:	C-01
APPROVED BY:	JJD		

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NOTES:

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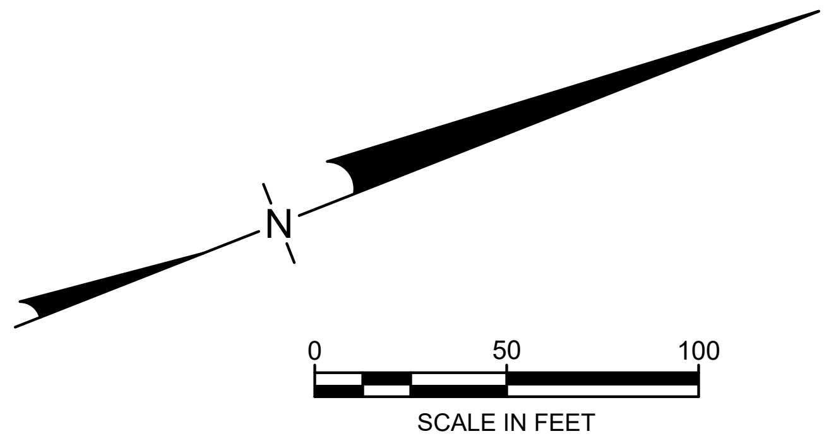

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A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
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919.870.0576

TITLE:

GROUNDWATER EXTRACTION SITE PLAN I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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NOTES:

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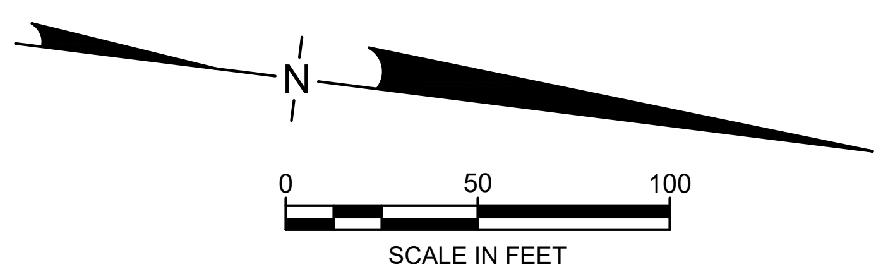

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B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GROUNDWATER EXTRACTION SITE PLAN II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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REVIEWED BY:	SV	DRAWING NO.:	C-03
APPROVED BY:	JJD		

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NOTES:

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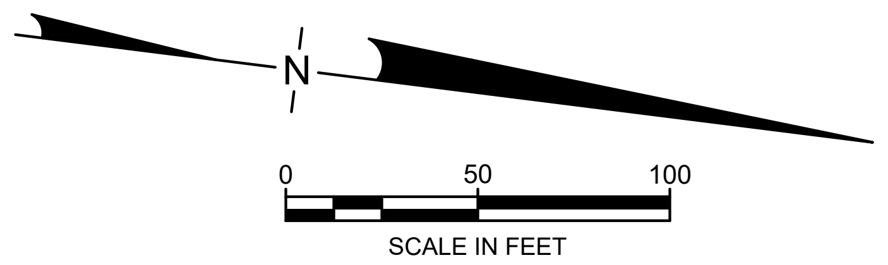

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B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GROUNDWATER EXTRACTION SITE PLAN III

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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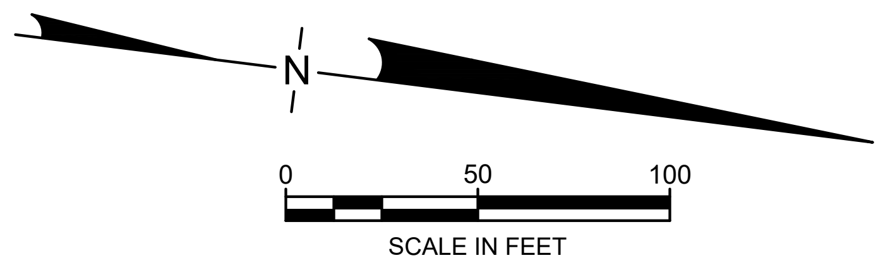

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7. CONTRACTOR SHALL INSTALL THE FORCEMAIN PIPE CROSSING FROM STA 30+71 TO STA 31+65 VIA HORIZONTAL DIRECTIONAL DRILLING OR JACK AND BORE, AS APPROPRIATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PREPARATION OF THE INSTALLATION WORK PLAN.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GROUNDWATER EXTRACTION SITE PLAN IV

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
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APPROVED BY:	JJD		

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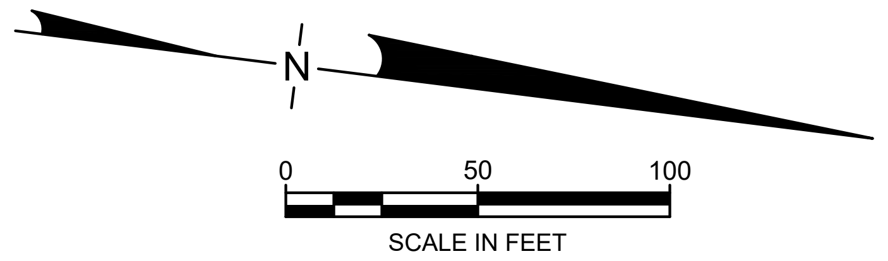

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Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GROUNDWATER EXTRACTION SITE PLAN V

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-C06.DWG
REVIEWED BY:	SV	DRAWING NO.:	C-06
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

NOTES:

1. GRID COORDINATE SYSTEM CORRESPONDS TO NAD83, NORTH CAROLINA. ELEVATIONS PRESENTED ARE IN FEET, NAVD 88.
2. TOPOGRAPHIC, ROADS, BUILDINGS, AND PROPERTY LINE INFORMATION OBTAINED FROM FREELAND-CLINK SCALES & ASSOCIATES, INC. OF NC. SURVEY OF THE CHEMOURS FAYETTEVILLE WORKS SITE DATE 7 JANUARY 2019.
3. APPROXIMATE EXTENT OF IMPACTED WETLANDS DELINEATED BY PARSONS (AUGUST 2020 WOTUS REPORT, CHEMOURS FAYETTEVILLE WORKS, FLOW THROUGH CELLS, SEEP C PILOT STUDY). APPROXIMATE EXTENT OF UNIMPACTED WETLANDS IN UPLAND LOCATIONS DELINEATED BY GEOSYNTEC, SEPTEMBER 2020 (WOTUS REPORT PENDING FOR SEEPS A, B, AND D PERMIT MODIFICATION).
4. FORCEMAIN ALIGNMENT AND LOCATION OF FORCEMAIN CLEANOUTS, AIR RELEASE VALVES, AND REDUCERS IS PRELIMINARY AND ARE SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
5. CONTRACTOR SHALL VERIFY HIGH POINTS ALONG VERTICAL ALIGNMENT PRIOR TO FINALIZING AIR RELEASE VALVE LOCATIONS.
6. CONTRACTOR SHALL FIELD-VERIFY BENDS ALONG FORCEMAIN.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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TITLE:
GROUNDWATER EXTRACTION SITE PLAN VI

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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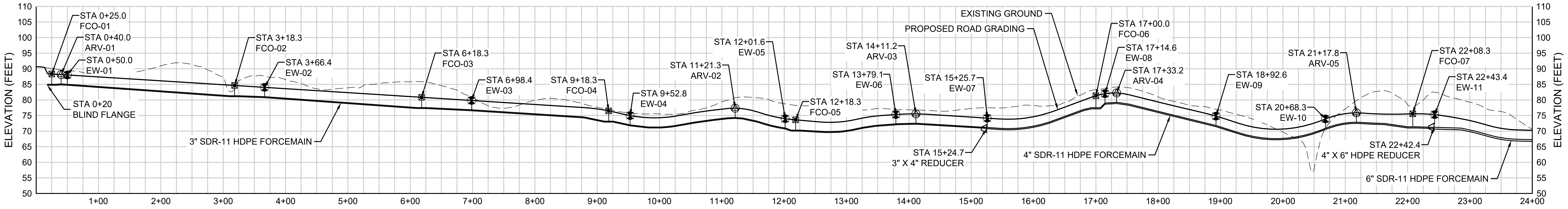
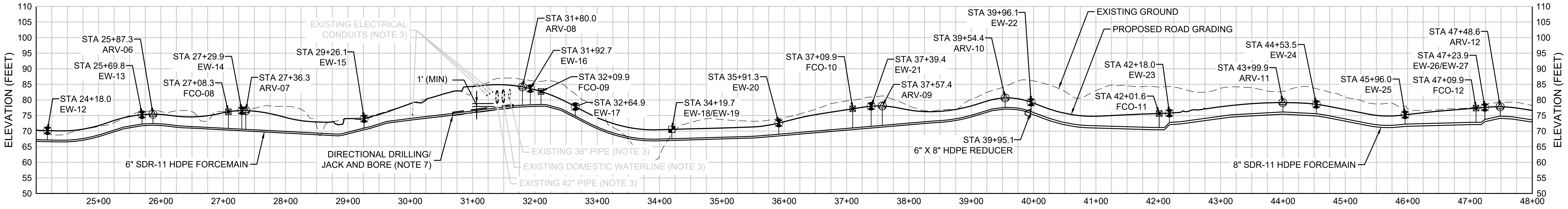
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-C07.DWG
REVIEWED BY:	SV	DRAWING NO.:	C-07
APPROVED BY:	JJD		

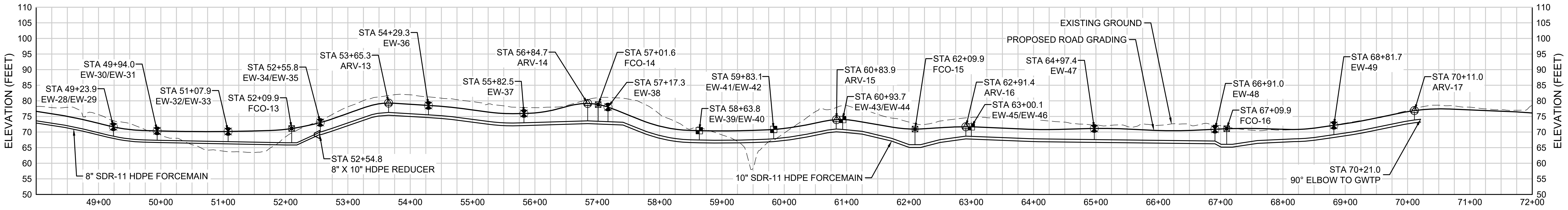
60% DESIGN - NOT FOR CONSTRUCTION



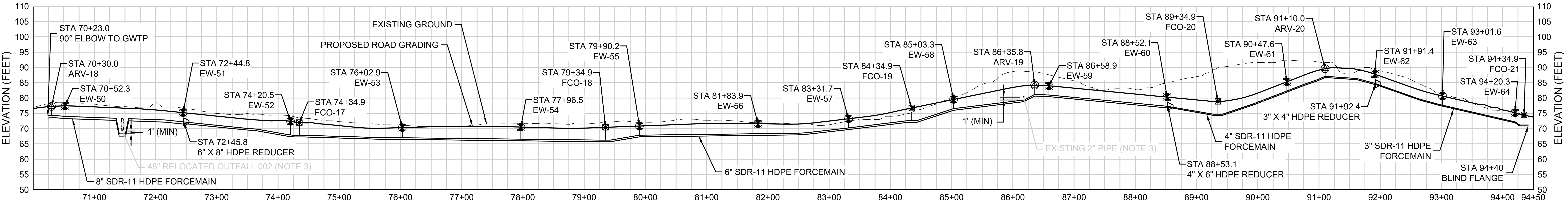
1 C-06
PROFILE
NORTH GROUNDWATER EXTRACTION FORCEMAIN
STA 0+00 TO 23+00
SCALE: 1" = 100' (HORIZONTAL); 1" = 20' (VERTICAL)



2 C-05
PROFILE
NORTH GROUNDWATER EXTRACTION FORCEMAIN
STA 23+00 TO 46+00
SCALE: 1" = 100' (HORIZONTAL); 1" = 20' (VERTICAL)



3 C-04
PROFILE
NORTH GROUNDWATER EXTRACTION FORCEMAIN
STA 46+00 TO 69+00
SCALE: 1" = 100' (HORIZONTAL); 1" = 20' (VERTICAL)



4 C-02
PROFILE
SOUTH GROUNDWATER EXTRACTION FORCEMAIN
STA 69+00 TO 92+00
SCALE: 1" = 100' (HORIZONTAL); 1" = 20' (VERTICAL)

NOTES:

1. ELEVATIONS PRESENTED ARE IN FEET, NAVD 88.
2. TOPOGRAPHIC, ROADS, BUILDINGS, AND PROPERTY LINE INFORMATION OBTAINED FROM FREELAND-CLINK SCALES & ASSOCIATES, INC. OF NC. SURVEY OF THE CHEMOURS FAYETTEVILLE WORKS SITE DATE 7 JANUARY 2019.
3. CONTRACTOR SHALL FIELD-VERIFY ELEVATION AND DIAMETER OF EXISTING PIPES PRIOR TO FORCEMAIN INSTALLATION.
4. FORCEMAIN ALIGNMENT AND LOCATION OF FORCEMAIN CLEANOUTS, AIR RELEASE VALVES, AND REDUCERS IS PRELIMINARY AND ARE SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
5. CONTRACTOR SHALL VERIFY HIGH POINTS ALONG VERTICAL ALIGNMENT PRIOR TO FINALIZING AIR RELEASE VALVE LOCATIONS.
6. CONTRACTOR SHALL FIELD-VERIFY BENDS ALONG FORCEMAIN.
7. CONTRACTOR SHALL INSTALL THE FORCEMAIN PIPE CROSSING FROM STA 30+71 TO STA 31+65 VIA HORIZONTAL DIRECTIONAL DRILLING OR JACK AND BORE, AS APPROPRIATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PREPARATION OF THE INSTALLATION WORK PLAN.

LEGEND

- - - -	EXISTING GROUND
——	PROPOSED ROAD GRADING (BY OTHERS)
═══	PROPOSED FORCEMAIN
▩	SURFICIAL AND BLACK CREEK AQUIFER EXTRACTION WELL
⧗	BLACK CREEK AQUIFER EXTRACTION WELL
⊠	FORCEMAIN CLEANOUT
◎	AIR RELEASE VALVE
◁	REDUCER

0 100 200
HORIZONTAL SCALE: 1" = 100'

0 20 40
VERTICAL SCALE: 1" = 20'

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A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
GROUNDWATER CONVEYANCE FORCEMAIN PROFILES

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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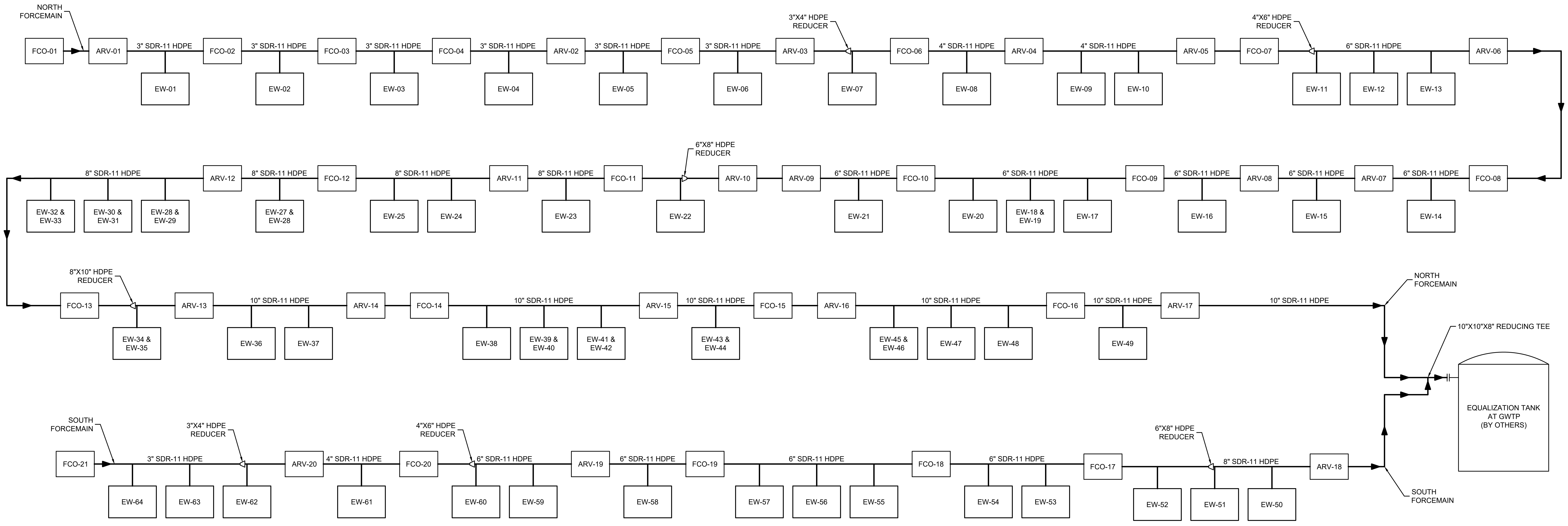
DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-C08.DWG
REVIEWED BY:	SV	DRAWING NO.:	C-08
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

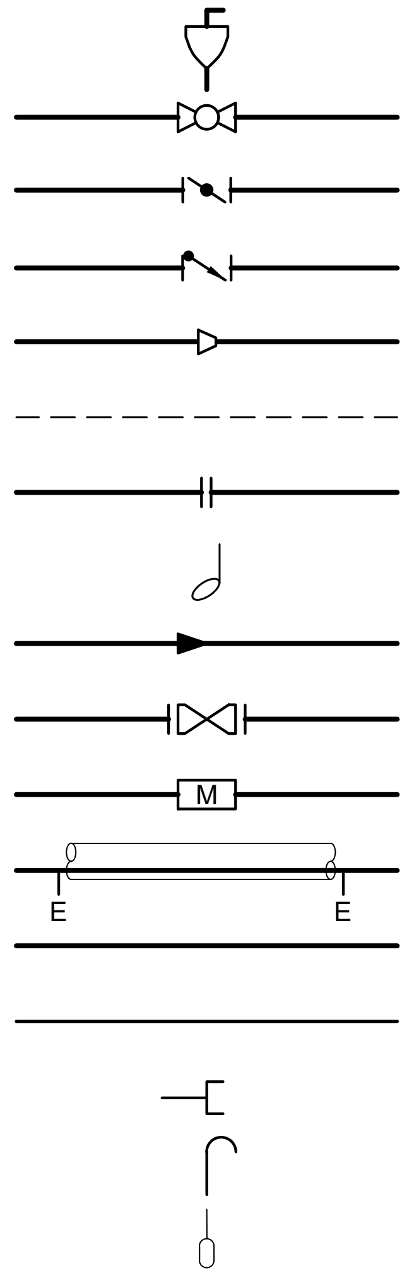


INSTRUMENT SOCIETY OF AMERICA TABLE

LETTER	FIRST LETTER(S)		SUCCEEDING LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (+)		ALARM		
B	BURNER FLAME		USER'S CHOICE (+)	USER'S CHOICE (+)	USER'S CHOICE (+)
C	CONDUCTIVITY			CONTROL	
D	DENSITY (S.G.)	DIFFERENTIAL			
E	VOLTAGE/EMF		PRIMARY ELEMENT		
F	FLOW RATE	RATIO/BIAS			
G	GAUGE		GLASS	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION				MIDDLE/INTERMEDIATE
N	USER'S CHOICE (+)		USER'S CHOICE (+)	USER'S CHOICE (+)	USER'S CHOICE (+)
O	USER'S CHOICE (+)		ORIFICE/RESTRICTION		
P	PRESSURE/VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY/EVENT (+)	INTEGRATE	INTEGRATE		
R	RADIOACTIVIT		RECORD/PRINT		
S	SPEED/FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTI-VARIABLE (+)		MULTIFUNCTION (+)	MULTIFUNCTION (+)	MULTIFUNCTION (+)
V	VISCOSITY			VALVE/DAMPER	
W	WEIGHT/FORCE		WELL		
X	UNCALSSIFIED (+)		UNCLASSIFIED (+)	UNCLASSIFIED (+)	UNCLASSIFIED
Y	USER'S CHOICE (+)			RELAY/COMPUTE (+)	
Z	POSITION			DRIVE, ACTUATE, OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(+) WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS LIST.

PROCESS AND INSTRUMENTATION SYMBOLS



AIR RELEASE VALVE
BALL VALVE
BUTTERFLY VALVE
CHECK VALVE
CONCENTRIC REDUCER
ELECTRICAL SIGNAL
FLANGED CONNECTION
FLOAT SWITCH
FLOW DIRECTION
GATE VALVE
MAGNETIC FLOW METER
PIPE INSULATION W/ ELECTRICAL HEAT TRACE
PRIMARY PIPING
SECONDARY PIPING
HOSE CONNECTION
VENT
SUBMERSIBLE LEVEL TRANSMITTER

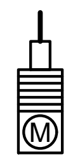
PIPING MATERIAL ABBREVIATIONS

PVC	POLYVINYL CHLORIDE
HDPE	HIGH DENSITY POLYETHYLENE

MISCELLANEAOUS ABBREVIATIONS

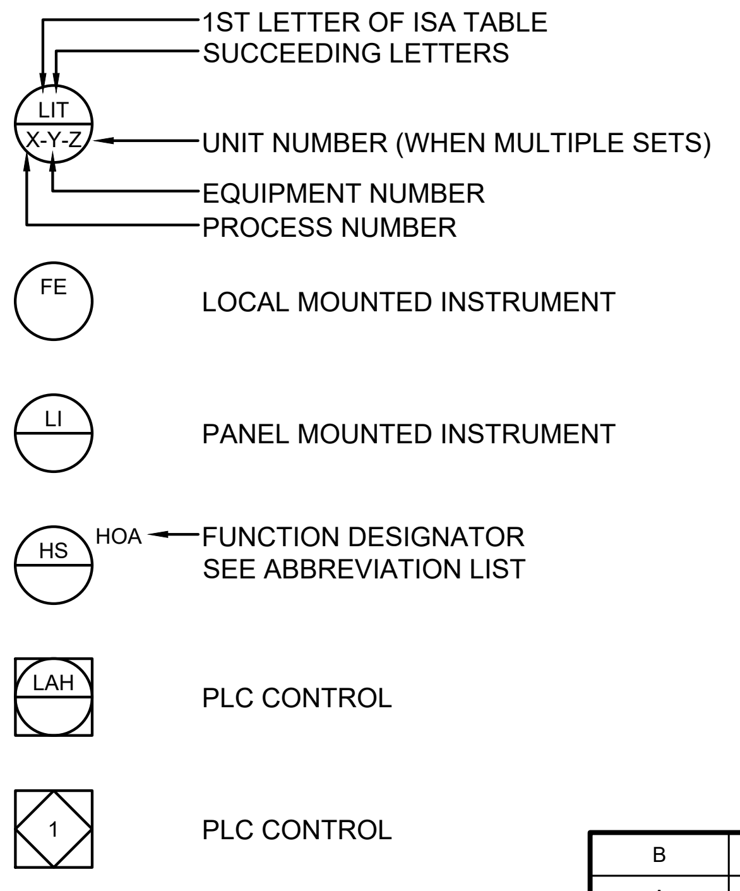
ARV	AIR RELEASE VALVE
CV	CHECK VALVE
HOA	HAND-OFF-AUTO
HV	HAND VALVE
M	MOTOR
PLC	PROGRAMMABLE LOGIC CONTROLLER
SCH	SCHEDULE
VFD	VARIABLE FREQUENCY DRIVE
R	REDUCER
SC	SPEED CONTROL
SDR	STANDARD DIAMETER RATIO

PUMP SYMBOLS



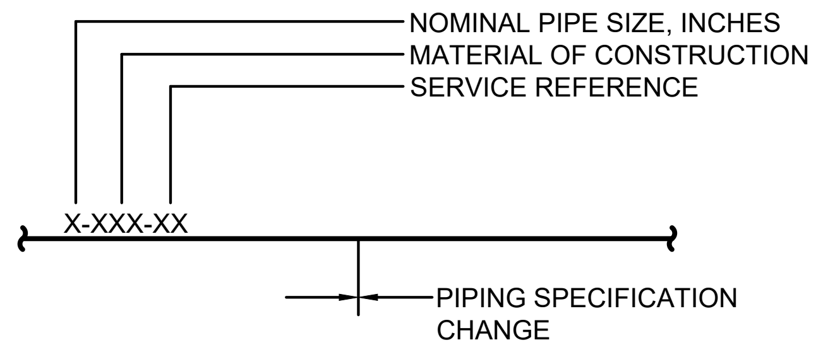
SUBMERSIBLE PUMP

INSTRUMENTATION SYMBOL IDENTIFICATION



LOCAL MOUNTED INSTRUMENT
PANEL MOUNTED INSTRUMENT
FUNCTION DESIGNATOR SEE ABBREVIATION LIST
PLC CONTROL
PLC CONTROL

PIPING IDENTIFICATION



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B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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ATRIUM AT BLUE RIDGE
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RALEIGH, NC 27607
919.870.0576

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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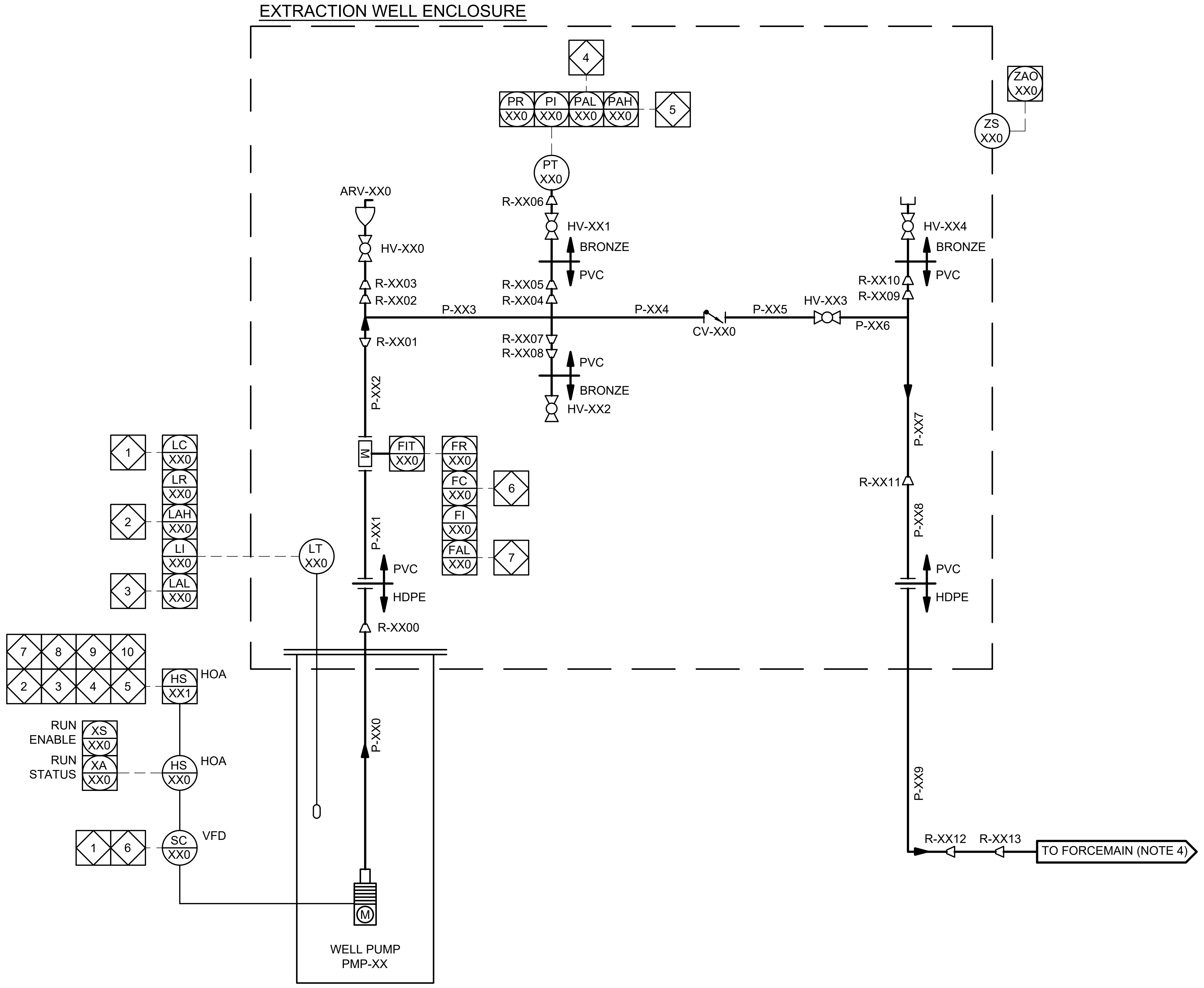
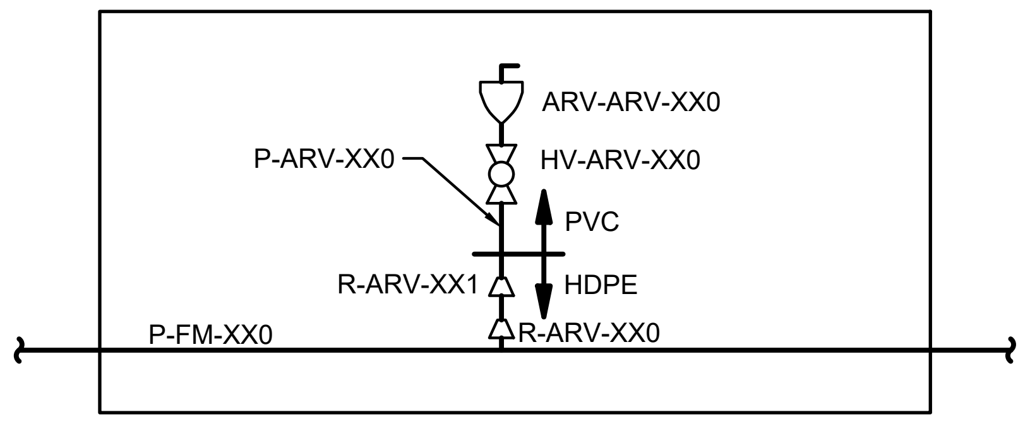
DATE

DESIGN BY: BMT		DATE:	AUGUST 2021
DRAWN BY: JFH		PROJECT NO.:	TR0795A
CHECKED BY: CMDS		FILE:	TR0795A-D01.DWG
REVIEWED BY: SV		DRAWING NO.:	D-01
APPROVED BY: JJD			

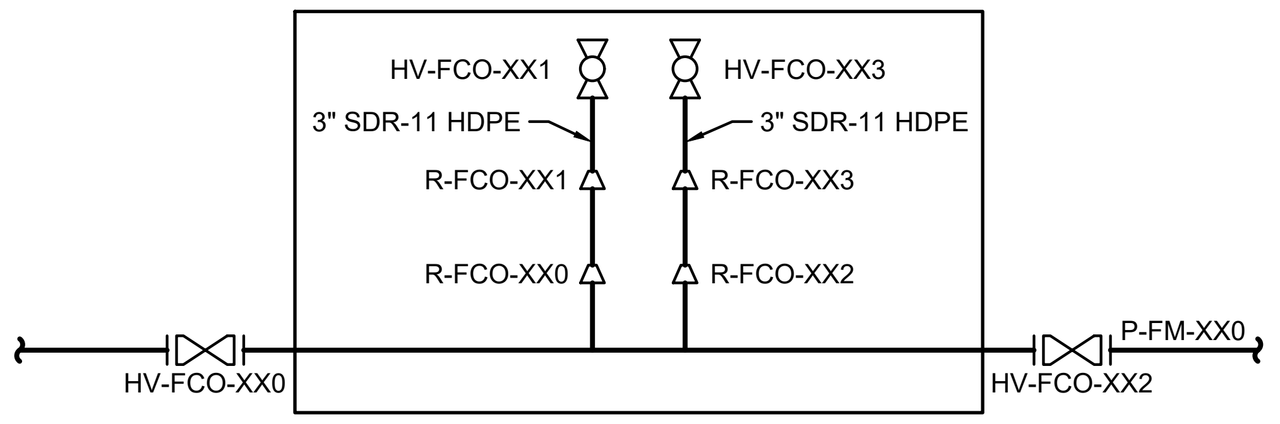
60% DESIGN - NOT FOR CONSTRUCTION



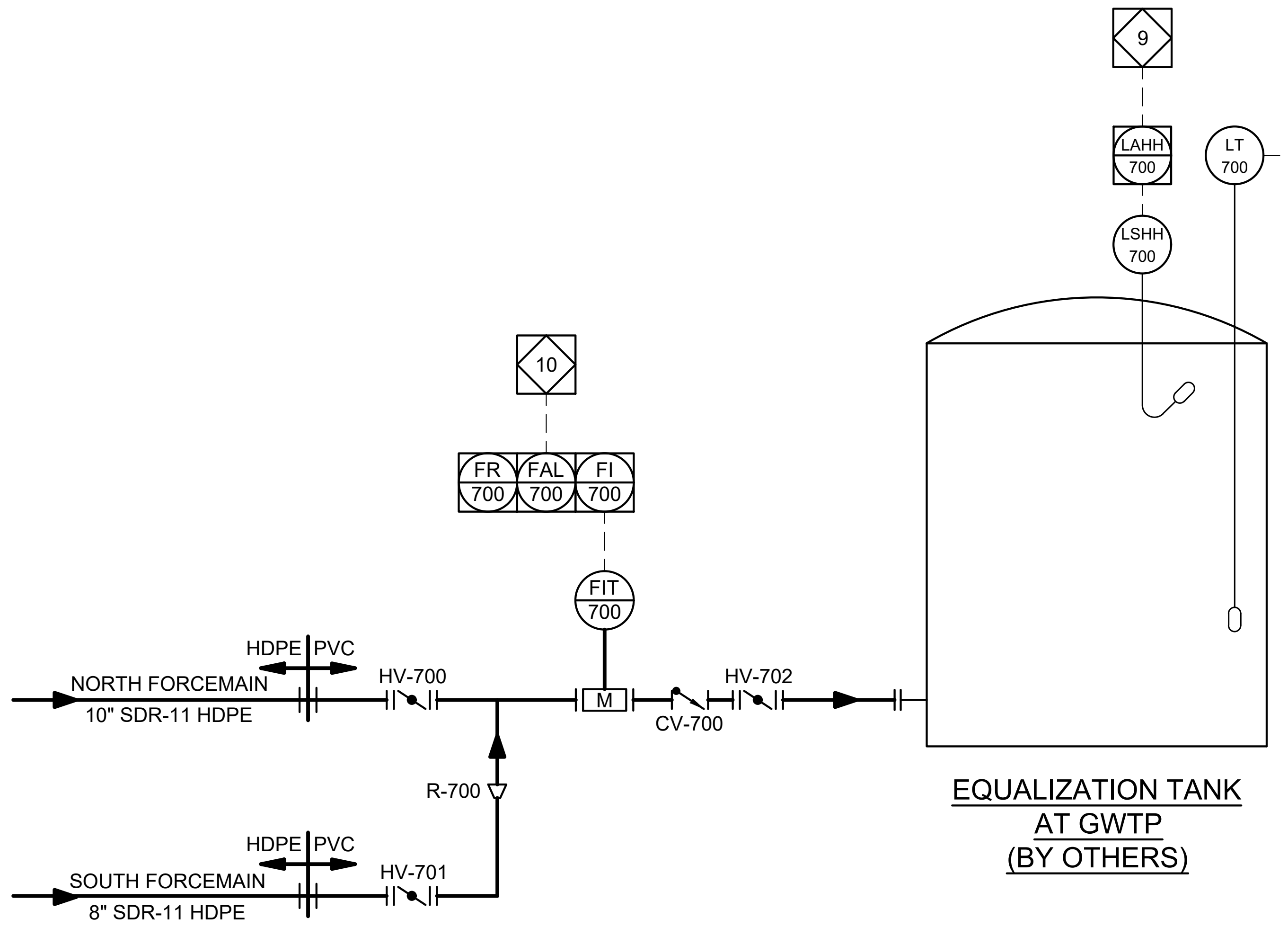
EXTRACTION WELL
(EW-XX)



FORCEMAIN
AIR RELEASE VALVE
(ARV-XX)



FORCEMAIN
CLEANOUT
(FCO-XX)



EQUALIZATION TANK
AT GWTP
(BY OTHERS)

INTERLOCK TABLE				
INTERLOCK NUMBER	TRIGGERING DEVICE(S)	DESCRIPTION	ALARM TAG	ACTION REQUIRED BY PLC
1	LT-XX0	EXTRACTION WELL PUMP SPEED CONTROL	LC-XX0	SC-XX0 (VFD) OPERATE ON PID CONTROL LOOP AROUND USER-DEFINED LEVEL SET POINT LC-XX0
2	LT-XX0	EXTRACTION WELL LEVEL HIGH	LAH-XX0	START CORRESPONDING EXTRACTION WELL PUMP
3	LT-XX0	EXTRACTION WELL LEVEL LOW	LAL-XX0	SHUT OFF CORRESPONDING EXTRACTION WELL PUMP
4	PT-XX0	EXTRACTION WELL PIPE PRESSURE LOW	PAL-XX0	SHUT OFF CORRESPONDING EXTRACTION WELL PUMP
5	PT-XX0	EXTRACTION WELL PIPE PRESSURE HIGH	PAH-XX0	SHUT OFF CORRESPONDING EXTRACTION WELL PUMP
6	FIT-XX0	EXTRACTION WELL PUMP SPEED CONTROL	FC-XX0	SC-XX0 (VFD) OPERATE ON PID CONTROL LOOP AROUND USER-DEFINED FLOW SET POINT FC-XX0
7	FIT-XX0	EXTRACTION WELL PUMP FLOW LOW	FAL-XX0	RUN PERMISSIVE CONDITION FOR CORRESPONDING EXTRACTION WELL PUMP IS FIT-XX0 > FAL-XX0 SHUT OFF CORRESPONDING EXTRACTION WELL PUMP IF FAL-XX0 IS ENABLED
8	LT-700	EQUALIZATION TANK LEVEL HIGH	LAH-700	RUN PERMISSIVE CONDITION FOR EXTRACTION WELL PUMPS IS LT-700 < LAH-700 SHUT OFF EXTRACTION WELL PUMPS IF LAH-700 IS ENABLED
9	LSHH-700	EQUALIZATION TANK LEVEL HIGH-HIGH	LAHH-700	SHUT OFF EXTRACTION WELL PUMPS PMP-XX
10	FIT-700	INCOMING FLOW TO EQUALIZATION TANK	FAL-700	FAL-700 MINUS THE SUMMATION OF EXTRACTION WELL FLOW RATES FIT-XX0 IS MONITORED. A DIFFERENCE GREATER THAN __ GPM SHUTS OFF EXTRACTION WELL PUMPS.

NOTES:

1. TAGGING SCHEME SHOWN HEREIN IS GENERIC. XX SIGNIFIES THE EXTRACTION WELL NUMBER (I.E., EW-01 THROUGH EW-64), FORCEMAIN CLEANOUT NUMBER (I.E., FCO-01 THROUGH FCO-22) OR FORCEMAIN AIR RELEASE VALVE NUMBER (I.E., ARV-01 THROUGH ARV-21).
2. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
3. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
4. THE LATERALS FOR COLLOCATED WELLS (I.E., EW-18, EW-19, EW-26, EW-27, EW-28, EW-29, EW-30, EW-31, EW-32, EW-33, EW-34, EW-35, EW-39, EW-40, EW-41, EW-42, EW-43, EW-44, EW-45, AND EW-46) WILL COMBINE PRIOR TO REACHING THE FORCEMAIN.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec
consultants

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RALEIGH, NC 27607
919.870.0576

TITLE:
PIPING AND INSTRUMENTATION DIAGRAM II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-D02.DWG
REVIEWED BY:	SV	DRAWING NO.:	D-02
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

EQUALIZATION TANK TAGGING SCHEME				
	P&ID GENERIC LABEL	**ELEMENT**	**MATERIAL**	**DESCRIPTION**
INSTRUMENTATION	FIT-700	FLOW INDICATING TRANSMITTER	--	10"
	LT-700	LEVEL TRANSMITTER	--	BY OTHERS
	LSHH-700	LEVEL SWITCH	--	BY OTHERS
VALVES/FITTINGS	CV-700	CHECK VALVE	STAINLESS STEEL	10"
	HV-700	BUTTERFLY VALVE	STAINLESS STEEL	10"
	HV-702	BUTTERFLY VALVE	STAINLESS STEEL	10"
	HV-701	BUTTERFLY VALVE	STAINLESS STEEL	8"
	R-700	REDUCING TEE	SCH 80 PVC	10"X10"X8"

FORCEMAIN CLEANOUTS TAGGING SCHEME								
	P&ID GENERIC LABEL	**ELEMENT**	**MATERIAL**	**DESCRIPTION BASED ON FORCEMAIN CLEANOUT SIZE**				
				3"	**4"**	**6"**	**8"**	**10"**
VALVES/FITTINGS	HV-FCO-XX0, HV-FCO-XX2	MJ GATE VALVE	STAINLESS STEEL	3"	4"	6"	8"	10"
	HV-FCO-XX1, HV-FCO-XX3	FULL-PORT BALL VALVE	PVC	3"	3"	3"	3"	3"
	R-FCO-XX0, R-FCO-XX2	REDUCER	SDR-11 HDPE	--	3"X4"	3"X6"	6"X8"	6"X10"
	R-FCO-XX1, R-FCO-XX3	REDUCER	SDR-11 HDPE	--	--	--	3"X6"	3"X6"

EXTRACTION WELL TAGGING SCHEME						
	P&ID GENERIC LABEL	**ELEMENT**	**MATERIAL**	**WELL TYPE (NOTE 2)**		
				TYPE I	**TYPE II**	**TYPE III**
PUMPS	PMP-XX	EXTRACTION WELL PUMP	--	SEE WELL DETAIL TABLE ON SHEET M-04		
VALVES	ARV-XX0	AIR RELEASE VALVE	PVC	3/4"	3/4"	3/4"
	HV-XX0	BALL VALVE	PVC	3/4"	3/4"	3/4"
	HV-XX1	BALL VALVE	BRONZE	1/2"	1/2"	1/2"
	HV-XX2	BALL VALVE	BRONZE	1/2"	1/2"	1/2"
	HV-XX3	BALL VALVE	PVC	1-1/2"	1-1/2"	2"
	HV-XX4	BALL VALVE	BRONZE	1/2"	1/2"	1/2"
	CV-XX0	CHECK VALVE	PVC	1-1/2"	1-1/2"	2"
INSTRUMENTATION	FIT-XX0	FLOW INDICATING TRANSMITTER	--	1"	1-1/2"	1-1/2"
	PT-XX0	PRESSURE TRANSMITTER	--	--	--	--
	LT-XX0	LEVEL TRANSMITTER	--	--	--	--
	ZS-XX0	POSITION SWITCH (WELL ENCLOSURE OPEN/CLOSED STATUS)	--	--	--	--
FITTINGS	R-XX00	REDUCER	SDR-11 HDPE	1" X 1-1/4"	--	--
	R-XX01	REDUCER	SCH 80 PVC	1" X 1-1/2"	--	1-1/2" X 2"
	R-XX02	REDUCER	SCH 80 PVC	1" X 1-1/2"	1" X 1-1/2"	1" X 2"
	R-XX03	REDUCER	SCH 80 PVC	3/4" X 1"	3/4" X 1"	3/4" X 1"
	R-XX04	REDUCER	SCH 80 PVC	1" X 1-1/2"	1" X 1-1/2"	1" X 2"
	R-XX05	REDUCER	SCH 80 PVC	1/2" X 1"	1/2" X 1"	1/2" X 1"
	R-XX06	REDUCER	SCH 80 PVC	1" X 1-1/2"	1" X 1-1/2"	1" X 2"
	R-XX07	REDUCER	SCH 80 PVC	1/2" X 1"	1/2" X 1"	1/2" X 1"
	R-XX08	REDUCER	BRONZE	1/2" X 1/4"	1/2" X 1/4"	1/2" X 1/4"
	R-XX09	REDUCER	SCH 80 PVC	1" X 1-1/2"	1" X 1-1/2"	1" X 2"
	R-XX10	REDUCER	SCH 80 PVC	1/2" X 1"	1/2" X 1"	1/2" X 1"
	R-XX11	REDUCER	SCH 80 PVC	1-1/2" x 2"	1-1/2" x 2"	--
	R-XX12	REDUCER	SDR-11 HDPE	SEE NOTE 4		
	R-XX13	REDUCING TEE	SDR-11 HDPE			
PIPING	P-XX0	PIPE	SDR-11 HDPE	1-1/4"	1-1/2"	1-1/2"
	P-XX1	PIPE	SCH 80 PVC	1"	1-1/2"	1-1/2"
	P-XX2	PIPE	SCH 80 PVC	1"	1-1/2"	1-1/2"
	P-XX3, P-XX4, P-XX5, P-XX6, P-XX7, P-XX8	PIPE	SCH 80 PVC	1-1/2"	1-1/2"	2"
	P-XX9	PIPE	SDR-11 HDPE	2"	2"	2"

FORCEMAIN AIR RELEASE VALVES TAGGING SCHEME								
	P&ID GENERIC LABEL	**ELEMENT**	**MATERIAL**	**DESCRIPTION BASED ON FORCEMAIN AIR RELEASE VALVE SIZE**				
				3"	**4"**	**6"**	**8"**	**10"**
VALVES	ARV-ARV-XX0	AIR RELEASE VALVE	PVC	1"	1"	1"	2"	2"
	HV-ARV-XX0	BALL VALVE	PVC	1"	1"	1"	2"	2"
FITTINGS	R-ARV-XX0	REDUCING TEE	SDR-11 HDPE	3"X3"X2"	4"X4"X2"	6"X6"X2"	8"X8"X2"	10"X10"X4"
	R-ARV-XX1	REDUCER	SDR-11 HDPE	2"X1"	2"X1"	2"X1"	--	2"X4"
PIPING	P-ARV-XX0	PIPE	SCH 80 PVC	1"	1"	1"	2"	2"

INSTRUMENTATION SCHEDULE						
P&ID LABEL	**ELEMENT**	**MATERIAL**	**QUANTITIES**	**SIZE**	**DESCRIPTION**	**MANUFACTURER/MODEL**
FIT-010, FIT-020, FIT-030, FIT-040, FIT-090, FIT-100, FIT-110, FIT-120, FIT-130, FIT-160, FIT-180, FIT-190, FIT-200, FIT-330, FIT-350, FIT-360, FIT-370, FIT-380, FIT-400, FIT-420, FIT-440, FIT-460, FIT-490, FIT-500, FIT-530	MAGNETIC FLOWMETER	--	25	1"	FLANGED CONNECTION, 4-20MA HART/DIGITAL HART, POLYURETHANE LINED, 316 L STAINLESS STEEL ELECTRODES	ROSEMOUNT 8705 OR APPROVED EQUAL
FIT-050, FIT-060, FIT-070, FIT-080, FIT-140, FIT-150, FIT-170, FIT-210, FIT-220, FIT-230, FIT-240, FIT-250, FIT-260, FIT-270, FIT-280, FIT-290, FIT-300, FIT-310, FIT-320, FIT-340, FIT-390, FIT-410, FIT-430, FIT-450, FIT-470, FIT-480, FIT-510, FIT-520, FIT-540, FIT-550, FIT-560, FIT-570, FIT-580, FIT-590, FIT-600, FIT-610, FIT-620, FIT-630, FIT-640	MAGNETIC FLOWMETER	--	39	1-1/2"	FLANGED CONNECTION, 4-20MA HART/DIGITAL HART, POLYURETHANE LINED, 316 L STAINLESS STEEL ELECTRODES	ROSEMOUNT 8705 OR APPROVED EQUAL
PT-010, PT-020, PT-030, PT-040, PT-050, PT-060, PT-070, PT-080, PT-090, PT-100, PT-110, PT-120, PT-130, PT-140, PT-150, PT-160, PT-170, PT-180, PT-190, PT-200, PT-210, PT-220, PT-230, PT-240, PT-250, PT-260, PT-270, PT-280, PT-290, PT-300, PT-310, PT-320, PT-330, PT-340, PT-350, PT-360, PT-370, PT-380, PT-390, PT-400, PT-410, PT-420, PT-430, PT-440, PT-450, PT-460, PT-470, PT-480, PT-490, PT-500, PT-510, PT-520, PT-530, PT-540, PT-550, PT-560, PT-570, PT-580, PT-590, PT-600, PT-610, PT-620, PT-630, PT-640	PRESSURE TRANSMITTER	--	64	1/4"	4 TO 20 MA OUTPUT, 316 L STAINLESS STEEL BODY, 0-100 PSIG RATED, GAUGE PRESSURE TRANSMITTER	PROSENSE PTD25/ROSEMOUNT 3051T OR APPROVED EQUAL
LT-010, LT-020, LT-030, LT-040, LT-050, LT-060, LT-070, LT-080, LT-090, LT-100, LT-110, LT-120, LT-130, LT-140, LT-150, LT-160, LT-170, LT-180, LT-190, LT-200, LT-210, LT-220, LT-230, LT-240, LT-250, LT-260, LT-270, LT-280, LT-290, LT-300, LT-310, LT-320, LT-330, LT-340, LT-350, LT-360, LT-370, LT-380, LT-390, LT-400, LT-410, LT-420, LT-430, LT-440, LT-450, LT-460, LT-470, LT-480, LT-490, LT-500, LT-510, LT-520, LT-530, LT-540, LT-550, LT-560, LT-570, LT-580, LT-590, LT-600, LT-610, LT-620, LT-630, LT-640	LEVEL TRANSMITTER	--	64	--	SUBMERSIBLE, 316 L STAINLESS STEEL BODY, POLYURETHANE CABLE, 4 TO 20 MA OUTPUT	KPSI SERIES 320 OR APPROVED EQUAL
ZS-010, ZS-020, ZS-030, ZS-040, ZS-050, ZS-060, ZS-070, ZS-080, ZS-090, ZS-100, ZS-110, ZS-120, ZS-130, ZS-140, ZS-150, ZS-160, ZS-170, ZS-180, ZS-190, ZS-200, ZS-210, ZS-220, ZS-230, ZS-240, ZS-250, ZS-260, ZS-270, ZS-280, ZS-290, ZS-300, ZS-310, ZS-320, ZS-330, ZS-340, ZS-350, ZS-360, ZS-370, ZS-380, ZS-390, ZS-400, ZS-410, ZS-420, ZS-430, ZS-440, ZS-450, ZS-460, ZS-470, ZS-480, ZS-490, ZS-500, ZS-510, ZS-520, ZS-530, ZS-540, ZS-550, ZS-560, ZS-570, ZS-580, ZS-590, ZS-600, ZS-610, ZS-620, ZS-630, ZS-640	POSITION SWITCH	--	64	--	WELL ENCLOSURE OPEN/CLOSED STATUS	IDEM SERIES MPC OR APPROVED EQUAL
FIT-700	MAGNETIC FLOWMETER	--	1	--	FLANGED CONNECTION, 4-20MA HART/DIGITAL HART, POLYURETHANE LINED, 316 L STAINLESS STEEL ELECTRODES	ROSEMOUNT 8705 OR APPROVED EQUAL
LT-700	LEVEL TRANSMITTER	--	1	--	SUBMERSIBLE, 316 L STAINLESS STEEL BODY, POLYURETHANE CABLE, 4 TO 20 MA OUTPUT	ENDRESS + HAUSER SERIES WATERPILOT FMX21 OR APPROVED EQUAL
LSHH-700	LEVEL SWITCH	--	1	--	FREE FLOATING LEVEL SWITCH, WETTED PARTS - POLYPROPYLENE BODY, PVC CABLE	ENDRESS + HAUSER SERIES LIQUIFLOAT FTS20 OR APPROVED EQUAL

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS
2. SEE WELL DETAIL TABLE ON SHEET M-04 FOR CORRESPONDING EXTRACTION WELL TYPE.
3. "--" INDICATES THAT ITEM IS NOT APPLICABLE.
4. DIMENSIONS VARY AND ARE DEPENDENT ON INDIVIDUAL EXTRACTION WELL CONNECTION TO THE FORCEMAIN. CONTRACTOR SHALL VERIFY SIZE PRIOR TO INSTALLATION.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL P&ID SCHEDULES I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-D03.DWG
REVIEWED BY:	SV	DRAWING NO.:	D-03
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

VALVE SCHEDULE

P&ID LABEL	ELEMENT	MATERIAL	QUANTITIES	SIZE	DESCRIPTION	MANUFACTURER/MODEL
ARV-010, ARV-020, ARV-030, ARV-040, ARV-050, ARV-060, ARV-070, ARV-080, ARV-090, ARV-100, ARV-110, ARV-120, ARV-130, ARV-140, ARV-150, ARV-160, ARV-170, ARV-180, ARV-190, ARV-200, ARV-210, ARV-220, ARV-230, ARV-240, ARV-250, ARV-260, ARV-270, ARV-280, ARV-290, ARV-300, ARV-310, ARV-320, ARV-330, ARV-340, ARV-350, ARV-360, ARV-370, ARV-380, ARV-390, ARV-400, ARV-410, ARV-420, ARV-430, ARV-440, ARV-450, ARV-460, ARV-470, ARV-480, ARV-490, ARV-500, ARV-510, ARV-520, ARV-530, ARV-540, ARV-550, ARV-560, ARV-570, ARV-580, ARV-590, ARV-600, ARV-610, ARV-620, ARV-630, ARV-640	AIR RELEASE VALVE	PVC	64	3/4"	--	PLAST-O-MATIC OR APPROVED EQUAL
ARV-ARV-010, ARV-ARV-020, ARV-ARV-030, ARV-ARV-040, ARV-ARV-050, ARV-ARV-060, ARV-ARV-070, ARV-ARV-080, ARV-ARV-090, ARV-ARV-100, ARV-ARV-190, ARV-ARV-200	AIR RELEASE VALVE	PVC	12	1"	--	PLAST-O-MATIC OR APPROVED EQUAL
ARV-ARV-110, ARV-ARV-120, ARV-ARV-130, ARV-ARV-140, ARV-ARV-150, ARV-ARV-160, ARV-ARV-170, ARV-ARV-180	AIR RELEASE VALVE	PVC	8	2"	--	PLAST-O-MATIC OR APPROVED EQUAL
CV-010, CV-020, CV-030, CV-040, CV-050, CV-060, CV-070, CV-080, CV-090, CV-100, CV-110, CV-120, CV-130, CV-140, CV-150, CV-160, CV-170, CV-180, CV-190, CV-200, CV-210, CV-230, CV-240, CV-250, CV-260, CV-270, CV-280, CV-290, CV-300, CV-310, CV-320, CV-330, CV-340, CV-350, CV-360, CV-370, CV-380, CV-390, CV-400, CV-410, CV-420, CV-430, CV-440, CV-450, CV-460, CV-470, CV-480, CV-490, CV-500, CV-510, CV-520, CV-530, CV-540, CV-550, CV-560, CV-570, CV-580	CHECK VALVE	PVC	57	1-1/2"	--	ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
CV-220, CV-590, CV-600, CV-610, CV-620, CV-630, CV-640	CHECK VALVE	PVC	7	2"	--	ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
HV-010, HV-020, HV-030, HV-040, HV-050, HV-060, HV-070, HV-080, HV-090, HV-100, HV-110, HV-120, HV-130, HV-140, HV-150, HV-160, HV-170, HV-180, HV-190, HV-200, HV-210, HV-220, HV-230, HV-240, HV-250, HV-260, HV-270, HV-280, HV-290, HV-300, HV-310, HV-320, HV-330, HV-340, HV-350, HV-360, HV-370, HV-380, HV-390, HV-400, HV-410, HV-420, HV-430, HV-440, HV-450, HV-460, HV-470, HV-480, HV-490, HV-500, HV-510, HV-520, HV-530, HV-540, HV-550, HV-560, HV-570, HV-580, HV-590, HV-600, HV-610, HV-620, HV-630, HV-640	BALL VALVE	PVC	64	3/4"	--	ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
HV-011, HV-021, HV-031, HV-041, HV-051, HV-061, HV-071, HV-081, HV-091, HV-101, HV-111, HV-121, HV-131, HV-141, HV-151, HV-161, HV-171, HV-181, HV-191, HV-201, HV-211, HV-221, HV-231, HV-241, HV-251, HV-261, HV-271, HV-281, HV-291, HV-301, HV-311, HV-321, HV-331, HV-341, HV-351, HV-361, HV-371, HV-381, HV-391, HV-401, HV-411, HV-421, HV-431, HV-441, HV-451, HV-461, HV-471, HV-481, HV-491, HV-501, HV-511, HV-521, HV-531, HV-541, HV-551, HV-561, HV-571, HV-581, HV-591, HV-601, HV-611, HV-621, HV-631, HV-641, HV-012, HV-022, HV-032, HV-042, HV-052, HV-062, HV-072, HV-082, HV-092, HV-102, HV-112, HV-122, HV-132, HV-142, HV-152, HV-162, HV-172, HV-182, HV-192, HV-202, HV-212, HV-222, HV-232, HV-242, HV-252, HV-262, HV-272, HV-282, HV-292, HV-302, HV-312, HV-322, HV-332, HV-342, HV-352, HV-362, HV-372, HV-382, HV-392, HV-402, HV-412, HV-422, HV-432, HV-442, HV-452, HV-462, HV-472, HV-482, HV-492, HV-502, HV-512, HV-522, HV-532, HV-542, HV-552, HV-562, HV-572, HV-582, HV-592, HV-602, HV-612, HV-622, HV-632, HV-642, HV-014, HV-024, HV-034, HV-044, HV-054, HV-064, HV-074, HV-084, HV-094, HV-104, HV-114, HV-124, HV-134, HV-144, HV-154, HV-164, HV-174, HV-184, HV-194, HV-204, HV-214, HV-224, HV-234, HV-244, HV-254, HV-264, HV-274, HV-284, HV-294, HV-304, HV-314, HV-324, HV-334, HV-344, HV-354, HV-364, HV-374, HV-384, HV-394, HV-404, HV-414, HV-424, HV-434, HV-444, HV-454, HV-464, HV-474, HV-484, HV-494, HV-504, HV-514, HV-524, HV-534, HV-544, HV-554, HV-564, HV-574, HV-584, HV-594, HV-604, HV-614, HV-624, HV-634, HV-644	BALL VALVE	BRONZE	192	1/2"	--	APOLLO OR APPROVED EQUAL
HV-013, HV-023, HV-033, HV-043, HV-053, HV-063, HV-073, HV-083, HV-093, HV-103, HV-113, HV-123, HV-133, HV-143, HV-153, HV-163, HV-173, HV-183, HV-193, HV-203, HV-213, HV-233, HV-243, HV-253, HV-263, HV-273, HV-283, HV-293, HV-303, HV-313, HV-323, HV-333, HV-343, HV-353, HV-363, HV-373, HV-383, HV-393, HV-403, HV-413, HV-423, HV-433, HV-443, HV-453, HV-463, HV-473, HV-483, HV-493, HV-503, HV-513, HV-523, HV-533, HV-543, HV-553, HV-563, HV-573, HV-583	BALL VALVE	PVC	57	1-1/2"	--	ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
HV-223, HV-593, HV-603, HV-613, HV-623, HV-633, HV-643, HV-ARV-110, HV-ARV-120, HV-ARV-130, HV-ARV-140, HV-ARV-150, HV-ARV-160, HV-ARV-170, HV-ARV-180	BALL VALVE	PVC	15	2"		ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
HV-ARV-010, HV-ARV-020, HV-ARV-030, HV-ARV-040, HV-ARV-050, HV-ARV-060, HV-ARV-070, HV-ARV-080, HV-ARV-090, HV-ARV-100, HV-ARV-190, HV-ARV-200	BALL VALVE	PVC	12	1"	--	ASAHI/PLAST-O-MATIC OR APPROVED EQUAL
HV-FCO-010, HV-FCO-020, HV-FCO-030, HV-FCO-040, HV-FCO-050, HV-FCO-210, HV-FCO-012, HV-FCO-022, HV-FCO-032, HV-FCO-042, HV-FCO-052, HV-FCO-212	GATE VALVE	STAINLESS STEEL	12	3"	MECHANICAL JOINT CONNECTION	U.S. PIPE OR APPROVED EQUAL
HV-FCO-060, HV-FCO-070, HV-FCO-200, HV-FCO-062, HV-FCO-072, HV-FCO-202	GATE VALVE	STAINLESS STEEL	6	4"	MECHANICAL JOINT CONNECTION	U.S. PIPE OR APPROVED EQUAL
HV-FCO-080, HV-FCO-090, HV-FCO-100, HV-FCO-170, HV-FCO-180, HV-FCO-190, HV-FCO-082, HV-FCO-092, HV-FCO-102, HV-FCO-172, HV-FCO-182, HV-FCO-192	GATE VALVE	STAINLESS STEEL	12	6"	MECHANICAL JOINT CONNECTION	U.S. PIPE OR APPROVED EQUAL
HV-FCO-110, HV-FCO-120, HV-FCO-130, HV-FCO-112, HV-FCO-122, HV-FCO-132	GATE VALVE	STAINLESS STEEL	6	8"	MECHANICAL JOINT CONNECTION	U.S. PIPE OR APPROVED EQUAL
HV-FCO-140, HV-FCO-150, HV-FCO-160, HV-FCO-142, HV-FCO-152, HV-FCO-162	GATE VALVE	STAINLESS STEEL	6	10"	MECHANICAL JOINT CONNECTION	U.S. PIPE OR APPROVED EQUAL
HV-FCO-011, HV-FCO-021, HV-FCO-031, HV-FCO-041, HV-FCO-051, HV-FCO-061, HV-FCO-071, HV-FCO-081, HV-FCO-091, HV-FCO-101, HV-FCO-111, HV-FCO-121, HV-FCO-131, HV-FCO-141, HV-FCO-151, HV-FCO-161, HV-FCO-171, HV-FCO-181, HV-FCO-191, HV-FCO-201, HV-FCO-211, HV-FCO-013, HV-FCO-023, HV-FCO-033, HV-FCO-043, HV-FCO-053, HV-FCO-063, HV-FCO-073, HV-FCO-083, HV-FCO-093, HV-FCO-103, HV-FCO-113, HV-FCO-123, HV-FCO-133, HV-FCO-143, HV-FCO-153, HV-FCO-163, HV-FCO-173, HV-FCO-183, HV-FCO-193, HV-FCO-203, HV-FCO-213	FULL-PORT BALL VALVE	PVC	42	3"	PVC FULL-PORT BALL VALVE	HAYWARD OR APPROVED EQUAL
CV-700	CHECK VALVE	STAINLESS STEEL	1	10"	--	FERGUSON OR APPROVED EQUAL
HV-700, HV-702	BUTTERFLY VALVE	STAINLESS STEEL	2	10"	--	
HV-701	BUTTERFLY VALVE	STAINLESS STEEL	1	8"	--	

PUMP SCHEDULE

P&ID LABEL	ELEMENT	MATERIAL	QUANTITIES	SIZE	DESCRIPTION	MANUFACTURER/MODEL
PMP-01, PMP-02, PMP-03, PMP-04, PMP-05, PMP-06, PMP-07, PMP-08, PMP-09, PMP-10, PMP-11, PMP-12, PMP-13, PMP-14, PMP-15, PMP-16, PMP-17, PMP-18, PMP-19, PMP-20, PMP-21, PMP-22, PMP-23, PMP-24, PMP-25, PMP-26, PMP-27, PMP-28, PMP-29, PMP-30, PMP-31, PMP-32, PMP-33, PMP-34, PMP-35, PMP-36, PMP-37, PMP-38, PMP-39, PMP-40, PMP-41, PMP-42, PMP-43, PMP-44, PMP-45, PMP-46, PMP-47, PMP-48, PMP-49, PMP-50, PMP-51, PMP-52, PMP-53, PMP-54, PMP-55, PMP-56, PMP-57, PMP-58, PMP-59, PMP-60, PMP-61, PMP-62, PMP-63, PMP-64	EXTRACTION WELL PUMP	--	64	--	SUBMERSIBLE STAINLESS STEEL EXTRACTION WELL PUMP	GRUNDFOS SP SERIES OR APPROVED EQUAL (NOTE 2)

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS
2. SEE WELL DETAIL TABLE ON SHEET M-04 FOR CORRESPONDING EXTRACTION WELL PUMP MODEL.
3. "--" INDICATES THAT ITEM IS NOT APPLICABLE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL P&ID SCHEDULES II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

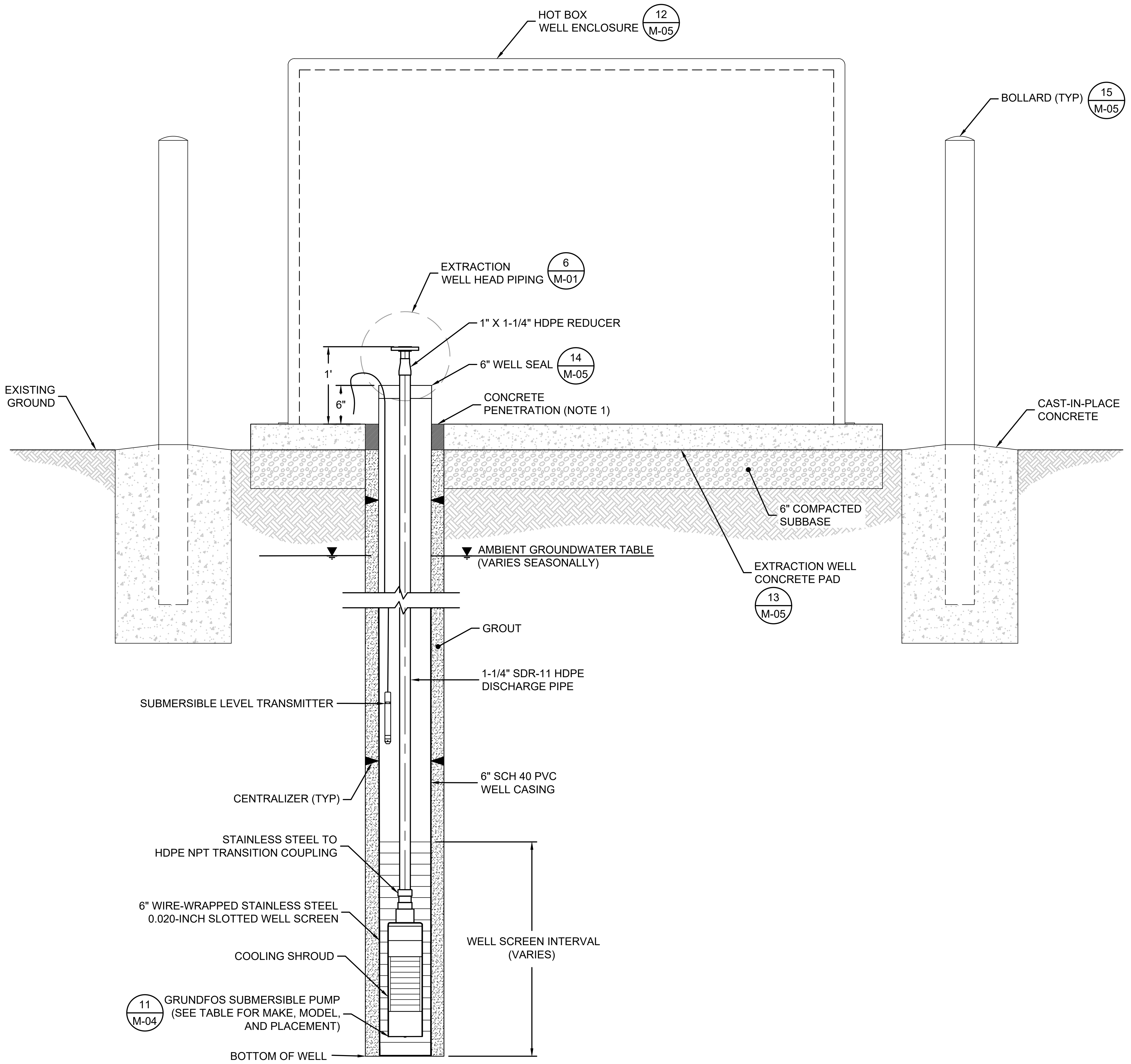
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

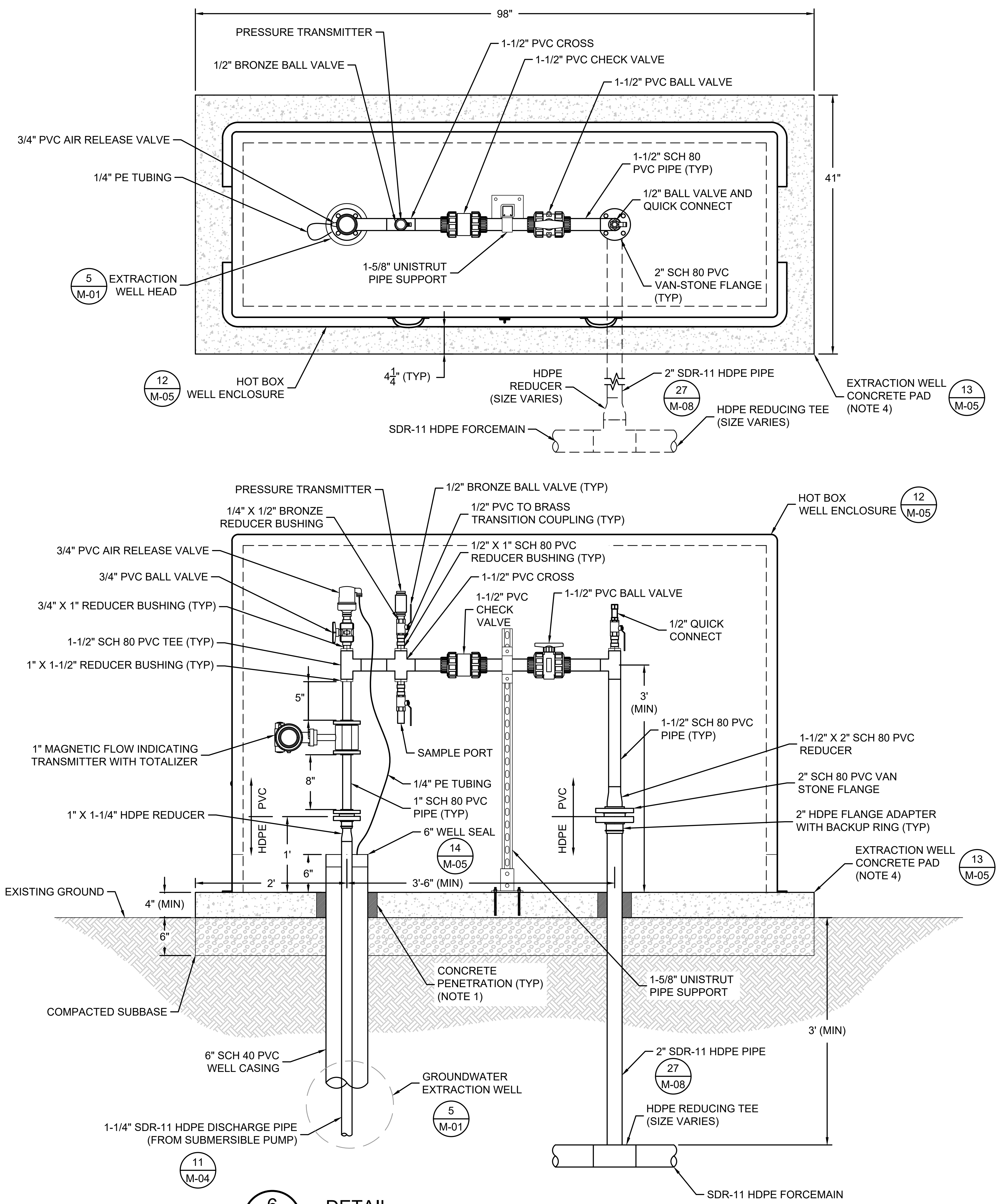
DATE

DESIGN BY: BMT
DRAWN BY: JFH
CHECKED BY: CMDS
REVIEWED BY: SV
APPROVED BY: JJD
DATE: AUGUST 2021
PROJECT NO.: TR0795A
FILE: TR0795A-D04.DWG
DRAWING NO.: D-04

60% DESIGN - NOT FOR CONSTRUCTION



5
C-01
DETAIL
GROUNDWATER EXTRACTION WELL - TYPE I
SCALE: 1" = 1'



6
M-01
DETAIL
WELL HEAD PIPING - TYPE I
SCALE: 1" = 1'

NOTES:

1. PENETRATIONS SHALL BE SEALED WITH GROUT TO PREVENT WATER INFILTRATION.
2. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
3. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
4. INDIVIDUAL CONCRETE PAD ORIENTATIONS SHALL BE DETERMINED IN FIELD TO FACILITATE CONNECTION TO LATERAL PIPE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL DETAILS I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

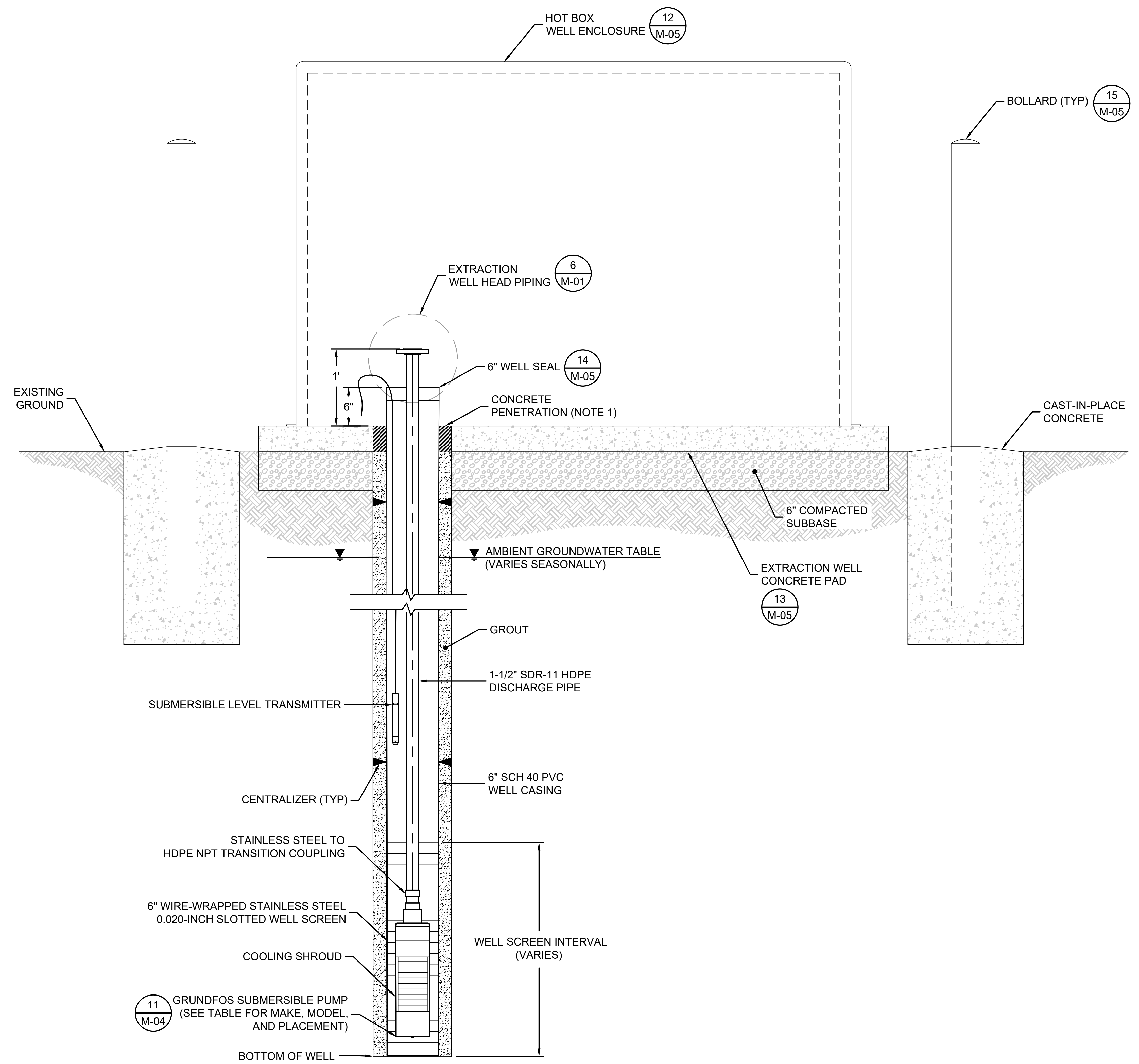
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

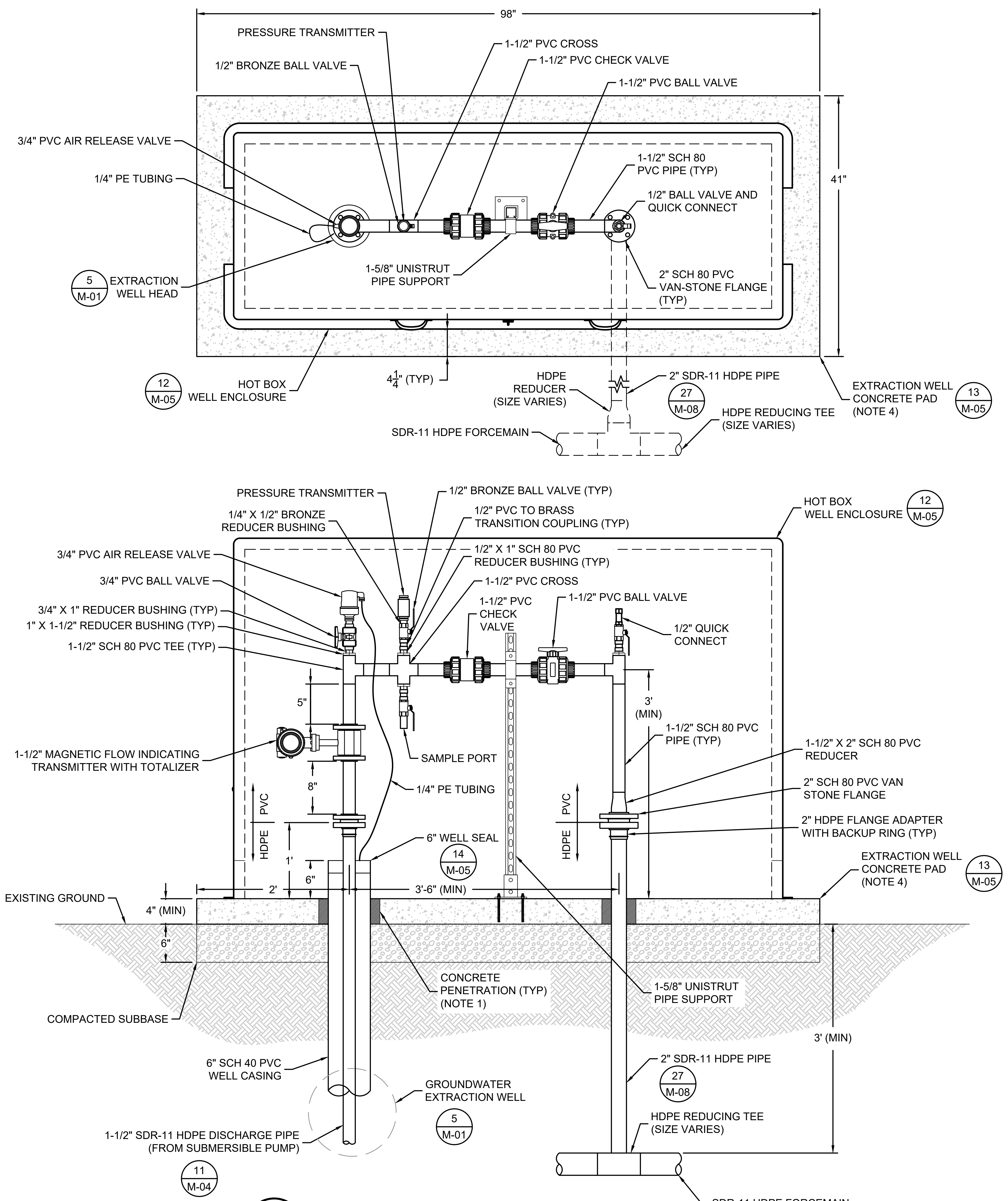
DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M01.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-01
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION



7
C-01
DETAIL
GROUNDWATER EXTRACTION WELL - TYPE II
SCALE: 1" = 1'



8
M-02
DETAIL
WELL HEAD PIPING - TYPE II
SCALE: 1" = 1'

NOTES:

1. PENETRATIONS SHALL BE SEALED WITH GROUT TO PREVENT WATER INFILTRATION.
2. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
3. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
4. INDIVIDUAL CONCRETE PAD ORIENTATIONS SHALL BE DETERMINED IN FIELD TO FACILITATE CONNECTION TO LATERAL PIPE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL DETAILS II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

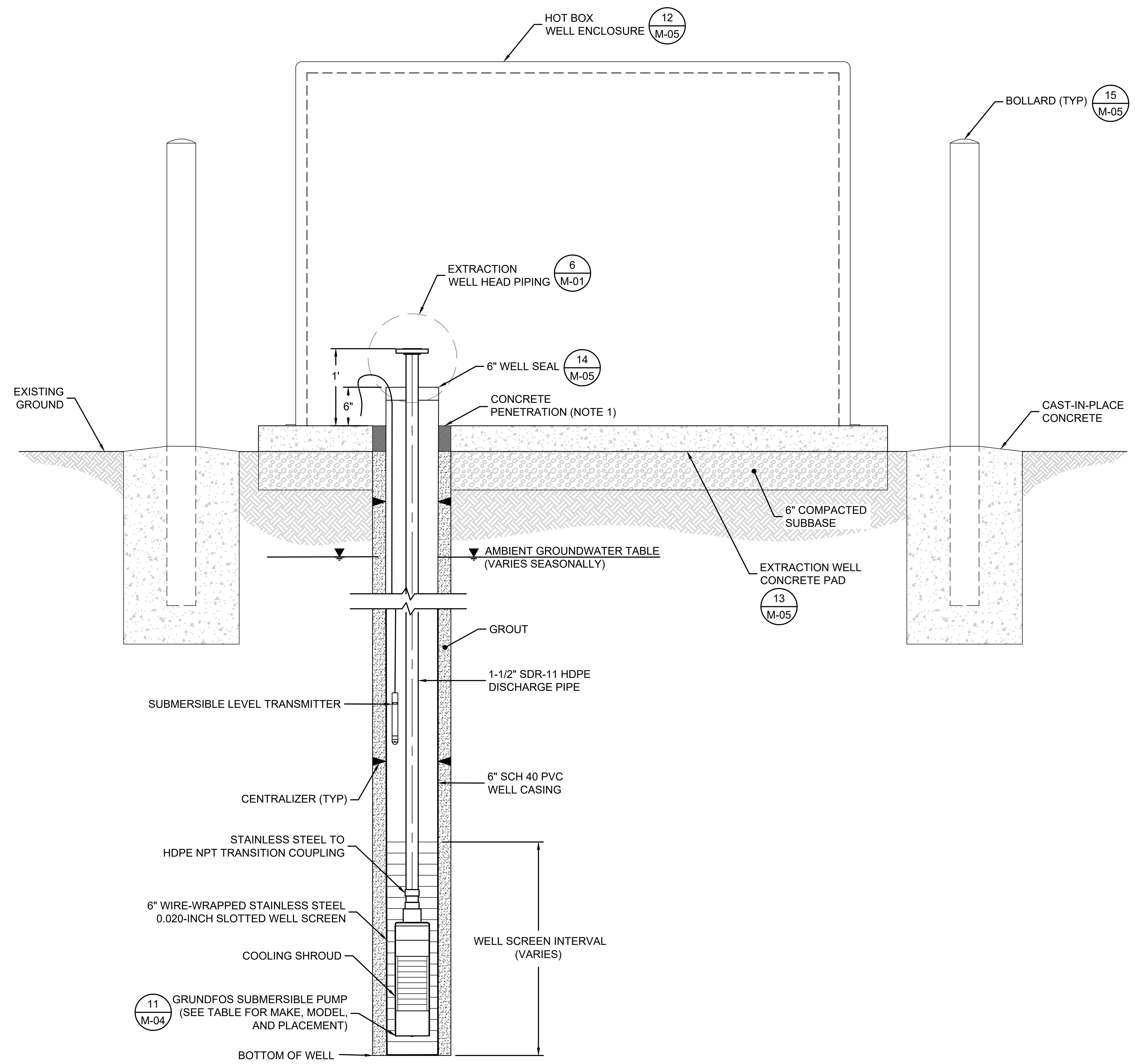
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

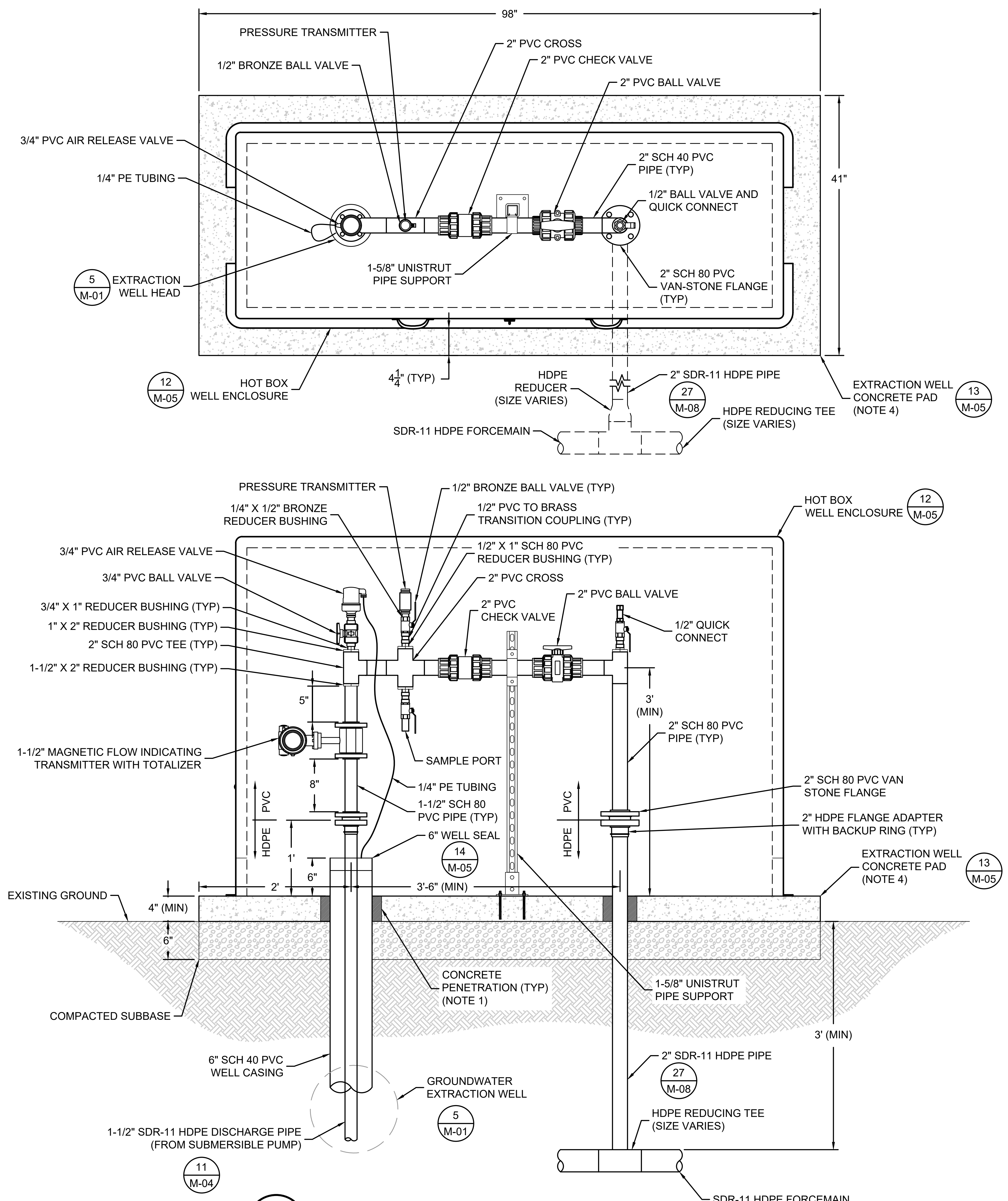
DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M02.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-02
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION



9 / C-01 DETAIL
GROUNDWATER EXTRACTION WELL - TYPE III
SCALE: 1" = 1'



10 / M-03 DETAIL
WELL HEAD PIPING - TYPE III
SCALE: 1" = 1'

NOTES:

1. PENETRATIONS SHALL BE SEALED WITH GROUT TO PREVENT WATER INFILTRATION.
2. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
3. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
4. INDIVIDUAL CONCRETE PAD ORIENTATIONS SHALL BE DETERMINED IN FIELD TO FACILITATE CONNECTION TO LATERAL PIPE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL DETAILS III

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M03.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-03
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

WELL ID	NORTHING (NAD83)	EASTING (NAD83)	WELL DIAMETER (IN)	WELL MATERIAL	GROUND SURFACE (FT NAVD88)	SCREEN DIAMETER (IN)	GRUNDFOS SP SERIES PUMP MODEL	WELL TYPE
EW-01	401717.69	2049929.24	6	PVC	86.96	6	16S15-14	TYPE I
EW-02	401717.69	2050267.37	6	PVC	85.00	6	16S15-14	TYPE I
EW-03	401745.76	2050594.44	6	PVC	80.48	6	16S15-14	TYPE I
EW-04	401725.25	2050848.75	6	PVC	77.48	6	25S30-15	TYPE I
EW-05	401660.10	2051068.95	6	PVC	77.44	6	25S30-15	TYPE II
EW-06	401494.36	2051130.31	6	PVC	78.80	6	25S30-15	TYPE II
EW-07	401356.63	2051180.56	6	PVC	82.10	6	25S30-15	TYPE II
EW-08	401177.76	2051186.50	6	PVC	87.49	6	25S30-15	TYPE II
EW-09	401006.18	2051139.01	6	PVC	78.28	6	16S20-18	TYPE I
EW-10	400851.65	2051156.44	6	PVC	72.99	6	16S15-14	TYPE I
EW-11	400756.68	2051327.11	6	PVC	90.11	6	16S15-14	TYPE I
EW-12	400673.51	2051479.32	6	PVC	76.88	6	16S15-14	TYPE I
EW-13	400552.28	2051554.81	6	PVC	80.84	6	16S15-14	TYPE I
EW-14	400396.17	2051590.41	6	PVC	80.71	6	16S15-14	TYPE II
EW-15	400229.73	2051580.54	6	PVC	71.66	6	16S15-14	TYPE II
EW-16	400041.76	2051487.08	6	PVC	87.05	6	16S15-14	TYPE I
EW-17	399963.90	2051492.89	6	PVC	84.43	6	16S15-14	TYPE II
EW-18	399832.57	2051554.08	6	PVC	70.82	6	16S15-14	TYPE I
EW-19	399823.09	2051557.27	6	PVC	73.18	6	16S15-14	TYPE I
EW-20	399691.63	2051633.41	6	PVC	83.59	6	16S15-14	TYPE I
EW-21	399546.03	2051662.60	6	PVC	92.73	6	25S15-9	TYPE II
EW-22	399290.52	2051737.10	6	PVC	90.84	6	35S30-11	TYPE III
EW-23	399089.65	2051831.39	6	PVC	99.57	6	25S15-9	TYPE II
EW-24	398872.47	2051862.28	6	PVC	89.29	6	25S15-9	TYPE II
EW-25	398736.57	2051851.66	6	PVC	81.24	6	25S10-7	TYPE II
EW-26	398619.49	2051837.14	6	PVC	79.80	6	25S10-7	TYPE II
EW-27	398609.56	2051835.99	6	PVC	79.85	6	25S15-9	TYPE II
EW-28	398409.96	2051819.11	6	PVC	76.23	6	25S15-9	TYPE II
EW-29	398400.10	2051820.75	6	PVC	75.28	6	25S15-9	TYPE II
EW-30	398333.60	2051846.97	6	PVC	70.01	6	25S15-9	TYPE II
EW-31	398324.75	2051851.62	6	PVC	69.46	6	25S15-9	TYPE II
EW-32	398234.58	2051905.44	6	PVC	66.05	6	25S15-9	TYPE II
EW-33	398225.89	2051910.39	6	PVC	66.19	6	25S15-9	TYPE I
EW-34	398108.51	2051982.93	6	PVC	76.09	6	25S15-9	TYPE II
EW-35	398099.82	2051987.88	6	PVC	76.80	6	25S15-9	TYPE I
EW-36	397946.13	2051997.68	6	PVC	86.18	6	16S10-10	TYPE I
EW-37	397793.03	2051992.37	6	PVC	81.57	6	16S10-10	TYPE I
EW-38	397658.39	2051985.91	6	PVC	83.72	6	16S10-10	TYPE I
EW-39	397522.04	2051979.89	6	PVC	74.92	6	25S10-7	TYPE II
EW-40	397512.05	2051979.39	6	PVC	73.89	6	16S10-10	TYPE I
EW-41	397400.06	2051967.77	6	PVC	66.50	6	25S10-7	TYPE II
EW-42	397390.06	2051968.07	6	PVC	68.28	6	16S10-10	TYPE I
EW-43	397276.89	2052000.99	6	PVC	84.21	6	25S10-7	TYPE II
EW-44	397268.00	2052005.57	6	PVC	84.46	6	16S10-10	TYPE I
EW-45	397099.58	2052077.00	6	PVC	79.52	6	25S10-7	TYPE II
EW-46	397089.80	2052079.07	6	PVC	79.76	6	16S10-10	TYPE I
EW-47	396898.29	2052127.04	6	PVC	76.93	6	25S10-7	TYPE II
EW-48	396706.78	2052156.95	6	PVC	69.18	6	25S10-7	TYPE II
EW-49	396526.26	2052201.59	6	PVC	72.31	6	16S07-8	TYPE I
EW-50	396357.14	2052225.17	6	PVC	76.03	6	16S07-8	TYPE I
EW-51	396164.48	2052232.61	6	PVC	77.06	6	25S10-7	TYPE II
EW-52	395987.93	2052230.68	6	PVC	74.81	6	25S10-7	TYPE II
EW-53	395808.71	2052273.95	6	PVC	73.92	6	16S07-8	TYPE I
EW-54	395616.25	2052295.78	6	PVC	76.17	6	25S10-7	TYPE II
EW-55	395423.99	2052320.37	6	PVC	73.93	6	25S10-7	TYPE II
EW-56	395231.72	2052344.96	6	PVC	72.40	6	25S10-7	TYPE II
EW-57	395108.05	2052304.39	6	PVC	73.00	6	25S10-7	TYPE II
EW-58	394996.62	2052174.83	6	PVC	82.46	6	35S20-8	TYPE II
EW-59	394824.85	2052113.33	6	PVC	95.24	6	35S20-8	TYPE III
EW-60	394706.10	2052058.20	6	PVC	92.37	6	35S20-8	TYPE III
EW-61	394661.56	2051909.76	6	PVC	96.58	6	35S20-8	TYPE III
EW-62	394617.03	2051769.80	6	PVC	90.00	6	35S30-11	TYPE III
EW-63	394561.90	2051668.01	6	PVC	82.57	6	35S30-11	TYPE III
EW-64	394483.44	2051578.95	6	PVC	76.11	6	35S30-11	TYPE III

11
M-01
TABLE
WELL DETAIL TABLE

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
2. EXTRACTION WELL SCREEN INTERVAL AND CORRESPONDING PUMP PLACEMENT SHALL BE DETERMINED DURING WELL CONSTRUCTION.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL DETAILS IV

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

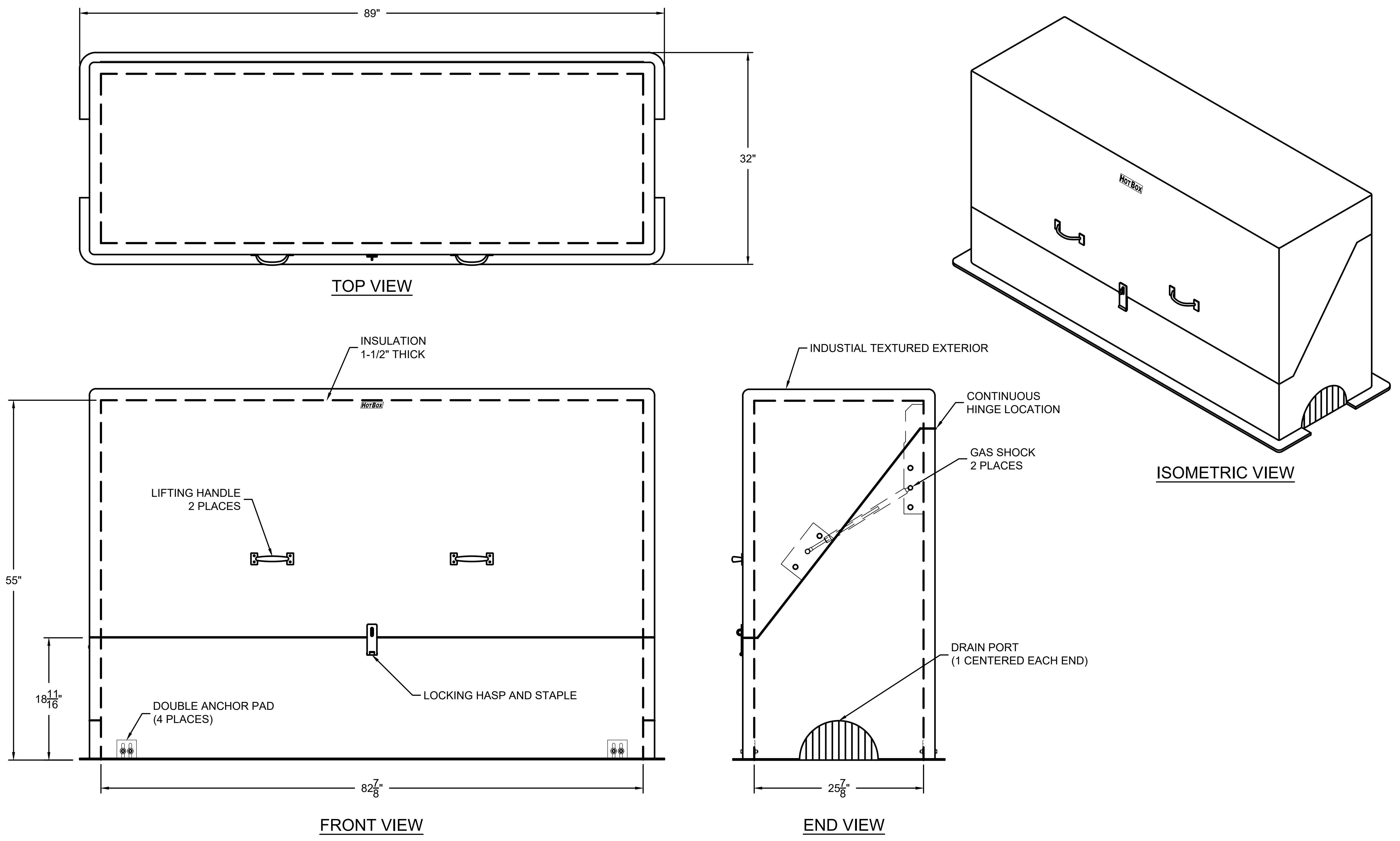
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

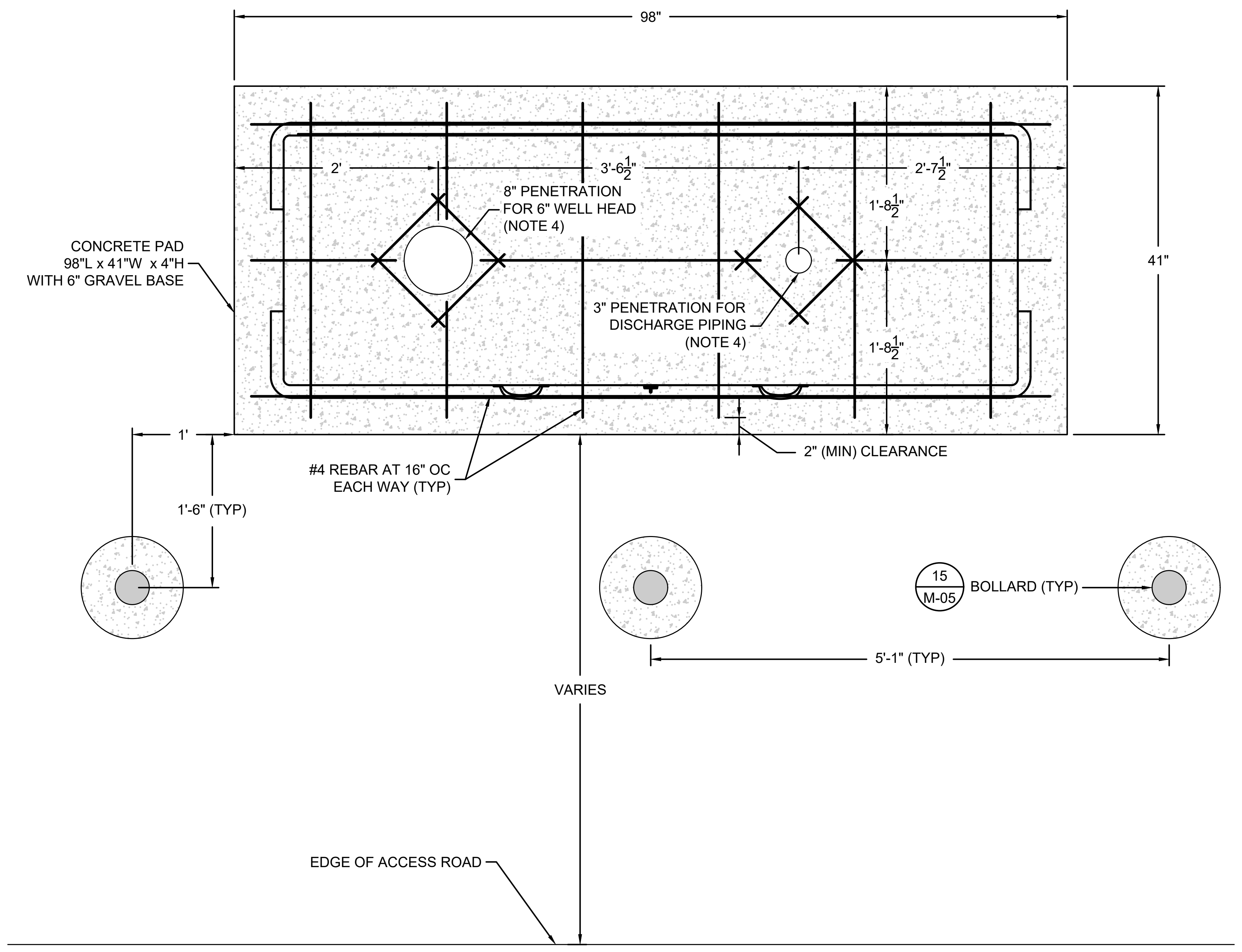
DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M04.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-04
APPROVED BY:	JJD		

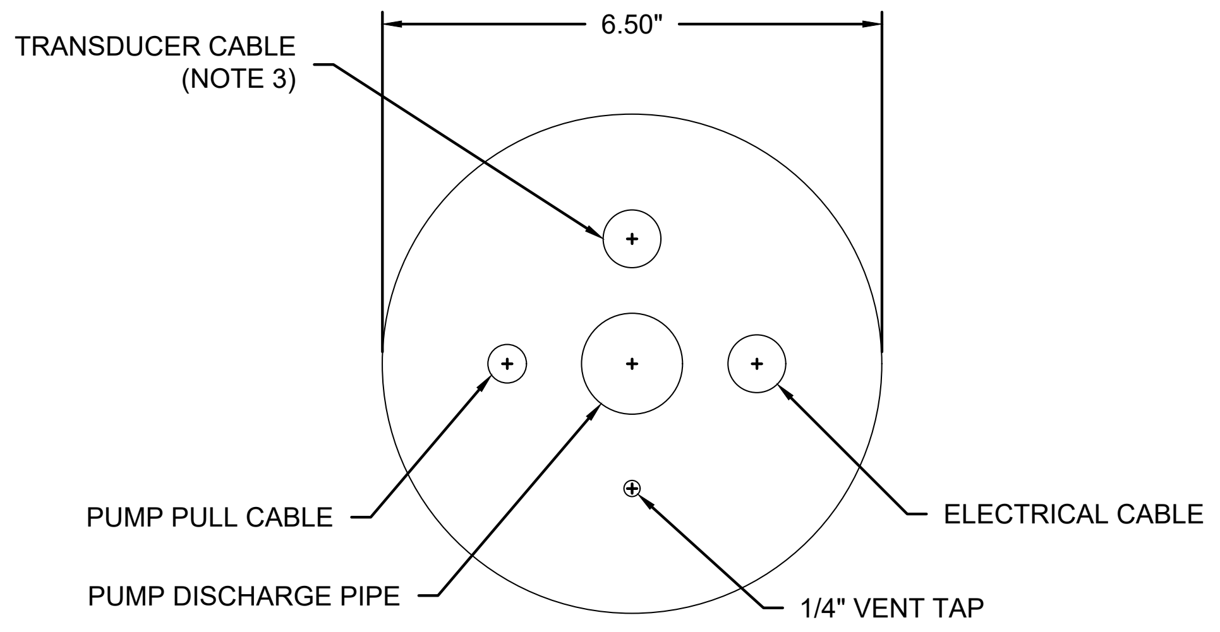
60% DESIGN - NOT FOR CONSTRUCTION



12
M-01
DETAIL
HOT BOX WELL ENCLOSURE
(NOTE 1)
SCALE: 1" = 1'

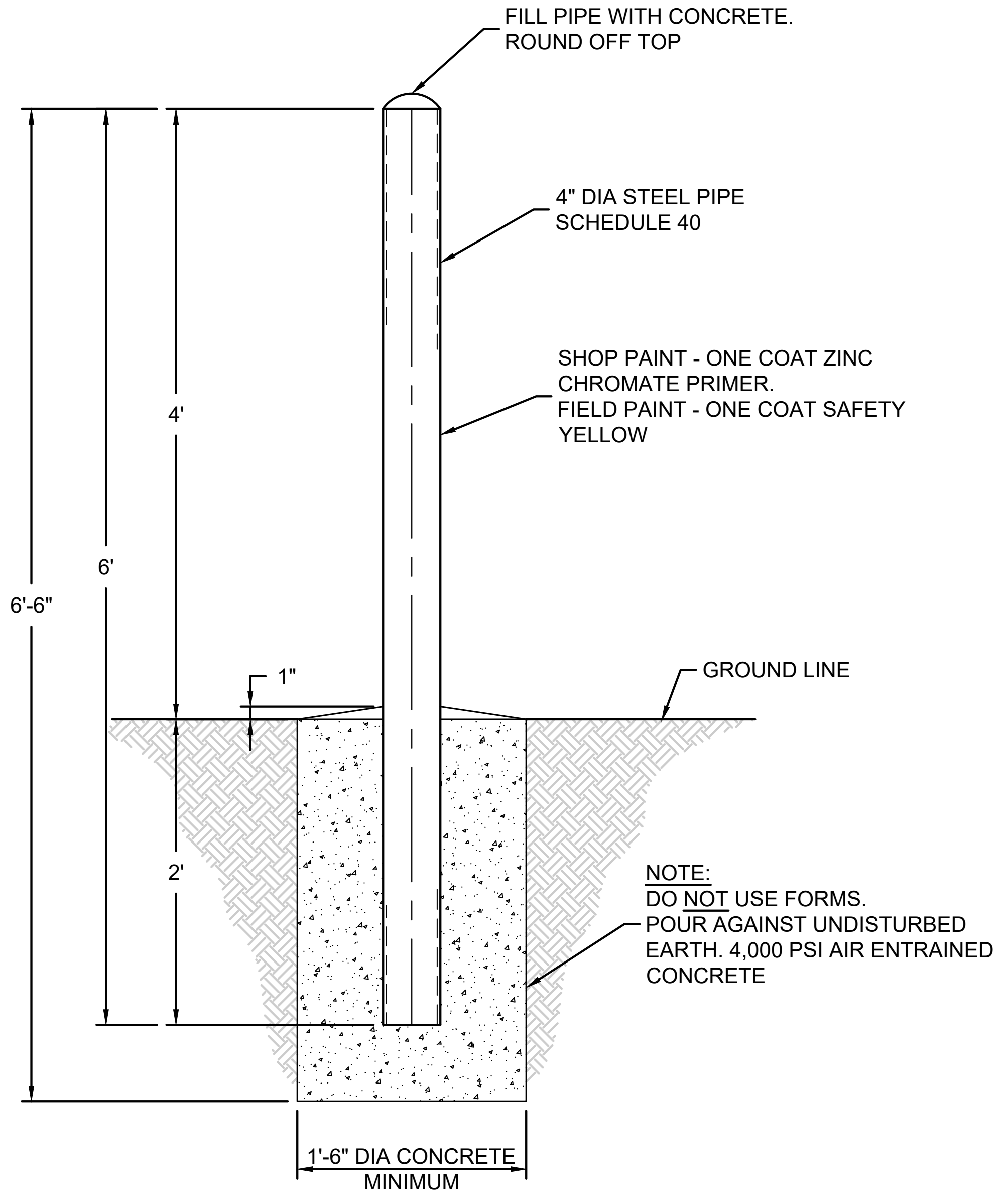


13
M-01
DETAIL
EXTRACTION WELL CONCRETE PAD
(NOTE 5)
SCALE: 1" = 1'



6" CAMPBELL CAST IRON WELL
SEAL PART NO. SUB6X1S

14
M-01
DETAIL
WELL SEAL
(NOTE 2)
SCALE: 1" = 1'



15
M-01
DETAIL
BOLLARD
SCALE: 1" = 1'

NOTES:

1. HOT BOX ENCLOSURE MODEL HB3ES. HEAT IS PROVIDED BY (1) 1500 WATT, 120V SINGLE PHASE HEATER. FOUR INTERNAL BRACKETS AND CONCRETE ANCHORS ARE SUPPLIED WITH THE ENCLOSURE.
2. WELL SEAL OPENING DIMENSIONS
    - 6-IN WELL SEAL WITH 1-1/4 OR 1-1/2 IN HOLE IN CENTER TO MATCH DISCHARGE PIPE DIAMETER.
    - TWO 3/4-IN NPT HOLES ON COLLAR
    - ONE 1/4-IN VENT TAP
3. 0.75-INCH HOLE SHALL BE DRILLED IN THE FIELD TO ACCOMMODATE TRANSDUCER DEPLOYMENT.
4. PENETRATIONS SHALL BE SEALED WITH GROUT TO PREVENT WATER INFILTRATION.
5. INDIVIDUAL CONCRETE PAD ORIENTATIONS SHALL BE DETERMINED IN FIELD TO FACILITATE CONNECTION TO LATERAL PIPE.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
EXTRACTION WELL DETAILS V

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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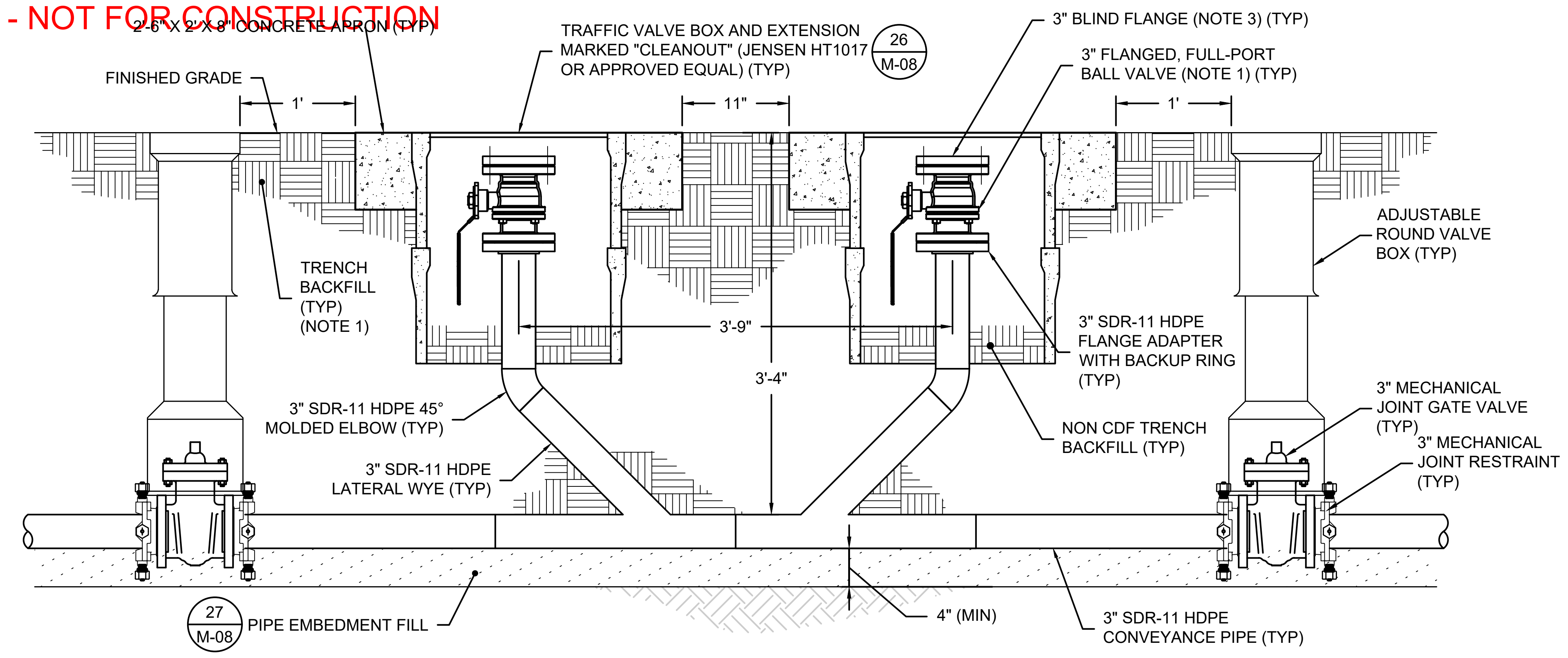
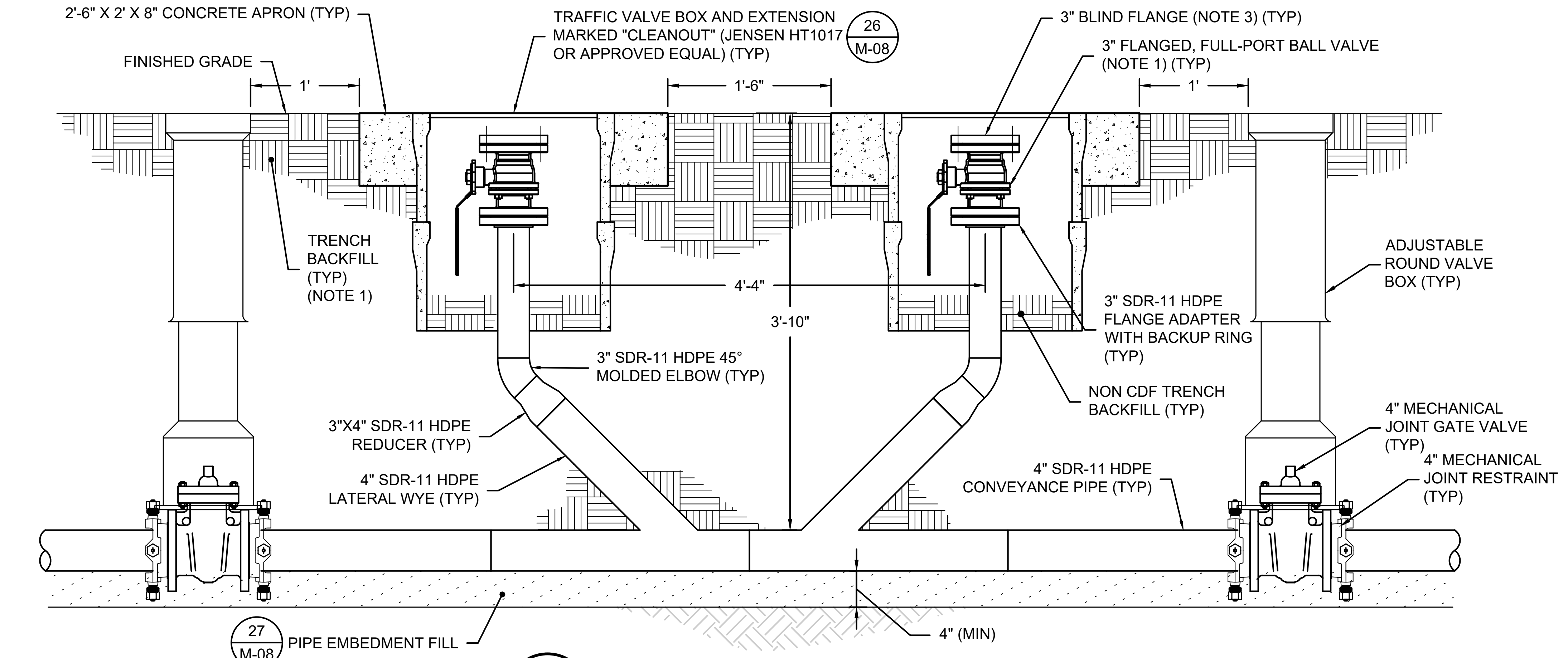
SIGNATURE

DATE

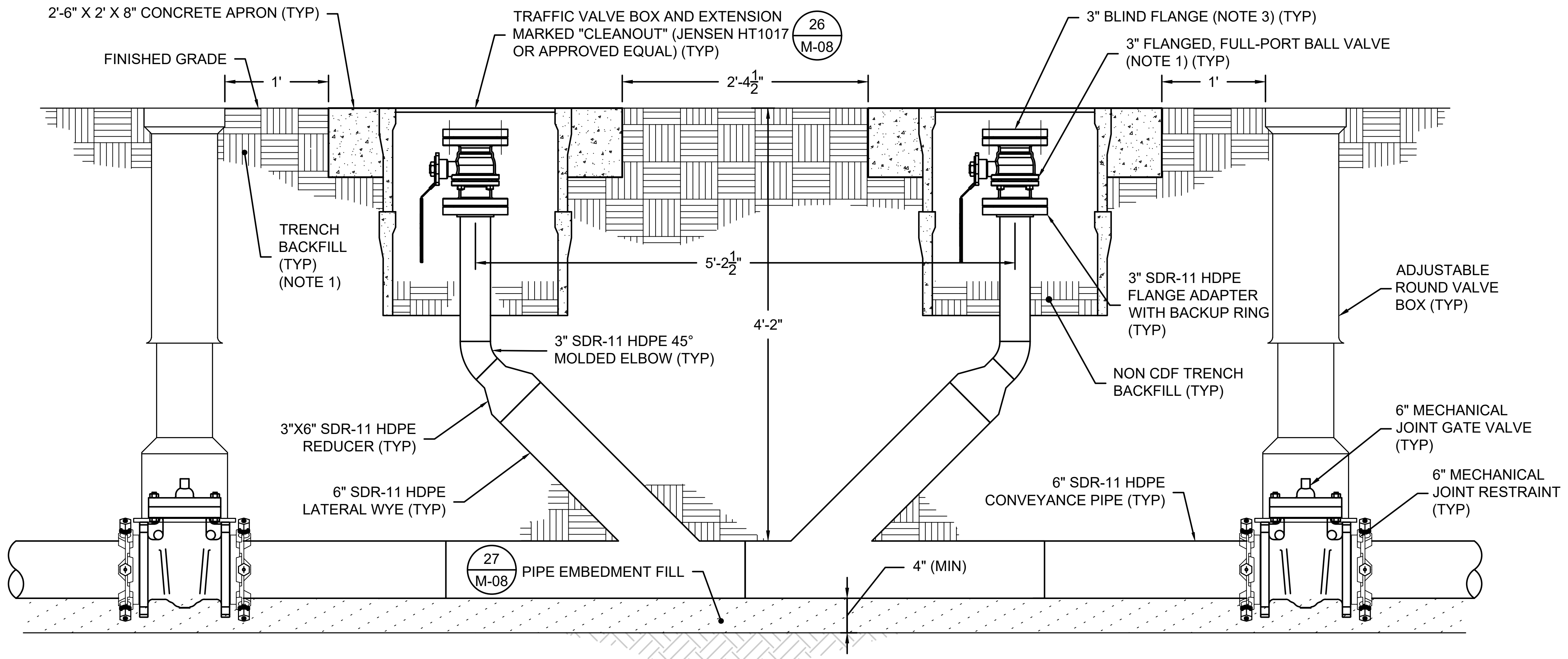
DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M05.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-05
APPROVED BY:	JJD		



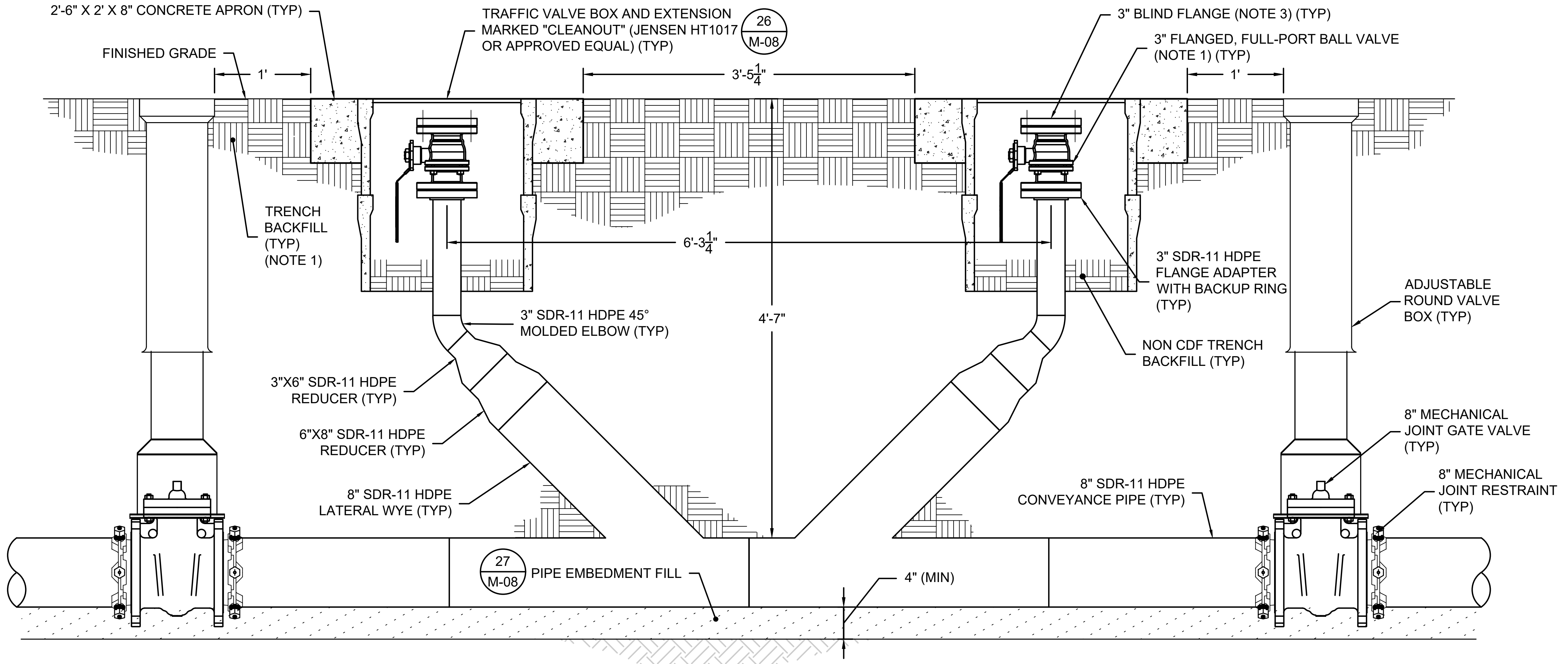
16
C-02
DETAIL
3 INCH FORCEMAIN CLEANOUT
SCALE: 1" = 1'



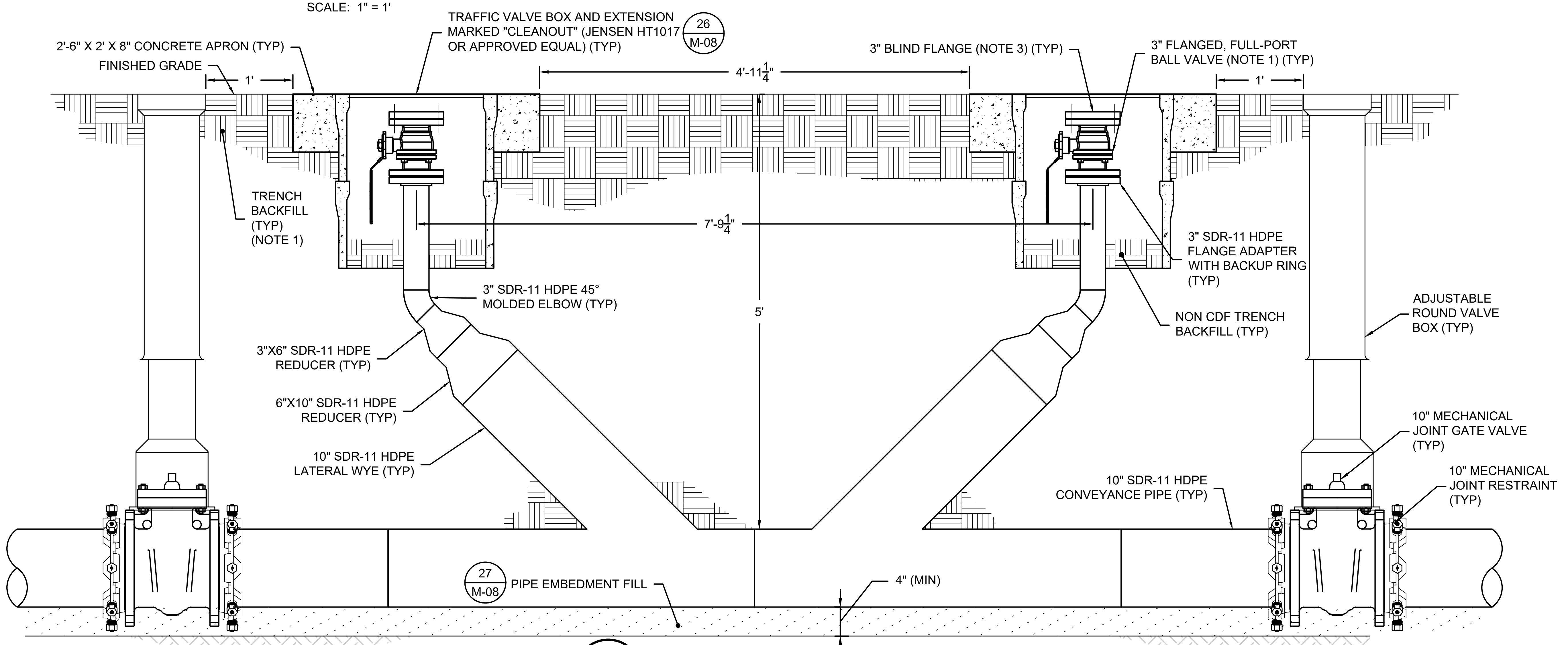
17
C-02
DETAIL
4 INCH FORCEMAIN CLEANOUT
SCALE: 1" = 1'



18
C-03
DETAIL
6 INCH FORCEMAIN CLEANOUT
SCALE: 1" = 1'



19
C-03
DETAIL
8 INCH FORCEMAIN CLEANOUT
SCALE: 1" = 1'



20
C-03
DETAIL
10 INCH FORCEMAIN CLEANOUT
SCALE: 1" = 1'

NOTES:

1. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
2. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
MECHANICAL DETAILS I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

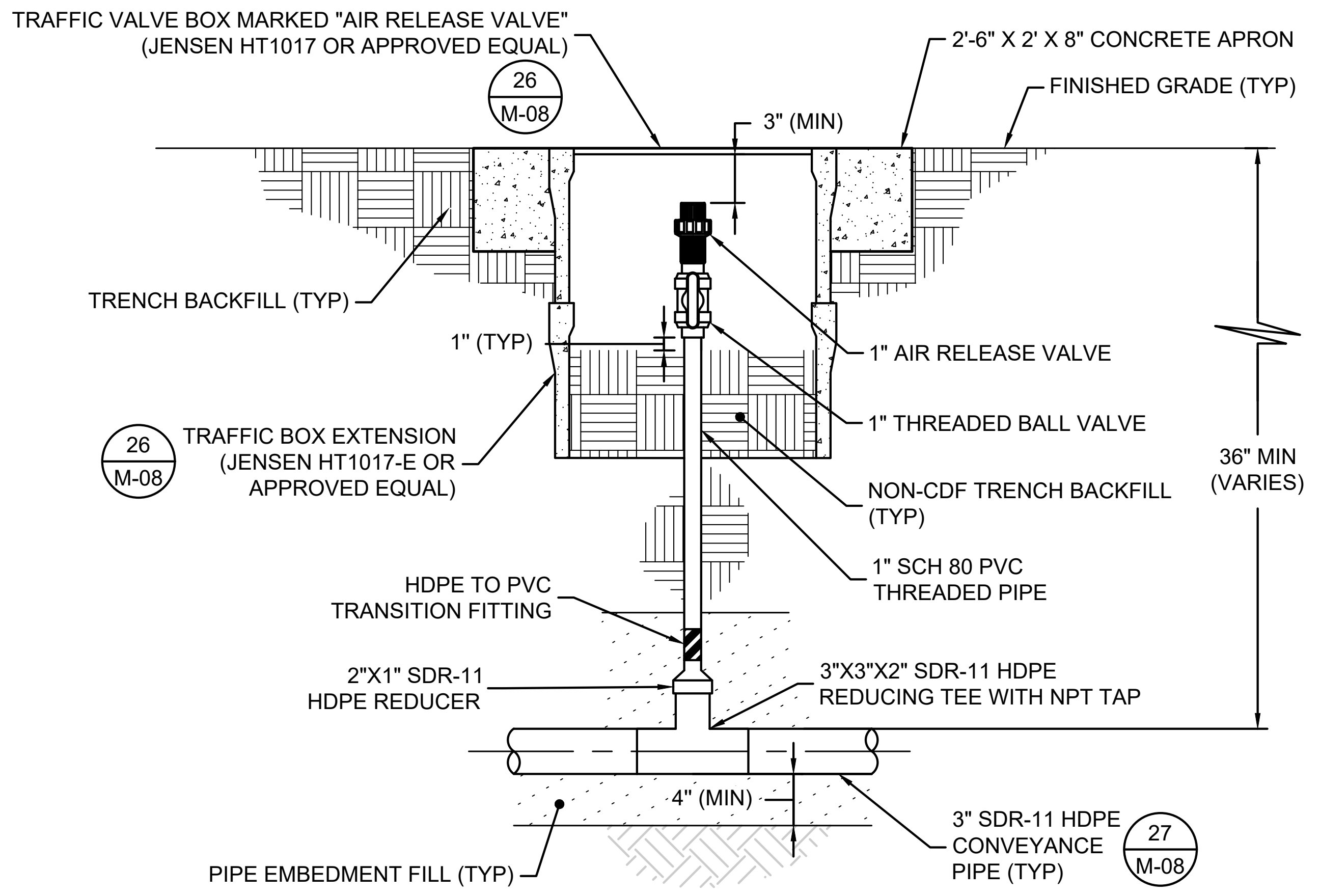
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

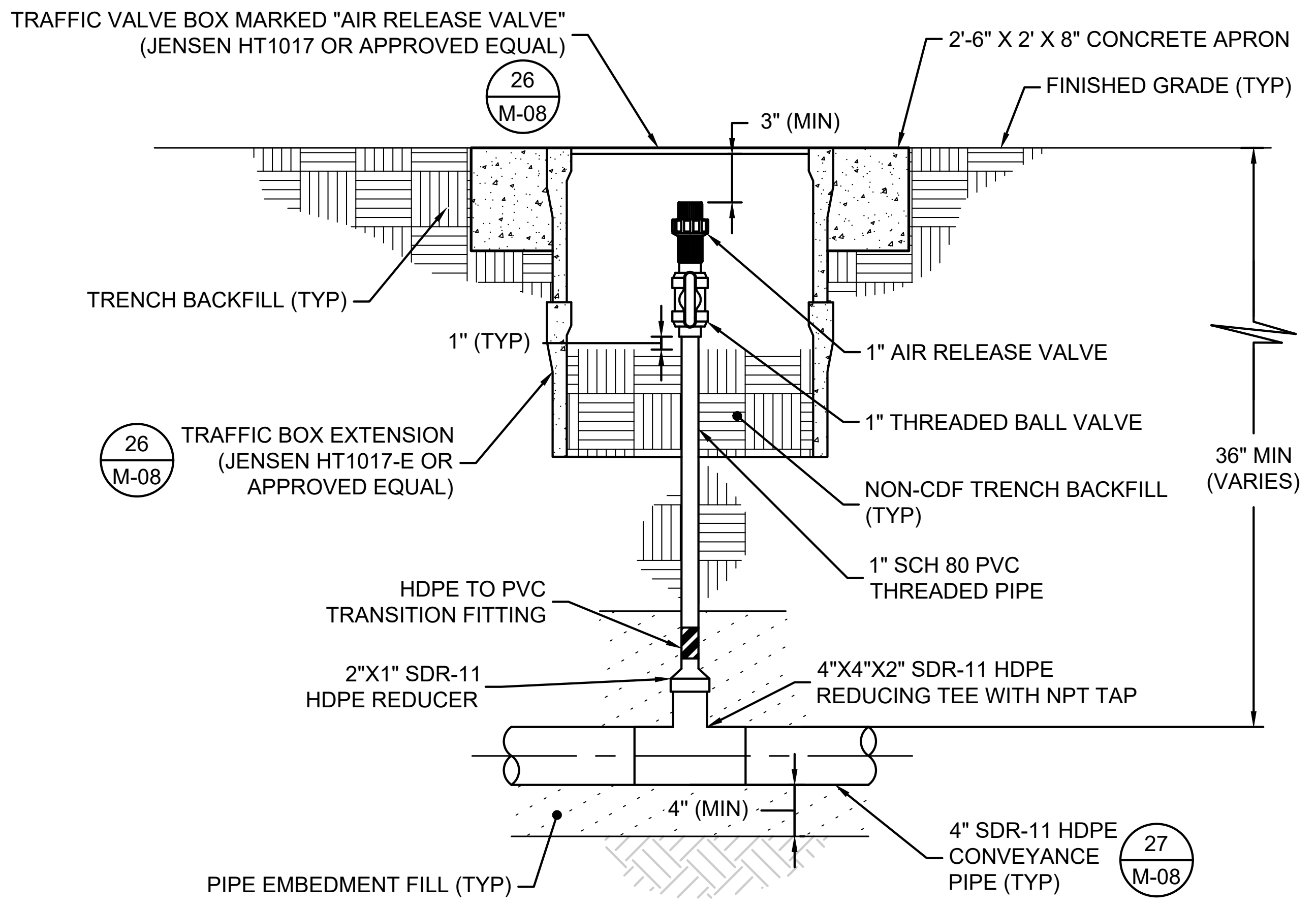
DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M06.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-06
APPROVED BY:	JJD		

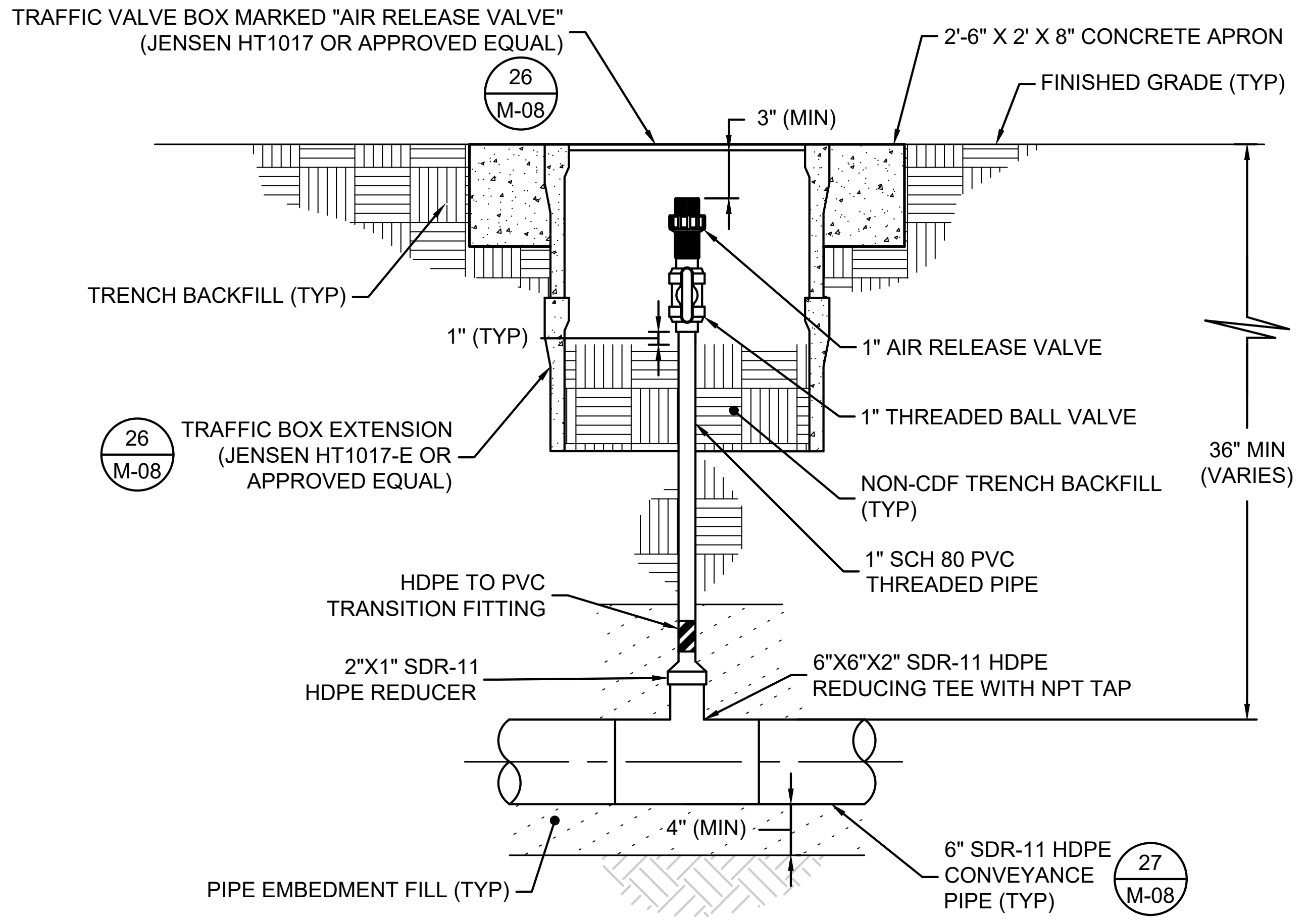
60% DESIGN - NOT FOR CONSTRUCTION



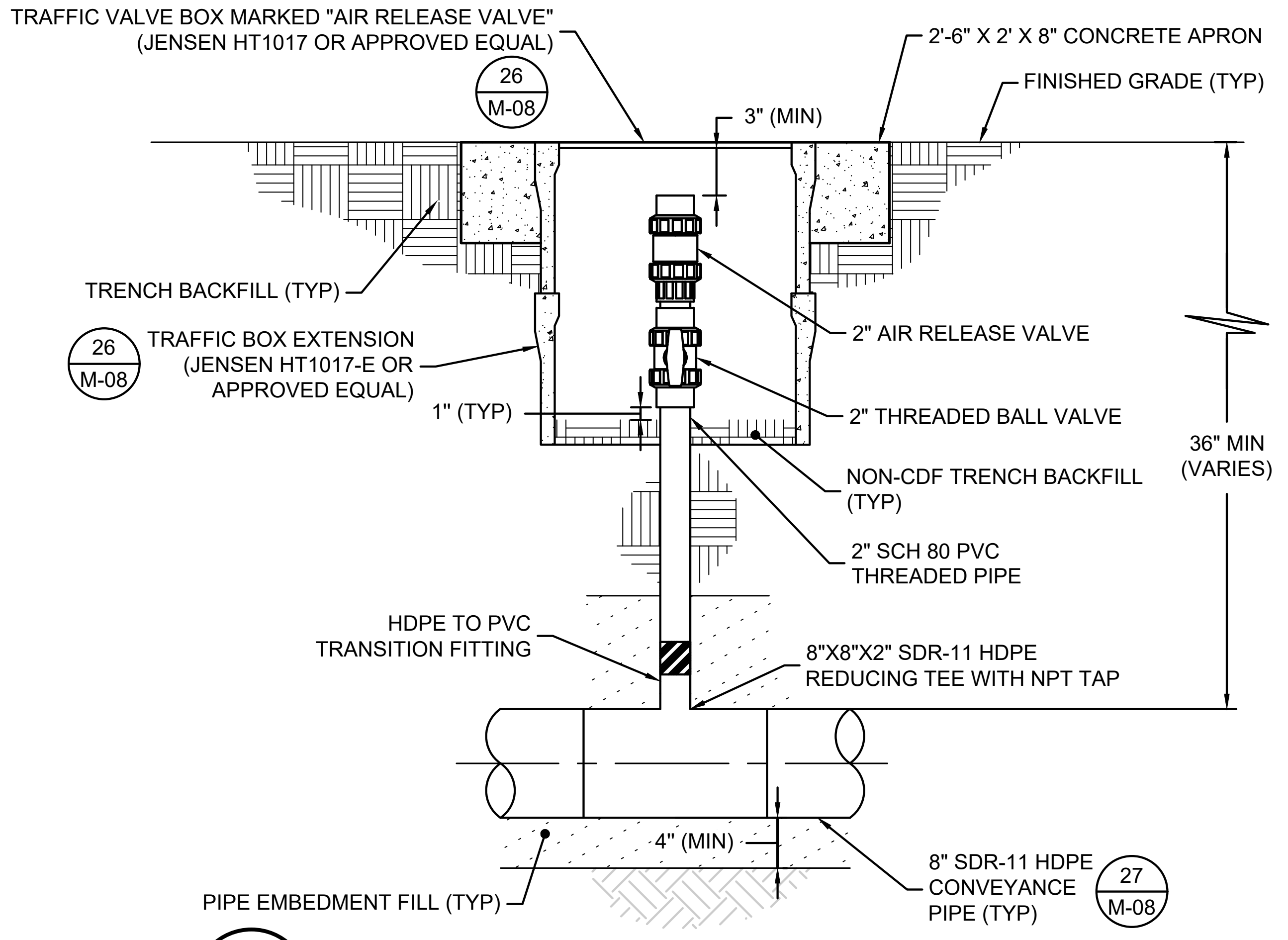
21
C-02
DETAIL
3 INCH FORCEMAIN AIR RELEASE VALVE
SCALE: 1" = 1'



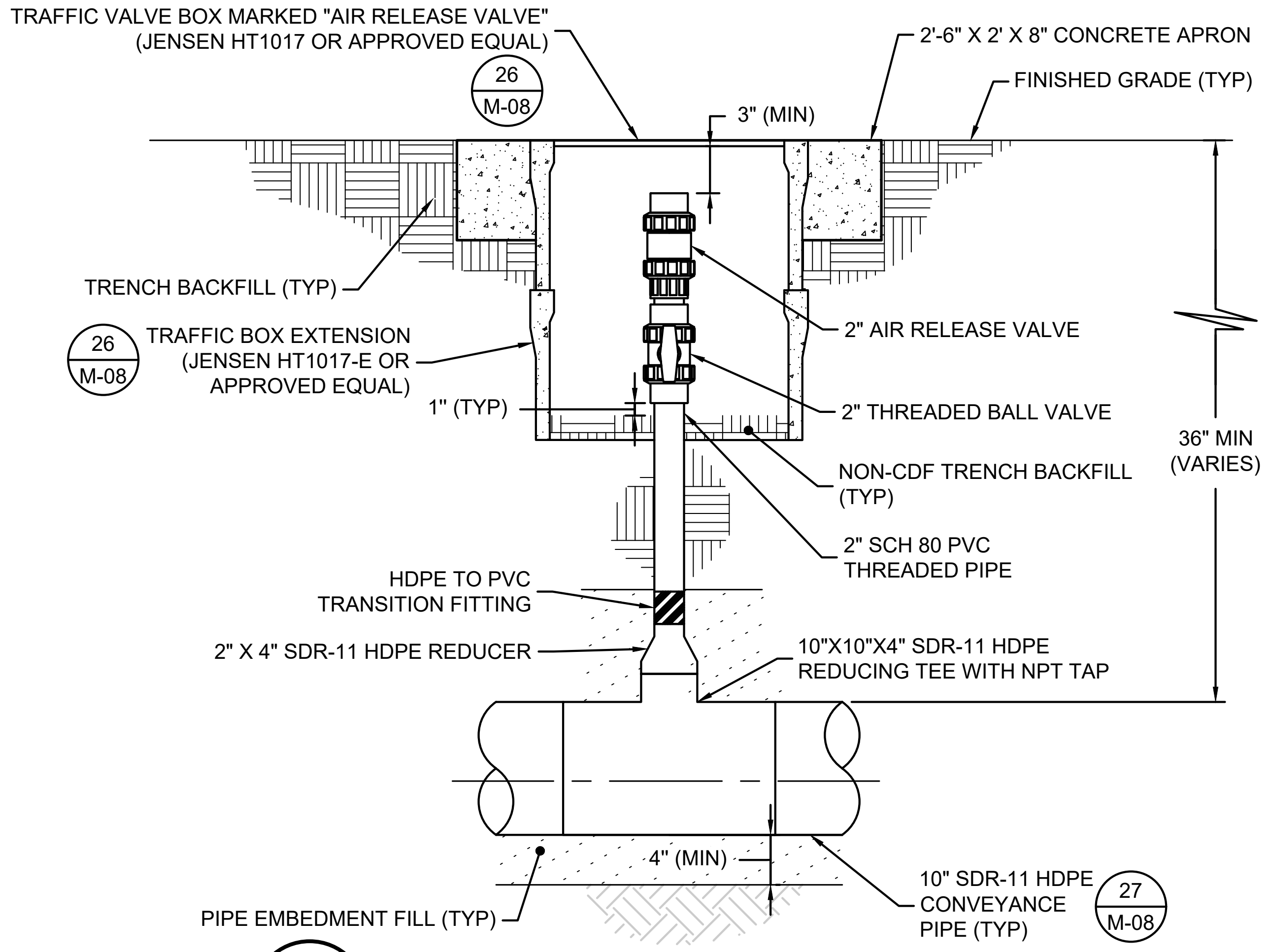
22
C-02
DETAIL
4 INCH FORCEMAIN AIR RELEASE VALVE
SCALE: 1" = 1'



23
C-03
DETAIL
6 INCH FORCEMAIN AIR RELEASE VALVE
SCALE: 1" = 1'



24
C-03
DETAIL
8 INCH FORCEMAIN AIR RELEASE VALVE
SCALE: 1" = 1'



25
C-03
DETAIL
10 INCH FORCEMAIN AIR RELEASE VALVE
SCALE: 1" = 1'

NOTES:

1. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
2. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
MECHANICAL DETAILS II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

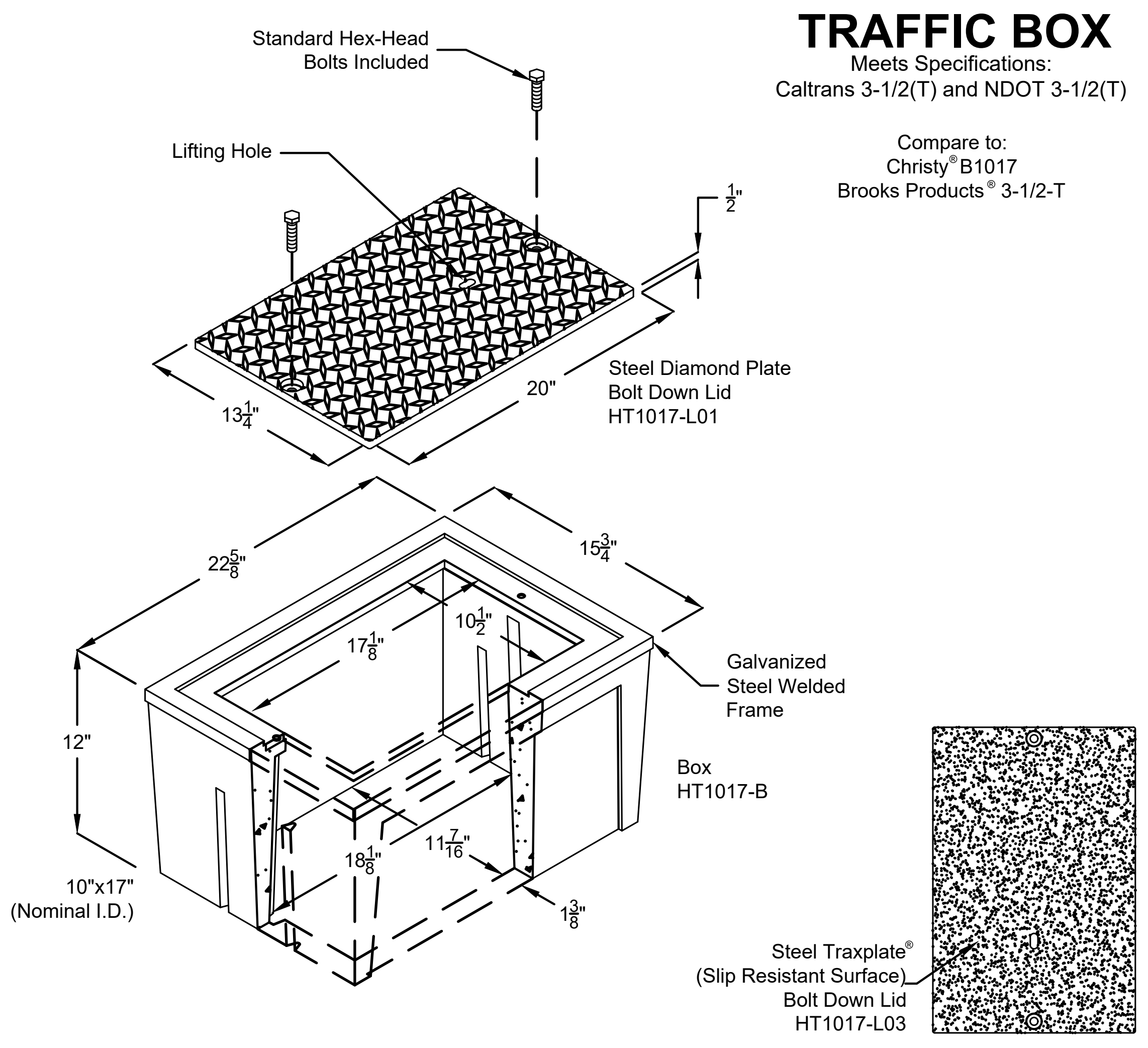
DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M07.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-07
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

HT1017
TRAFFIC BOX

Meets Specifications:
Caltrans 3-1/2(T) and NDOT 3-1/2(T)

Compare to:
Christy® B1017
Brooks Products® 3-1/2-T



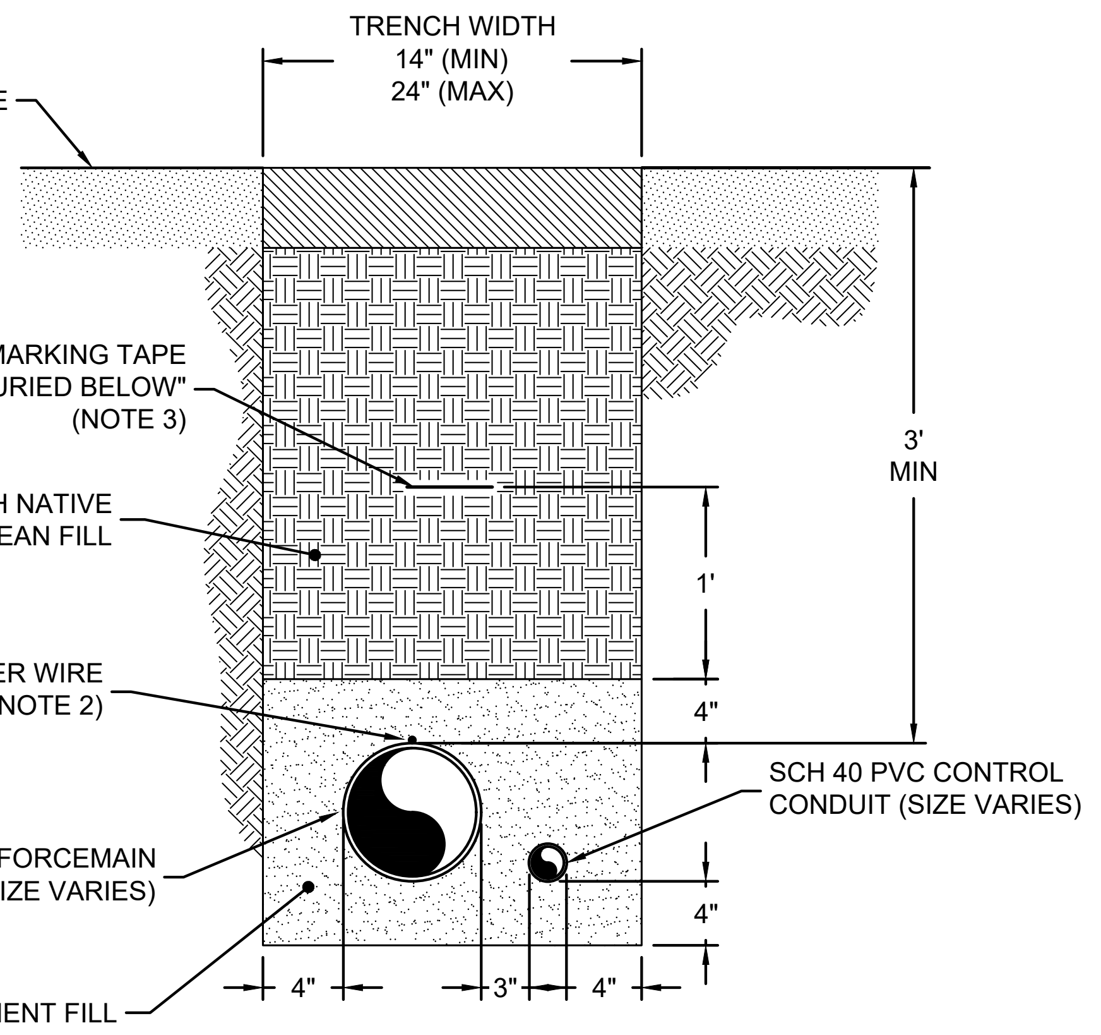
PART NO.	PRODUCT	DESCRIPTION	APPROX. WEIGHT	QTY. PER PALLET
HT1017-B	BOX	10"x17"x12" Concrete Traffic Rated Box (Comes Standard With Hex Bolts)	125	20
HT1017-E	EXTENSION	10"x17"x12" Concrete Extension	126	20
HT1017-L01	LID	Steel Diamond Plate Bolt Down Lid	38	
HT1017-L03	LID	Steel Traxplate® Bolt Down Slip Resistant Cover	38	
GALVANIZING AVAILABLE ON ALL STEEL LIDS				

For penta head and other bolt options, see security hardware sheet.

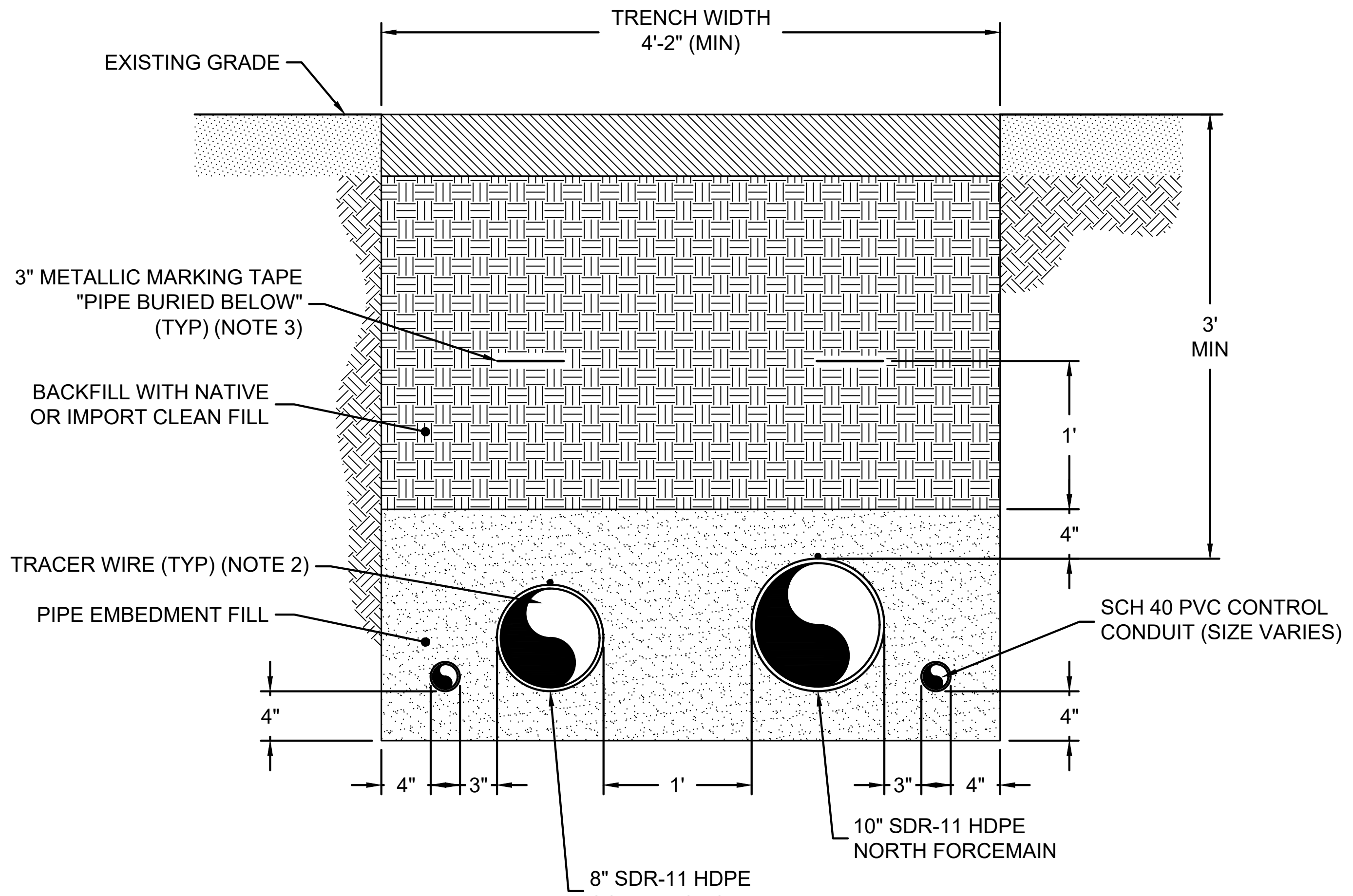
Design load: Traffic rated when installed per Caltrans ES-8B

JENSEN PRECAST
JENSENPRECAST.COM

26
M-06
DETAIL
TRAFFIC BOX
SCALE: 1" = 1'
XREF:



27
C-01
DETAIL
TYPICAL FORCEMAIN PIPE BEDDING
SCALE: 1" = 1'



28
C-03
DETAIL
TIE-IN' FORCEMAIN PIPE BEDDING
SCALE: 1" = 1'

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
2. TRACER WIRE SHALL BE 10 AWG PRO-TRACE HDD-CCS PE45 OR ENGINEER APPROVED EQUAL.
3. MARKING TAPE SHALL BE PRO-LINE, 5.0 MIL, 3-INCH WIDE DETECTABLE MARKING TAPE OR ENGINEER APPROVED EQUAL.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
MECHANICAL DETAILS III

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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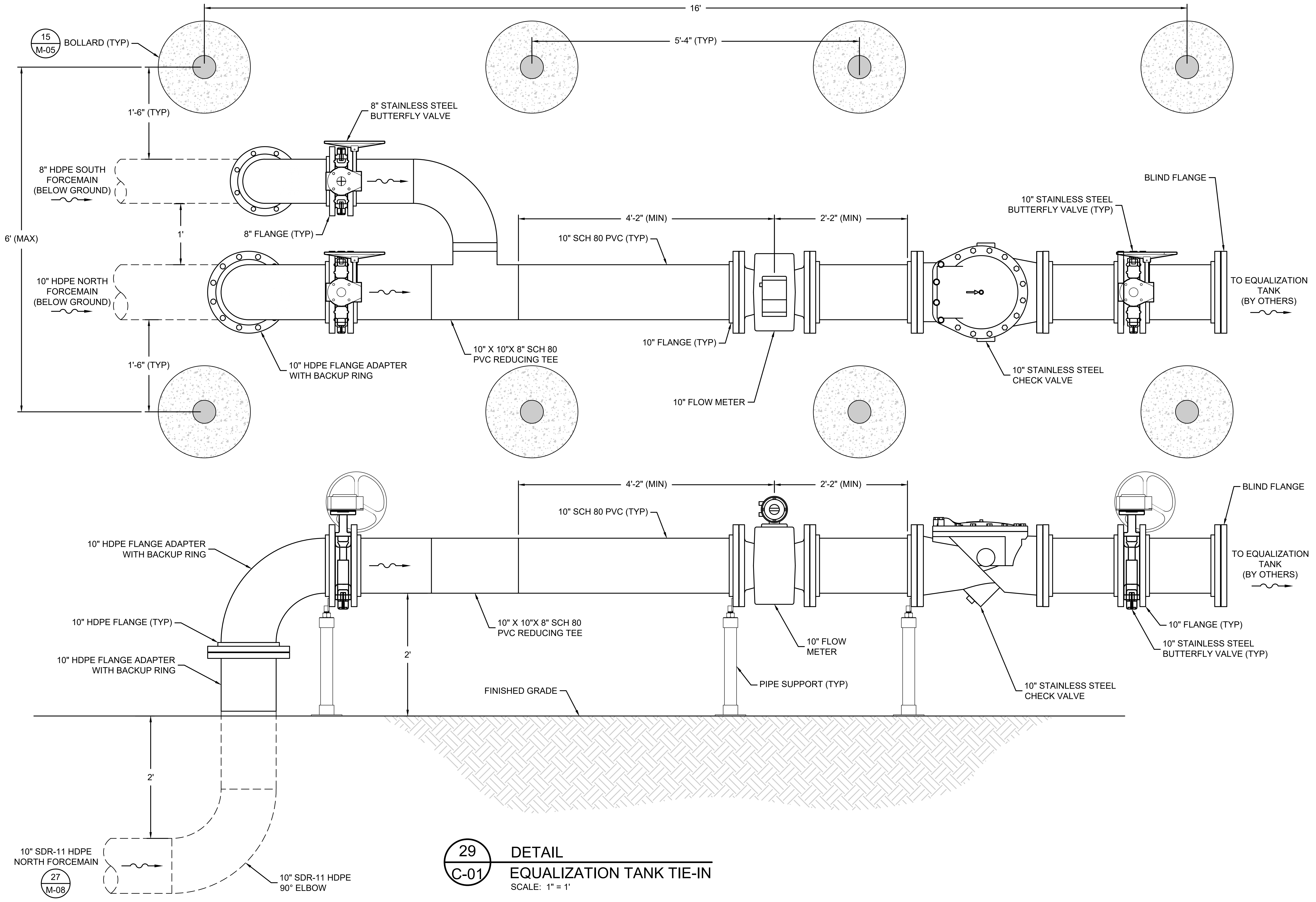
CHECKED BY:	CMDS	FILE:	TR0795A-M08.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-08
APPROVED BY:	JJD		

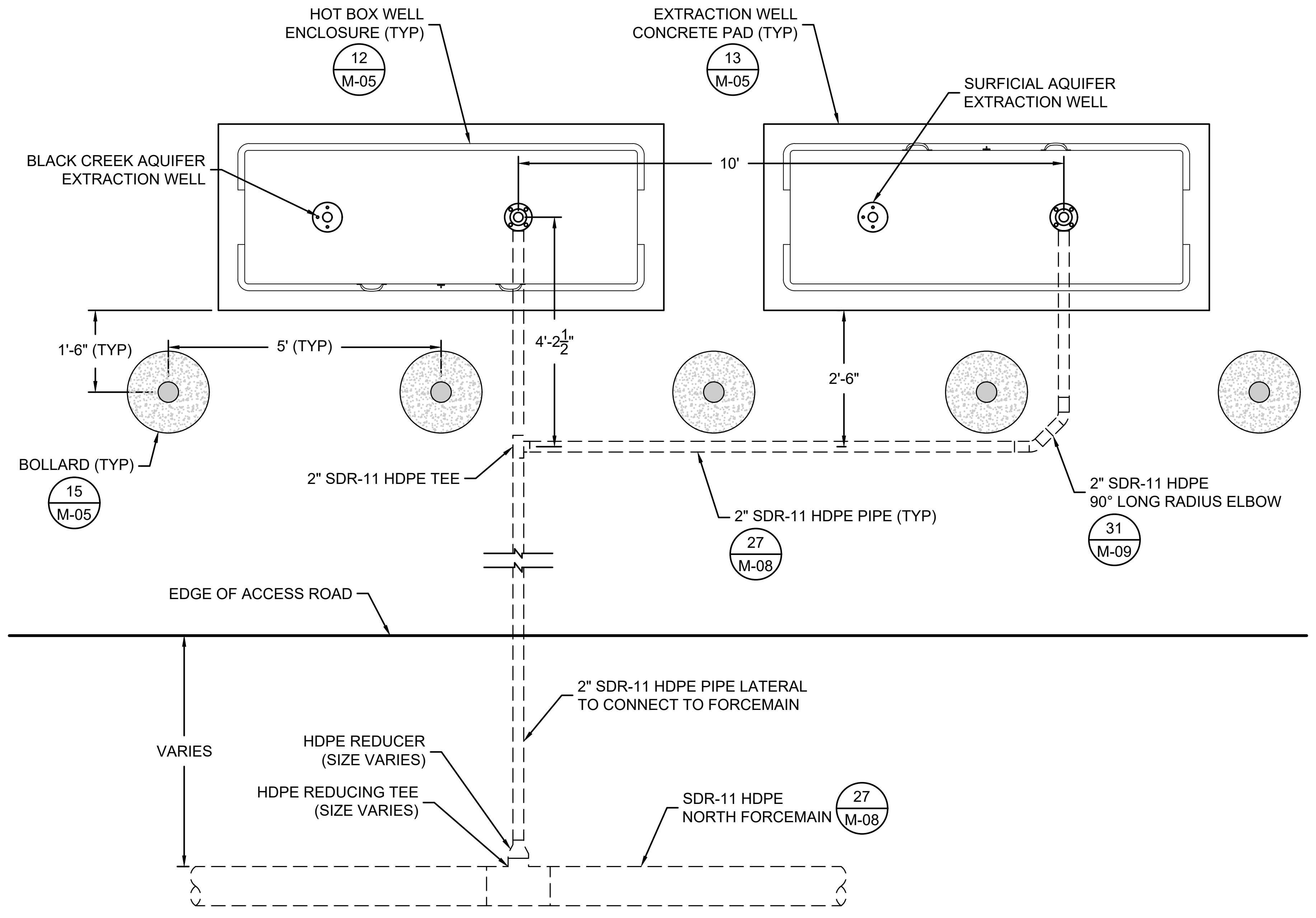
60% DESIGN - NOT FOR CONSTRUCTION



29
C-01

DETAIL
EQUALIZATION TANK TIE-IN

SCALE: 1" = 1'



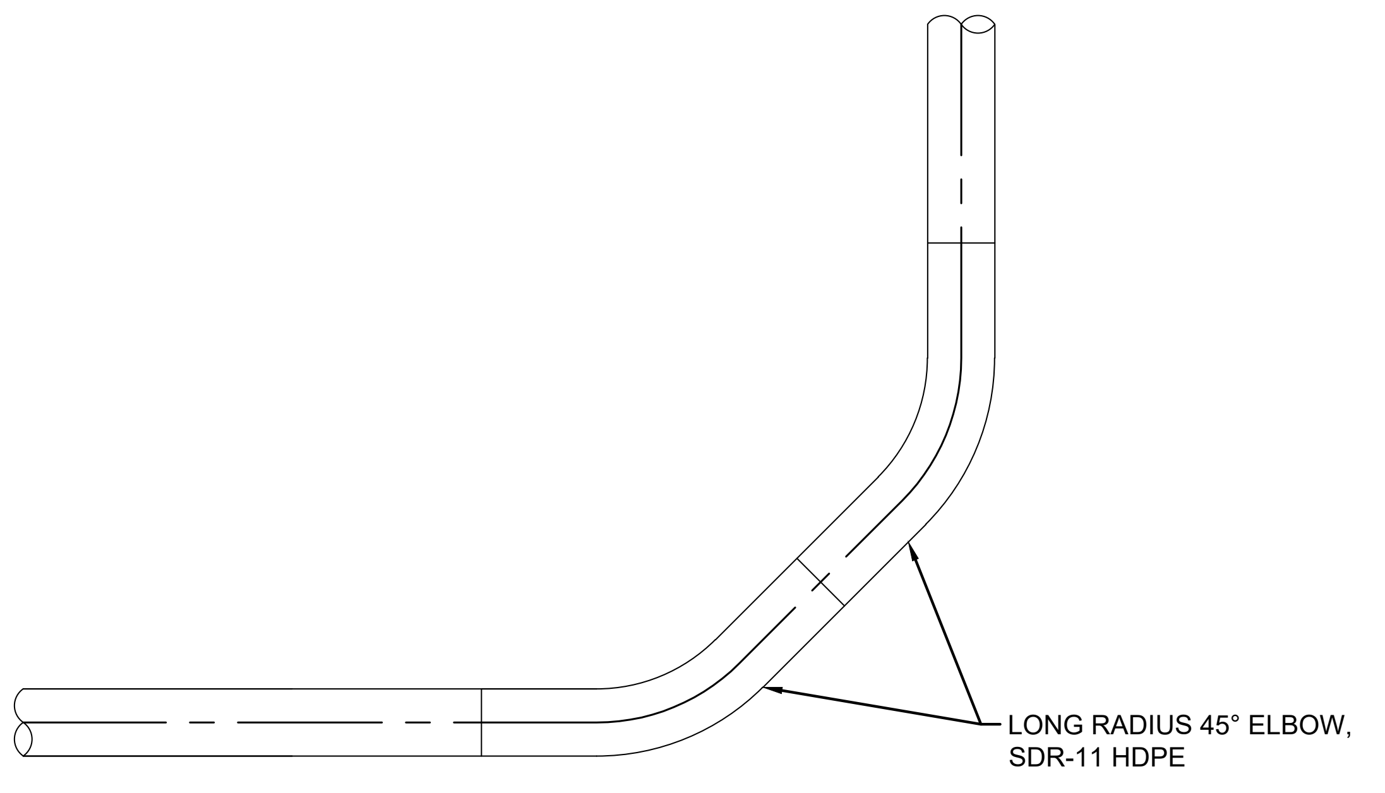
30
M-09

DETAIL
ADJACENT WELL PIPING

(NOTE 3)
SCALE: 1" = 2'

NOTES:

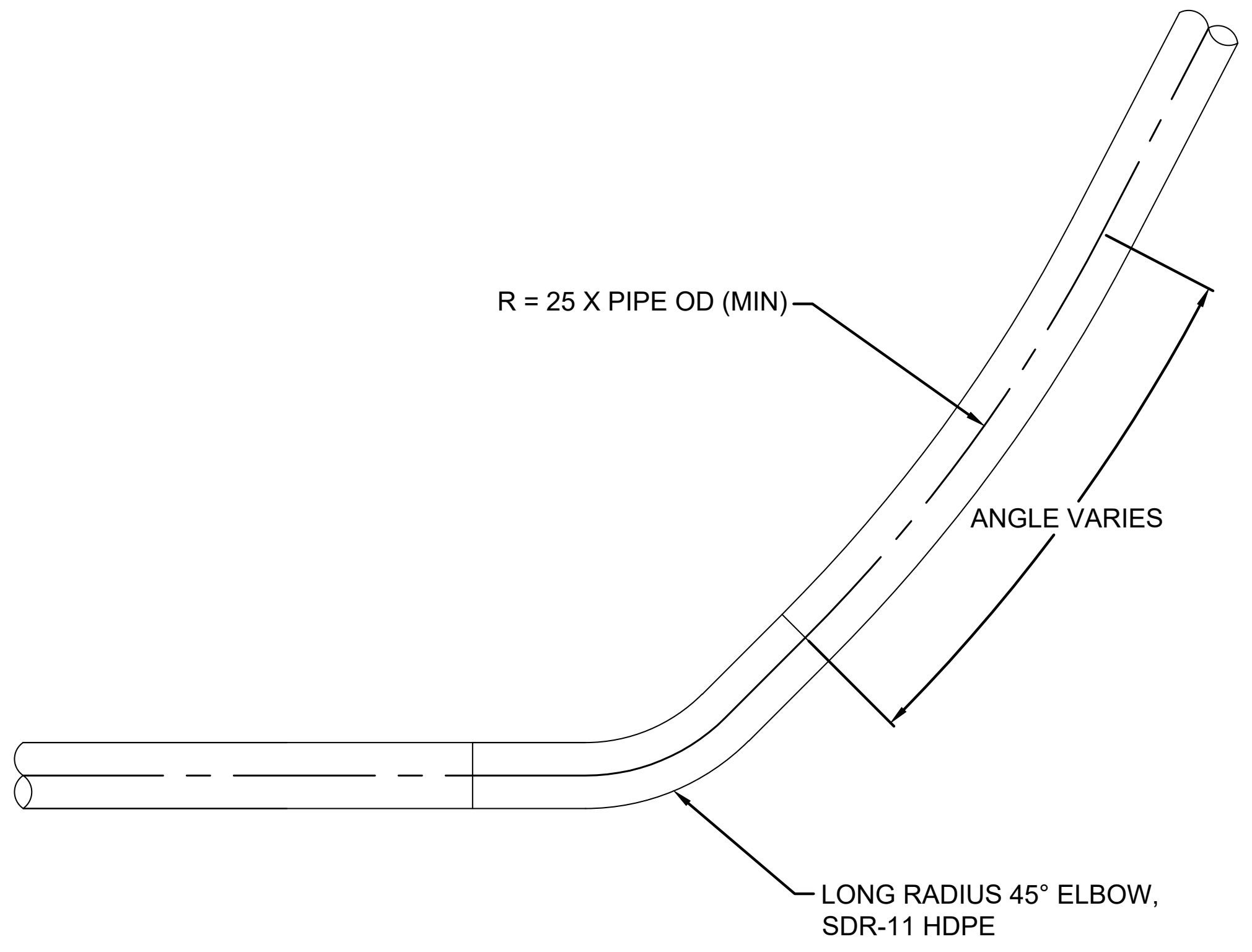
1. VALVE, PUMP, AND INSTRUMENTATION SCHEDULES SHALL BE PROVIDED IN FUTURE SUBMITTALS.
2. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
3. INDIVIDUAL CONCRETE PAD ORIENTATIONS SHALL BE DETERMINED IN FIELD TO FACILITATE CONNECTION TO LATERAL PIPE.



31
C-03

DETAIL
90º LONG RADIUS ELBOW

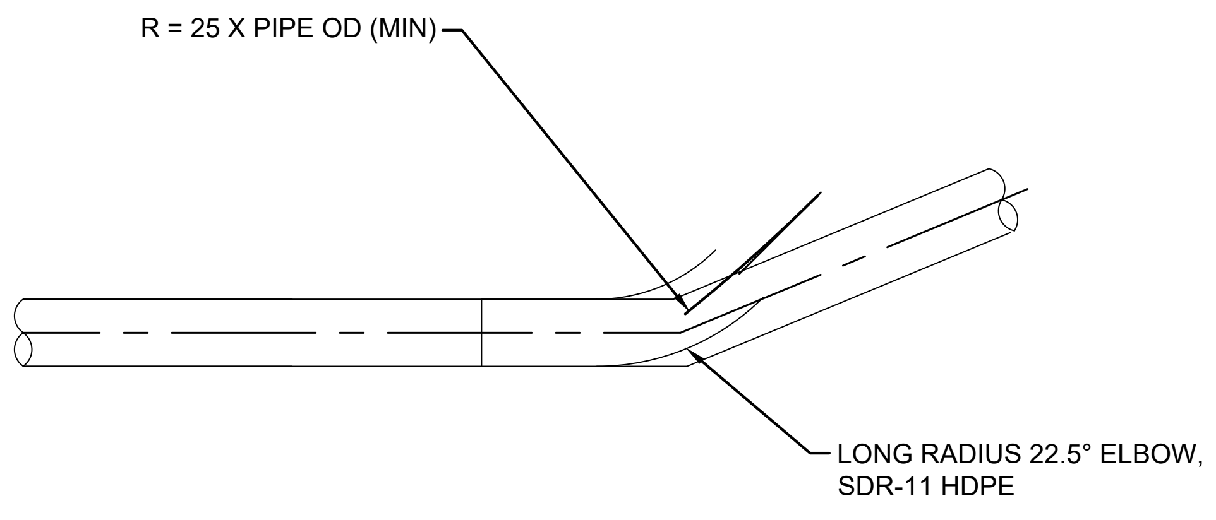
SCALE: 1" = 1'



32
M-07

DETAIL
45º LONG RADIUS ELBOW AND PIPE BEND

SCALE: 1" = 1'



33
C-05

DETAIL
22.5º LONG RADIUS ELBOW

SCALE: 1" = 1'

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
MECHANICAL DETAILS IV

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-M09.DWG
REVIEWED BY:	SV	DRAWING NO.:	M-09
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION

LEGEND

355	EXISTING GROUND MAJOR CONTOUR (5')	▨	WETLANDS
	EXISTING GROUND MINOR CONTOUR (1')	⊕	EXISTING INJECTION WELL
— — —	PROPERTY BOUNDARY	○	EXISTING EXTRACTION WELL
——	BARRIER WALL ALIGNMENT	■	SURFICIAL AND BLACK CREEK AQUIFER EXTRACTION WELL
= = =	EXISTING GRAVEL ROAD	⧗	BLACK CREEK AQUIFER EXTRACTION WELL
═	EXISTING PAVED ROAD	▣	FORCEMAIN CLEANOUT
——	GROUND WATER CONVEYANCE FORCEMAIN	◎	AIR RELEASE VALVE
—·—	STREAM	▮	CONTROL PANEL
○—○	RELOCATED OUTFALL 002	◆	FUTURE CONTROL PANEL (IF NEEDED)
		▭	WELL TERMINATION

NOTES:

1. GRID COORDINATE SYSTEM CORRESPONDS TO NAD83, NORTH CAROLINA. ELEVATIONS PRESENTED ARE IN FEET, NAVD 88.
2. TOPOGRAPHIC, ROADS, BUILDINGS, AND PROPERTY LINE INFORMATION OBTAINED FROM FREELAND-CLINK SCALES & ASSOCIATES, INC. OF NC. SURVEY OF THE CHEMOURS FAYETTEVILLE WORKS SITE DATE 7 JANUARY 2019.
3. APPROXIMATE EXTENT OF IMPACTED WETLANDS DELINEATED BY PARSONS (AUGUST 2020 WOTUS REPORT, CHEMOURS FAYETTEVILLE WORKS, FLOW THROUGH CELLS, SEEP C PILOT STUDY). APPROXIMATE EXTENT OF UNIMPACTED WETLANDS IN UPLAND LOCATIONS DELINEATED BY GEOSYNTEC, SEPTEMBER 2020 (WOTUS REPORT PENDING FOR SEEPS A, B, AND D PERMIT MODIFICATION).
4. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
5. MECHANICAL DETAILS NOT SHOWN FOR CLARITY.

REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
OVERALL ELECTRICAL SITE PLAN

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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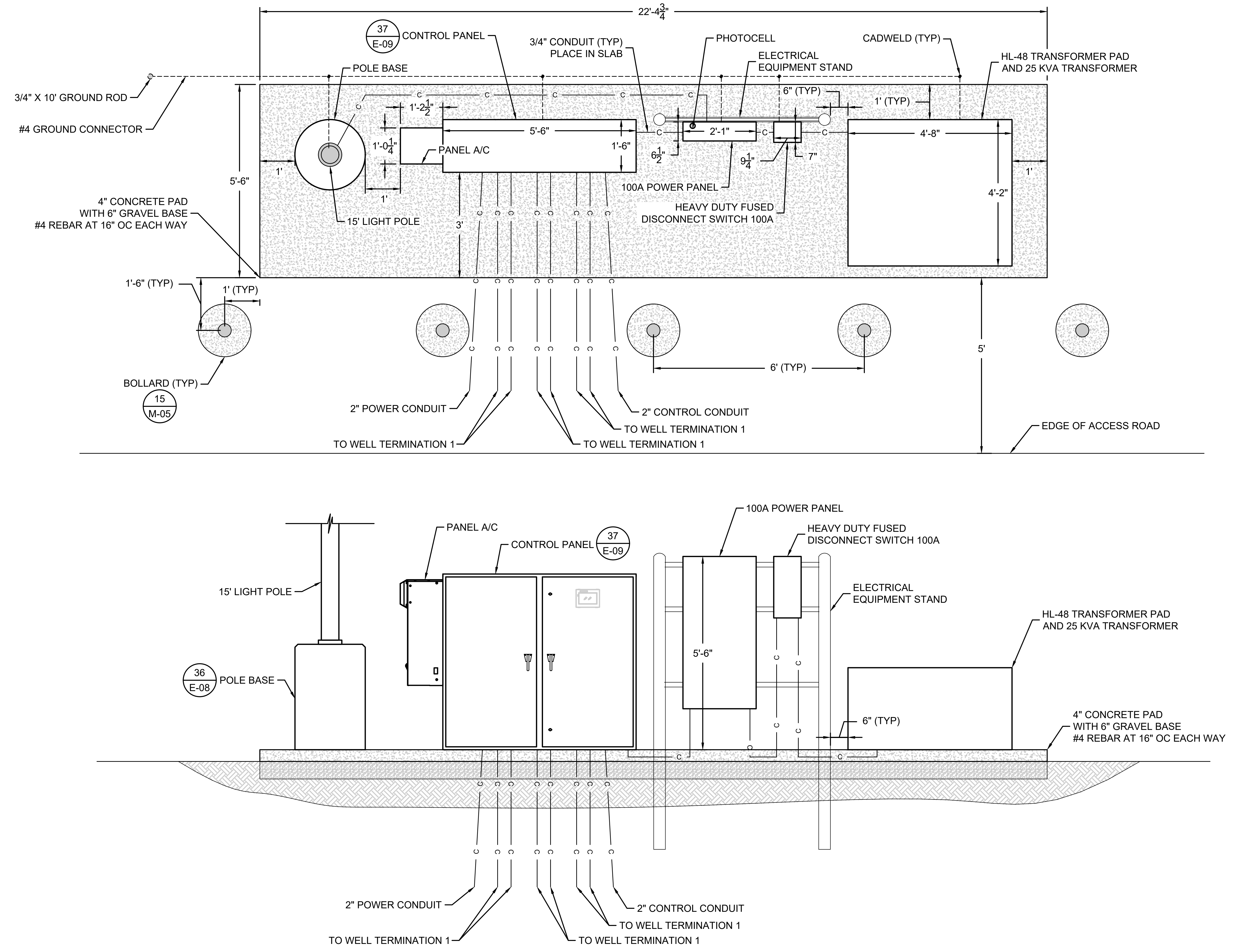
SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E01.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-01
APPROVED BY:	JJD		

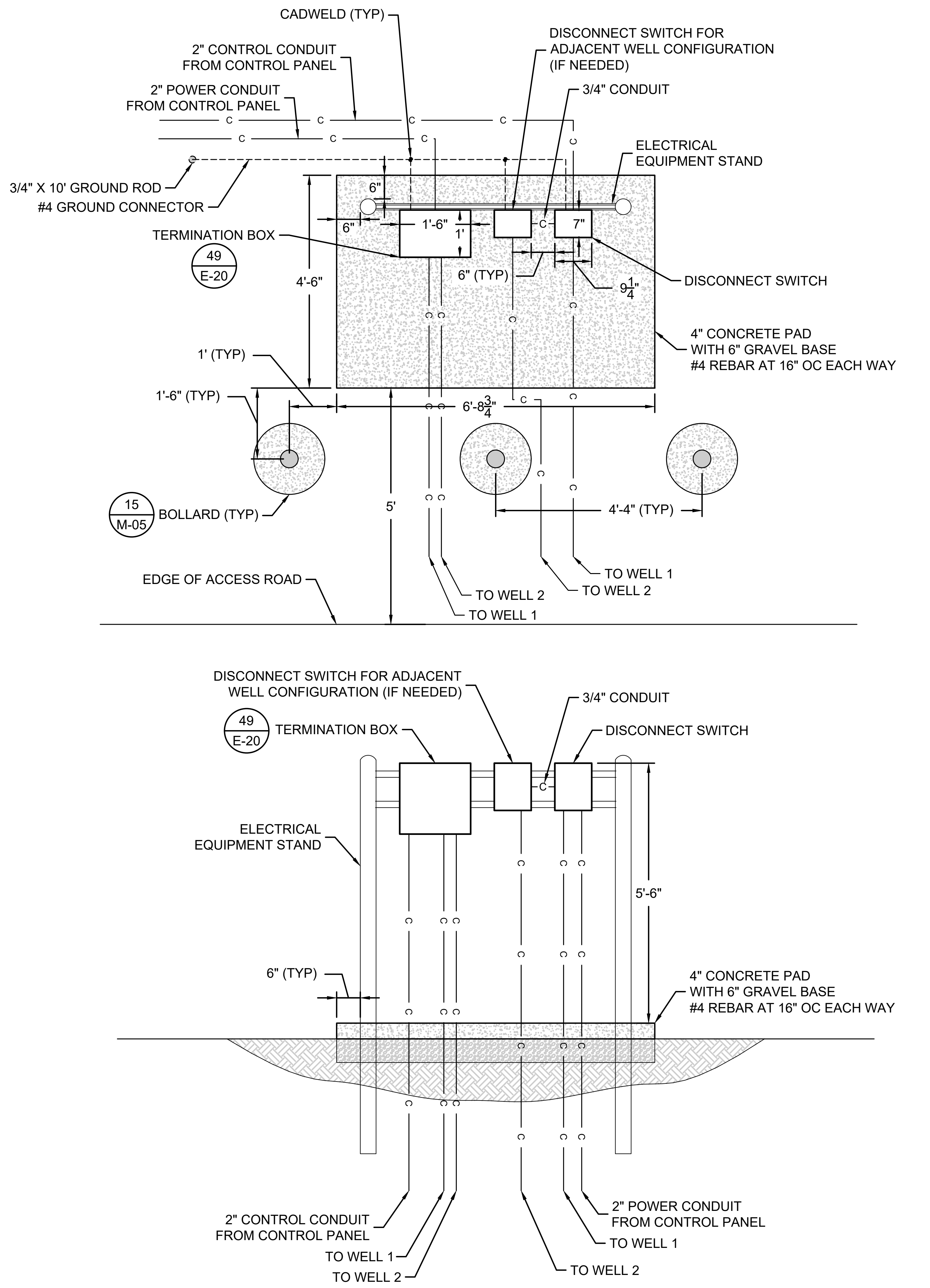
60% DESIGN - NOT FOR CONSTRUCTION



34
E-01

DETAIL
CONTROL PANEL GENERAL ARRANGEMENT

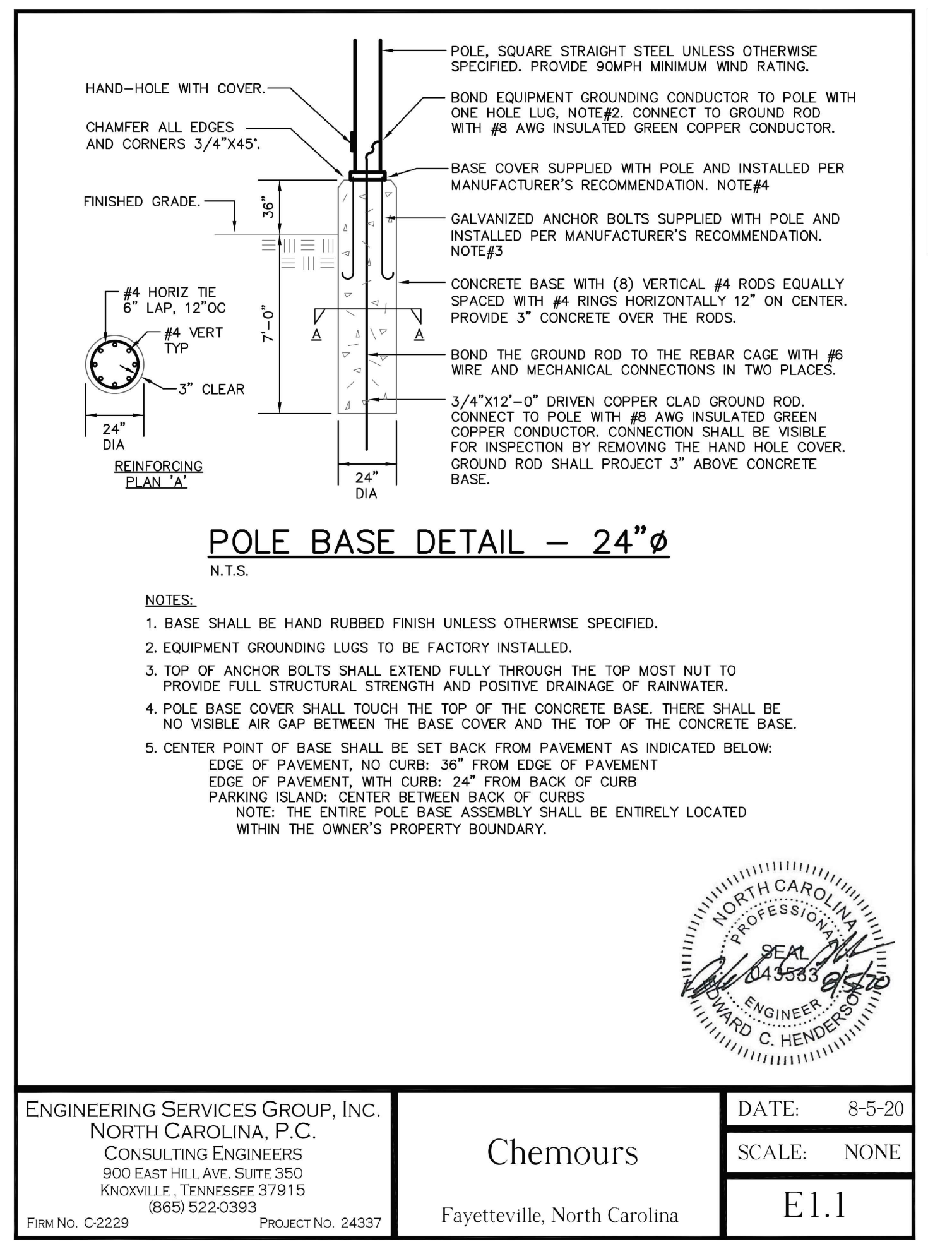
SCALE: 1" = 2'



35
E-01

DETAIL
WELL TERMINATION

SCALE: 1" = 2'



POLE BASE DETAIL – 24"Ø

N.T.S.

NOTES:

1. BASE SHALL BE HAND RUBBED FINISH UNLESS OTHERWISE SPECIFIED.
2. EQUIPMENT GROUNDING LUGS TO BE FACTORY INSTALLED.
3. TOP OF ANCHOR BOLTS SHALL EXTEND FULLY THROUGH THE TOP MOST NUT TO PROVIDE FULL STRUCTURAL STRENGTH AND POSITIVE DRAINAGE OF RAINWATER.
4. POLE BASE COVER SHALL TOUCH THE TOP OF THE CONCRETE BASE. THERE SHALL BE NO VISIBLE AIR GAP BETWEEN THE BASE COVER AND THE TOP OF THE CONCRETE BASE.
5. CENTER POINT OF BASE SHALL BE SET BACK FROM PAVEMENT AS INDICATED BELOW:
   EDGE OF PAVEMENT, NO CURB: 36" FROM EDGE OF PAVEMENT
   EDGE OF PAVEMENT, WITH CURB: 24" FROM BACK OF CURB
   PARKING ISLAND: CENTER BETWEEN BACK OF CURBS
   NOTE: THE ENTIRE POLE BASE ASSEMBLY SHALL BE ENTIRELY LOCATED WITHIN THE OWNER'S PROPERTY BOUNDARY.

SEAL 043533
EDWARD C. HENDERSON
8/5/20

ENGINEERING SERVICES GROUP, INC.
NORTH CAROLINA, P.C.
CONSULTING ENGINEERS
900 EAST HILL AVE. SUITE 350
KNOXVILLE , TENNESSEE 37915
(865) 522-0393
FIRM NO. C-2229
PROJECT NO. 24337

Chemours
Fayetteville, North Carolina

DATE: 8-5-20
SCALE: NONE
E1.1

POLE BASE DETAIL PROVIDED BY OWNER.

36
E-08

DETAIL
POLE BASE

THE CHEMOURS COMPANY
FENCE GATE AREA LIGHTING
LIGHT FIXTURE SCHEDULE

SYM	CATALOG NUMBER	QTY	FIXTURE			MOUNTING	DESCRIPTION
			WATTS	TYPE	VOLTS		
A	LIGHT UNIT HOLOPHANE MGLEDM P8 40K MVOLT AG VH GRSD PCSS PR7	1	280	LED	277	POLE	MONGOOSE LED MEDIUM, 38,000 LUMENS, 4000K CCT,AUTO-SENSING VOLTAGE (120-277), AREA w/REFRACTOR (TYPE 5), VERTICAL TENON/HORIZONTAL ARM, VITRACOAT SDCR GRAY
A POLE	ONE LIGHT PER POLE RTA3910G P2 ND GR 2	1	N/A	N/A	N/A	N/A	ROUND TAPERED ALUMINUM POLE 39FT, 10.0 X 6.0 .188 WALL, TENON – 2.38 OD X 4" LG, GRAY PAINT, ANCHOR BOLTS, BASE COVER

ELECTRICAL NOTES

1. WIRE AND CABLE REQUIREMENTS:
   1.1. ALL CONDUCTORS SHALL BE #12 AWG MINIMUM UNLESS OTHERWISE SPECIFIED.
   1.2. WIRES AND CABLES SHALL MEET APPLICABLE REQUIREMENTS OF THE 2017 NATIONAL ELECTRICAL CODE AND UL FOR THE TYPE OF INSULATION, JACKET, AND CONDUCTOR SPECIFIED OR INDICATED.
   1.3. ALL CONDUCTORS SHALL BE COPPER WITH 600 VOLT INSULATION UNLESS OTHERWISE INDICATED.
   1.4. WIRE AND CABLE SHALL BE MANUFACTURED BY BELDEN, GENERAL CABLE, ESSEX, ENCORE, ROME CABLE, SOUTHWIRE, OR APPROVED ALTERNATE.
   1.5. USE SOLID COPPER TYPE XHHW/XHHW-2 FOR BRANCH CIRCUIT WIRING #10 AWG AND SMALLER. NO CONDUCTOR FOR BRANCH CIRCUIT WIRING SHALL BE SMALLER THAN #12 AWG.
   1.6. PROVIDE COLOR CODED WIRE AND WITH A DIFFERENT COLOR FOR EACH PHASE AND NEUTRAL AND GROUND AS FOLLOWS: 208/120 VOLT CIRCUITS – PHASES A, B, AND C: BLACK, RED, AND BLUE RESPECTIVELY; NEUTRAL: WHITE; GROUND: GREEN; 4
   1.7. PROVIDE WIRE LABELS AND DESCRIPTION ON AS-BUILTS
2. CONDUIT REQUIREMENTS:
   2.1. ALL CONDUITS SHALL BE 1 INCH MINIMUM.
   2.2. ALL CONDUITS SHALL BE SCHEDULE 80 PVC.
   2.3. USE PROPER SIZED TOOLS FOR BENDING. DO NOT HEAT METAL CONDUIT. DENTS AND FLAT SPOTS WILL BE REJECTED. CUT AND THREAD CONDUIT SO ENDS WILL BUTT IN COUPLINGS. MAKE THREADS NO LONGER THAN NECESSARY AND REAM PIPE FREE OF BURRS.
   2.4. PROVIDE BUSHINGS ON THE OPEN ENDS OF CONDUIT CONTAINING CONDUCTORS. INSULATED BUSHINGS SHALL BE PROVIDED FOR CONDUITS CONTAINING CONDUCTORS #4 AWG OR LARGER WITH AN INSULATING RING AN INTEGRAL PART OF THE BUSHING.
   2.5. LEAVE ONE #10 AWG OR EQUIVALENT NYLON PULL WIRE IN EMPTY CONDUITS.
   2.6. JUNCTION BOXES
      2.6.1. PULL AND JUNCTION BOXES SHALL NOT BE LOCATED BELOW 100 YEAR FLOOD ELEVATION.
      2.6.2. PULL AND JUNCTION BOXES SHALL BE SIZED IN ACCORDANCE WITH THE 2017 NATIONAL ELECTRICAL CODE ACCORDING TO NUMBER OF CONDUCTORS IN BOX OR TYPE OF SERVICE TO BE PROVIDED. MINIMUM SIZE IS 4-11/16" SQUARE AND 2-1/2" DEEP.
      2.6.3. PULL BOXES SHALL BE PROVIDED WHERE NECESSARY IN THE CONDUIT SYSTEM TO FACILITATE CONDUCTOR INSTALLATION. CONDUIT RUNS LONGER THAN 100 FEET OR WITH BENDS EXCEEDING 270 DEGREES SHALL HAVE A PULL BOX INSTALLED AT A CONVENIENT INTERMEDIATE LOCATION.
      2.6.4. INSTALL IN LOCATIONS AS SHOWN ON DRAWINGS AND AS REQUIRED FOR SPLICES, TAPS, WIRE PULLING, EQUIPMENT CONNECTIONS, AND COMPLIANCE WITH REGULATORY REQUIREMENTS.
      2.6.5. INSTALL PULL AND JUNCTION BOXES IN ACCESSIBLE AREAS ONLY.
      2.6.6. INSTALL KNOCKOUT CLOSURES IN UNUSED BOX OPENINGS.
3. ALL WORK SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE NATIONAL ELECTRIC CODE, NFPA 70. SHOULD THE PLANS AND CODES CONFLICT, THE CODE TAKES PRECEDENCE. MAKE NO CHANGES EVEN IN THE CASE OF CONFLICT WITHOUT FIRST OBTAINING APPROVAL OF THE ENGINEER.
4. MATERIAL SHALL BE LISTED AND LABELED BY UNDERWRITER'S LABORATORIES, INC. OR OTHER RECOGNIZED TEST FACILITY. EQUIPMENT SHALL BE IDENTIFIED FOR USE.
5. INSTALL SPECIFIED EQUIPMENT AS NOTED ON THE DRAWINGS OR APPROVED ALTERNATE.

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
ELECTRICAL DETAILS I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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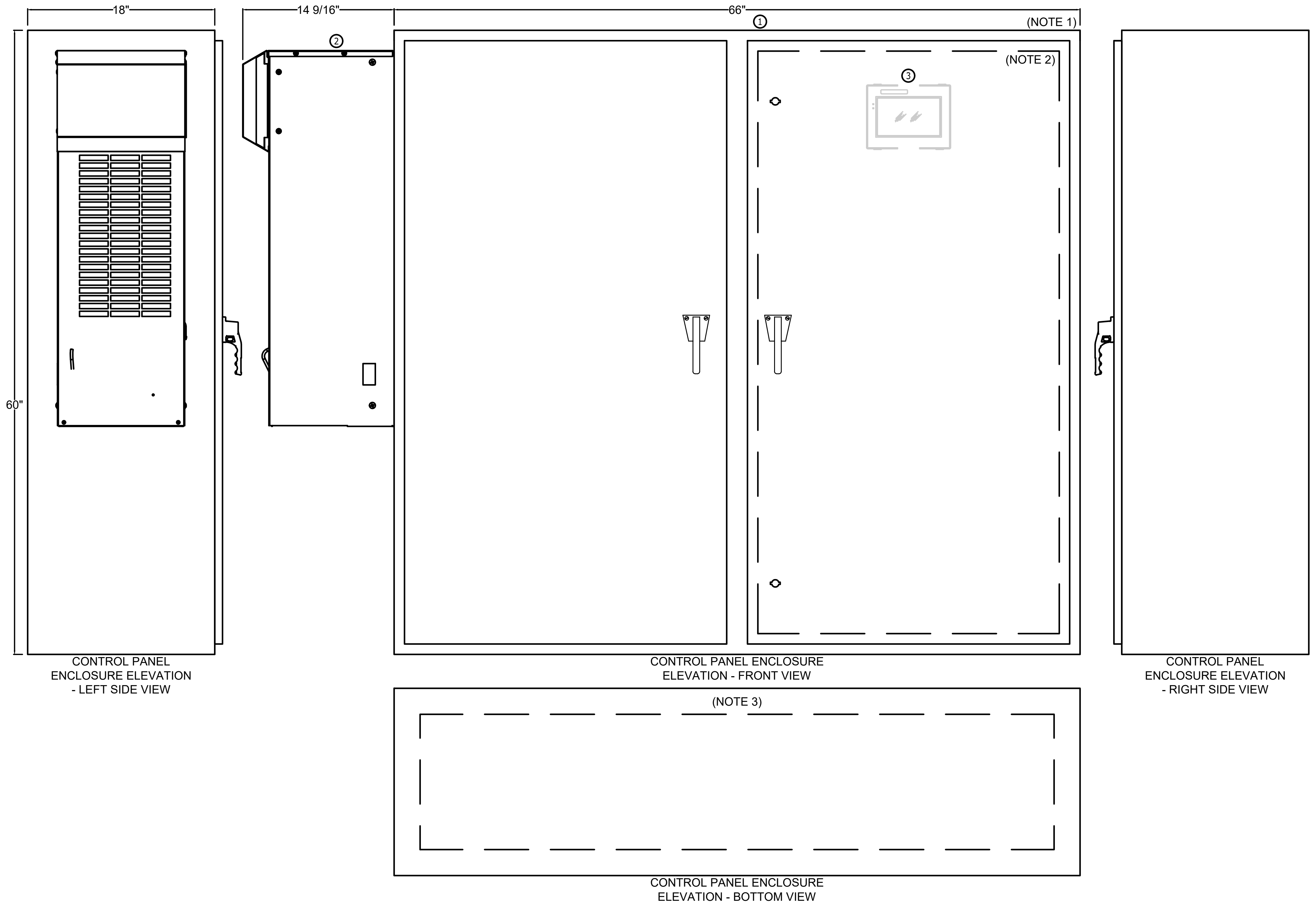
SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E08.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-08
APPROVED BY:	JJD		

60% DESIGN - NOT FOR CONSTRUCTION



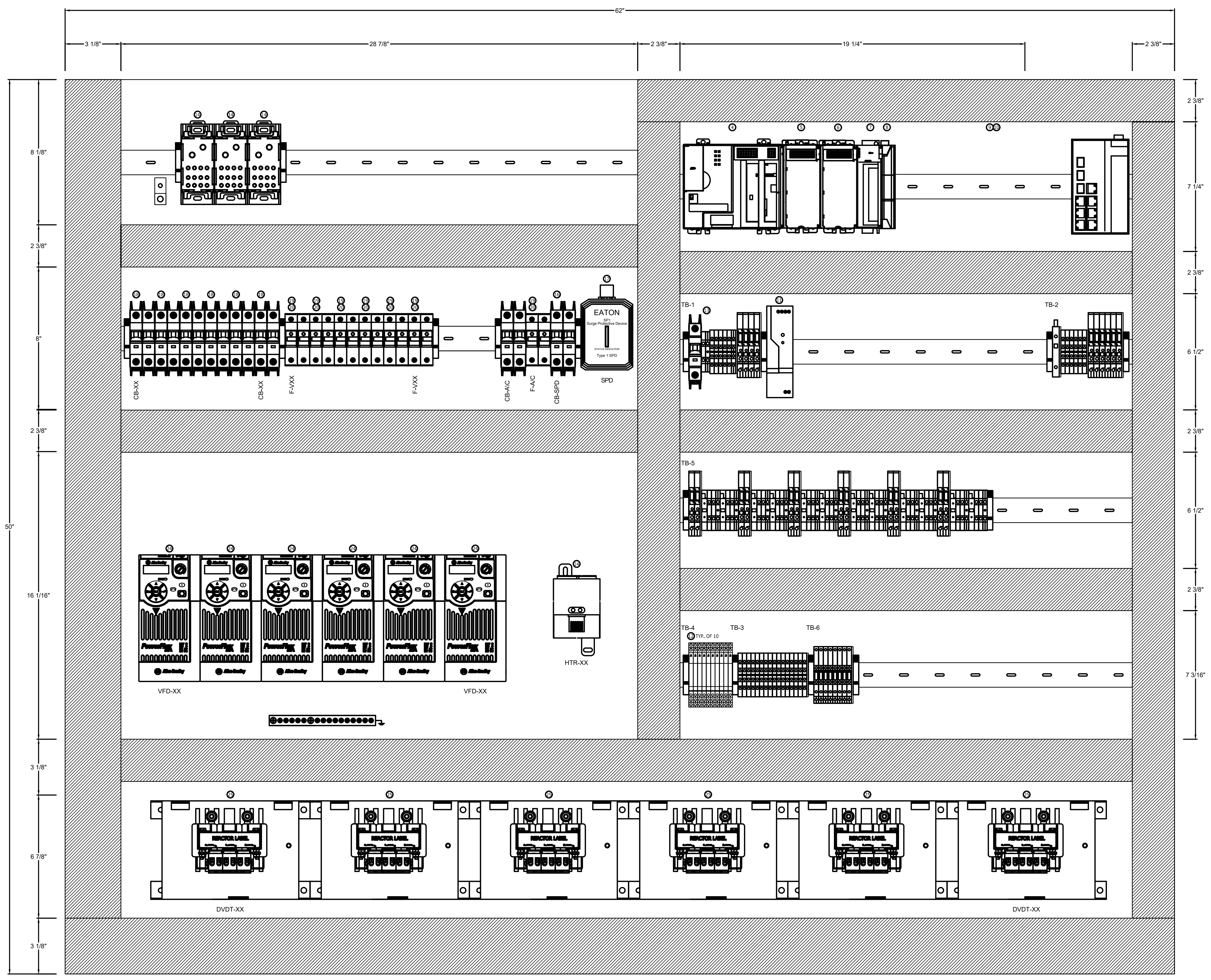
CONTROL PANEL ENCLOSURE ELEVATION - LEFT SIDE VIEW

CONTROL PANEL ENCLOSURE ELEVATION - FRONT VIEW

CONTROL PANEL ENCLOSURE ELEVATION - RIGHT SIDE VIEW

CONTROL PANEL ENCLOSURE ELEVATION - BOTTOM VIEW

37 E-09 DETAIL
ELECTRICAL CONTROL PANEL ENCLOSURE
SCALE: NTS



38 E-09 DETAIL
ELECTRICAL CONTROL PANEL BACKPLATE
SCALE: NTS

BILL OF MATERIALS				
ITEM #	QTY	PART NO.	MANUFACTURER	DESCRIPTION
1	1	FS486018N4X	GAYLORD MANUFACTURING	FREE STANDING ENCLOSURE, 48"(H) x 60" (W) x 18"(D), NEMA 4X, 304SST
2	1	13383441158	PFANNENBERG	ENCLOSURE AIR CONDITIONER, DTS3181 SL, NEMA 4X, 4,100 BTU/h, 230VAC, 50/60 Hz,
3	1	EA9-T7CL-R	AUTOMATION DIRECT	HMI, 7" COLOR TFT LCD, 800x400 PIXEL, WVGA, LED
4	1	1769-L24ER-QB1B	ALLEN-BRADLEY	PLC, COMPACTLOGIX, 5370 L2 CONTROLLER, 24VDC INPUT PWR, 16 DC INPUTS, 16 DC OUTPUTS
5	1	1769-IF16C	ALLEN-BRADLEY	16-CH ANALOG CURRENT INPUT MODULE
6	1	1769-IF8	ALLEN-BRADLEY	8-CH ANALOG CURRENT INPUT MODULE
7	1	1769-OF8C	ALLEN-BRADLEY	8-CH ANALOG CURRENT OUTPUT MODULE
8	1	1769-ECR	ALLEN-BRADLEY	END CAP RIGHT
9	1	EDS-510A-3SFP	MOXA	FIBER/ETHERNET SWITCH, (7) 10/100BASE T(X) PORTS, (3) 100/1000BASE SFP, MANAGED, 24VDC
10	3	SFP-1GLXLC	MOXA	SFP MODULE W/ (1) 1000 BASE LX PORT WITH LC CONNECTOR FOR 10 km TRANSMISSION
11	1	2904376	PHOENIX CONTACT	24VDC POWER SUPPLY, 6.25A OUTPUT, 120VAC INPUT
12	10	38.51.7.024.0050	FINDER	RELAY, 38 SERIES, SPDT, 24VDC COIL, 6.3A
13	1	FAZ-C15-1-NA-SP	EATON	CIRCUIT BREAKER, 1-POLE, 15A, TRIP CURVE C, UL489
14	1	032029-01	STEGO	ENCLOSURE HEATER, 1,000W, 100-120VAC
15	3	EPDB512	EDISON	DISTRIBUTION BLOCK, 1-POLE, 570A, LINE SIDE: (2) 300MCM TO 4AWG, LOAD SIDE: (12) 4AWG TO 14AWG
16	1	FAZ-C15-2-NA	EATON	CIRCUIT BREAKER, 2-POLE, 15A, TRIP CURVE C, UL489
17	1	SP1-480D	EATON	SURGE PROTECTIVE DEVICE, 480VAC DELTA, 50kA SURGE CURRENT CAPACITY
18	6	FAZ-D30-2-NA	EATON	CIRCUIT BREAKER, 2-POLE, 30A, TRIP CURVE D, UL489
19	6	EHCC2DU	EDISON	FUSE HOLDER, CLASS CC FUSES, 30A, 600V, 2-POLE
20	12	TBD	TBD	CC FUSE
21	-	25A-A2P5N104	ALLEN-BRADLEY	POWERFLEX 523 AC DRIVE, 240VAC, 1-PHASE, 2.5A, 0.5HP, FRAME A, IP20
22	-	25A-A4P8N104	ALLEN-BRADLEY	POWERFLEX 523 AC DRIVE, 240VAC, 1-PHASE, 4.8A, 1HP, FRAME A, IP20
23	-	25A-A8P0N104	ALLEN-BRADLEY	POWERFLEX 523 AC DRIVE, 240VAC, 1-PHASE, 8A, 2HP, FRAME B, IP20
24	6	25A-A011N104	ALLEN-BRADLEY	POWERFLEX 523 AC DRIVE, 240VAC, 1-PHASE, 11A, 3HP, FRAME B, IP20
25	6	V1K8A00EX	TCI	DV/DT FILTER, 12A, 3-PHASE, OPEN

NOTES:

1. FREE-STANDING ENCLOSURE, 304SST.
2. ENCLOSURE TO HAVE INTERNAL DEADFRONT WITH HMI.
3. ENCLOSURE TO HAVE CUTOUT ON BOTTOM OF ENCLOSURE.
4. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.

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A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
ELECTRICAL DETAILS II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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SIGNATURE

DATE

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DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E09.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-09
APPROVED BY:	JJD		

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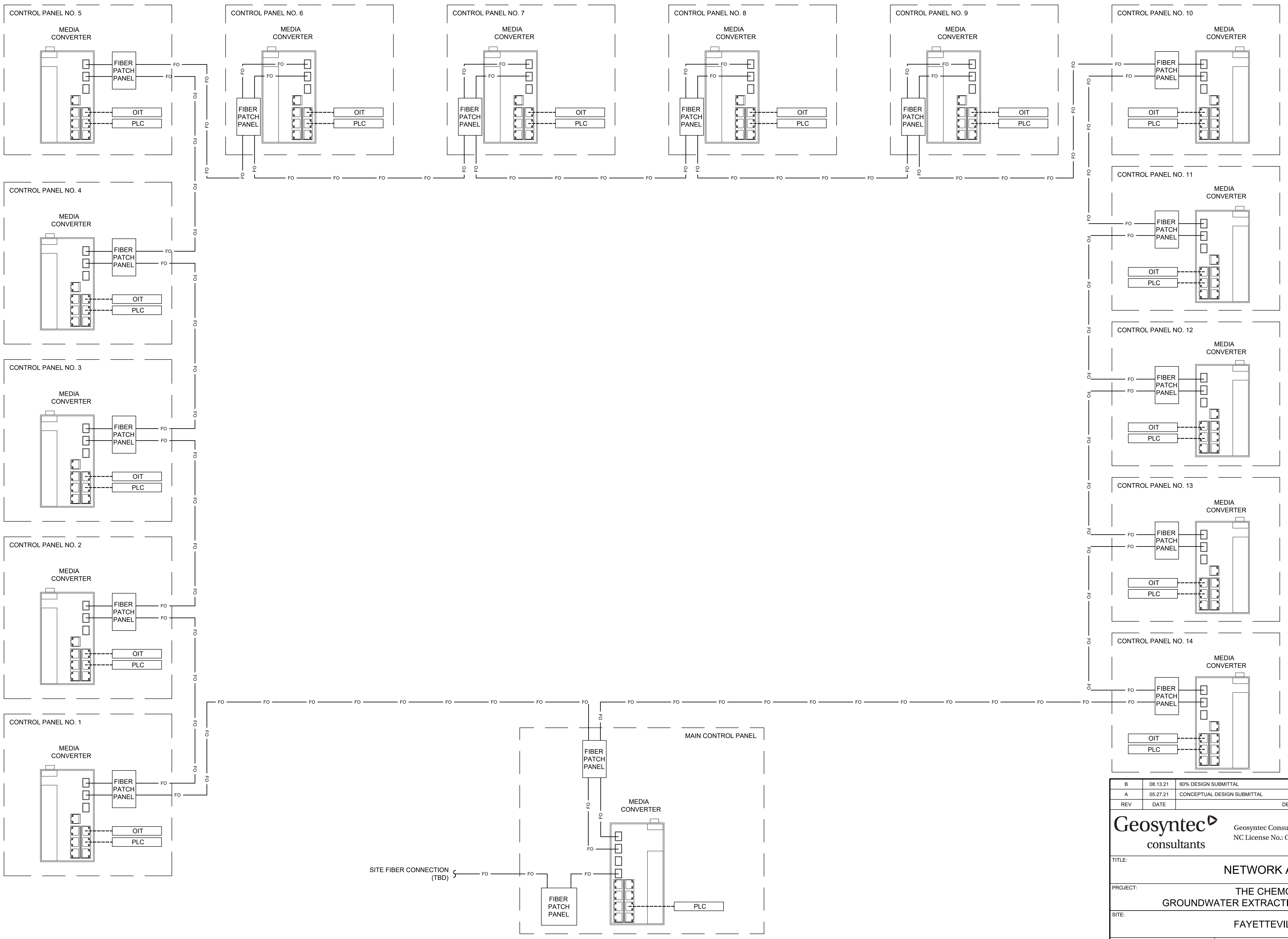

LEGEND

- - - - - - - - CAT6 ETHERNET CABLE
—— FO —— FIBER

NOTES:

1. FIBER SPECIFICATIONS ARE TO BE DETERMINED.
2. MANAGED MEDIA CONVERTERS INSIDE OF MAIN CONTROL PANEL TO BE DETERMINED IN FUTURE SUBMITTALS.
3. SFPS TO BE DETERMINED IN FUTURE SUBMITTALS.
4. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.

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B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec
consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
NETWORK ARCHITECTURE

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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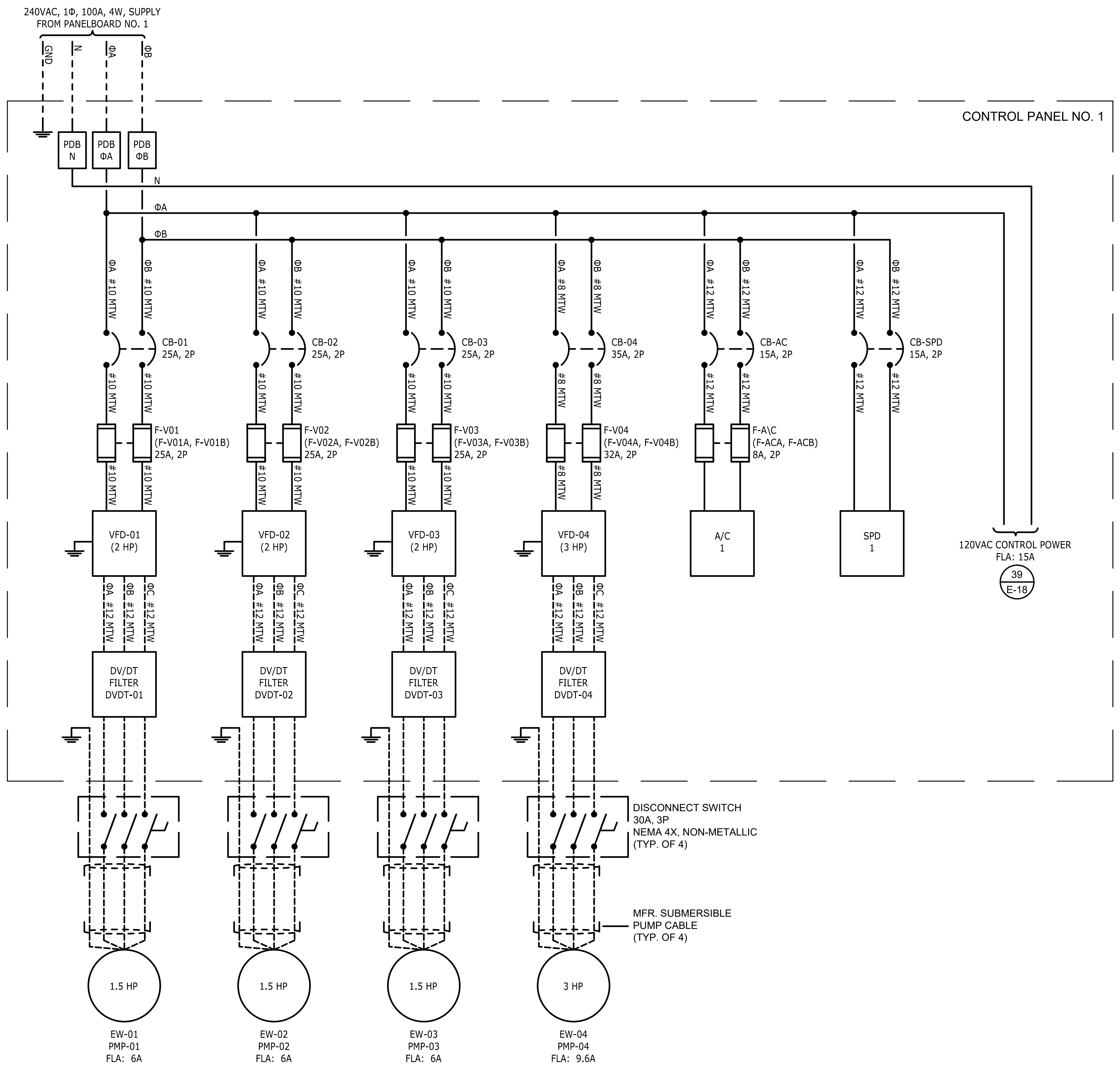

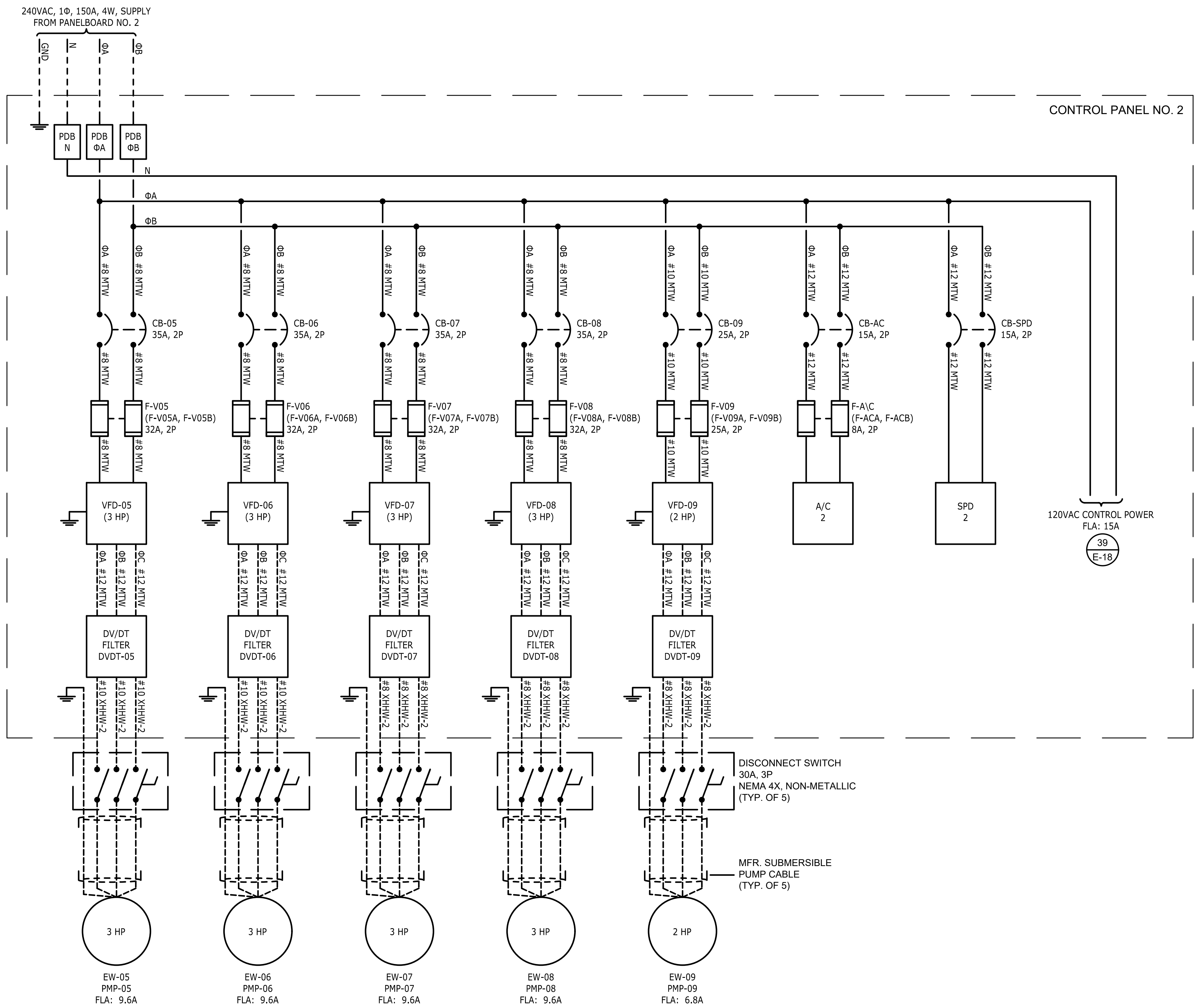

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 1

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-01 VFD (2 HP)	14.4A	14.4A
PUMP PMP-02 VFD (2 HP)	14.4A	14.4A
PUMP PMP-03 VFD (2 HP)	14.4A	14.4A
PUMP PMP-04 VFD (3 HP)	22.9 A	22.9 A
AIR CONDITIONER AC-1	4.5A	4.5A
CONTROLS	15A	--
CONTROL PANEL NO. 1 FLA PER PHASE:	85.6A	70.6 A
125% OF LARGEST MOTOR: 1.25 x 22.9 = 28.6A 28.6 - 22.9 = 5.7A		5.7A
CONTROL PANEL NO. 1 FLA:		91.3A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 2

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-05 VFD (3 HP)	22.9A	22.9A
PUMP PMP-06 VFD (3 HP)	22.9A	22.9A
PUMP PMP-07 VFD (3 HP)	22.9A	22.9A
PUMP PMP-08 VFD (3 HP)	22.9A	22.9A
PUMP PMP-09 VFD (2 HP)	18A	18A
AIR CONDITIONER AC-2	4.5A	4.5A
CONTROLS	15A	--
CONTROL PANEL NO. 2 FLA PER PHASE:	129.1A	114.1A
125% OF LARGEST MOTOR: 1.25 x 22.9 = 28.6A 28.6 - 22.9 = 5.7A		5.7A
CONTROL PANEL NO. 2 FLA:		134.8A

NOTES:

1. DESIGN PROVIDED HEREIN IS SUBJECT TO CHANGE IN FUTURE SUBMITTALS.
2. CONTROL PANELS HAVE BEEN DESIGNED TO ACCOMMODATE UP TO 6 EXTRACTION WELLS. EACH PANEL SHALL HAVE 1-2 SPARES TO ACCOMMODATE FUTURE EXPANSION IF NECESSARY. FINAL ELECTRICAL COMPONENT SIZING WILL BE COMPLETED ONCE THE PUMP MODEL SELECTIONS ARE CONFIRMED.

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A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
SINGLE LINE DIAGRAM I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E11.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-11
APPROVED BY:	JJD		

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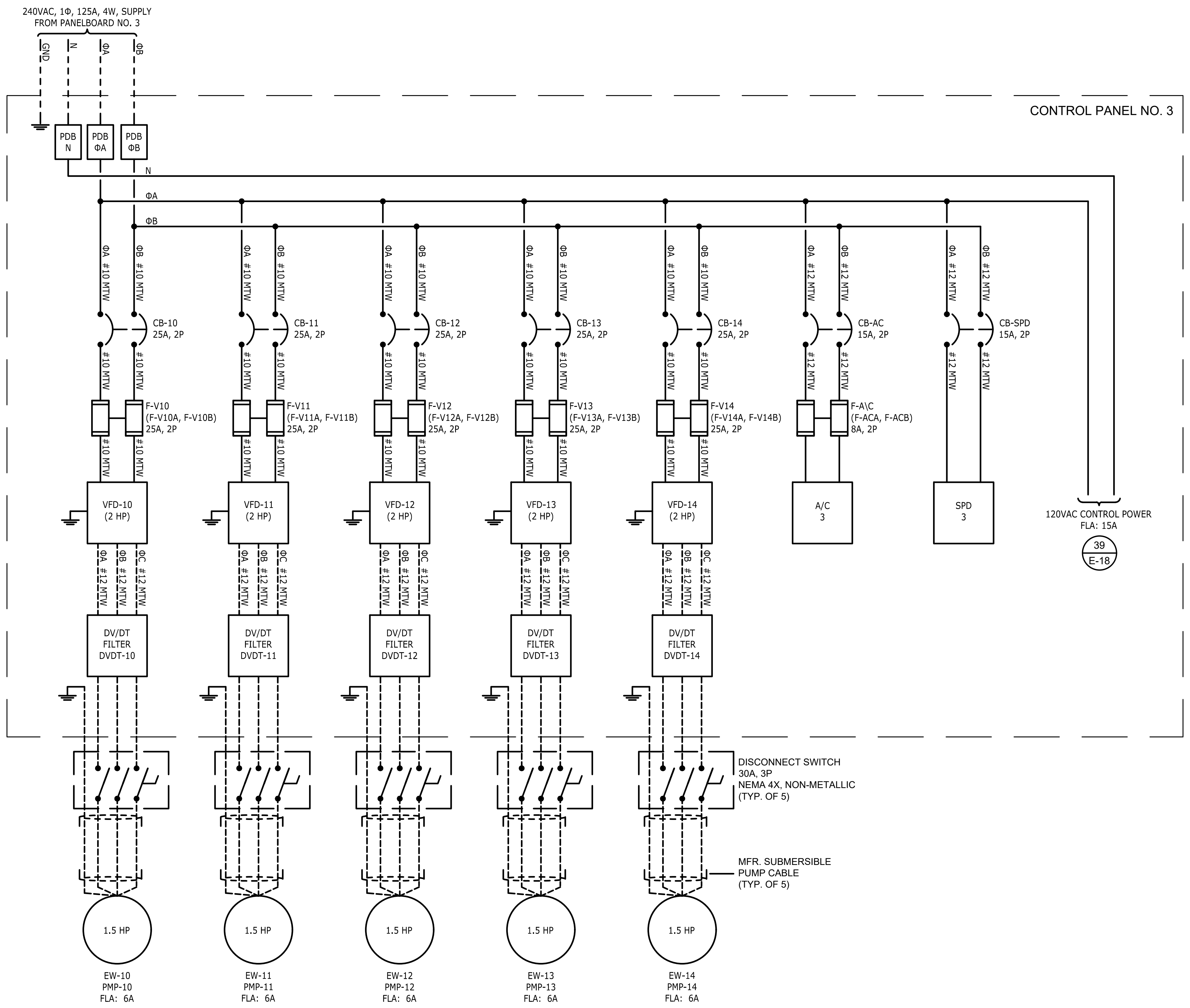

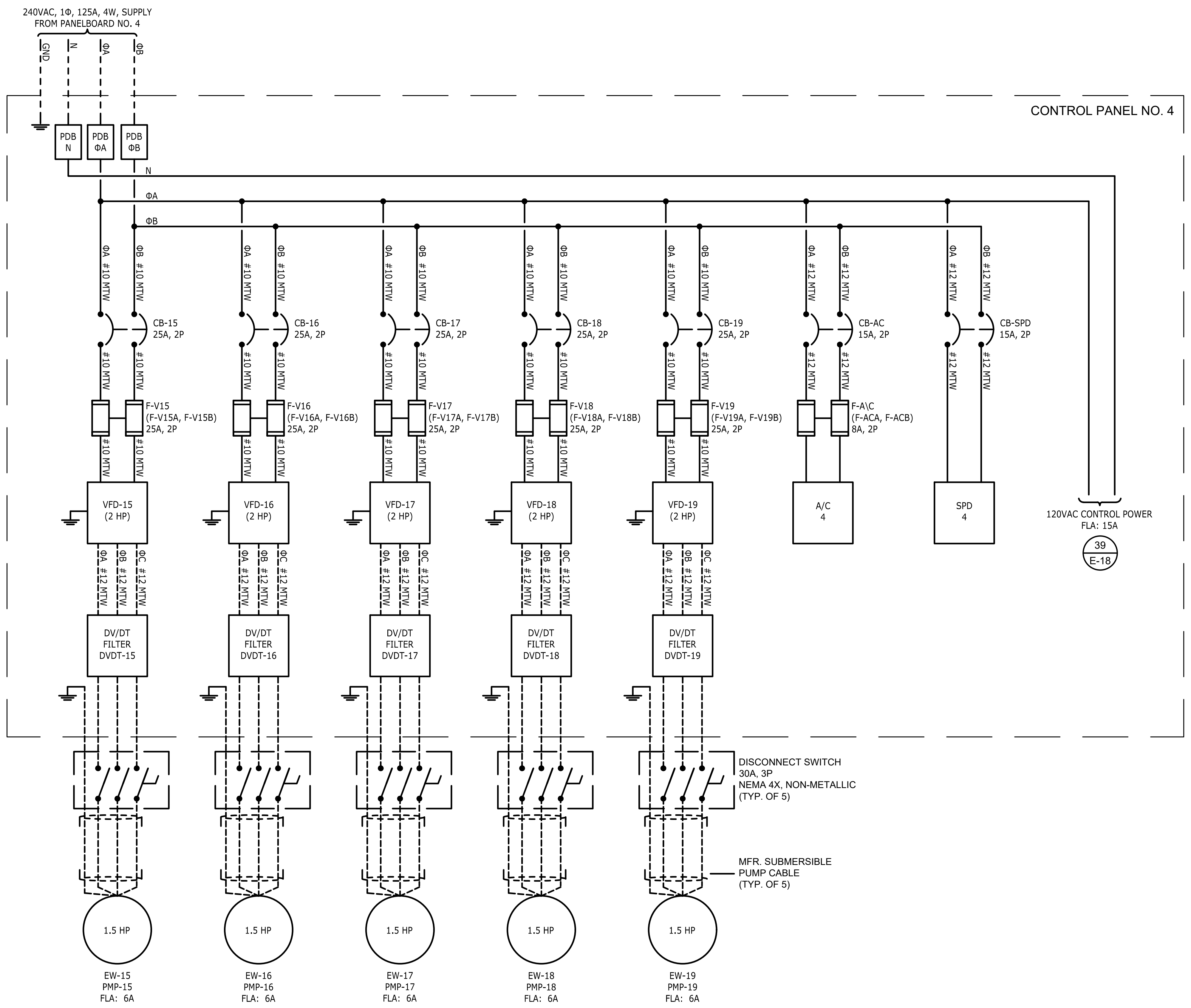

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 3

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-10 VFD (2 HP)	14.4A	14.4A
PUMP PMP-11 VFD (2 HP)	14.4A	14.4A
PUMP PMP-12 VFD (2 HP)	14.4A	14.4A
PUMP PMP-13 VFD (2 HP)	14.4A	14.4A
PUMP PMP-14 VFD (2 HP)	14.4A	14.4A
AIR CONDITIONER AC-3	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 3 FLA PER PHASE:	91.5A	76.5A
125% OF LARGEST MOTOR: 1.25 x 14.4 = 18A 18 - 14.4 = 3.6A		3.6A
CONTROL PANEL NO. 3 FLA:		95.1A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 4

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-15 VFD (2 HP)	14.4A	14.4A
PUMP PMP-16 VFD (2 HP)	14.4A	14.4A
PUMP PMP-17 VFD (2 HP)	14.4A	14.4A
PUMP PMP-18 VFD (2 HP)	14.4A	14.4A
PUMP PMP-19 VFD (2 HP)	14.4A	14.4A
AIR CONDITIONER AC-4	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 4 FLA PER PHASE:	91.5A	76.5A
125% OF LARGEST MOTOR: 1.25 x 14.4 = 18A 18 - 14.4 = 3.6A		3.6A
CONTROL PANEL NO. 4 FLA:		95.1A

NOTES:

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REV	DATE	DESCRIPTION	DRN	APP
B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
SINGLE LINE DIAGRAM II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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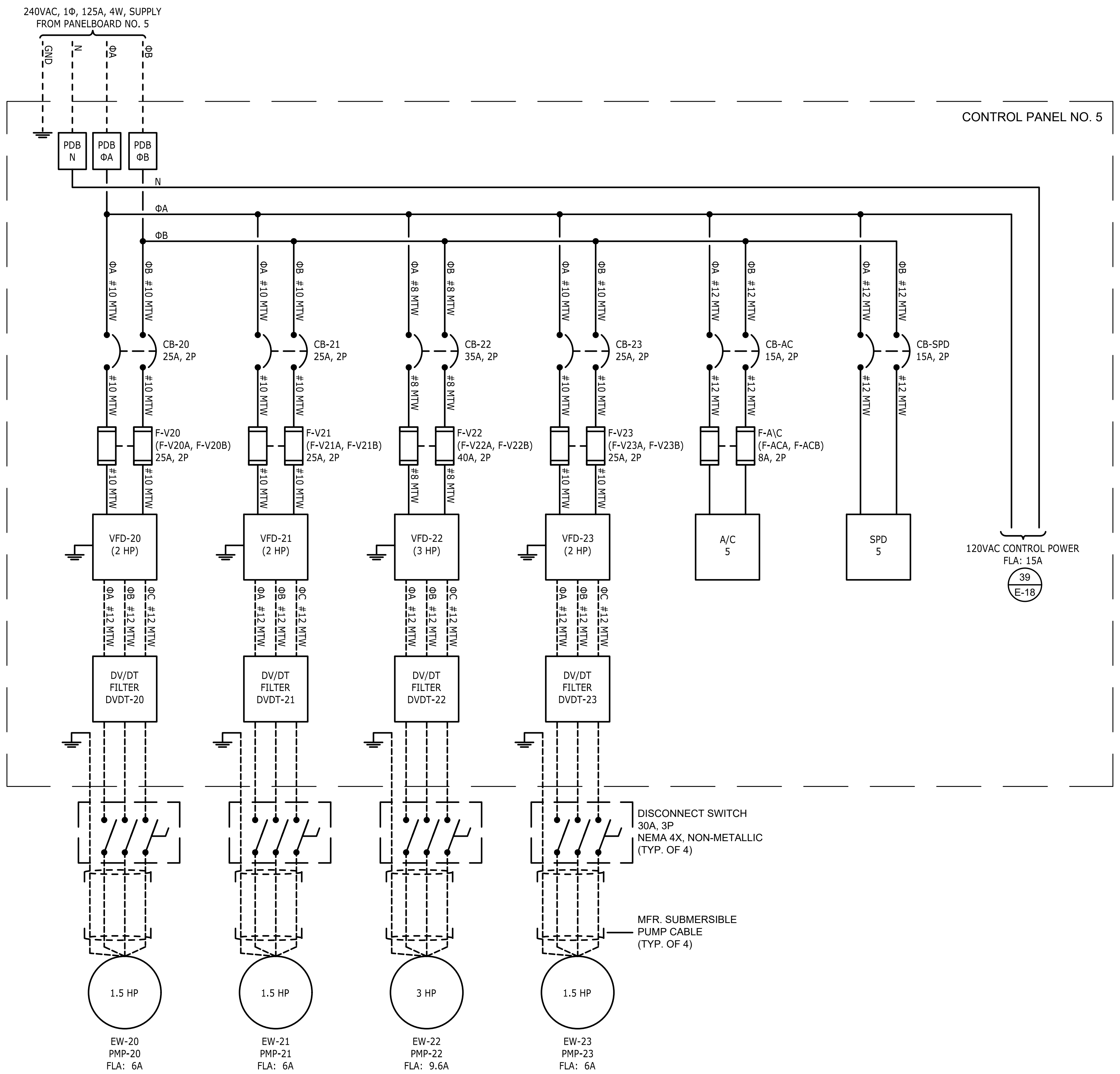

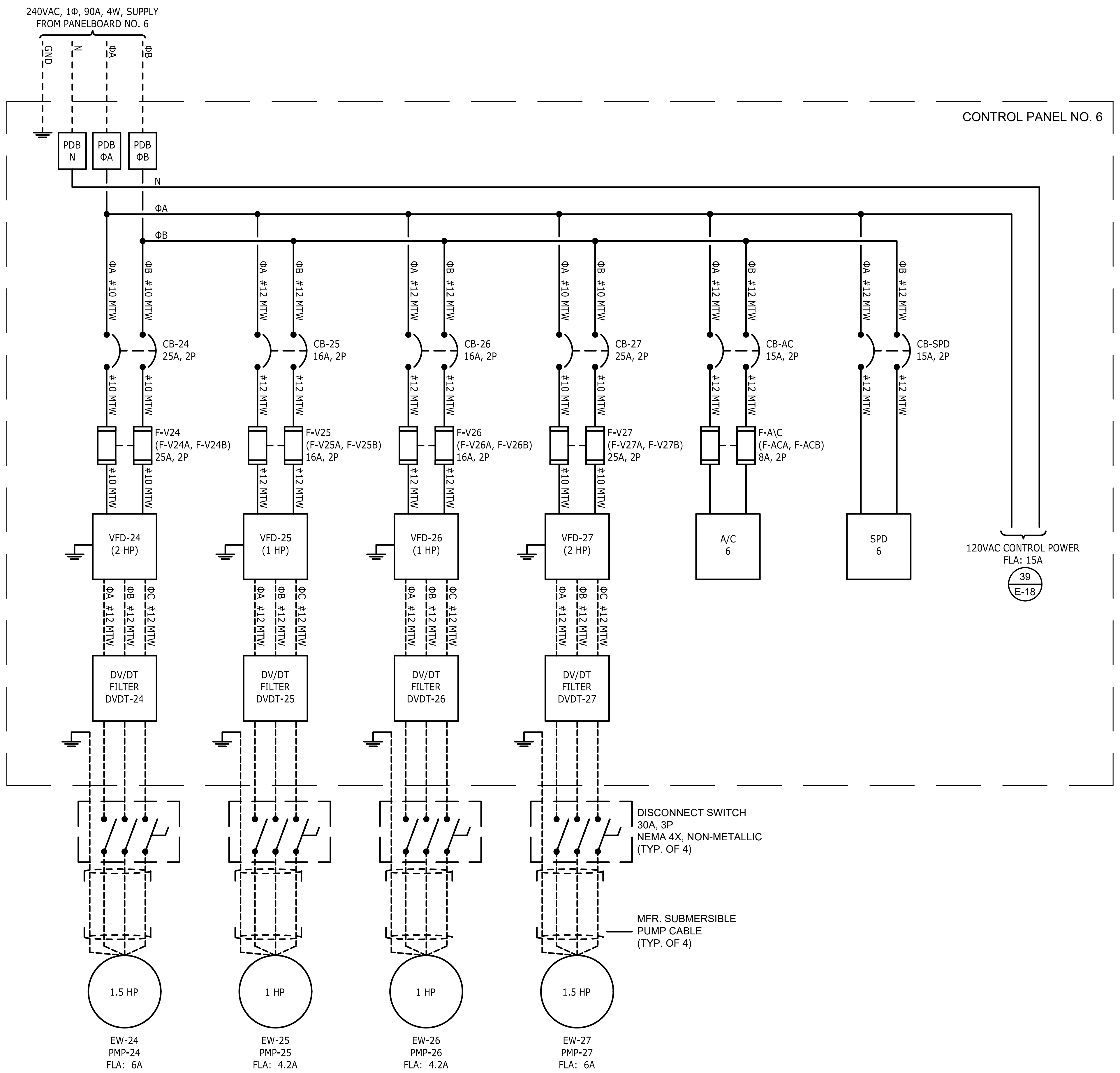

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 5

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-20 VFD (2 HP)	14.4A	14.4A
PUMP PMP-21 VFD (2 HP)	14.4A	14.4A
PUMP PMP-22 VFD (3 HP)	22.9A	22.9A
PUMP PMP-23 VFD (2 HP)	14.4A	14.4A
AIR CONDITIONER AC-5	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 5 FLA PER PHASE:	85.6A	70.6A
125% OF LARGEST MOTOR: 1.25 x 22.9 = 28.6A 28.6 - 22.9 = 5.7A		5.7A
CONTROL PANEL NO. 5 FLA:		91.3A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 6

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-24 VFD (2 HP)	14.4A	14.4A
PUMP PMP-25 VFD (1 HP)	10.7A	10.7A
PUMP PMP-26 VFD (1 HP)	10.7A	10.7A
PUMP PMP-27 VFD (2 HP)	14.4A	14.4A
AIR CONDITIONER AC-6	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 6 FLA PER PHASE:	69.7A	54.7A
125% OF LARGEST MOTOR: 1.25 x 14.4 = 18A 18 - 14.4 = 3.6A		3.6A
CONTROL PANEL NO. 6 FLA:		73.3A

NOTES:

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RALEIGH, NC 27607
919.870.0576

TITLE:
SINGLE LINE DIAGRAM III

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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REVIEWED BY:	SV	DRAWING NO.:	E-13
APPROVED BY:	JJD		

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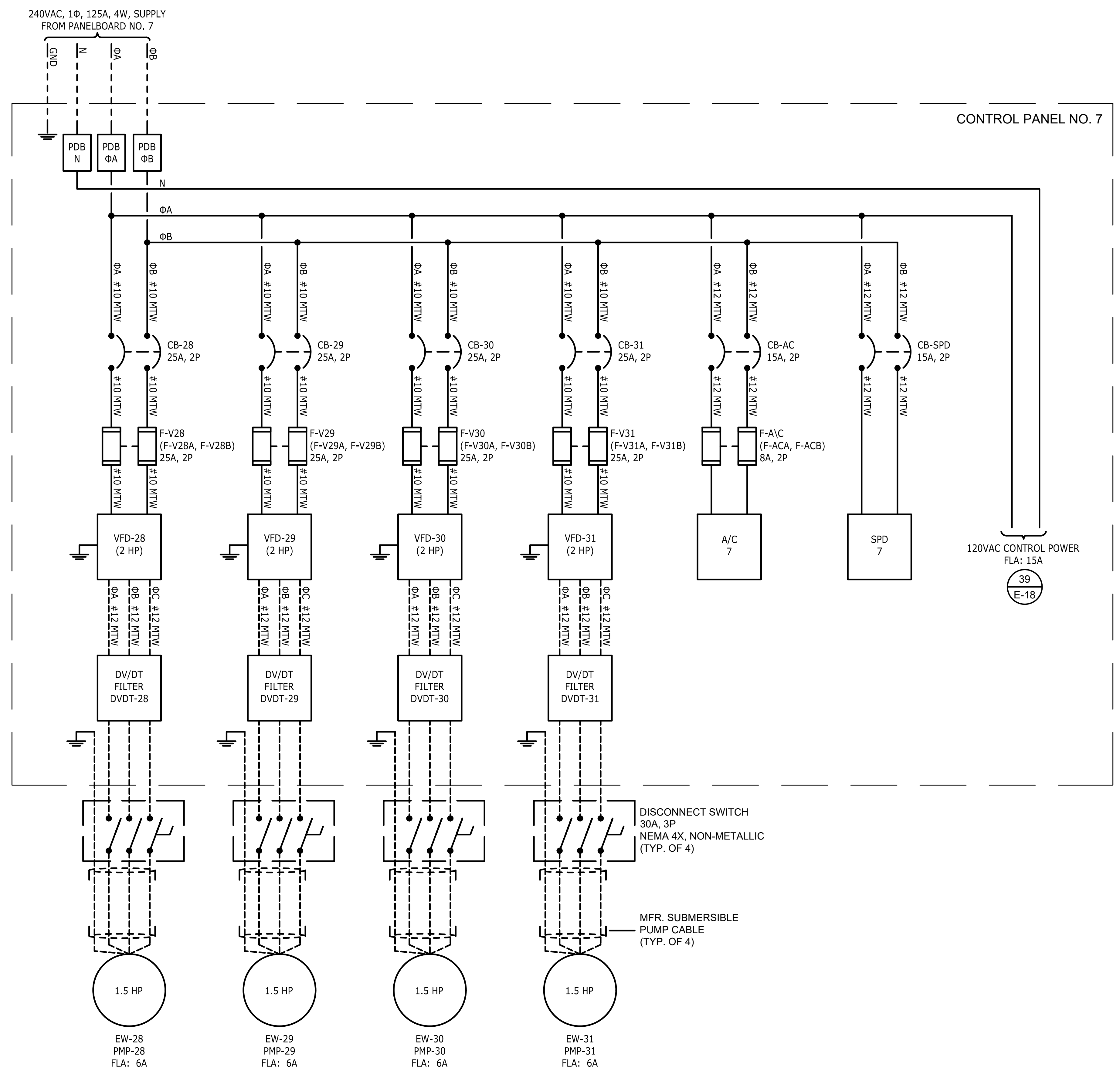

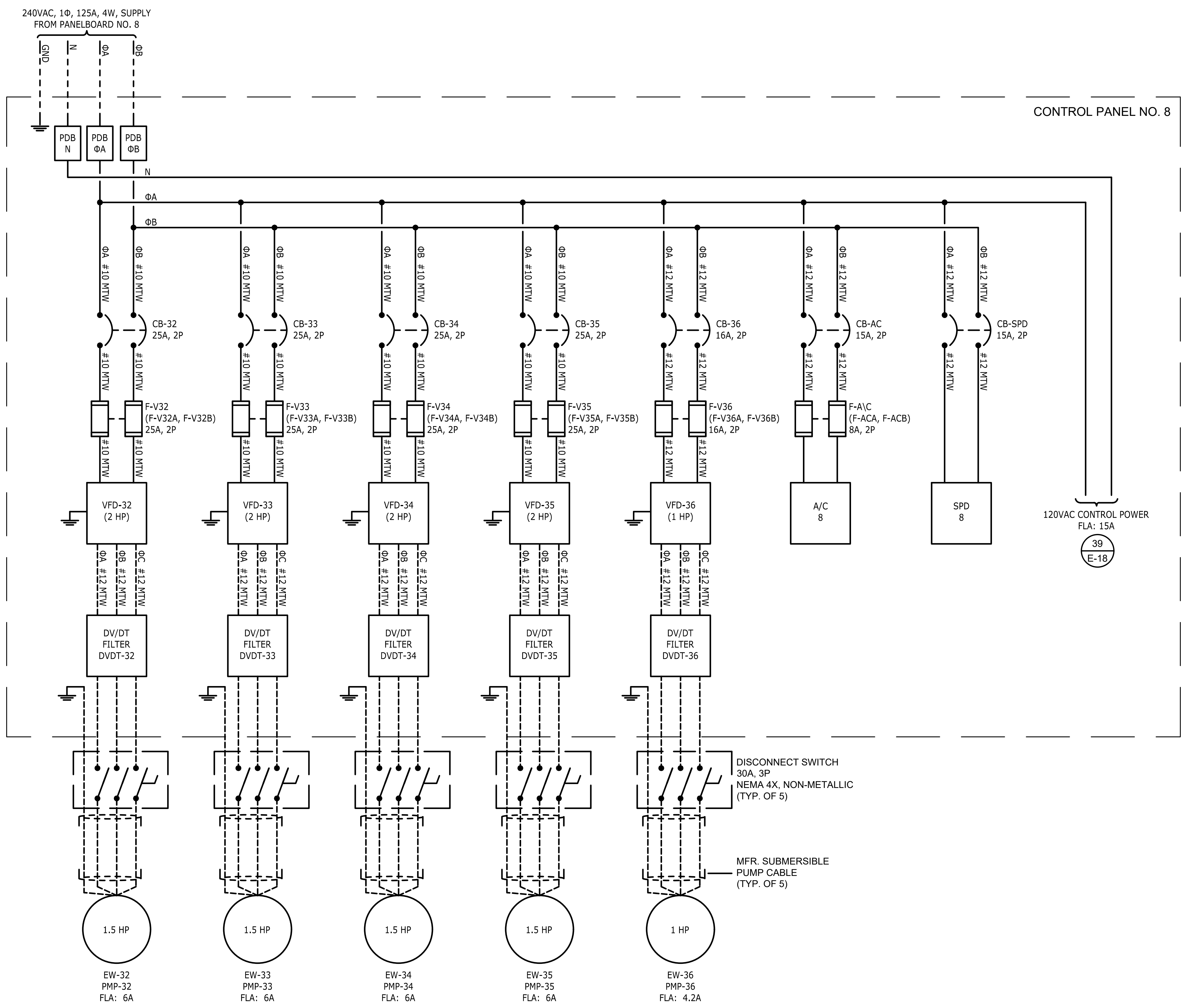

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 7

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-28 VFD (2 HP)	14.4A	14.4A
PUMP PMP-29 VFD (2 HP)	14.4A	14.4A
PUMP PMP-30 VFD (2 HP)	14.4A	14.4A
PUMP PMP-31 VFD (2 HP)	14.4A	14.4A
AIR CONDITIONER AC-7	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 7 FLA PER PHASE:	77.1A	62.1A
125% OF LARGEST MOTOR: 1.25 x 14.4 = 18A 18 - 14.4 = 3.6A		3.6A
CONTROL PANEL NO. 7 FLA:		80.7A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 8

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-32 VFD (2 HP)	14.4A	14.4A
PUMP PMP-33 VFD (2 HP)	14.4A	14.4A
PUMP PMP-34 VFD (2 HP)	14.4A	14.4A
PUMP PMP-35 VFD (2 HP)	14.4A	14.4A
PUMP PMP-36 VFD (1 HP)	10.7A	10.7A
AIR CONDITIONER AC-8	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 8 FLA PER PHASE:	87.8A	72.8A
125% OF LARGEST MOTOR: 1.25 x 14.4A = 18A 18 - 14.4A = 3.6A		3.6A
CONTROL PANEL NO. 8 FLA:		91.4A

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ATRIUM AT BLUE RIDGE
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RALEIGH, NC 27607
919.870.0576

TITLE:
SINGLE LINE DIAGRAM IV

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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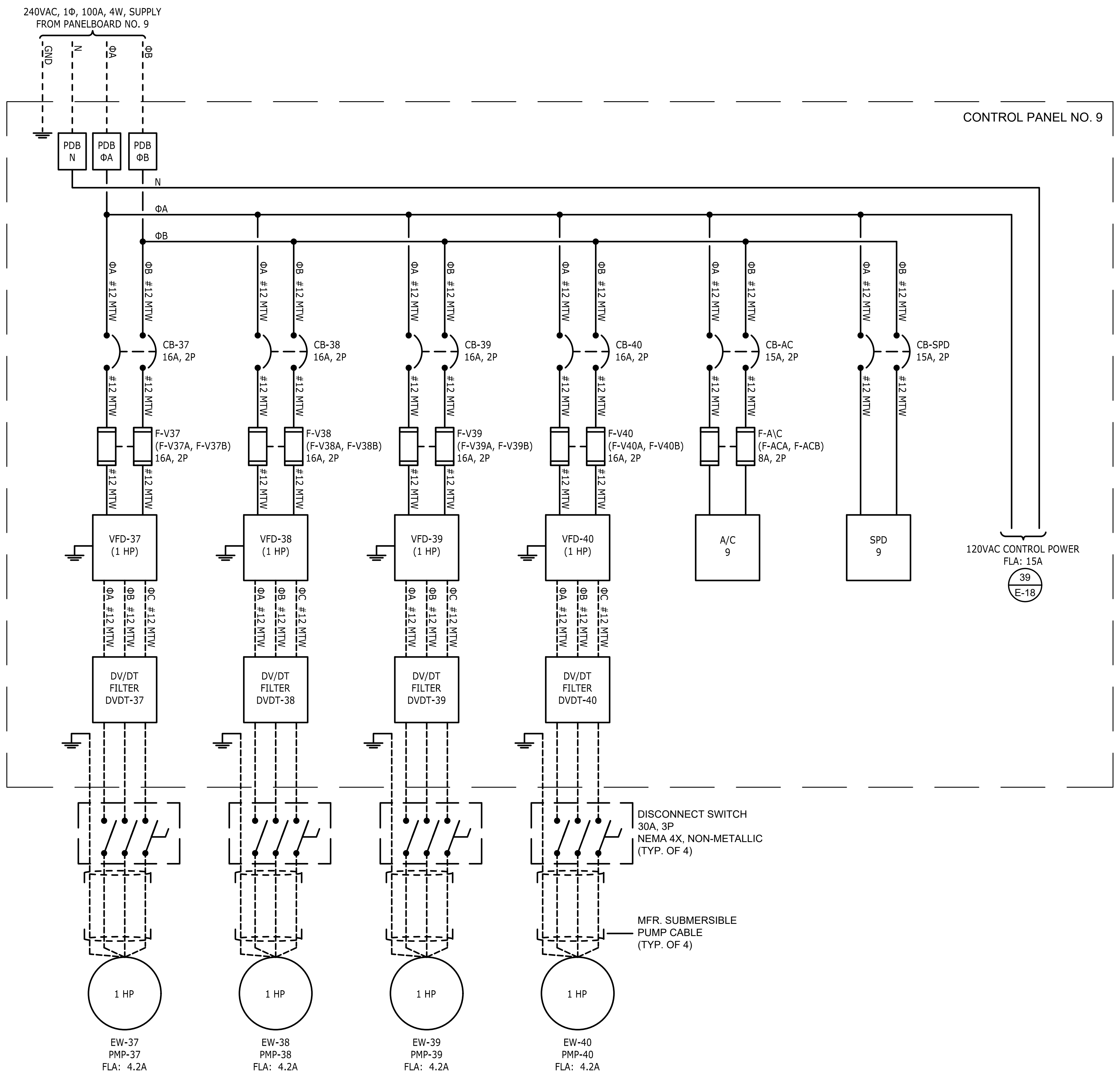

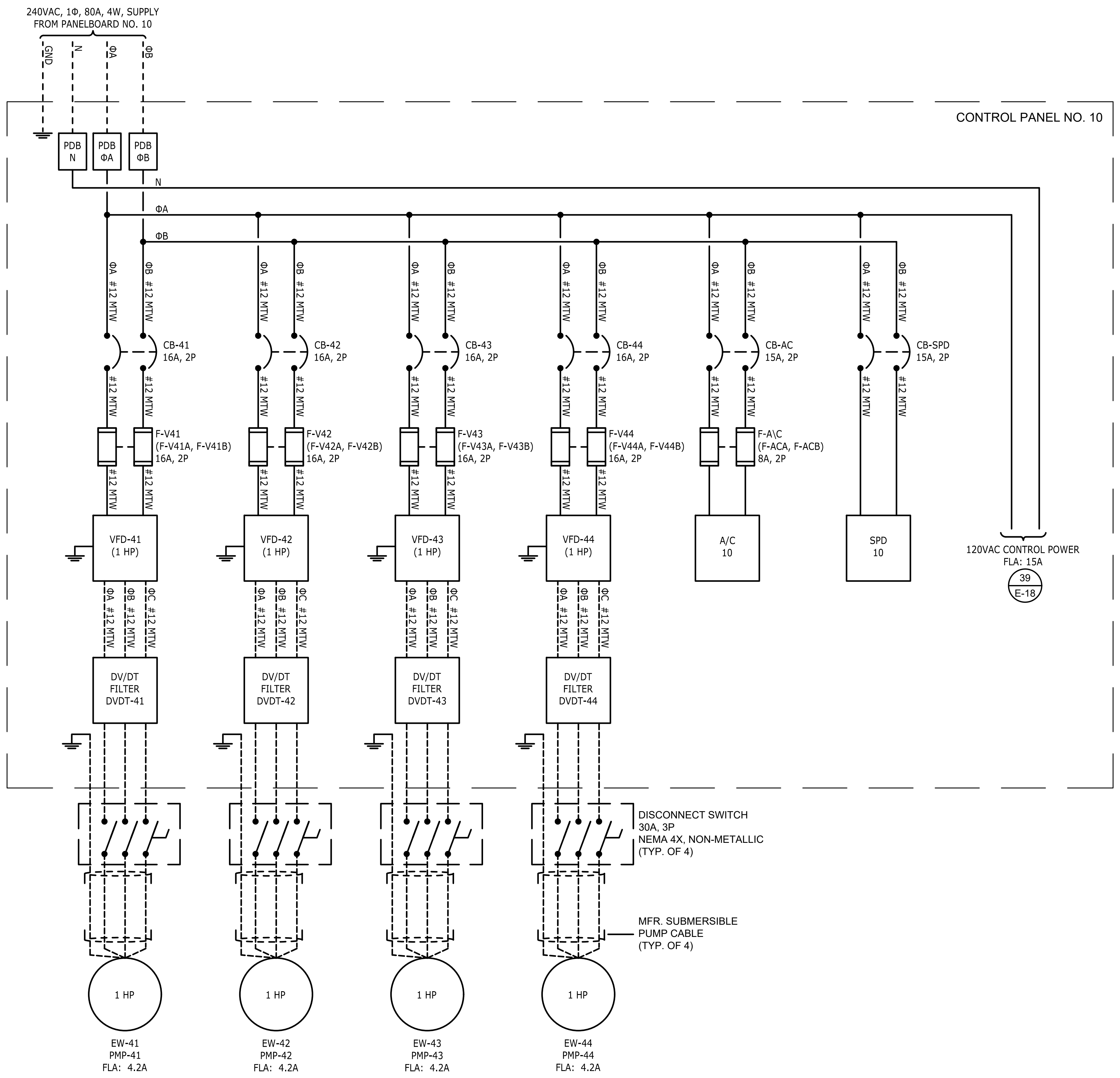

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 9

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-37 VFD (1 HP)	10.7A	10.7A
PUMP PMP-38 VFD (1 HP)	10.7A	10.7A
PUMP PMP-39 VFD (1 HP)	10.7A	10.7A
PUMP PMP-40 VFD (1 HP)	10.7A	10.7A
AIR CONDITIONER AC-9	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 9 FLA PER PHASE:	62.3A	47.3A
125% OF LARGEST MOTOR: 1.25 x 10.7 = 13.4A 13.4 - 10.7 = 2.7A		2.7A
CONTROL PANEL NO. 9 FLA:		65A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 10

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-41 VFD (1 HP)	10.7A	10.7A
PUMP PMP-42 VFD (1 HP)	10.7A	10.7A
PUMP PMP-43 VFD (1 HP)	10.7A	10.7A
PUMP PMP-44 VFD (1 HP)	10.7A	10.7A
AIR CONDITIONER AC-10	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 10 FLA PER PHASE:	62.3A	47.3A
125% OF LARGEST MOTOR: 1.25 x 10.7 = 13.4A 13.4 - 10.7 = 2.7A		2.7A
CONTROL PANEL NO. 10 FLA:		65A

NOTES:

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919.870.0576

TITLE:
SINGLE LINE DIAGRAM V

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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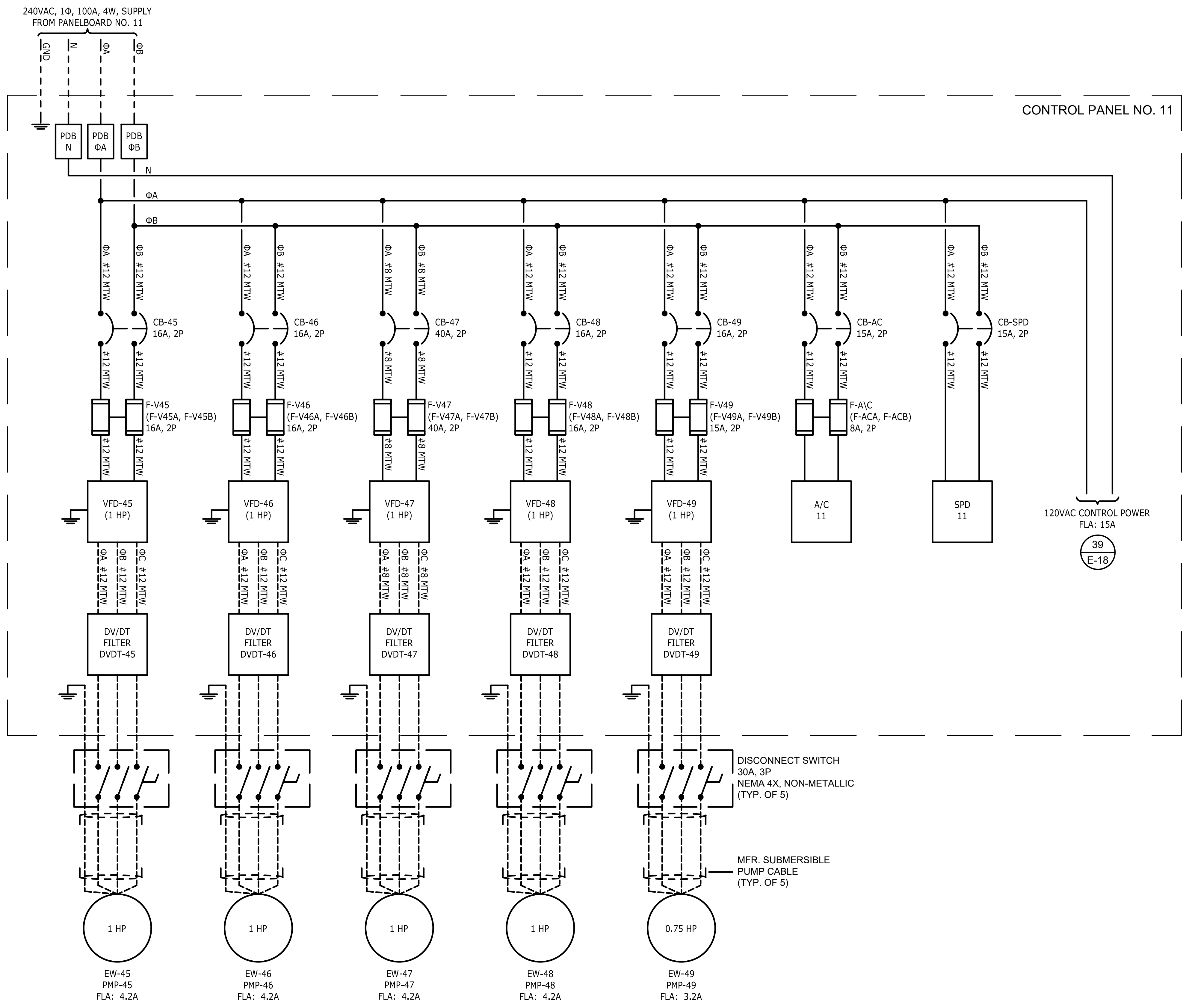

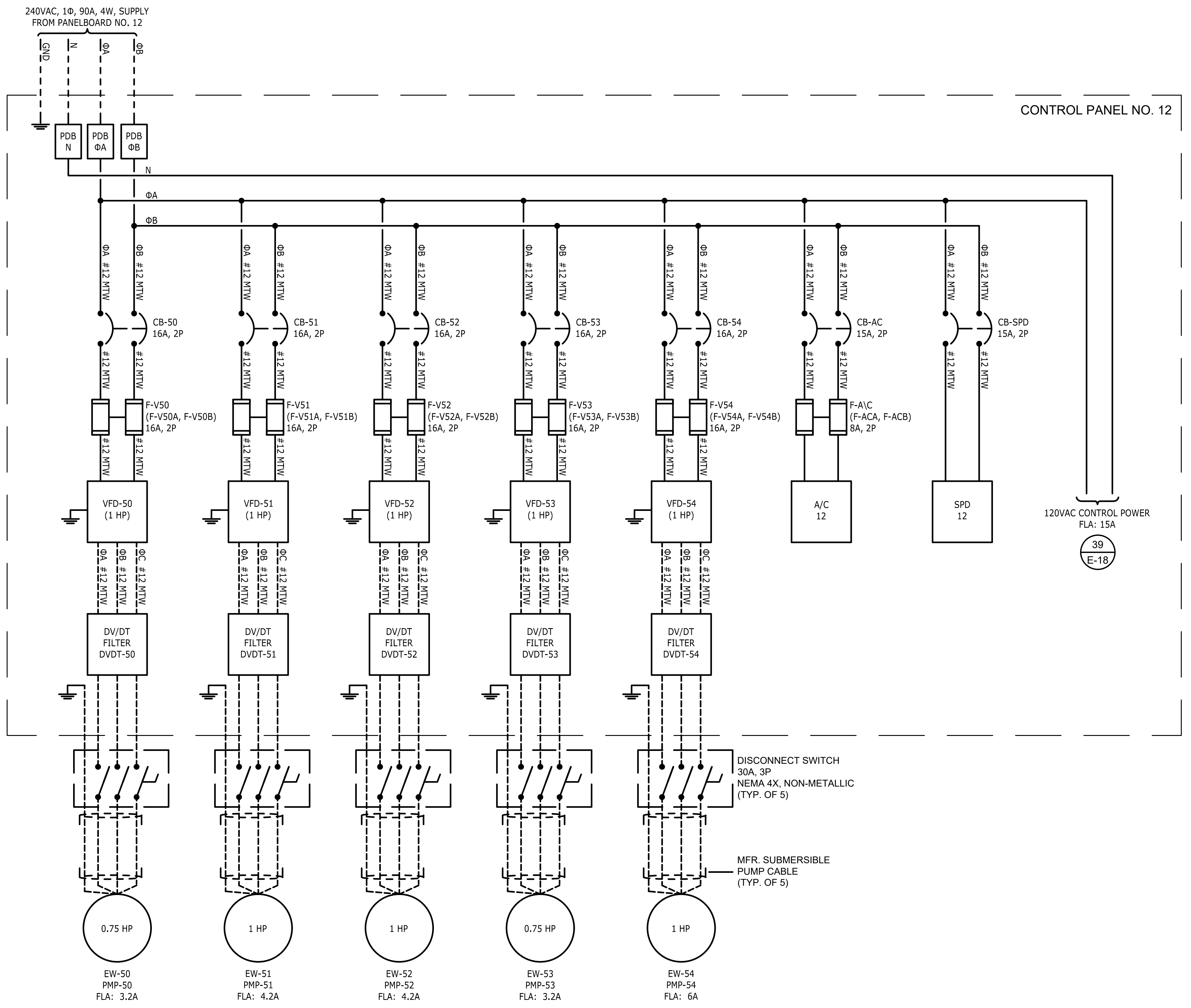

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 11

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-45 VFD (1 HP)	10.7A	10.7A
PUMP PMP-46 VFD (1 HP)	10.7A	10.7A
PUMP PMP-47 VFD (1 HP)	10.7A	10.7A
PUMP PMP-48 VFD (1 HP)	10.7A	10.7A
PUMP PMP-49 VFD (1 HP)	8.6A	8.6A
AIR CONDITIONER AC-11	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 11 FLA PER PHASE:	70.9A	55.9A
125% OF LARGEST MOTOR: 1.25 x 10.7 = 13.4A 13.4 - 10.7 = 2.7A		2.7A
CONTROL PANEL NO. 11 FLA:		73.6A

240VAC, 1Ø LOAD CALCULATIONS CONTROL PANEL NO. 12

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-50 VFD (1 HP)	8.6A	8.6A
PUMP PMP-51 VFD (1 HP)	10.7A	10.7A
PUMP PMP-52 VFD (1 HP)	10.7A	10.7A
PUMP PMP-53 VFD (1 HP)	8.6A	8.6A
PUMP PMP-54 VFD (1 HP)	10.7A	10.7A
AIR CONDITIONER AC-12	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 12 FLA PER PHASE:	68.8A	53.8A
125% OF LARGEST MOTOR: 1.25 x 10.7 = 13.4A 13.4 - 10.7 = 2.7A		2.7A
CONTROL PANEL NO. 12 FLA:		71.5A

NOTES:

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ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
SINGLE LINE DIAGRAM VI

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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APPROVED BY:	JJD		

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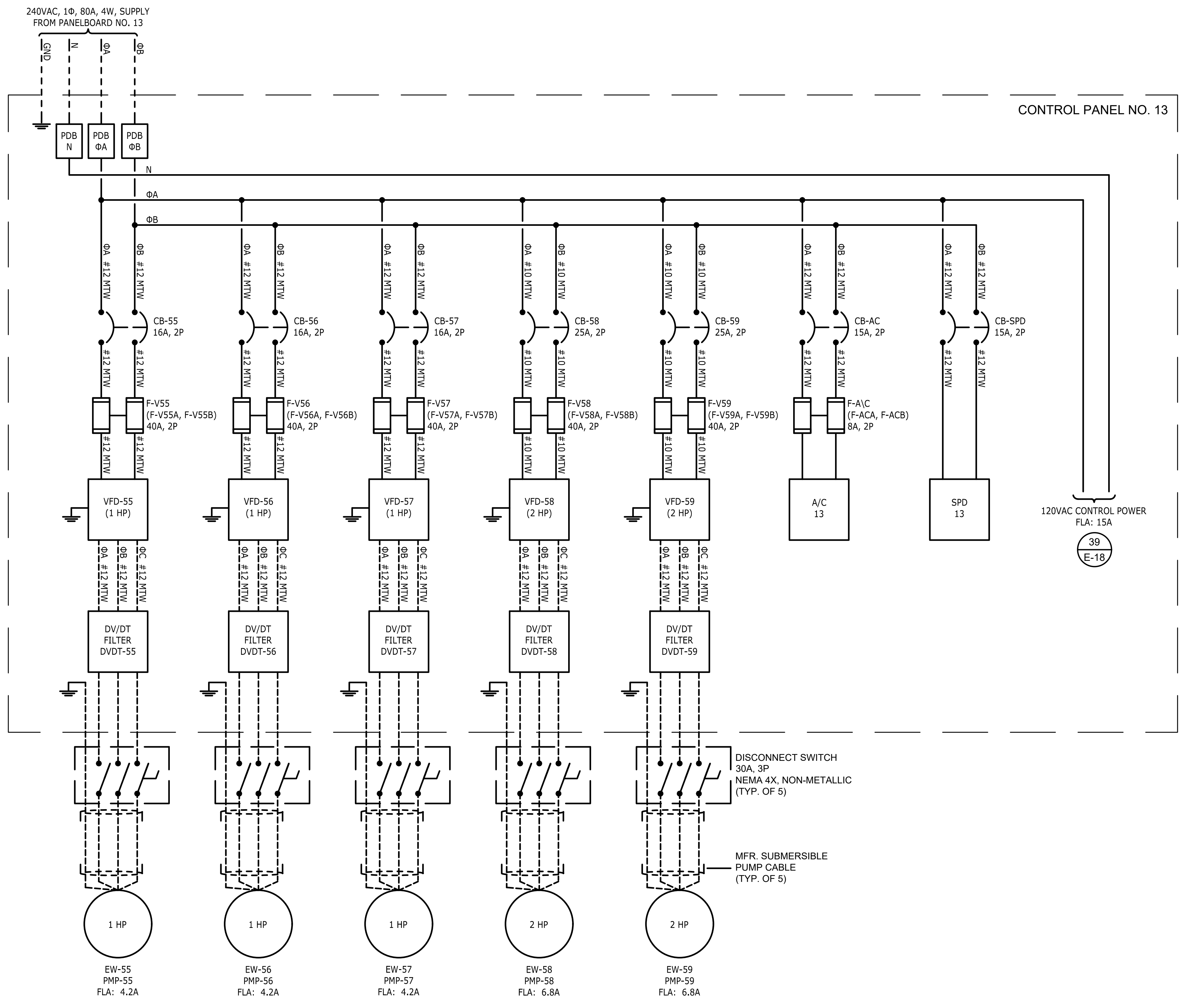

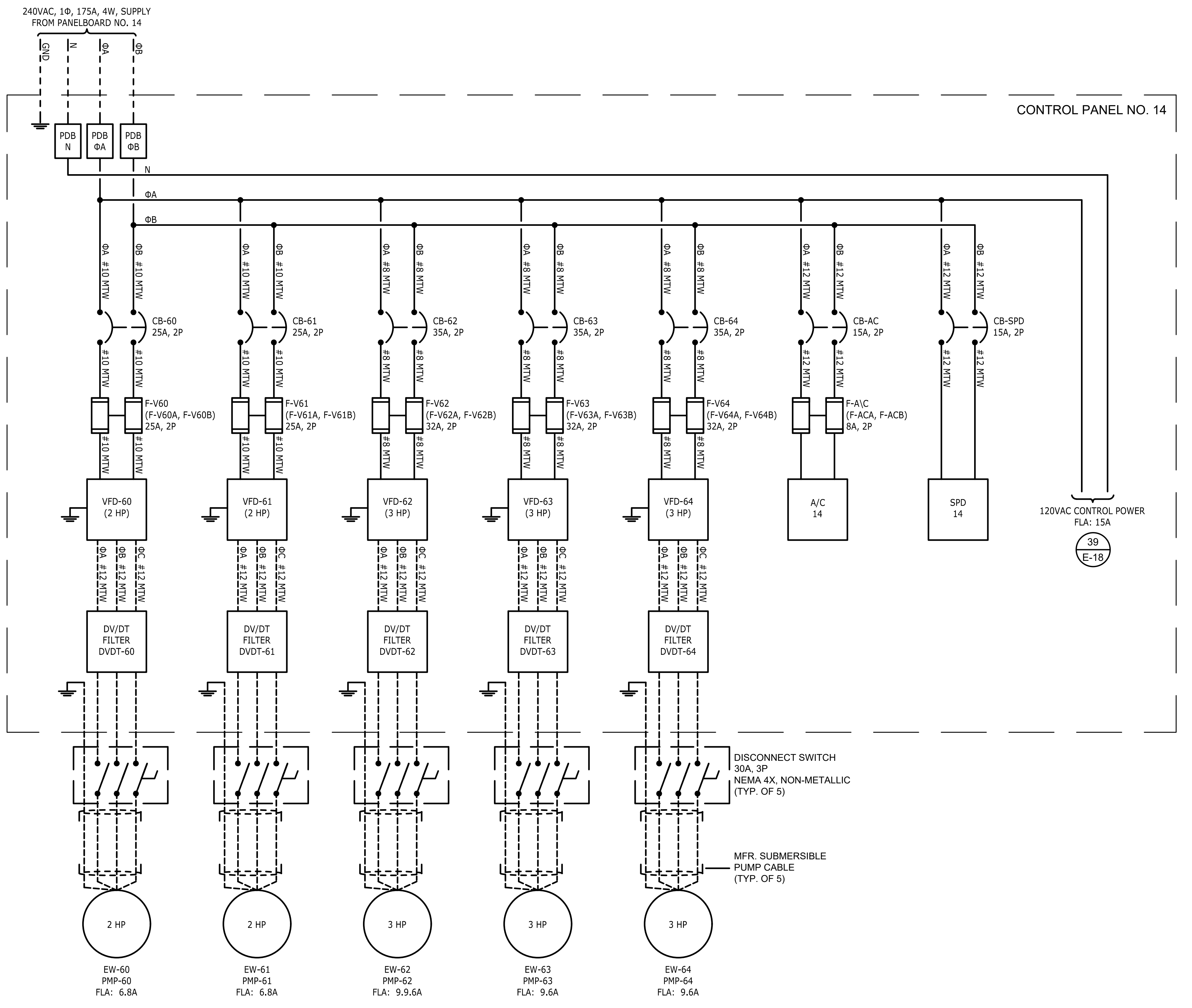

240VAC, 1Ø LOAD CALCULATIONS
CONTROL PANEL NO. 13

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-55 VFD (1 HP)	10.7A	10.7A
PUMP PMP-56 VFD (1 HP)	10.7A	10.7A
PUMP PMP-57 VFD (1 HP)	10.7A	10.7A
PUMP PMP-58 VFD (2 HP)	18A	18A
PUMP PMP-59 VFD (2 HP)	18A	18A
AIR CONDITIONER AC-13	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 13 FLA PER PHASE:	87.6A	72.6A
125% OF LARGEST MOTOR: 1.25 x 18 = 22.5A 22.5 - 18 = 4.5A		4.5A
CONTROL PANEL NO. 13 FLA:		92.1A

240VAC, 1Ø LOAD CALCULATIONS
CONTROL PANEL NO. 14

EQUIPMENT TYPE	PHASE L1	PHASE L2
PUMP PMP-60 VFD (2 HP)	18A	18A
PUMP PMP-61 VFD (2 HP)	18A	18A
PUMP PMP-62 VFD (3 HP)	22.9A	22.9A
PUMP PMP-63 VFD (3 HP)	22.9A	22.9A
PUMP PMP-64 VFD (3 HP)	22.9A	22.9A
AIR CONDITIONER AC-14	4.5A	4.5A
CONTROLS	15A	-
CONTROL PANEL NO. 14 FLA PER PHASE:	124.2A	109.2A
125% OF LARGEST MOTOR: 1.25 x 22.9 = 28.6A 28.6 - 22.9 = 5.7A		5.7A
CONTROL PANEL NO. 14 FLA:		129.9A

NOTES:

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919.870.0576

TITLE:
SINGLE LINE DIAGRAM VII

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
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APPROVED BY:	JJD		

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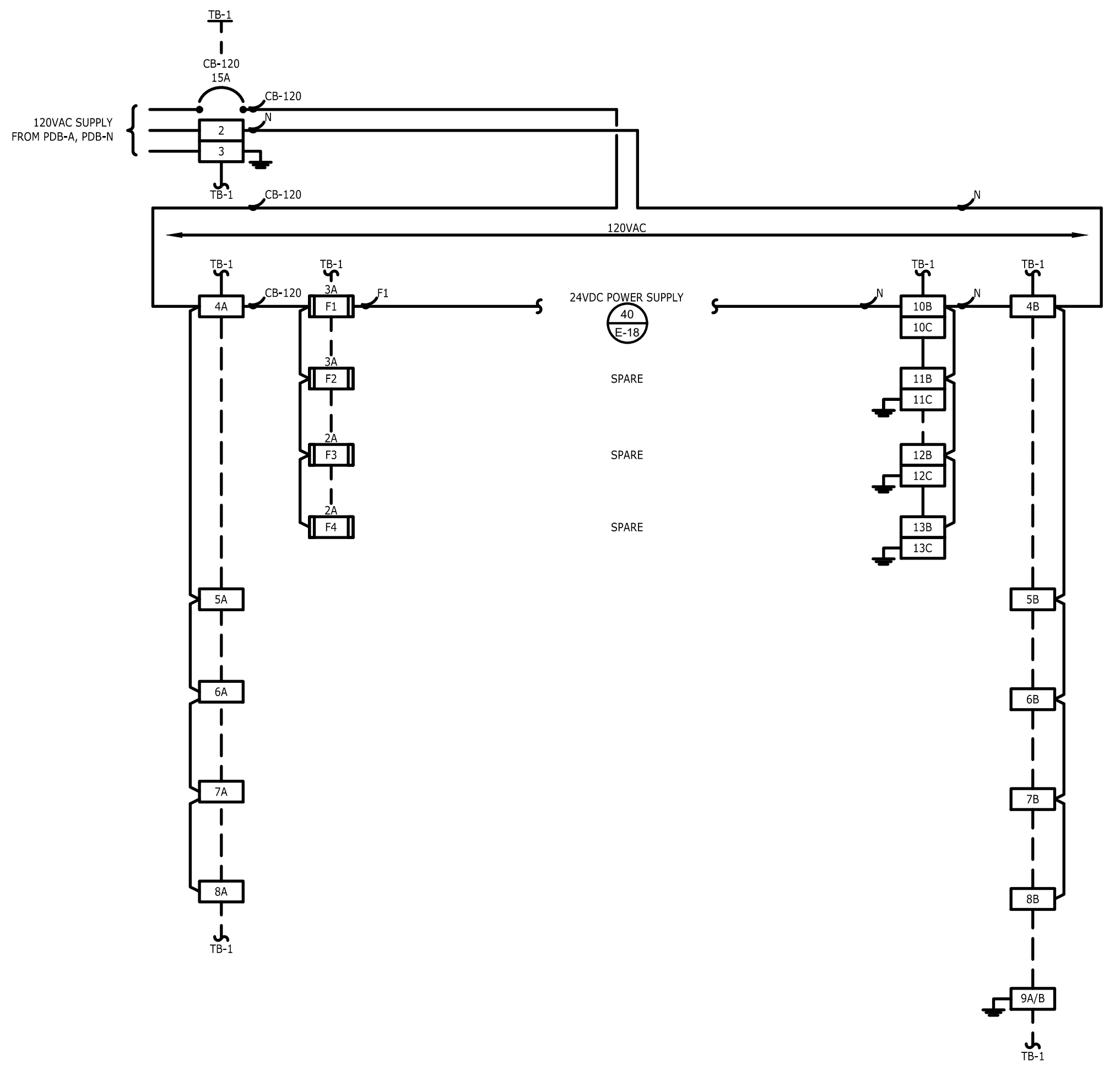
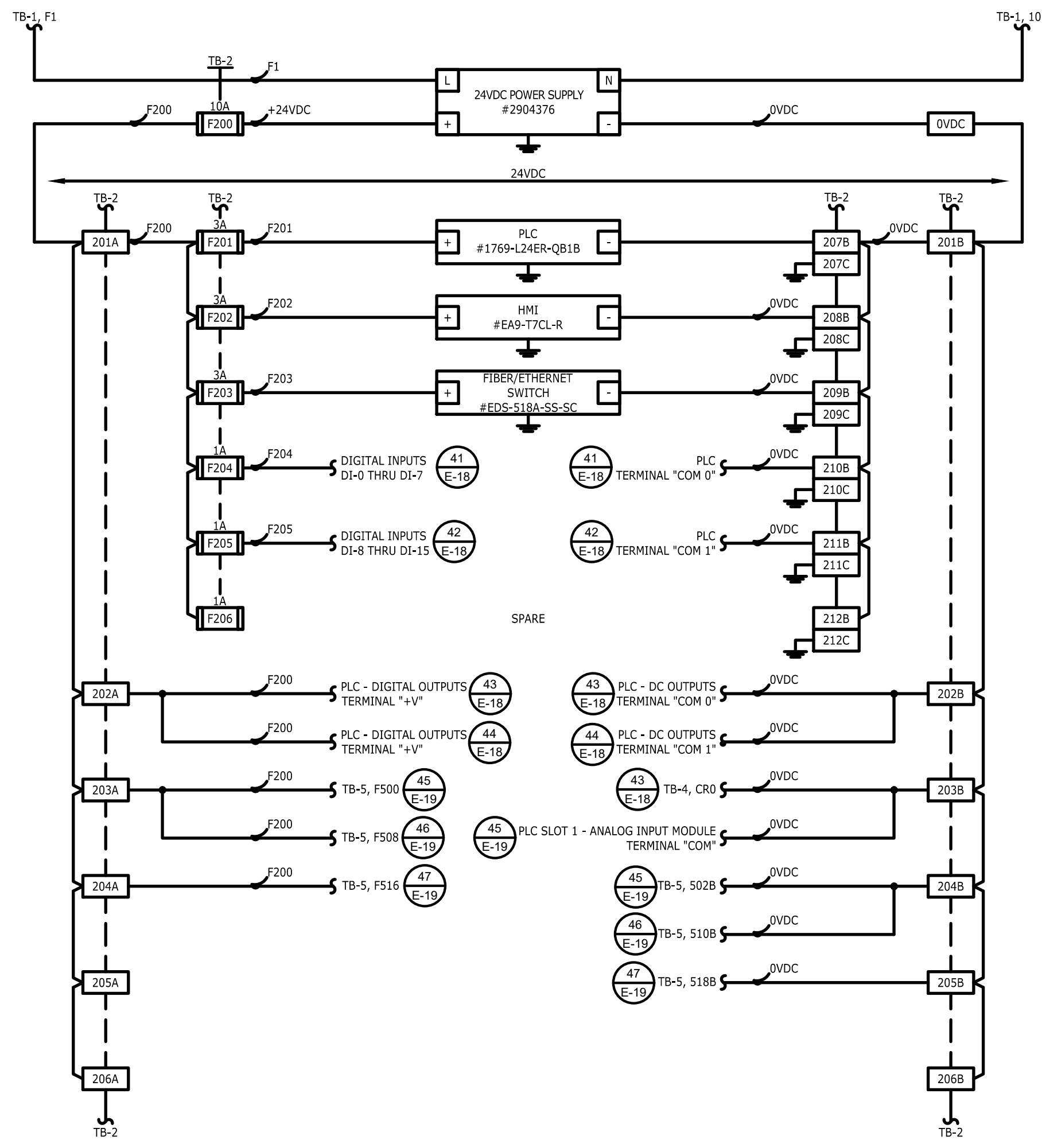
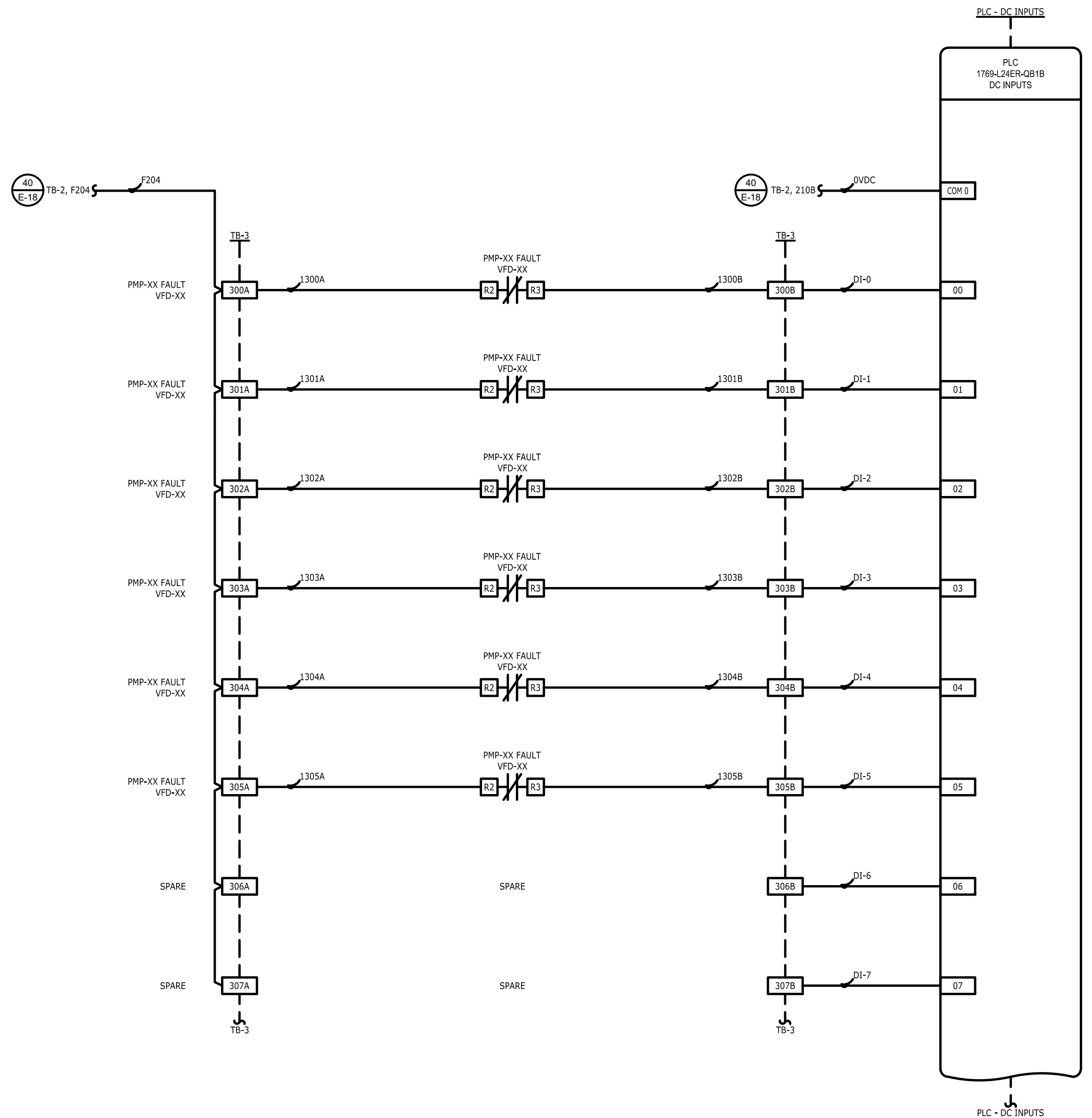


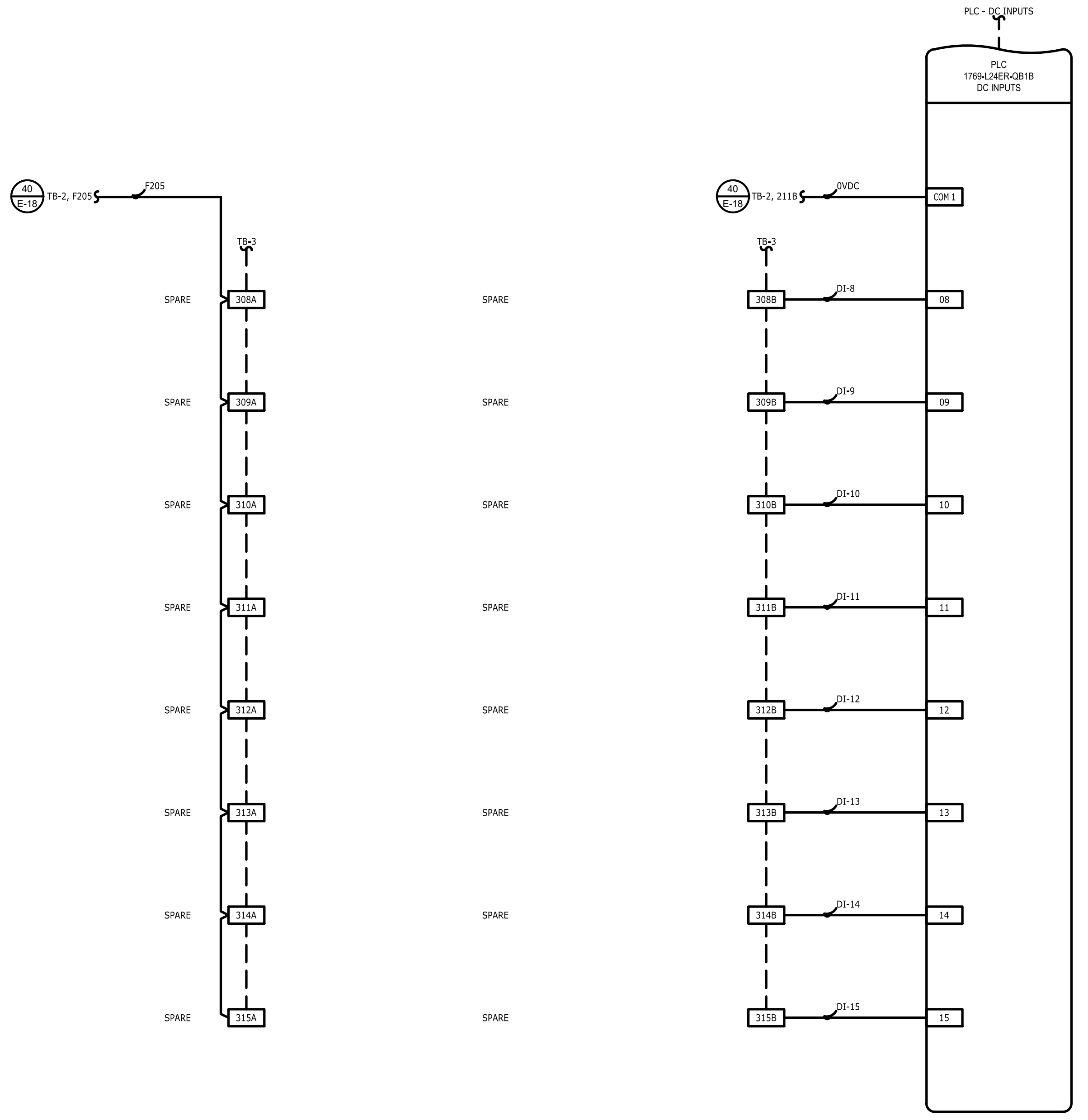
39 E-11 DETAIL
120VAC POWER DISTRIBUTION



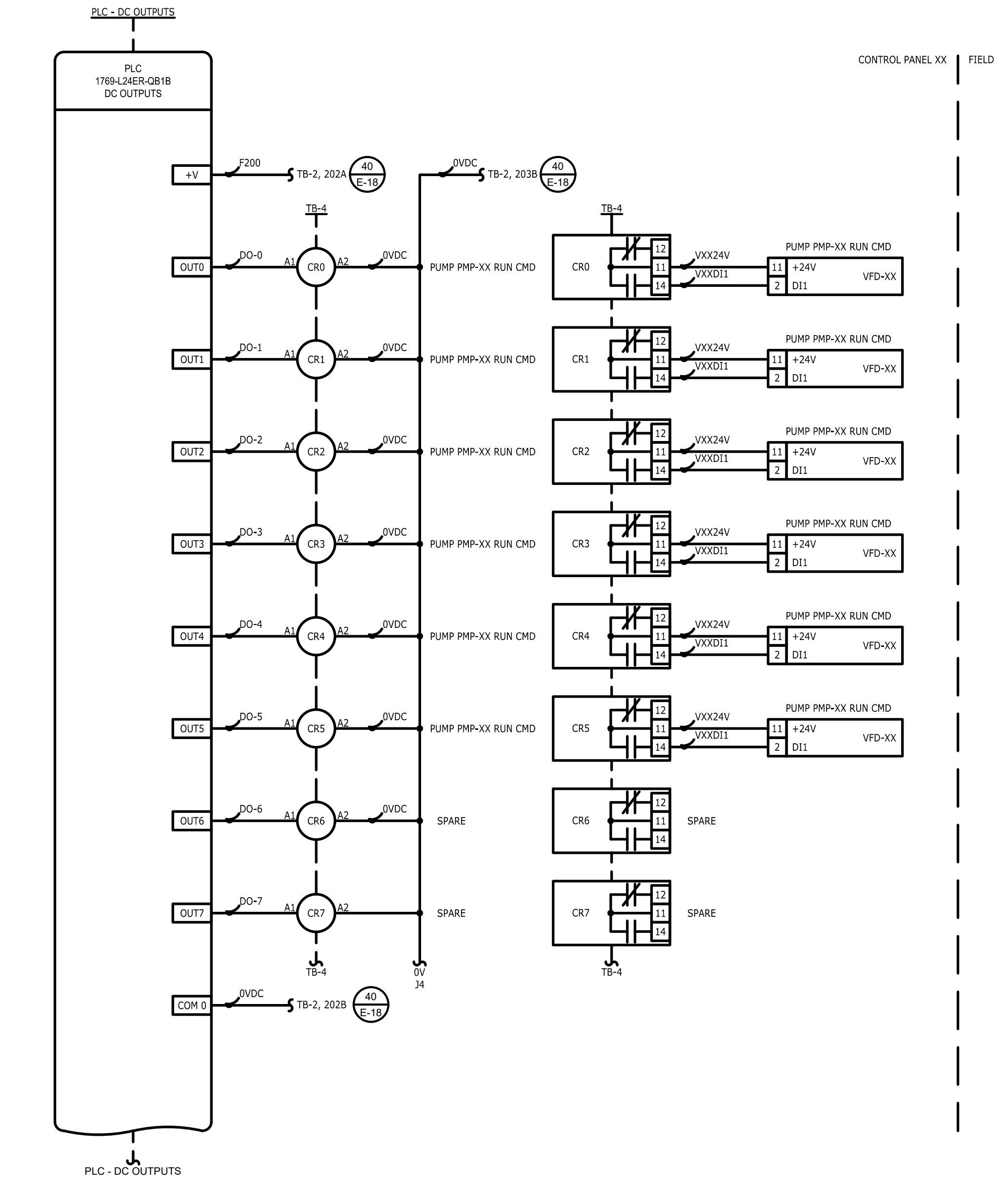
40 E-18 DETAIL
24VDC POWER DISTRIBUTION



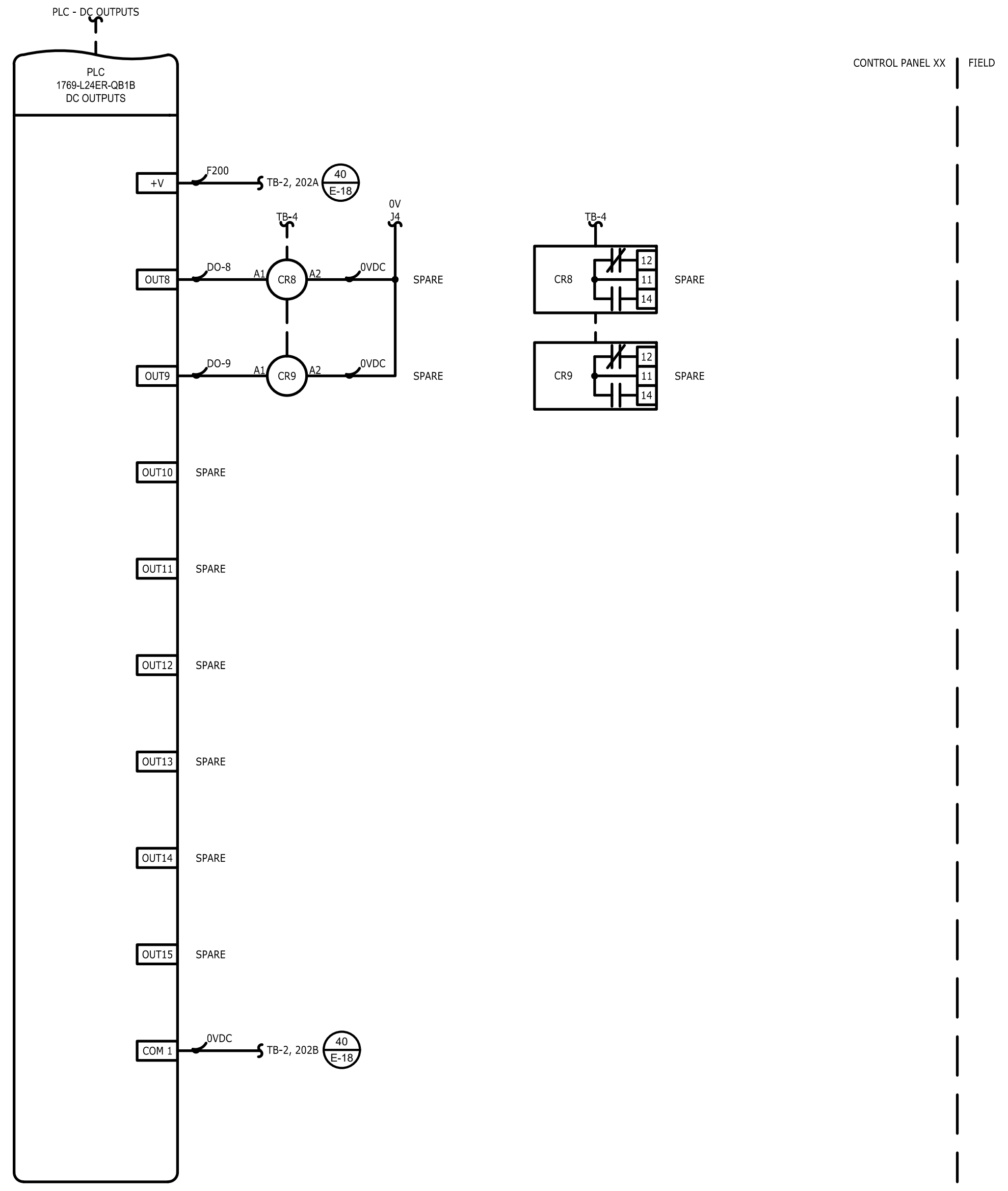
41 E-18 DETAIL
PLC DIGITAL INPUT WIRING DIAGRAM I



42 E-18 DETAIL
PLC DIGITAL INPUT WIRING DIAGRAM II



43 E-18 DETAIL
PLC RELAY OUTPUT WIRING DIAGRAM I



44 E-18 DETAIL
PLC RELAY OUTPUT WIRING DIAGRAM II

NOTES:

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NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
CONTROL PANEL POWER DISTRIBUTION I

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E18.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-18
APPROVED BY:	JJD		

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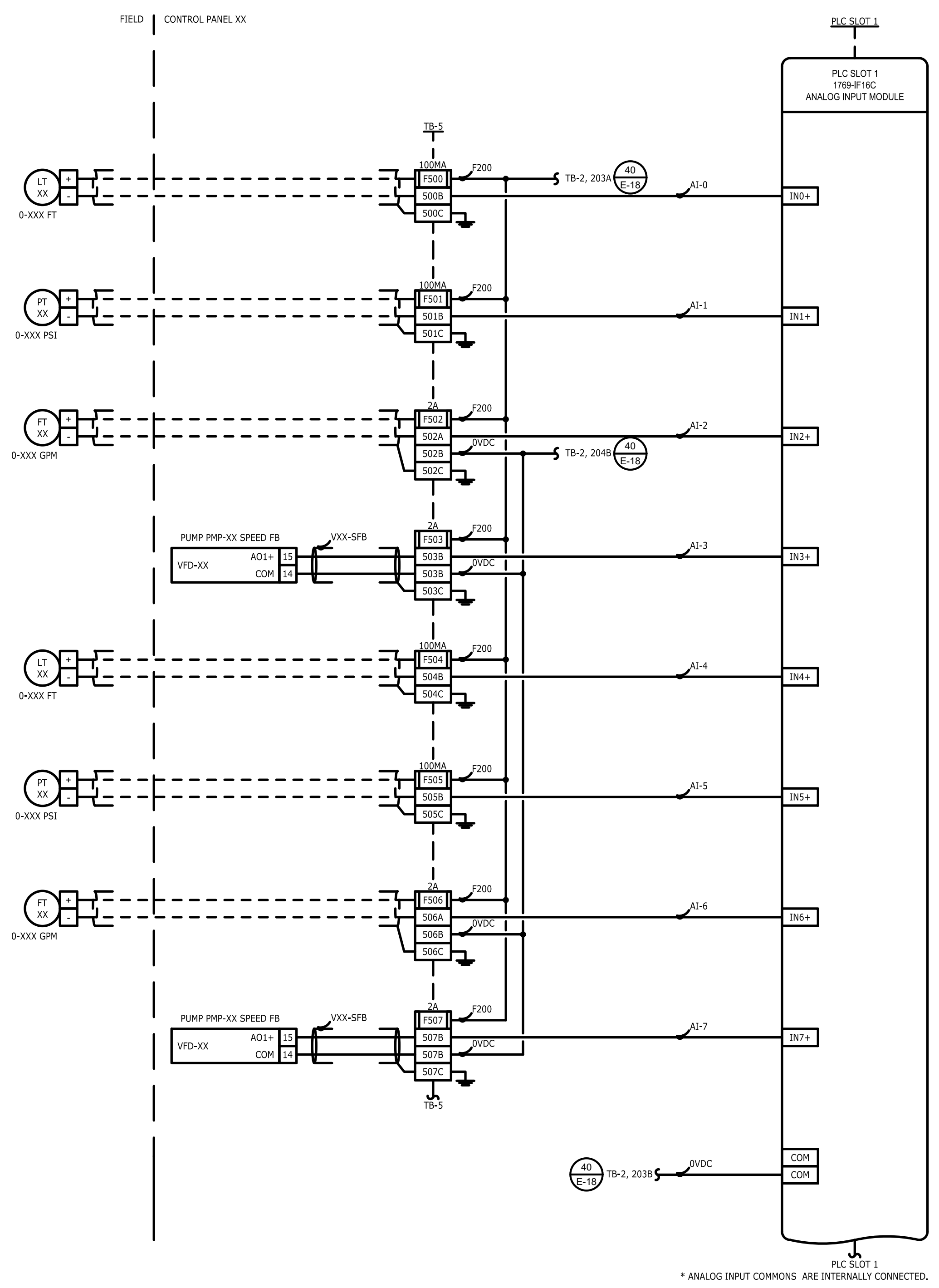
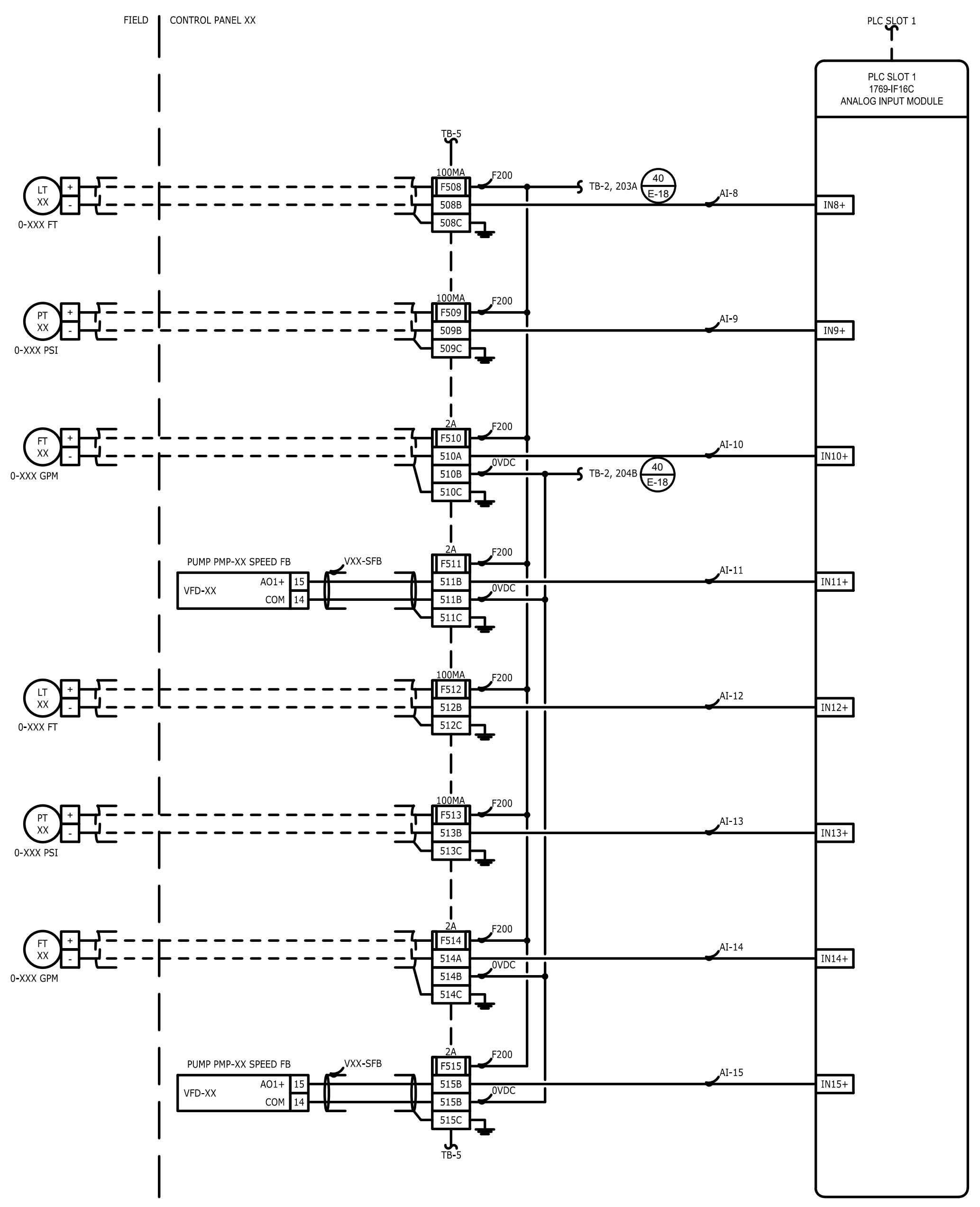


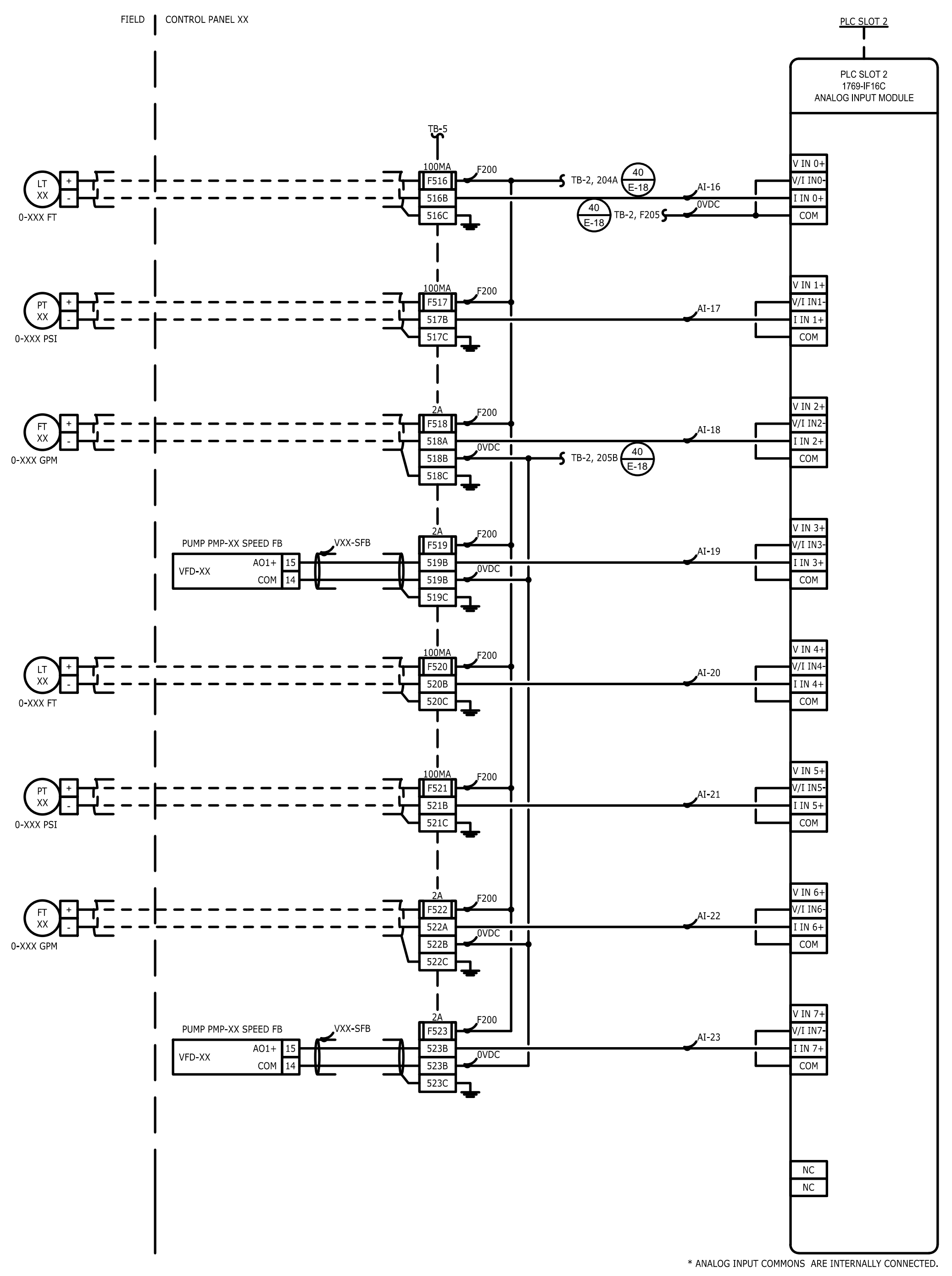
45 E-19 DETAIL

PLC SLOT 1 ANALOG INPUT WIRING DIAGRAM I



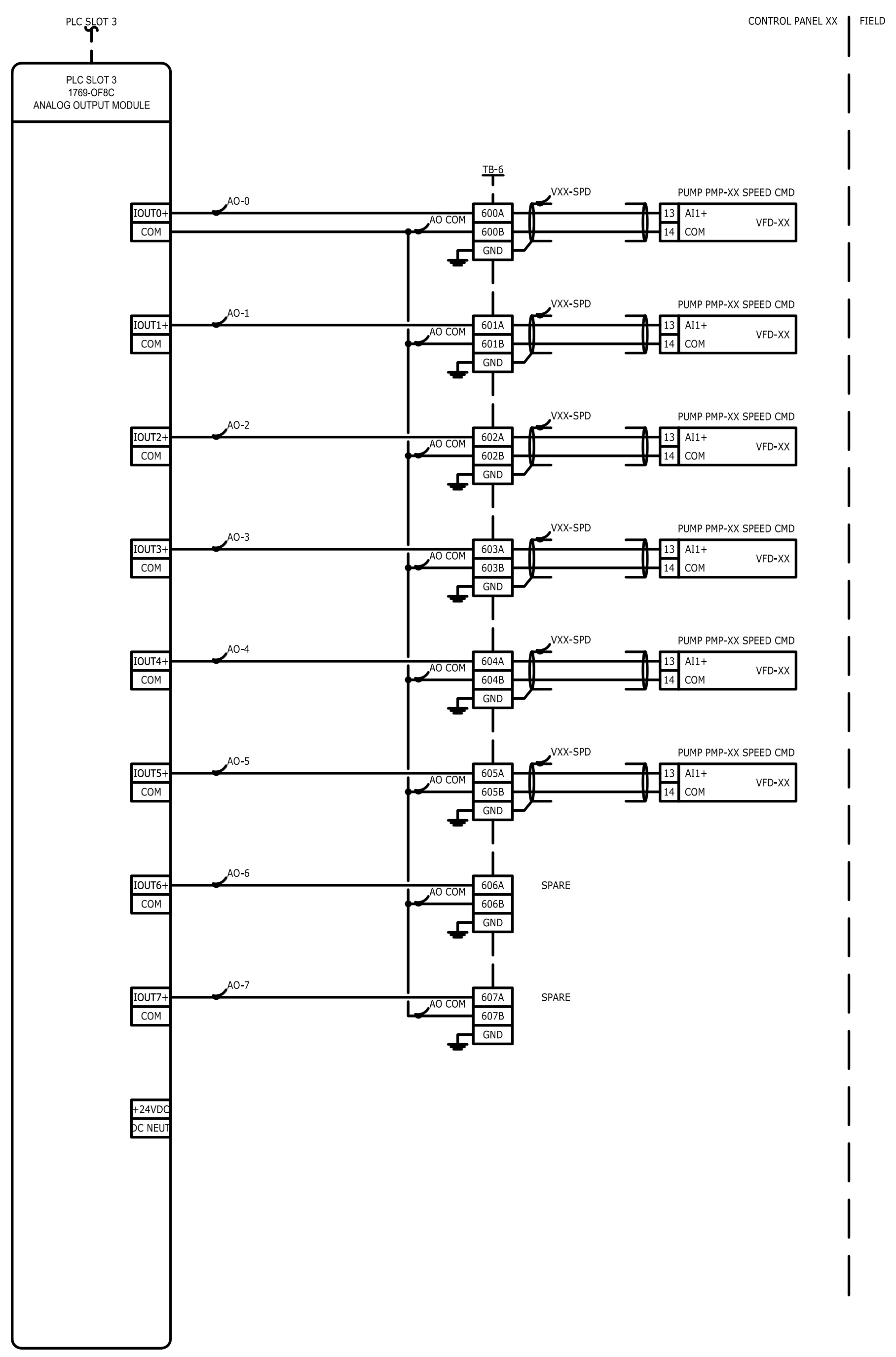
46 E-19 DETAIL

PLC SLOT 1 ANALOG INPUT WIRING DIAGRAM II



47 E-19 DETAIL

PLC SLOT 2 ANALOG INPUT WIRING DIAGRAM



48 E-19 DETAIL

PLC SLOT 3 ANALOG OUTPUT WIRING DIAGRAM

NOTES:

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B	08.13.21	60% DESIGN SUBMITTAL	JFH	JJD
A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
CONTROL PANEL POWER DISTRIBUTION II

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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REVIEWED BY: SV
APPROVED BY: JJD
DATE: AUGUST 2021
PROJECT NO.: TR0795A
FILE: TR0795A-E19.DWG
DRAWING NO.: E-19

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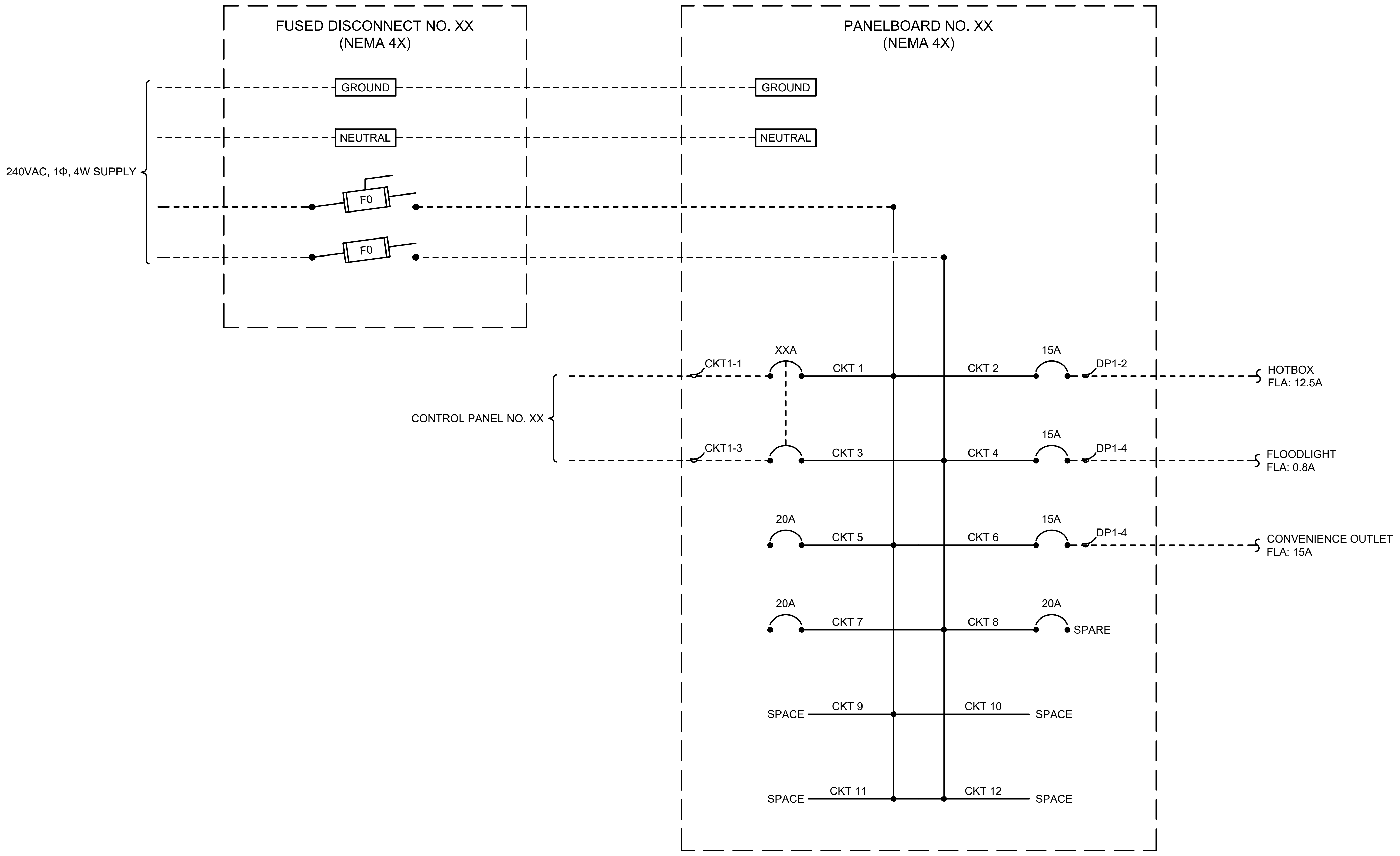

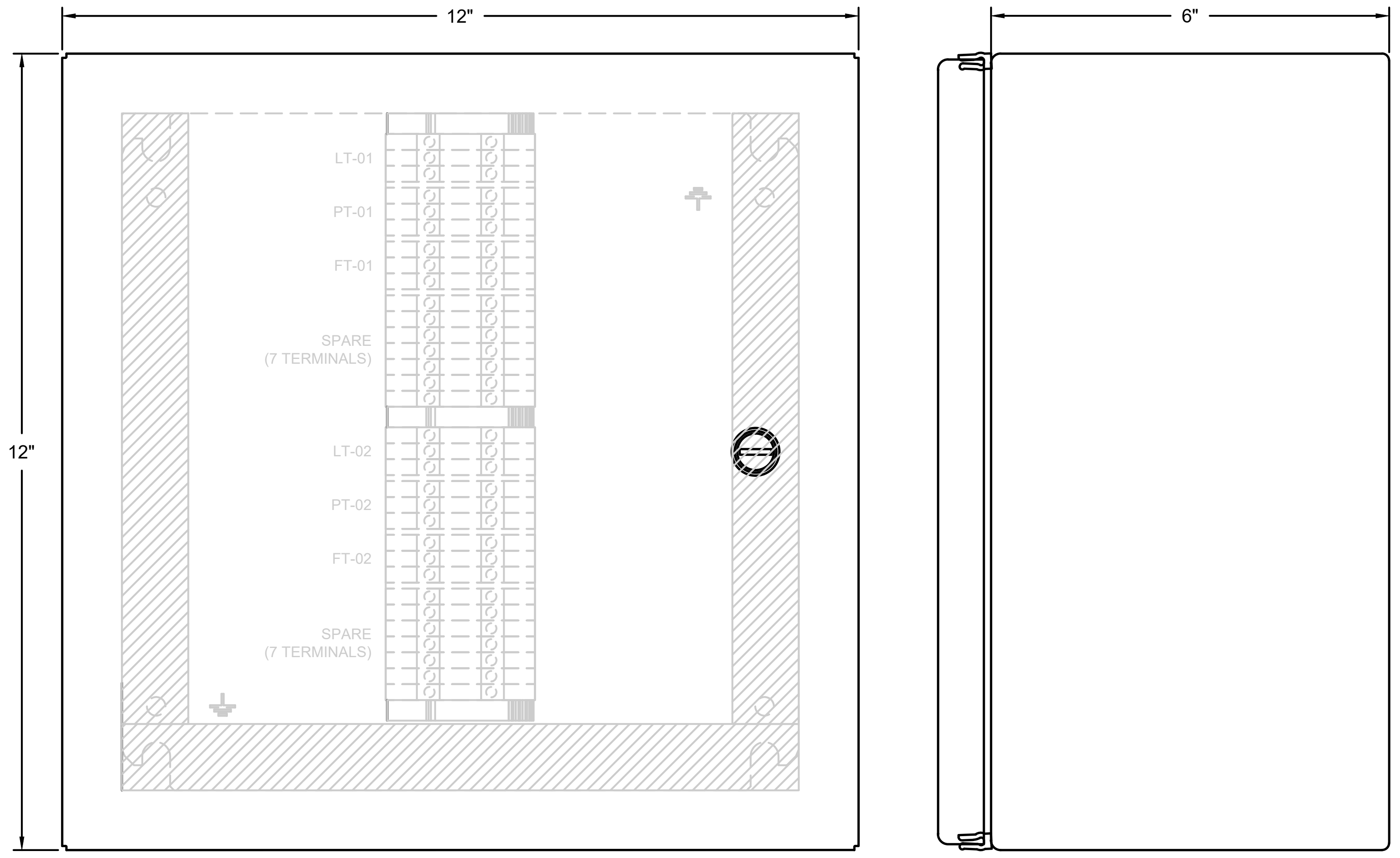

49
E-08

DETAIL
TERMINATION BOX
SCALE: 1" = 2"

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 1

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 1	91.3A	76.3A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 1 FLA PER PHASE:	103.8A	92.1A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 2

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 2	134.8A	119.8A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 2 FLA PER PHASE:	147.3	135.6A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 3

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 3	95.1A	80.1A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 3 FLA PER PHASE:	107.6A	95.9A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 4

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 4	95.1A	80.1A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 4 FLA PER PHASE:	107.6A	95.9A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 5

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 5	91.3A	76.3A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 5 FLA PER PHASE:	103.8	92.1A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 6

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 6	73.3A	58.3A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 6 FLA PER PHASE:	85.8A	74.1A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 7

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 7	80.7A	65.7A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 7 FLA PER PHASE:	93.2A	81.5A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 8

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 8	91.4A	76.4A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 8 FLA PER PHASE:	103.9A	92.2A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 9

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 9	65A	45A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 9 FLA PER PHASE:	77.5	60.8A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 10

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 10	65A	50A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 10 FLA PER PHASE:	77.5A	65.8A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 11

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 11	73.6A	58.6A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 11 FLA PER PHASE:	86.1A	74.4A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 12

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 12	71.5A	56.5A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 12 FLA PER PHASE:	84A	72.3A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 13

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 13	92.1A	77.1A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 13 FLA PER PHASE:	104.6A	92.9A

240VAC, 1Φ LOAD CALCULATIONS
PANELBOARD NO. 14

EQUIPMENT TYPE	PHASE L1	PHASE L2
CONTROL PANEL NO. 14	129.9A	114.9A
HOTBOX	12.5A	-
FLOODLIGHT	-	0.8
CONVENIENCE RECEPTACLE	-	15A
PANELBOARD NO. 14 FLA PER PHASE:	142.4A	130.7A

NOTES:

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A	05.27.21	CONCEPTUAL DESIGN SUBMITTAL	JFH	JJD

Geosyntec
consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ATRIUM AT BLUE RIDGE
2501 BLUE RIDGE ROAD, SUITE 430
RALEIGH, NC 27607
919.870.0576

TITLE:
PANELBOARD SCHEDULES AND JUNCTION BOX

PROJECT:
THE CHEMOURS COMPANY
GROUNDWATER EXTRACTION AND CONVEYANCE SYSTEM

SITE:
FAYETTEVILLE WORKS SITE

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CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	BMT	DATE:	AUGUST 2021
DRAWN BY:	JFH	PROJECT NO.:	TR0795A
CHECKED BY:	CMDS	FILE:	TR0795A-E20.DWG
REVIEWED BY:	SV	DRAWING NO.:	E-20
APPROVED BY:	JJD		

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

GEOServices, LLC, Geotechnical and Materials Engineers

Appendix E
Seep Flow at Barrier Wall Memo

Geosyntec consultants

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Memorandum

Date: August 13, 2021

To: The Chemours Company, FC, LLC

From: Geosyntec Consultants of NC, P.C.

Subject: **Assessment of Seep Flows at Barrier Wall**

Introduction and Objectives

Geosyntec Consultants of NC, PC (Geosyntec) has prepared this memorandum for The Chemours Company, FC, LLC (Chemours) to describe the assessment of expected Seep flow rates where the seeps will cross the underground barrier wall to be constructed pursuant to paragraph 2 of the Addendum to Consent Order Paragraph 12 (CO Addendum) among Chemours, the North Carolina Department of Environmental Quality (NCDEQ) and Cape Fear River Watch. Chemours operates the Chemours Fayetteville Works facility in Bladen County, North Carolina (the Site) where there are four onsite groundwater Seeps A, B, C, and D (Figure 1) that originate on the bluff at Site and discharge into the Cape Fear River. Seeps C and D occur down gradient of the proposed barrier wall location and do not cross the barrier wall. Therefore, this assessment considers Seep A and Seep B flow rates that are present upgradient of the barrier wall. Chemours will capture and treat total dry weather base flow plus rain events up to 0.5 inches in a 24-hours period, for the two seeps that daylight upgradient of the Barrier Wall. There are four onsite groundwater Seeps A, B, C, and D that originate on the bluff at the facility and discharge into the Cape Fear River. Seeps C and D occur down gradient of the proposed barrier wall location. Therefore, Seep A and Seep B flow rates and rain events up to 0.5 inches in a 24-hour period will be captured and treated.

The objectives of this report are:

1. To summarize measurement of the flowrates at Seep A and Seep B locations that daylight upgradient of the barrier wall under dry weather conditions.
2. To summarize modeling predictions of the stormwater runoff volumes at Seep A and Seep B locations that daylight upgradient of the barrier wall for rain events up to 0.5 inches over a 24-hour period.
3. Estimate volumes and flow rates from seeps for a preliminary design basis for seeps ex situ capture, retention and conveyance designs.

These objectives are addressed through analysis of historical onsite flume and rainfall data, in addition to assessment of stormwater runoff volumes and flowrates. The Stormwater flows and volumes from the drainage areas to Seep A and Seep B (upgradient of the barrier wall) are assessed based on North Carolina stormwater design guidance, in addition to the development and execution of a long-term continuous hydrologic model in combination with static calculations. The hydrologic model will provide estimates of stormwater runoff, but not seep flow rates under dry conditions.

The remainder of this memorandum is organized into the following sections as follows:

- **Flume Data Assessment –** describes data collection methodology and results of the flume data relevant to the assessment of seep flows upgradient of the Barrier Wall.
- **Stormwater Assessment** – describes the stormwater runoff volumes that may be experienced in the Seep A and Seep B catchment areas during rain events, based on both static calculations and the hydrologic model.
- **Seep Basis of Design Flow Rates and Volumes –** describes the recommended flow rates and stormwater volumes to use as the basis of design for the ex-situ capture systems.

Flume Data Assessment

Chemours has previously installed several flumes at Seeps A and B including locations at the end of each seep, as close as practicable to the Cape Fear River, to estimate Seep flow rates entering the river. Additionally, several other flumes were installed at various tributaries that feed the main seep channels. The detailed locations and analysis of this flume data was presented in the Interim Seep Remediation System Plan (Geosyntec, 2020).

For the purposes of this assessment, only a subset of the flume installations were applicable in estimating the flow at the proposed barrier wall intersection. Figure 2 depicts the locations of flume installation at locations Seep A-4 and Seep B-2. These locations, while downgradient of the planned barrier wall route, are the closest representative flume locations to where the upgradient portions of Seep A and Seep B intersect the barrier wall, respectively. Therefore, these locations are used as a substitute for understanding potential flows at the intersection of the seep channels and the barrier wall.

These locations are interpreted to provide a conservative estimate (i.e., overestimate) of flows at the barrier wall as these two locations are substantially downgradient the barrier wall and therefore encompass larger drainage areas. The location of the flume measurement at Seep A-4 was approximately 500 feet (ft) downgradient of the proposed barrier wall location. A few minor tributaries join the main channel within that 500 ft. Similarly, Seep B-2 flume location was approximately 250 ft down gradient of the barrier wall location. However, there are no tributaries joining the seep channel within that 250 ft stretch, so measurement at Seep B-2 may be more representative than Seep A-4.

Data Collection

Flow rate data were monitored at Seep locations A-4 and B-2 (Figure 2) for the period of August 2019 to November 2020 and September 2019 to October 2020, respectively. The flow rates were measured by converting the depth of water in the flume using a formula based on the instrument geometry. The Extra-large 60^o trapezoidal flume was used at Seep B-2 and a Large 60^o trapezoidal flume was used at Seep A-4. These were installed using a pond liner in front of and below the flume to mitigate the potential for underflow and using plywood panels and sandbags at the sides to channel the seep flow and mitigate the potential for flow around the flumes. Level loggers (Solinst 3001 LT F30/M10) were installed to measure the water elevations in the flumes, these data were then barometrically corrected and used in flow rate estimates. Periodically, the flumes were inspected and maintained, particularly when field teams observed occurrences of bypass around the flumes or other obstructions near the measurement location.

Precipitation data and weather conditions for the monitored periods were assessed using the onsite meteorological station and supplementing that data with the existing USGS weather monitoring station at the W.O. Huske Dam (gage 02105500) when there were data gaps.

Flume Uncertainties

Uncertainties in the observed data may be present when using flumes to measure flow rates in channels for several reasons. Some of these potential reasons include:

- Missed flows:
    - Bypass of the flume due to leakage under the flume or new flow channels routing water around the flume.
- Inaccurate water depth estimates based on pressure:
    - Incorrect pressure measurement due to placement of pressure sensor.
    - Sediment buildup at the flume base that moves the elevation of zero water depth.
- Flowrate outside of flume accuracy ranges estimates due to flume sizing:
    - Flow can periodically be outside of the accuracy range of the flume resulting in too high or low ranges in pressure/depths.
- Inaccurate flowrate estimates due to compatibility limitations of the hydraulic assumptions behind the flume equations with field conditions:

- Flow turbulence upstream of flume installation, inadequate length of straight channel or variable cross section size of channel prior to flume installation.
- Obstructions (e.g., by branches, leaves, rocks) that alter the assumed cross-sectional area of flow (or that could affect the pressure measurement).

Maintenance events were completed approximately once every month. After maintenance events flumes were operating as per desired conditions (limited to no obstructions, no sediment accumulation, flow directed into flume, and liner to minimize underflow). As time extended past maintenance events, the potential for factors causing bias likely increases. A standard practice to reduce flume uncertainty is perform frequent maintenance.

Seep Flow Rate Assessment Methodology

Flume data underwent organization and preparation to represent flow readings on 30-minute intervals. Interval lengths were kept constant across the analysis for each flume to reduce potential bias when calculating statistics. The flowrate data were then paired with the corresponding precipitation data for that date and time. Precipitation data were taken from the onsite meteorological station and supplemented with precipitation data from the United States Geological Survey (USGS) monitoring station at the W.O. Huske Dam if there were no onsite precipitation data available.

Certain data points were excluded from the data set for each flume. Data were excluded when: (a) the flume was not operational, (b) the flume was inundated by elevated Cape Fear River water levels, (c) the flume data exhibited a low bias, and (d) the measured flow was above the upper limit or below the bottom limit of the flume’s measurement range.

Categories based on precipitation were established to analyze the data under different weather conditions. The data were then assessed statistically and graphed based on the categories established. These categories included:

- Total data – All data except excluded data.
- Dry weather (i.e. No Rain) – Data that has a period of 24 hours prior to measurement with no precipitation measured.
- Rain ≤ 0.5 inches – Period of 24 hours with 0.5 inches or less of measured precipitation.
- Rain > 0.5 inches – Period of 24 hours with greater than 0.5 inches of measured precipitation.

Results

The data for Seep A-4 are shown Figure 3 and the data for Seep B-2 are shown in Figure 4. These time series (Figures 3 and 4) include an indication of the upper and lower flow rates that the flume can accurately measure. Data outside of these limits were excluded during the data preparation process prior to the statistical assessment. However, understanding where the data exceeds or falls below these limits may still be helpful with interpretation of the data, so the excluded data was plotted on Figure 3 and Figure 4 as grey data points to aide in visual interpretation of flume flow trends.

A table summarizing the numerical assessment of the flume flowrates at flume locations Seep A-4 and Seep B-2 is presented in Table 1 below.

Table 1: Seep A-4 and Seep B-2 Flow Rate Summary

Seep A-4						
Weather Conditions	**Number of days**	**25th percentile (gpm)**	**Median Flow (gpm)**	**95th percentile (gpm)**	**99th percentile (gpm)**	**Peak Flow[1] (gpm)**
Total	273	14	18	34	66	110
Dry Weather	179	14	18	31	36	49
Rain ≤ 0.5”	64	14	19	36	56	110
Rain > 0.5”	30	16	23	83	110	110
Seep B-2						
Weather Conditions	**Number of days**	**25th percentile (gpm)**	**Median Flow (gpm)**	**95th percentile (gpm)**	**99th percentile (gpm)**	**Peak Flow[2] (gpm)**
Total	276	68	83	170	290	680
Dry Weather	184	65	77	130	150	260
Rain ≤ 0.5”	64	74	92	160	190	450
Rain > 0.5”	28	95	130	340	470	680

The peak flow rate measured at Seep A-4 was 110 gallon per minute (gpm) and the median flow for this period was 18 gpm. The peak flowrate measured at Seep B-2 over 276 observed days was 680 gpm and the median flow from this period was 83 gpm.

To estimate the baseline flow rates at Seep A-4 and Seep B-2, the “Dry Weather” data in Table 1 should be considered. Seep A-4 had a median flowrate was 18 gpm and a 95th percentile flow of

---

[1] The Seep A-4 Flume has an upper limit of measurement of 116 gpm and a lower limit of 5 gpm

[2] The Seep B-2 Flume has an upper limit of measurement of 695 gpm and a lower limit of 0.4 gpm.

31 gpm while Seep B-2 had a median flow rate of 77 gpm and a 95th percentile flow of 130 gpm, during 24-hour periods of no measured rainfall.

The dry weather flowrates at Seep A-2 had a measured peak flow of 49 gpm and storms up to 0.5 inches increased the measured peak flow to 110 gpm (124% increase), while dry weather flowrates at Seep B-2 had a peak of 260 gpm and storms up to 0.5" increased the measured peak flow rate to 450 gpm (73% increase). Rainfall will increase total seep runoff volumes as well as peak flow rates due to overland flow.

The CO Addendum requires the capture and treatment of total dry weather flow plus rain events up to 0.5 inches in a 24-hours period. Figure 5 and Figure 6 show the time series of dry weather data in addition to data for rain event up to and equal to 0.5 inches of rain in a rolling 24 hour period for Seep A-4 and Seep B-2, respectively. These figures show the representation of the flow rates from the observation period that need to be captured and treated upgradient of the barrier wall.

Stormwater Assessment

The seeps ex situ capture systems must capture seeps flow during rainfall events up to 0.5" in depth over 24-hours. As stormwater flows are variable in nature and can occur at relatively high intensities the seeps ex situ capture systems are expected to utilize equalization storage to meter out flows to a groundwater treatment plant (GWTP) so as to not overwhelm plant capacity. Consequently, stormwater runoff volumes were assessed, for both the Seep A and Seep B drainage areas upgradient of the barrier wall, for rain events up to 0.5 inches over a 24-hour period. Stormwater is defined as wet weather-driven flows that exclude baseflows (such as groundwater exfiltration or seeps).

Methodology and Calculations

Sizing a stormwater control measure involves calculating the volume and/or flowrate of runoff resulting from the specified design storm, or the hypothetical discrete rainstorm. Guidance from the NCDEQ Stormwater Design Manual (Manual) was followed to perform static calculations for the CO Addendum specified design storm of 0.50 inches in 24-hours, and these calculations are outlined in the following subsections. These static calculations were followed by an analysis of results from a long-term continuous, non-calibrated simulation with a hydrologic model as a check, as outlined in the "Hydrologic Model" section.

Stormwater Runoff Volume

Stormwater runoff volumes from the Seep A and Seep B drainage areas upgradient of the barrier wall were first assessed for storm events with 0.5-inches of rainfall. Stormwater runoff volumes based on total rainfall depth were calculated using the Simple Method for Runoff Volume based on guidance from the Manual (Part B, Stormwater Calculations, Simple Method for Runoff Volume). This method first determines the runoff coefficient, which reflects the runoff potential, using the impervious fraction of the drainage area (discussed further in the "Drainage Area Characteristics" subsection), as shown in Equation 1.

Equation 1: Runoff Coefficient

$$\boldsymbol{R_v = 0.05 + 0.9\ x\ I_A}$$

where,
R_v is the runoff coefficient (unitless); and
I_A is the impervious fraction (unitless).

$$R_v\ (Seep\ A) = 0.05 + 0.9\ x\ 0.24 = 0.27$$

$$R_v\ (Seep\ B) = 0.05 + 0.9\ x\ 0.13 = 0.17$$

The stormwater runoff volumes were then calculated using Equation 2. For comparison purposes, the stormwater runoff volumes were also calculated for storm depths of 0.25, 0.75, and 1.00-inch, in addition to the 0.50-inches specified in the CO Addendum. Table 2 shows the calculated stormwater runoff volumes for the Seep A and B drainage areas for the designated design storm depths, based on guidance from the Manual.

Equation 2: Design Volume

$$\boldsymbol{DV = 3630\ x\ R_D\ x\ R_V\ x\ A}$$

where,
DV is the design volume (cubic feet);
R_D is the design storm depth (inches);
R_v is the runoff coefficient (unitless); and
A is the drainage area (acres).

Table 2. Stormwater Runoff Volumes for Seep A and Seep B based on the Simple Method from the Manual

Seep	Design Storm Depth (in)	Stormwater Runoff Volume (cubic feet)	Stormwater Runoff Volume (gallons)
A	0.25	7,200	54,000
	0.5	**14,000**	**110,000**
	0.75	22,000	160,000
	1	29,000	220,000
B	0.25	3,100	23,000
	0.5	**6,200**	**46,000**
	0.75	9,300	69,000
	1	12,000	92,000

Hydrologic Model

A long-term continuous simulation hydrologic model was developed with the Seep A and B drainage area inputs to verify the calculated stormwater runoff volumes (Table 2) and estimate peak stormwater runoff rates draining to the Seep A and B capture points (Figure 7).

Stormwater runoff rates can vary considerably based on the high variability in the total rainfall depths, durations, and intensities that are associated with storm events, including the antecedent dry period between storm events. Therefore, a long-term simulation of the hydrology of the drainage areas was conducted. The United States Environmental Protection Agency (USEPA) Storm Water Management Model (SWMM) was used to develop a long-term continuous simulation hydrologic model of the drainage areas. The subsections below outline input data for the model and model results.

Meteorological Data

Historical hourly precipitation data from the Fayetteville Regional Airport Grannis Field, NC US gauge (USW00093740) were downloaded from the Climate Data Online database from the National Oceanic and Atmospheric Administration (NOAA). Fifteen years of rainfall data from January 1, 2006 to December 31, 2020 were modeled[3]. The model used a one-hour time step during

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[3] The average annual rainfall in Fayetteville, NC is approximately 45.5 inches (based on historical rainfall data from 1930 to 2020). The average annual rainfall from 2006 through 2020 was 45.6 inches. Therefore, the modeled time period was considered representative of typical rainfall. The modeled period included several hurricanes. The most significant (recorded) rainfall was due to Hurricane Matthew (which resulted in 16.2 inches of recorded rainfall in Fayetteville on October 8, 2016).

dry weather and a one-minute time step during wet weather. Monthly averages of daily evaporation loss rates were incorporated based on evapotranspiration values for the Fayetteville area[4].

Drainage Area Characteristics

The hydrologic model includes details of the drainage areas to the seep capture points for Seeps A and B. The drainage areas were delineated using a digital elevation model (DEM) and the proposed seep capture points as shown in Figure 7. The impervious fraction and runoff coefficient for each drainage area were evaluated using aerial imagery. The drainage areas were divided into the following classifications: asphalt/concrete; building/rooftop; gravel/river rock; unimproved; wooded areas; and lawns, sandy soil, flat. Table 3 shows the characterization of the drainage areas by land cover.

Runoff coefficients (C) and values of imperviousness were assumed based on land cover classification. The values used for each land cover classification were based on guidance from the Manual (Part B, Stormwater Calculations, Table 1). The gravel/river rock land cover classification was not included in the Manual; assumed values for this land cover classification are consistent with those used at other sites. These values are shown in Table 3. The land cover-based runoff coefficients and impervious fractions were area-weighted for each drainage area. In the Seep A drainage area, the runoff coefficient was assumed to be 0.27 and the impervious fraction was 0.24, or 24% impervious. In the Seep B drainage area, the runoff coefficient was assumed to be 0.17 and the impervious fraction was 0.13, or 13% impervious.

Table 3. Land Cover of Seep Drainage Areas

Land Cover	**Runoff Coefficient (C)**	**Imperviousness**	**Drainage Area (acre)**	
			Seep A	**Seep B**
Asphalt/concrete	0.95	1.0	2.4	0
Building/rooftop	0.9	0.94	0.56	0.10
Gravel/river rock	0.77	0.8	1.9	0.46
Unimproved	0.35	0.33	1.9	0
Wooded area	0.15	0.11	15	19
Lawns, sandy soil, flat	0.15	0.11	8.1	0.36
Total Area			**29.4**	**19.9**

Geospatial files downloaded from the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey indicate that 87% of the Seep A drainage area has

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[4] Miller, Grady, et al. “Water Requirements of North Carolina Turfgrasses.” *NC State Extension Publications*, NC State Extension, 2018.

soils classified as Hydrologic Soil Group (HSG) A and 13% of the Seep A drainage area contains soils classified as HSG C. In the Seep B drainage area, 29% of the area is classified as HSG A and 71% is classified as HSG C. Soil suction head, initial deficit, and hydraulic conductivity values were obtained from the SWMM User's Guide. However, the industrial portions of the drainage areas were assumed to be more compacted than typical HSG A or C soils, so hydraulic conductivities were adjusted in the on-site industrial areas to present more conservative (i.e., lower) estimates of hydraulic conductivity. Soil suction head, initial deficit, and hydraulic conductivity values assigned for each soil type and drainage area are shown in Table 4.

Table 4. Soil Properties

Seep	Area (acres)	HSG	Suction head (in)	Conductivity (in/hr)	Initial deficit (fraction)
A	26	A	2.90	0.24	0.32
	3.7	C	8.60	0.10	0.24
B	5.7	A	2.90	0.32	0.32
	14	C	8.60	0.10	0.24

Area-weighted averages were calculated for each parameter for each drainage area. The width of each drainage area was estimated by dividing the total area by the length of the estimated longest flow path. The slope for each drainage area was assessed by computing the slope throughout the drainage areas, using a digital elevation model, and then calculating the average slope of the drainage area. Input parameters for the hydrologic models of the Seep A and B drainage areas are shown in Table 5.

Table 5. SWMM Modeling Drainage Area Parameters

Parameter for SWMM Model	Drainage Area to Seep A	Drainage Area to Seep B
Area (ac)	29.4	19.9
Width (ft)	424	561
Slope (%)	4.7	11
Imperviousness (%)	24	13
Soil Suction Head (in)	3.62	6.97
Hydraulic Conductivity (in/hr)	0.23	0.16
Initial Deficit (fraction)	0.31	0.26

Model Uncertainties

There are uncertainties in the ability of the hydrologic model to accurately predict stormwater runoff volumes and rates from the drainage areas. All input parameters to the hydrologic model (e.g., drainage area boundaries, imperviousness, soil types and associated infiltration rates, depression storage, parameters that govern interflow) have a degree of uncertainty, which contribute to the overall uncertainty of model results. However, the most uncertain and sensitive parameters for determining runoff volumes include Green-Ampt infiltration parameters and depression storage. For examining stormwater runoff flowrates, flow width is also a sensitive parameter, in addition to the parameters noted to be sensitive for determining runoff volumes.

Importantly, the hydrologic model was not calibrated with measured flow data. Modeled flow rates are more accurate when calibrated, but since there were no flume measurements for the portion modeled, i.e., the catchment upgradient of the barrier wall only, the model was not calibrated.

Model Results

Stormwater Runoff Volumes

Historical storm events (during the modeled period of record from 2006 through 2020) with total rainfall depths approximately equal to 0.50 inches were examined. The average total stormwater runoff volumes during these storm events, as predicted by the hydrologic model, are shown in Table 6.

Table 6. Model Predicted Stormwater Runoff Volumes for the 0.50-inch Storm Event

Seep	Storm Event Total Rainfall Depth (in)	Average Model-Predicted Stormwater Runoff Volume (cubic feet)	Average Model-Predicted Stormwater Runoff Volume (gallons)
A	0.45 - 0.55	11,000	80,000
	0.40 - 0.60	10,000	77,000
B	0.45 - 0.55	4,000	30,000
	0.40 - 0.60	4,000	29,000

Results from the hydrologic model (Table 6) were compared to the estimated stormwater runoff volumes using the Simple Method for Runoff Volume from the Manual (Table 2) for the 0.50-inch design storm. The stormwater runoff volumes for the 0.50-inch design storm estimated using guidance from the Manual are slightly higher (i.e., more conservative) than the model-predicted runoff volumes. This is consistent with expectations that the approximate calculation methodology (outlined in the Manual) would result in conservative (i.e. higher) estimates of runoff volumes than a hydrologic model.

Seep Basis of Design Flow Rates

This section presents the recommended basis of design flow rates and stormwater volumes for the seeps ex situ capture systems. First, the recommended seeps baseflow are described, then the stormwater volumes for 0.5” or less rainfall events.

Dry weather flows were measured using flumes in both seeps down gradient of the planned barrier wall location. The 95th percentile dry weather flows from both seeps are recommended to be used as the basis of design for dry weather flow capture. For Seep A this flow rate is 31 gpm and for Seep B 130 gpm for a total of 161 gpm.

Stormwater runoff volumes for a 0.5-inch design storm were calculated using both the Simple Method for Runoff Volume and by using a hydrologic model to serve as a check on the Simple Method. The Simple Method was the more conservative design basis with a higher total stormwater flow volume; these results are recommended to be used as the basis of design for stormwater capture volumes. For 0.5" rainstorms during a 24-hour period, Seep A was estimated to receive up to 110,000 gallons of flow and Seep B receive up to 46,000 gallons of flow for a total volume of 156,000 gallons. The ex-situ seeps capture system will include equalization storage. Assuming the ability to store and equally meter out the entire 24-hr, 0.5" rain event flow volume to the GWTP over a 24-hour period yields estimated flow rates of 76 gpm for Seep A and 32 gpm for Seep B for a total of 108 gpm. This calculation is shown below in Table 7.

Table 7: Storm Flows Basis - Simple Method

Seep A		
Seep A - 0.5" Rain Volume	110,000	gal
0.5" Rain Volume over 24-hrs	76	gpm
Seep B		
Seep B - 0.5" Rain Volume	46,000	gal
0.5" Rain Volume over 24-hrs	32	gpm
Combined		
Combined Volume - 0.5" Rain	156,000	gal
0.5" Rain Volume over 24-hrs	108	gpm

Taken together the dry weather and the stormflows for rainfall events up to 0.5" over 24-hrs comprise a total design flowrate of 269 gpm (Table 8), which will be directed to the GWTP.

Table 8: Design Flowrates and Volumes

Flow Source	Flowrate to GWTP (gpm)	Stormwater Volume During 0.5" Storm (gallons)
Seep A Rainfall	76	110,000
Seep B Rainfall	32	46,000
Subtotal	*108*	*156,000*
Seeps A Baseflow	31	-
Seeps B Baseflow	130	-
Subtotal	*161*	-
Total	**269**	**156,000**

References

Geosyntec 2020, Interim Seep Remediation System Plan, Prepared for The Chemours Company FC, LLC.

NCDEQ, 2020. NCDEQ Stormwater Design Manual. Part B: Calculations Guidance. Available at: https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/stormwater/stormwater-program/stormwater-design.

Larry W. Mays, 2010. Water Resources Engineering. Second Edition.

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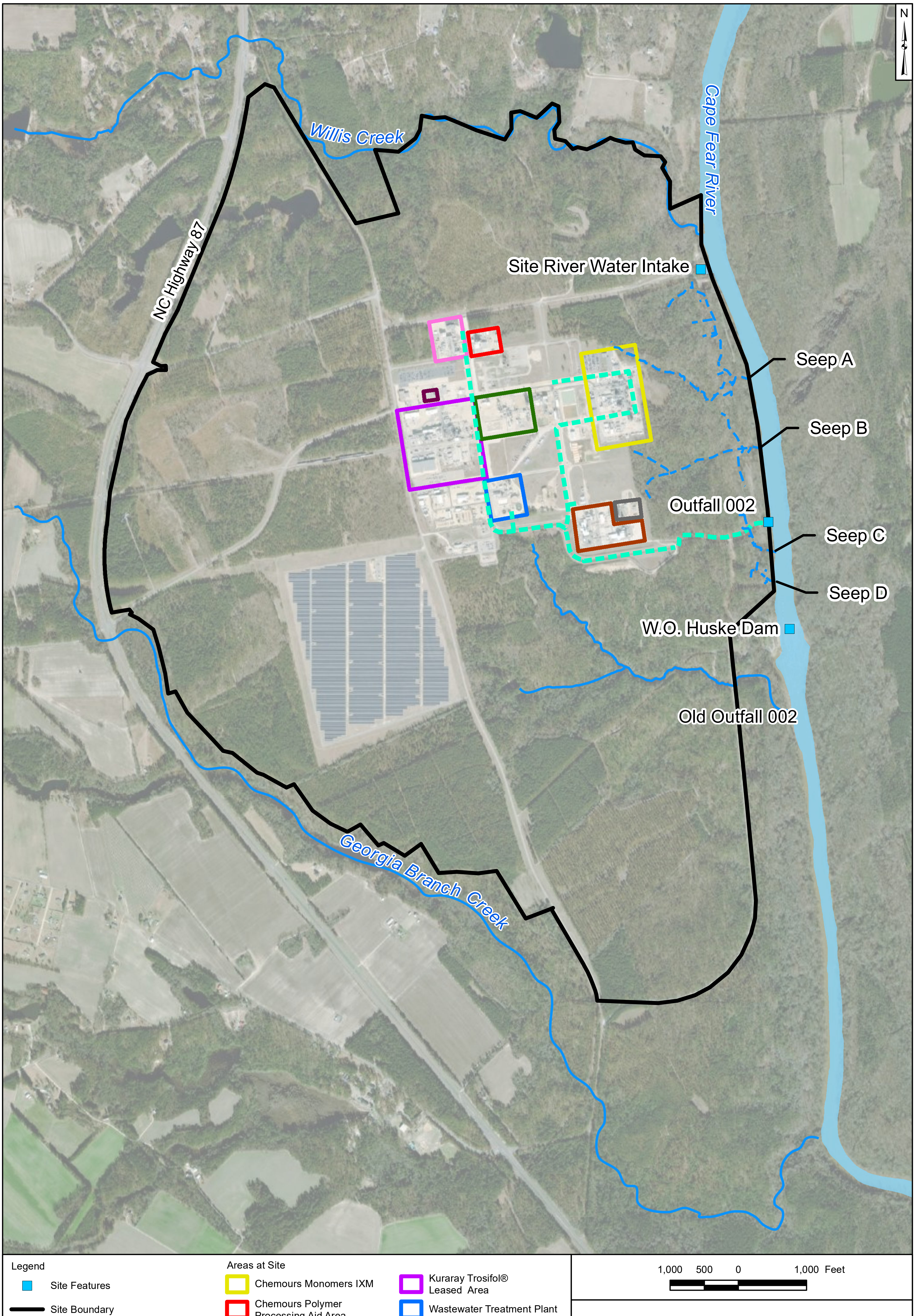
Figures



Legend

- 🟦 Site Features
- ━ Site Boundary
- ─ Nearby Tributary
- ╌ Observed Seep (Natural Drainage)
- ╍ Site Conveyance Network

Areas at Site

- ☐ Chemours Monomers IXM
- ☐ Chemours Polymer Processing Aid Area
- ☐ DuPont Polyvinyl Fluoride Leased Area
- ☐ Former DuPont PMDF Area
- ☐ Kuraray SentryGlas® Leased Area
- ☐ Kuraray Trosifol® Leased Area
- ☐ Wastewater Treatment Plant
- ☐ Power - Filtered and Demineralized Water Production
- ☐ Kuraray Laboratory

Notes:
1. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
2. Basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Site Location Map

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

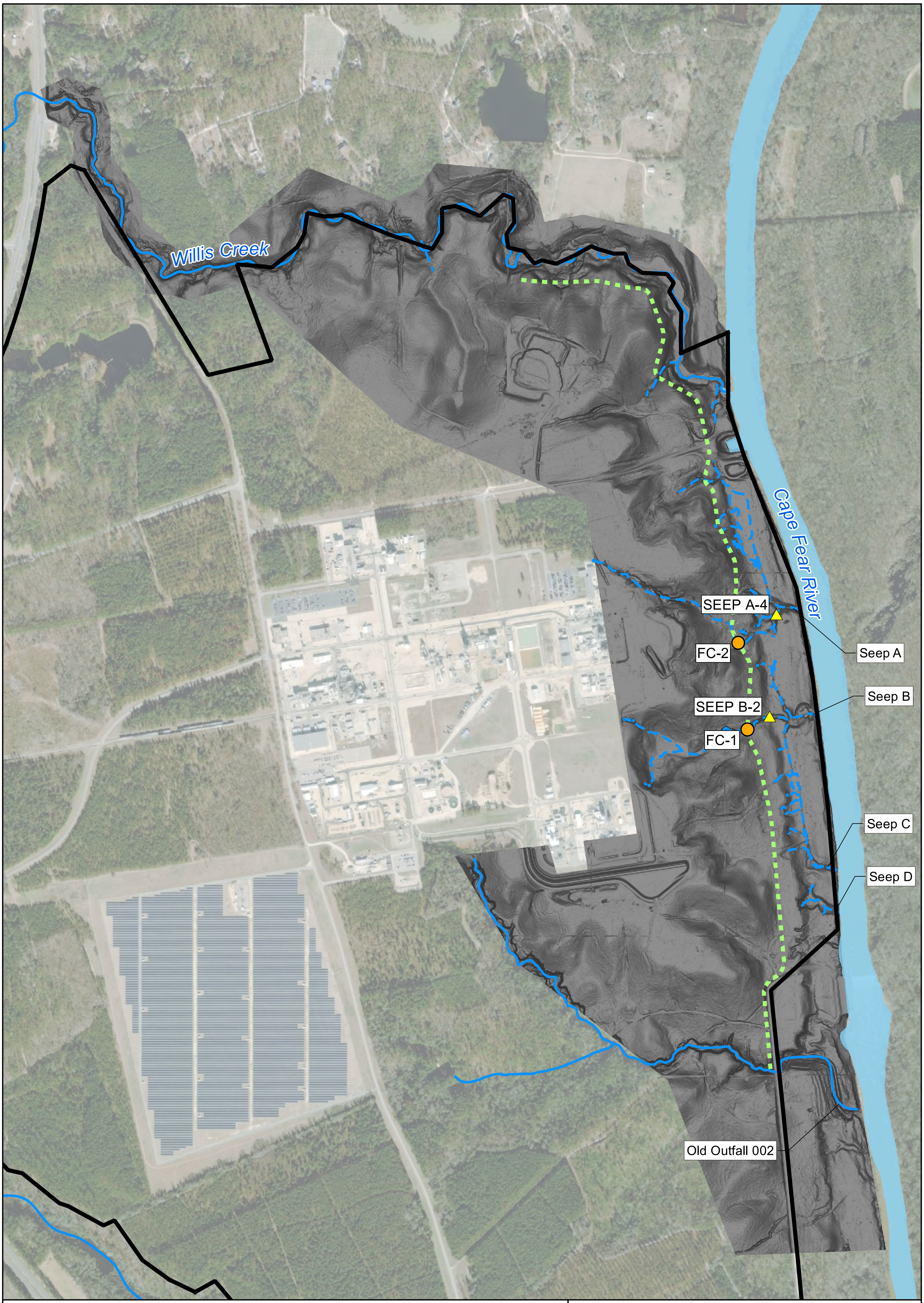
Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Raleigh

August 2021

Figure

1



Legend

● Proposed Flow Measurement Location[3]

△ Flow Measurement Location

⋯ Planned Groundwater Remedy Route

— Site Boundary

- - Observed Seep

— Nearby Tributary

Notes:

1. Topographic surface was generated using LiDAR scans performed on December 1, 2019 and December 19, 2019 by Spectral Data Consultants, Inc.
2. Seep locations identified visually as reported in Geosyntec, 2019. Seeps and Creeks Investigation Report. Chemours Fayetteville Works. 26 August 2019.
3. Proposed flow measurement locations are placed at points where the observed seeps cross the planned groundwater remedy route.
4. The outline of Cape Fear River is approximate and is based on open data from ArcGIS Online and North Carolina Department of Environmental Quality Online GIS (MajorHydro shapefile).
5. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

1,000 500 0 1,000 Feet

Surrogate Flow Measurement Locations

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Geosyntec consultants

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Figure 2

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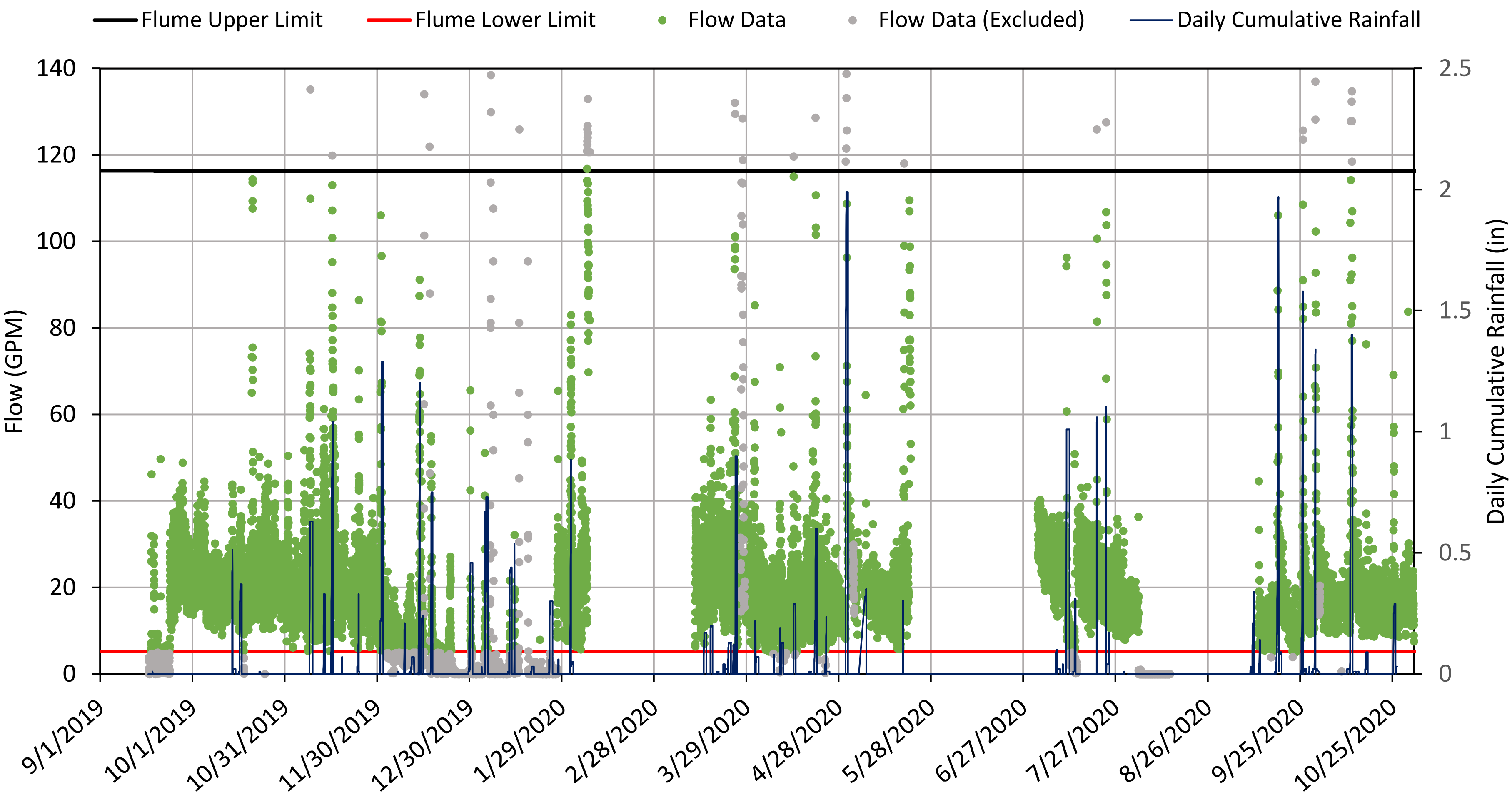
Seep A-4



Notes:

1. Time spans without data are associated with periods when the flume was not operational.
2. Daily cumulative rainfall is the cumulative rainfall in one calendar day.
3. Excluded flow data was determined from river inundation and data outside of the flume limits.

Abbreviations:

gpm - gallon per minute
in - inch

Seep A-4 Time Trends
Chemours Fayetteville Works, North Carolina

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Figure
3

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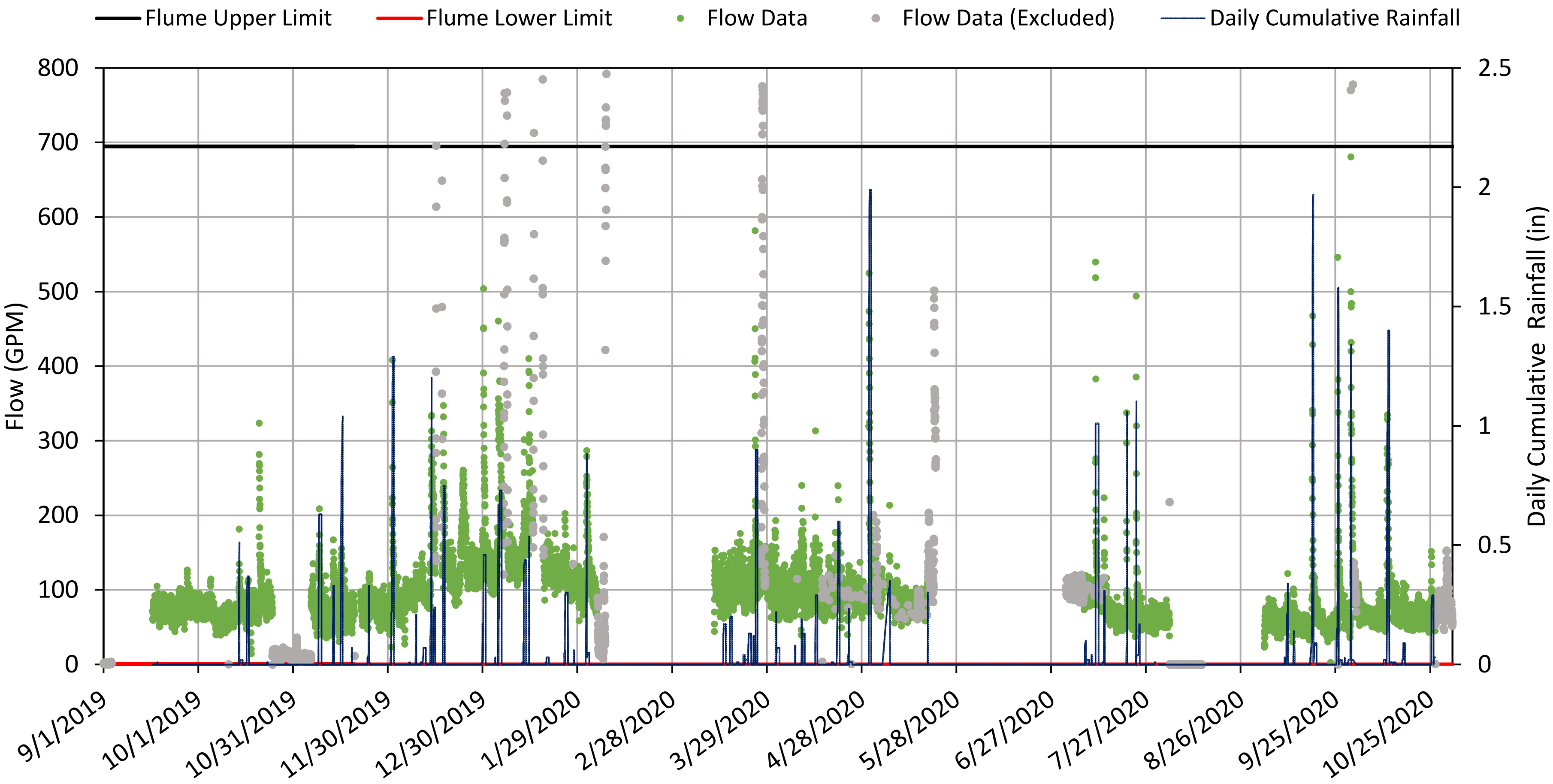
Seep B-2



Notes:

1. Time spans without data are associated with periods when the flume was not operational.
2. Daily cumulative rainfall is the cummulative rainfall in one calendar day.
3. Excluded flow data was determined from river inundation and data outside of the flume limits.

Abbreviations:

gpm - gallon per minute
in - inch

Seep B-2 Time Trends
Chemours Fayetteville Works, North Carolina

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Figure

4

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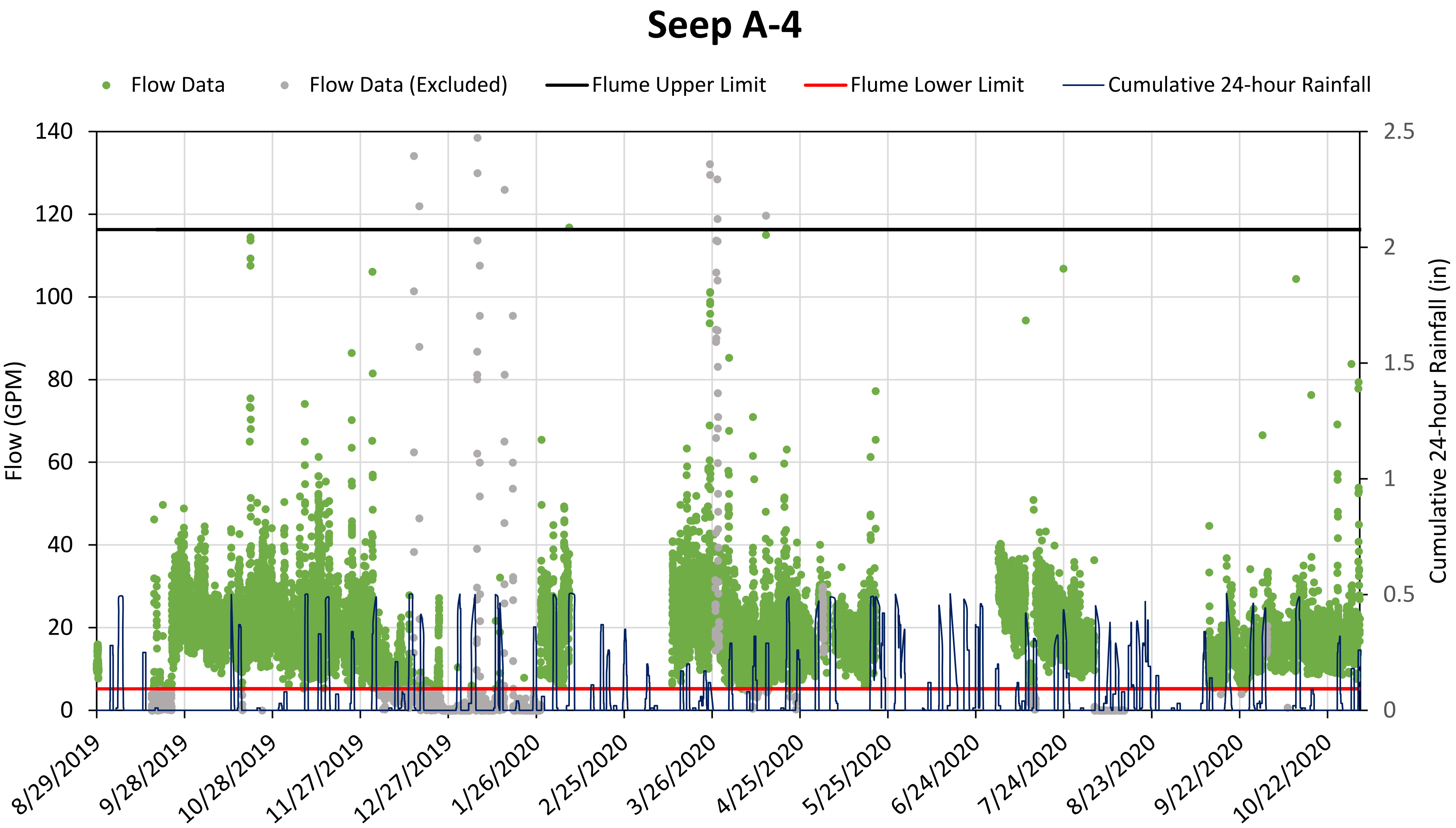

Notes:
1. Time spans without data are associated with periods when the flume was not operational.
2. Cumulative 24-hour rainfall is the cumulative rainfall over a rolling 24 hour period.
3. Excluded flow data was determined from river inundation and data outside of the flume limits.

Abbreviations:

gpm - gallon per minute

in - inch

Seep A-4 Time Trends
Cumulative 24-hour rainfall up to 0.5 inches
Chemours Fayetteville Works, North Carolina

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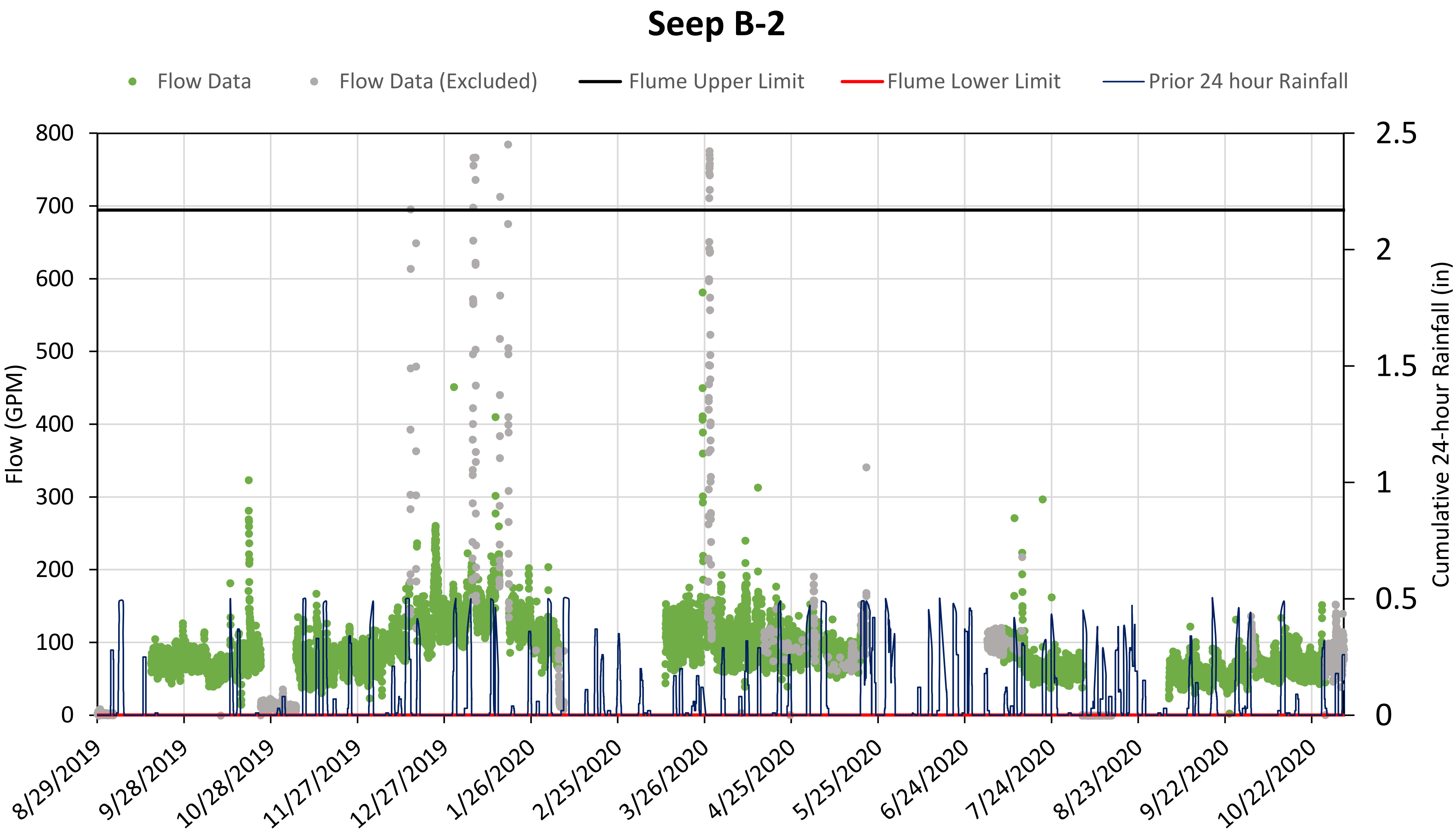
Raleigh | August 2021

Figure 5



Notes:

1. Time spans without data are associated with periods when the flume was not operational.
2. Cumulative 24-hour rainfall is the cumulative rainfall over a rolling 24 hour period.
3. Excluded flow data was determined from river inundation and data outside of the flume limits.

Abbreviations:

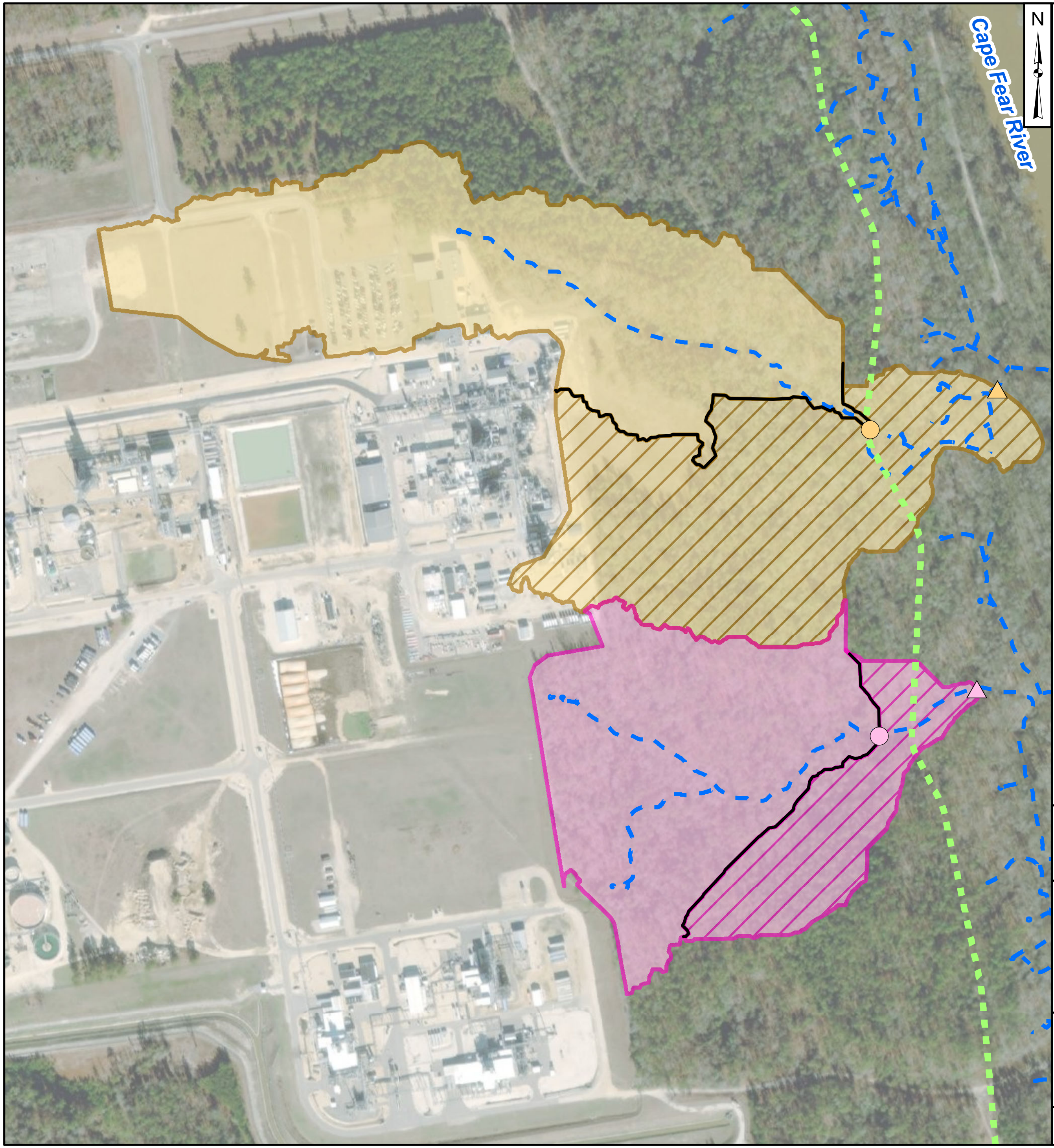
gpm - gallon per minute
in - inch

Seep B-2 Time Trends
Cumulative 24-hour rainfall up to 0.5 inches
Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Raleigh	August 2021	Figure 6



Legend

● Seep A Upstream Capture Point

● Seep B Upstream Capture Point

▲ Seep A-4 Flume Location

▲ Seep B-2 Flume Location

⋯ Planned Groundwater Remedy Route

-- Seep

Estimated Watershed

🟨 Seep A - Modeled Catchment

🟪 Seep B - Modeled Catchment

▨ Seep A - Additional Catchment Measured by Flume

▨ Seep B - Additional Catchment Measured by Flume

Notes:
1. Seep catchment areas were estimated using geospatial methods and tools, and based on lidar data collected for Chemours.
2. Seep locations identified visually as reported in Geosyntec, 2019. Seeps and Creeks Investigation Report. Chemours Fayetteville Works. 26 August 2019.
3. Basemap source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

500 250 0 500 Feet

Seep Drainage Areas

Chemours Fayetteville Works, North Carolina

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Figure 7

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Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US

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GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

Appendix F
Seep Ex-Situ Capture Remedy Design Report

Ex-Situ Capture Remedy 60% Design Submittal

Chemours Fayetteville Works

Prepared for

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22828 NC Highway 87
Fayetteville, NC 28306

Prepared by

GEOServices, LLC
5559 North Lee Highway
Cleveland, TN 37312

August 2021

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Attachments

List of Abbreviations

BOD	Basis of Design
COA	Consent Order Paragraph 12 Addendum
ft	feet
gpm	gallons per minute
GWTP	groundwater treatment plant
HFPO-DA	hexafluoropropylene oxide dimer acid
mg/L	milligram per liter
MSL	Mean Sea Level
NCDEQ	North Carolina Department of Environmental Quality
PFAS	per- and polyfluoroalkyl substances
PFMOAA	perfluoro-1-methoxyacetic acid
PMPA	perfluoro-2-methoxypropanoic acid
TSS	total suspended solids

1. Introduction and Objectives

GEOServices, LLC (GEOS) has prepared for The Chemours Company, FC, LLC (Chemours) this 60% Engineering Design Report for the long-term seep remediation system planned to be installed at the Chemours Fayetteville Works facility in Bladen County, North Carolina. This report has been prepared pursuant to the Consent Order Paragraph 12 Addendum (COA) which requires a 60% design report for the Barrier Wall and Groundwater Extraction and Treatment System be submitted by August 15, 2021 to North Carolina Department of Environmental Quality (NCDEQ) for approval. This report describes the basis of design (BOD) for the long- term seep capture system portion of the overall system.

The COA provides that Chemours shall proceed with the design and the installation of a barrier wall and groundwater extraction and treatment system to reduce per- and polyfluoroalkyl substances (PFAS) loading from groundwater flow from under the Facility to the Cape Fear River and Willis Creek. The primary objective of the long-term seep remedy is to reduce the total annual mass loading of PFAS (as measured by the indicator parameters hexafluoropropylene oxide dimer acid [HFPO-DA], perfluoro-2-methoxypropanoic acid [PMPA], and perfluoro-1-methoxyacetic acid [PFMOAA]) to the Cape Fear River from Seeps A through D.

The remedy objectives outlined in the COA results in a remedy design with three components:

- The groundwater interception remedy
- The Seeps A and B ex-situ capture remedy
- The groundwater treatment plant

The following sections of this document and the supporting figures outline the design basis, capture basis, implementation, and methods utilized for the ex situ seeps capture.

Per paragraph 2(c)(i) of the COA, the seeps ex-situ capture remedy design consists of two capture locations where the seep flow headwaters exist above ground above the barrier wall alignment at Seep A and Seep B. The design uses impoundment and pumping systems along with equalization basins sized to accommodate dry weather flows and stormwater flows from rainfall events up to 0.5 inches over 24 hours. The captured water is then conveyed to the groundwater treatment plant (GWTP) which is being designed to treat collected water and remove 99% of indicator parameters.

2. Seeps Capture Remedy Design

Pursuant to paragraph 2(c)(i) of the COA, the seep remedy at Seeps A and B will consist of the ex-situ capture of dry weather flow and stormflow up to one-half inches in a 24-hour period. The seep remedy was developed based on flume data and catchment modeling prepared by Geosyntec Consultants of NC, P.C. (Geosyntec; see Appendix E of the 60% Design Report). The flows utilized for design were based on the flows submitted in Table 8 of Appendix E. The table outlining these flows is shown below.

Flow	Flow Rate to GWTP (gpm)	Flow Volume During 0.5" storm (gallons)
Seep A Rainfall	76	110,000
Seep B Rainfall	32	46,000
Subtotal	*108*	*156,000*
Seep A Dry Weather Flow	31	NA
Seep B Dry Weather Flow	130	NA
Subtotal	*161*	*NA*
Total	**269**	**156,000**

The remaining sections of this document discuss the basis for the design, the collection, storage, conveyance, solids control and maintenance requirements for the Ex-Situ Capture 60% design.

2.1 Seep Capture Basis of Design

The preliminary design of the seep capture system is shown on the attached plans (Sheets SC-0.1 through SC-2.2). attached plans. The site slopes east toward the proposed barrier wall. The upper elevation of the drainage area for each seep is approximately 148 feet (ft) Mean Sea Level (MSL). The preliminary alignment of the barrier wall (Appendix C) crosses both Seep A & B at elevation 64ft (MSL). The seeps will be collected in the existing channels/low areas at elevation 80ft (MSL) above the barrier wall elevation of 72 ft (MSL). The collection system will gravity drain to a proposed basin system shown on the attached plans. The required volume for treatment from each seep will be collected and stored upstream of the barrier wall.

The collection system for each seep will function as an equalization basin allowing the continuous flow to the treatment plant. The basin system will capture and store both the dry weather flow and the stormwater flows from rainfall events up to 0.5 inches over 24 hours.

2.2 Seep Ex-Situ Capture Design

The dry weather flow for each seep will be collected via a gravity system flowing from the channel to the equalization basin system (Figure 1). The additional seep flow from rainfall events up to 0.5 inches over 24 hours will be collected via a second gravity system that drains to an upper basin that will function as a detention / equalization basin. The upper basin will provide steady flow into the lower equalization basin removing spikes in flow resulting from stormwater flows from rainfall events up to 0.5 inches over 24 hours.

2.2.1 Implementation

2.2.1.1 Collection/Storage

A concrete channel will be constructed to provide the means for collecting the dry weather flow. The concrete channel will include a small diversion weir to divert the dry weather flow into the first catch basin of the collection structure (Figures 1 - 2).

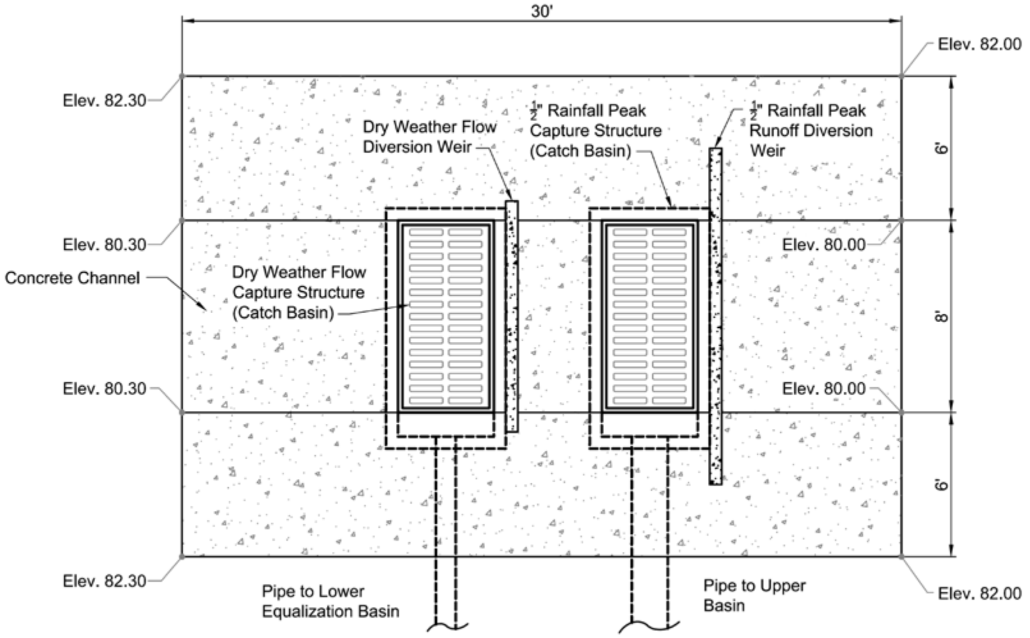


Figure 1 – Concrete Channel Capture Detail (Plan View flow left to right)

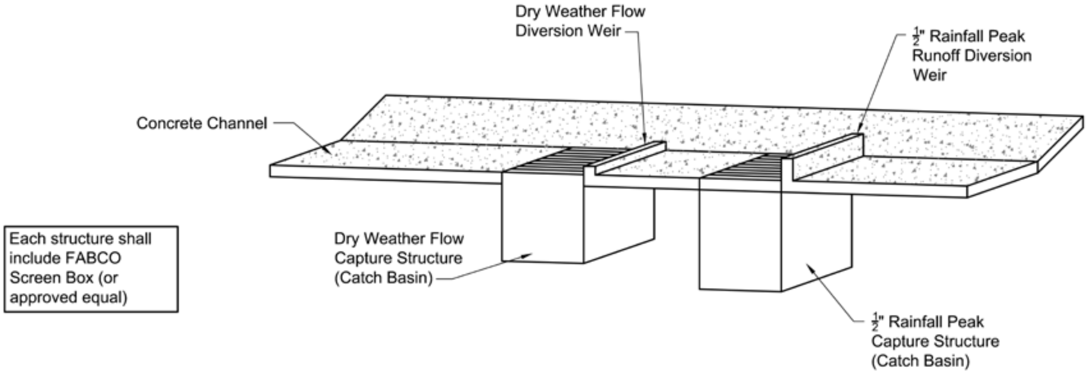


Figure 2 – Concrete Channel Capture Detail (Section)

Flow from the collection structure to the equalization basin will be controlled via an orifice (Figure 3). The orifice will be sized to allow the dry weather flow from each seep into the gravity pipe system. The gravity pipe will be oversized to allow adjustments to the collection system including enlarging the orifice if necessary. A trash rack type system will be installed at the upstream end of the concrete channel to reduce effects of unwanted material in the collection structures. A detail of the collection structure is provided in Figure 3 below.

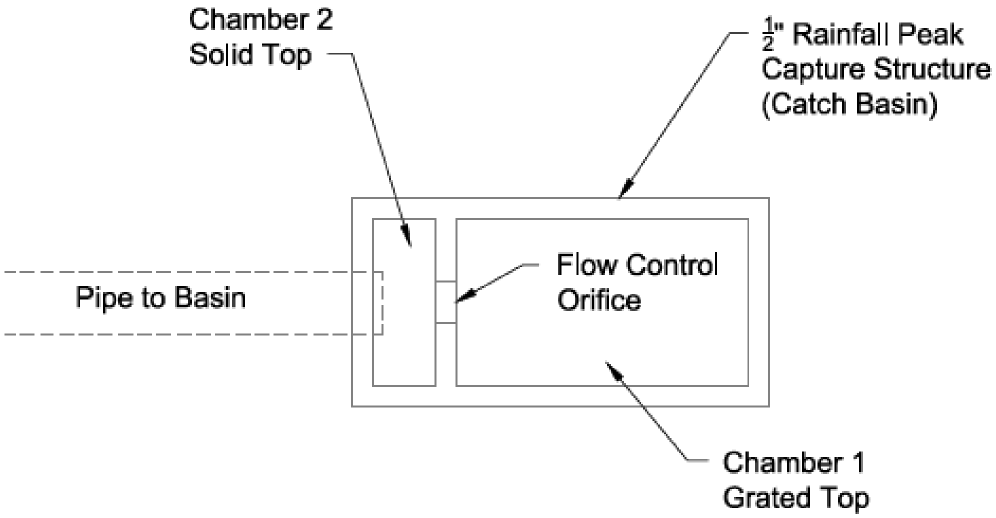


Figure 3 – Collection Structure Detail

All flow above the dry weather flow rate will overtop the dry weather flow diversion weir and continue to flow in the concrete channel (Figure 2). A second diversion weir will be included in the channel to direct all flow rates more than the dry weather flow and up to the peak flow from rainfall events up to 0.5 inches over 24 hours into the second collection structure. This structure will also include an orifice to control the flow into the gravity system. The gravity system from the second collection structure drains into the upper basin. The upper basin will include an outlet structure that detains the ½" rainfall runoff volume and outlets the water into the lower equalization basin over a 24-hour period. Because the flow rate between the upper and lower basin is controlled, the upper basin also adds the benefit of acting as a settling basin to reduce the sediment/ total suspended solids (TSS) load that is transferred to the lower equalization basin. The basin system includes a float-controlled gate that will minimize capture of volumes above the ½" rainfall in 24 hours runoff volume. Once the volume in the upper basin reaches the required collection volume, the float will close the gravity pipe from the second collection structure. The pipe will open again once the water level has lowered via the detention outlet structure.

Both basins are sized to accommodate the conservative BOD collection volumes. Both basins will also include emergency spillways to maintain integrity in the event that there is a malfunction of the system. All basins will include a liner system to prevent infiltration of captured water back into the soil.

An overview of the anticipated seep capture system outlining the location of the collection channel and equalization basins can be seen on Sheets SC-1.0 and SC-2.0 in the Attachments.

2.2.1.2 Conveyance

The equalization basin will gravity flow into the wet well for the pump station. The pump station will provide a steady/known flow to the treatment plant via a force main system. This force main is separate from the extraction well force main discussed in Appendix D. Each seep (A and B) will include a pump station that is sized to function based on the size of the equalization basin of each seep. The general location of the pump station and conveyance system are shown on Sheet SC-0.1 in the Attachments.

2.2.2 Mitigation of Sediment Loading

The ex-situ capture system will deliver captured flow to the treatment plant discussed in Appendix G. The hydraulic loading at the treatment plant will include seep dry weather flow, seeps stormflow, groundwater from the Surficial Aquifer, and Groundwater from the Black Creek Aquifer transferred via force main from respective collection points. The current technical specification for the treatment plant assumes 250 milligram per liter (mg/L) peak solids loading at a max design flow of 1500 gallons per minute (gpm) including all combined sources. The turnkey treatment facility is not currently planned to have a means of addressing sudden surges in influent solids loading. As such, the solids handling must be addressed in the ex-situ capture.

The collected stormwater flow is expected to be the most sediment laden component of the proposed ex situ capture network. Sheets SC-1.2 and 2.2 in the attachments shows how a series of basins will be utilized for TSS control. The upper basin for each seep is designed to operate as a dry basin during dry weather storage conditions but will be utilized during stormflow events. The upper basin for each seep capture system will allow settlement of TSS prior to the water entering the lower equalization basin.

2.2.3 Operation and Maintenance

As with all systems, general maintenance will be required. A summary of expected weekly inspections and maintenance is listed below:

- Inspect trash rack system upstream of concrete channel. Remove all material from trash rack screen (debris, leaves, limbs, sticks, etc.).
- Inspect dry weather flow collection structure including inlet grates and orifice. Remove any debris blocking the inlet grate and/or orifice.
- Inspect ½” rainfall collection structure including inlet grates and orifice. Remove any debris blocking the inlet grate and/or orifice.
- Inspect outlets into each basin. Verify that the gravity systems are discharging freely into each basin.

- Inspect outlet structure and gravity system from upper basin to lower equalization basin.
- Measure sediment in each basin and record depths. Remove sediment, as necessary.
- Inspect pump station and test each pump.

In addition to the general maintenance listed above, the system shall be monitored after rainfall events on a routine schedule.

3. Summary and Closing

The 60% design of ex-situ seep capture is part of the overall hydraulic barrier system planned to accomplish requirements pursuant to paragraph 2(c) (i) of the COA. The hydraulic modeling results and subsequent hydraulic loading information prepared by Geosyntec has been utilized to prepare the design documents which are attached. The hydraulic loading information can be found in the BOD located in Appendix E.

The design plan indicates the collection system for each seep will function as an equalization basin allowing steady flow to the treatment plant. The basins at each seep will capture and store both the dry weather flow and stormwater flows from rainfall events up to 0.5 inches over 24 hours. The upper basin for each seep will operate as a dry basin during dry weather flow conditions but will be utilized during stormflow events. The control of flow between upper basin and lower basin for each seep will allow settlement of TSS prior to the water entering the lower equalization basin for additional solids control.

Specific next steps include developing TSS control measures for the basins and sizing conveyance infrastructure between basin systems and the water treatment plan. The 90% design submittal will include plans, calculations, and specifications for the ex-situ seep capture system.

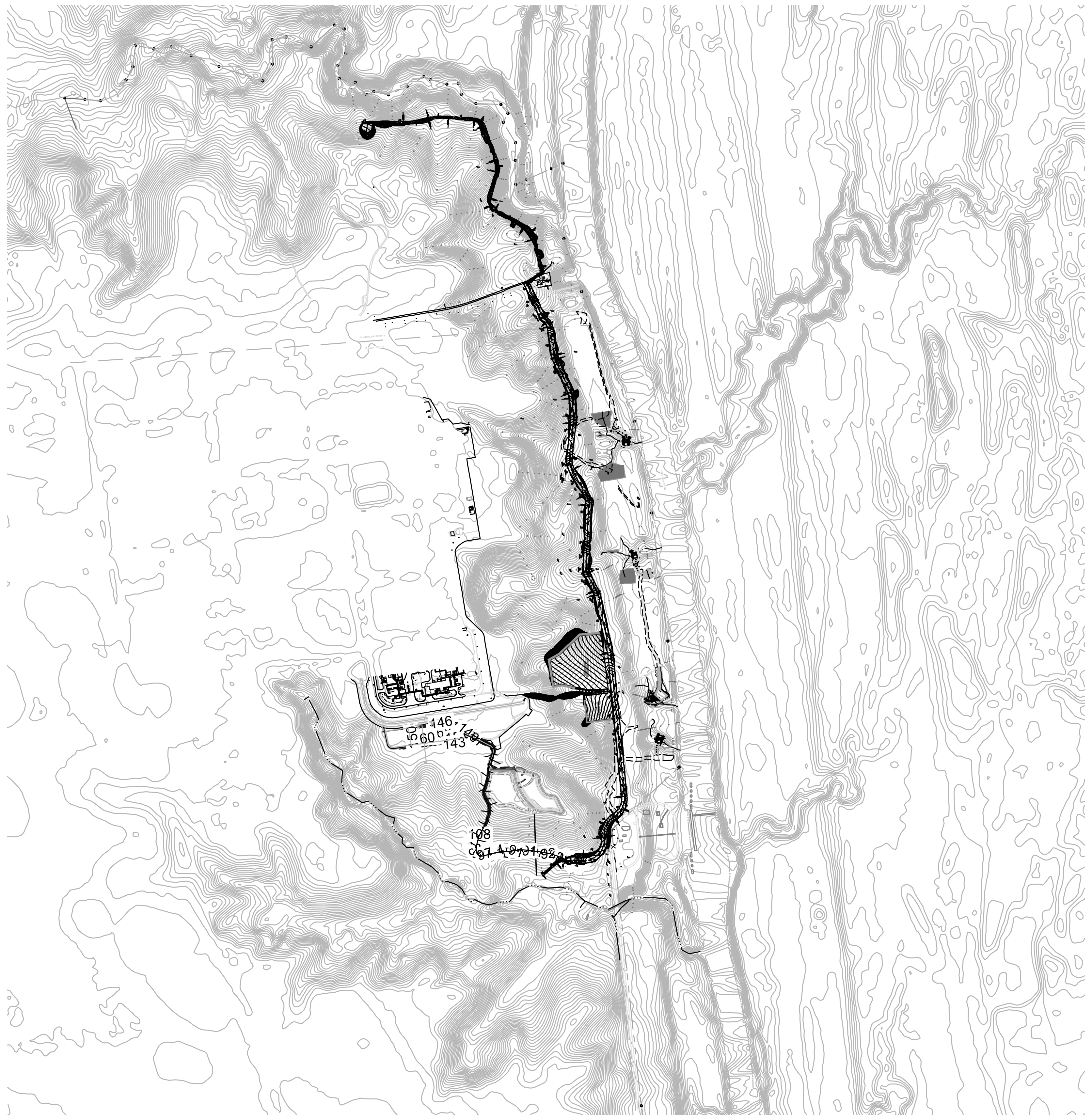
Attachments
60% Plan Set

The Chemours Company

Fayetteville, North Carolina

Ex-Situ Seep Capture Design Plans

August 12, 2021



DRAWING INDEX

GENERAL

G-1.0	COVER SHEET

EX-SITU SEEP CAPTURE

SC-0.1	LOCATION PLAN
SC-1.0	SEEP A CAPTURE SYSTEM GRADING PLAN
SC-1.1	SEEP A CAPTURE SYSTEM DETAILS
SC-1.2	SEEP A CAPTURE SYSTEM DETAILS
SC-2.0	SEEP B CAPTURE SYSTEM GRADING PLAN
SC-2.1	SEEP B CAPTURE SYSTEM DETAILS
SC-2.2	SEEP B CAPTURE SYSTEM DETAILS

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Cover Sheet

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

No.	Date	Description	By:
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5			
6			

DRAWING: G-1.0

PROJECT NUMBER: 45-20803

1 SC-0.1 Seep Capture – Location Plan

SCALE: 1" = 200'

0' 200' 400'

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Location Plan

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

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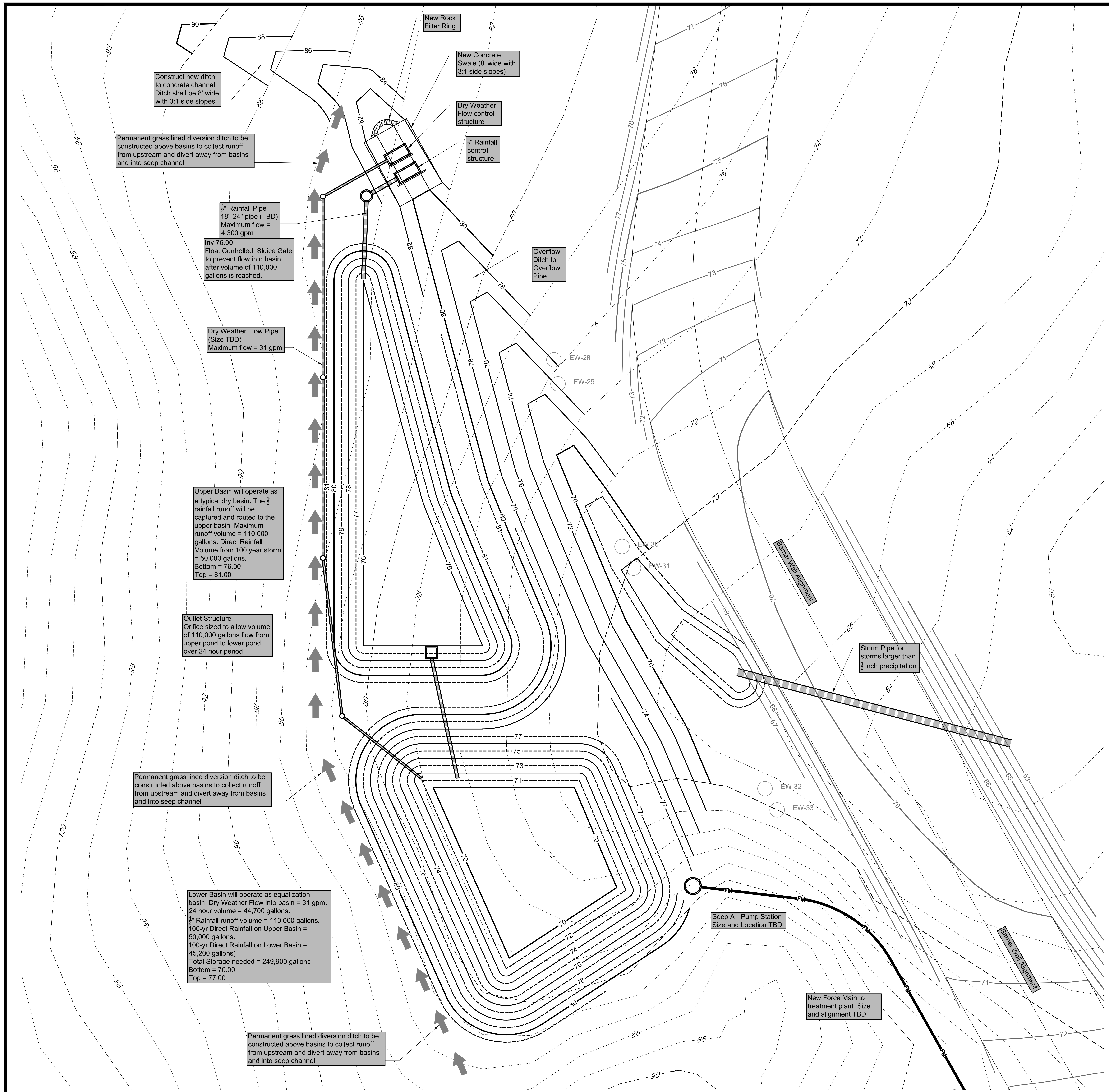
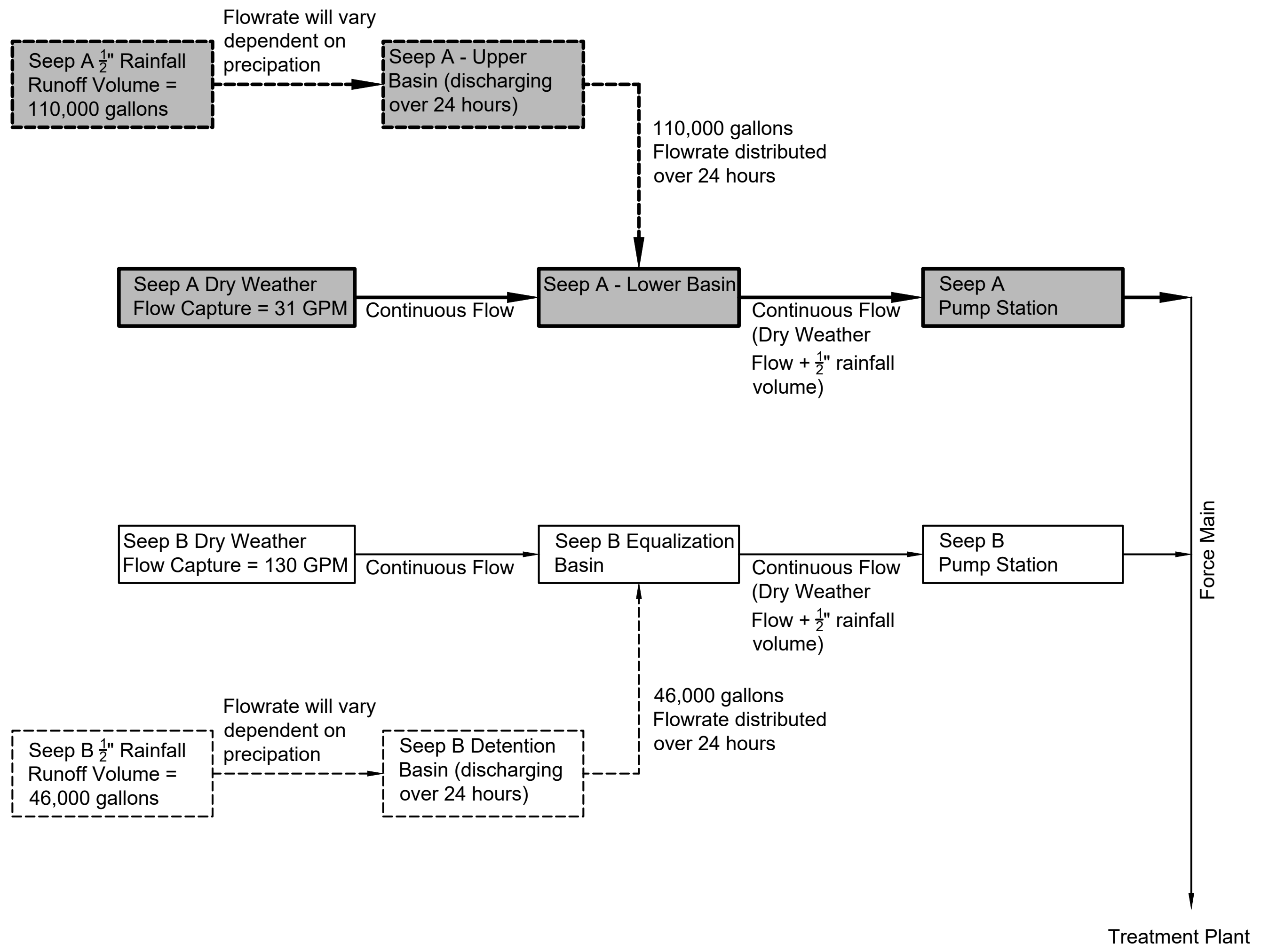
DRAWING: SC-0.1

PROJECT NUMBER: 45-20803



1 SC-1.0 Seep A – Capture System & Basin Grading Plan



GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep A Capture System Grading Plan

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:
SCALE: AS SHOWN	
DATE: August 12, 2021	

Revisions

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2			
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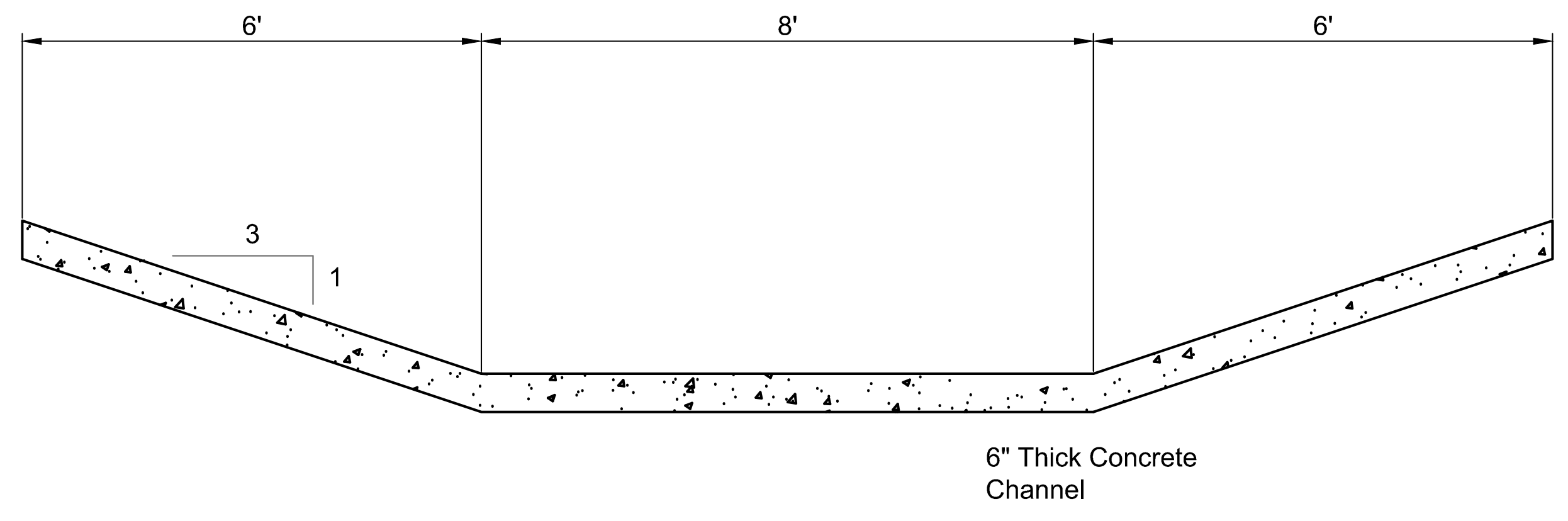
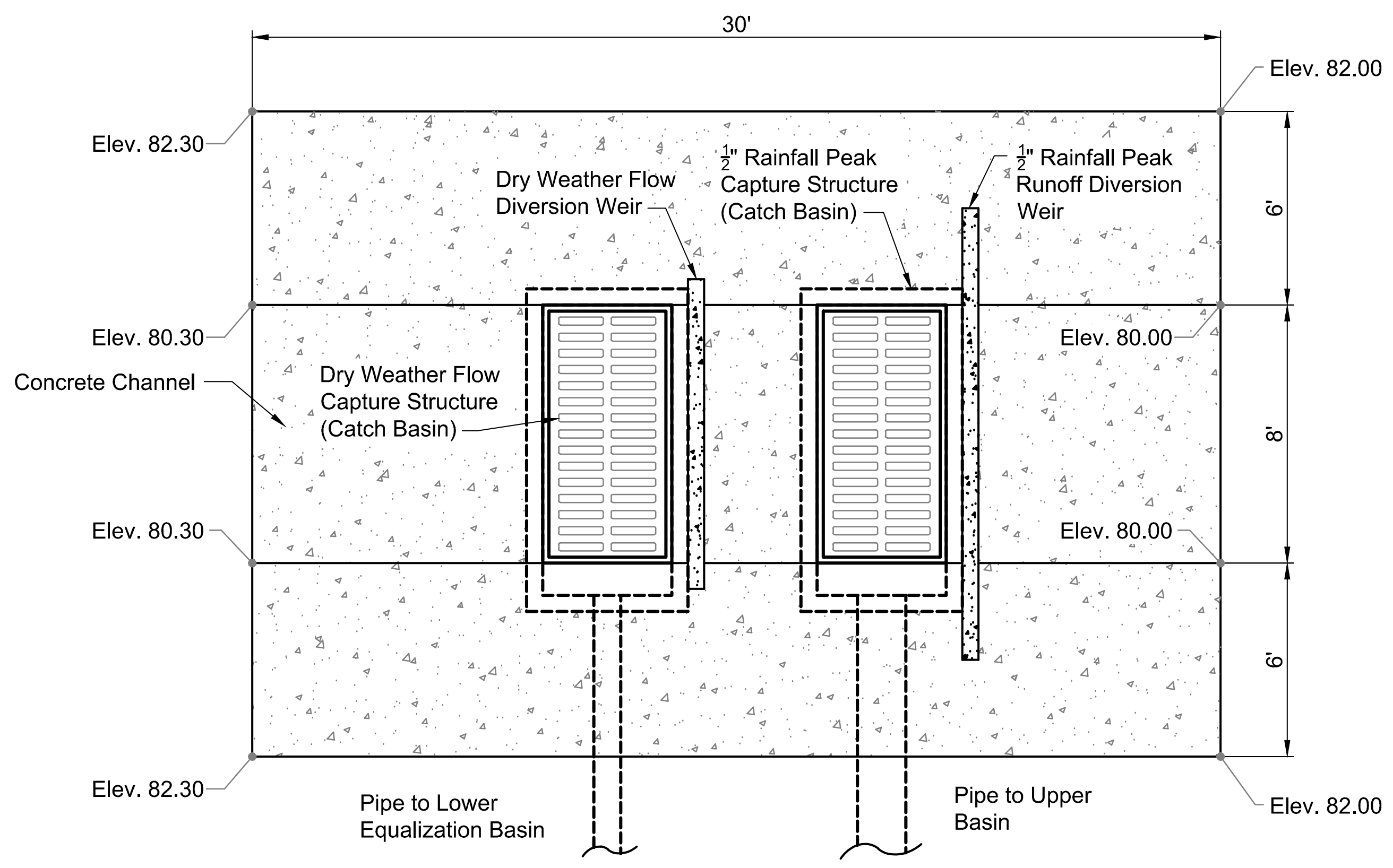
DRAWING:
SC-1.0

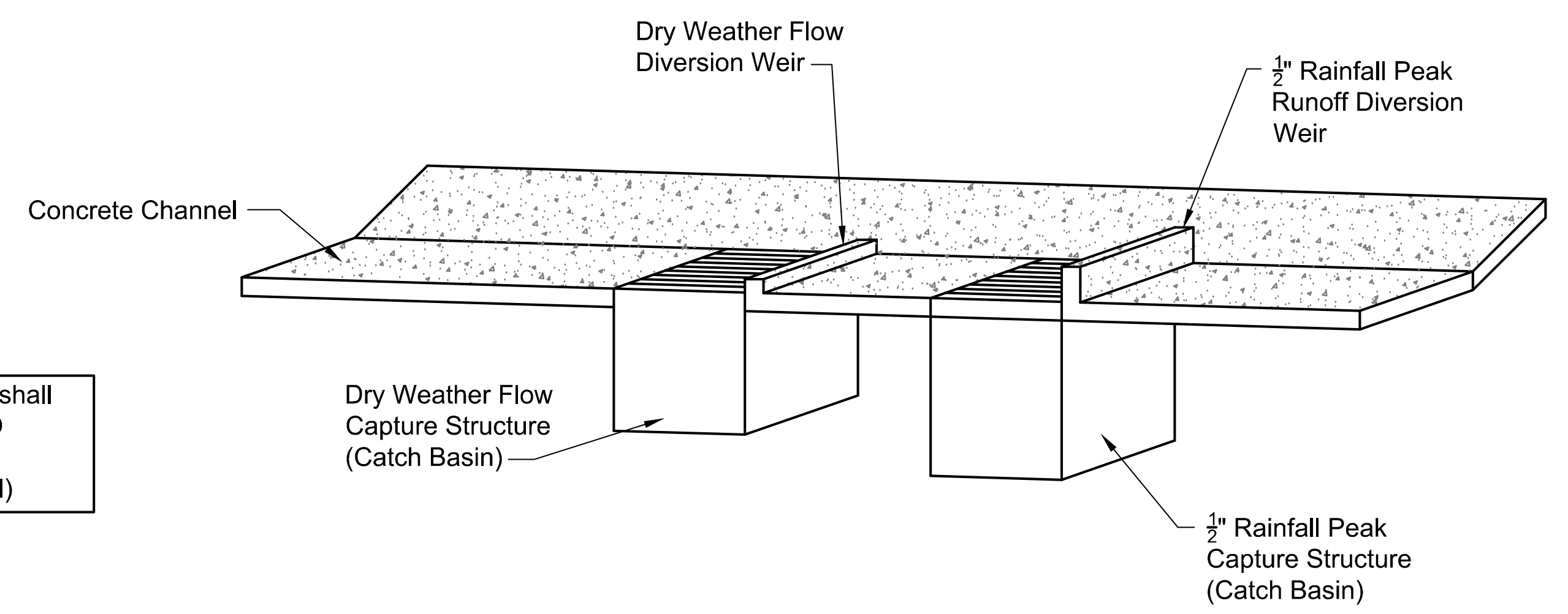
PROJECT NUMBER:
45-20803



Section A-A

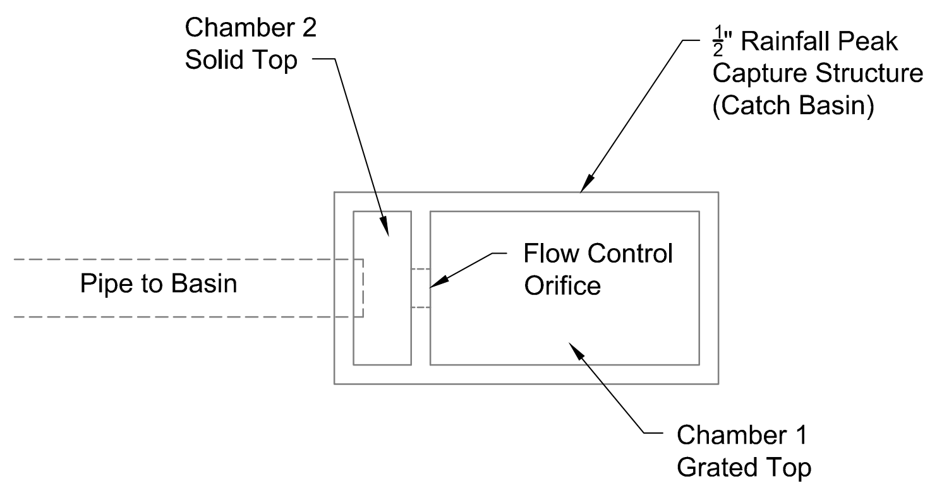


Plan

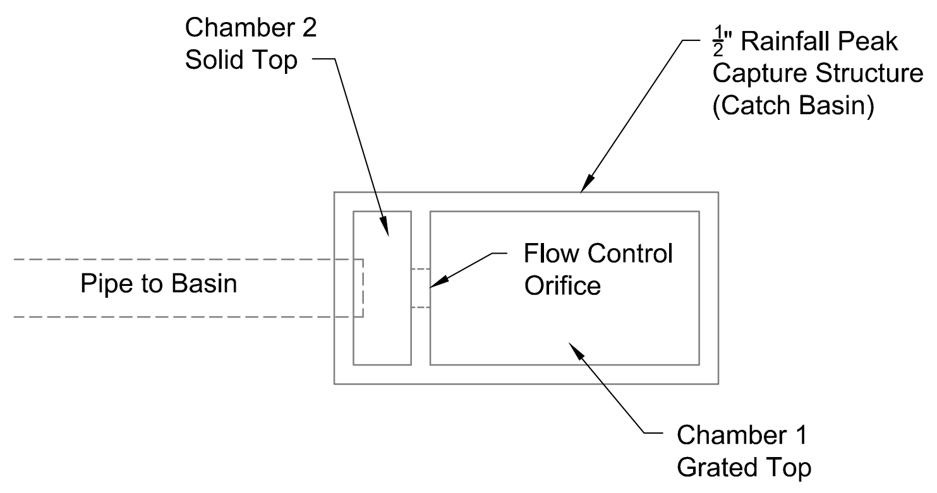


Each structure shall include FABCO Screen Box (or approved equal)

Section B-B - Skewed



Dry Weather Flow Capture Structure - Plan View



$\frac{1}{2}$" Rainfall Flow Capture Structure - Plan View

1 SC-1.1 *Seep A – Capture System*

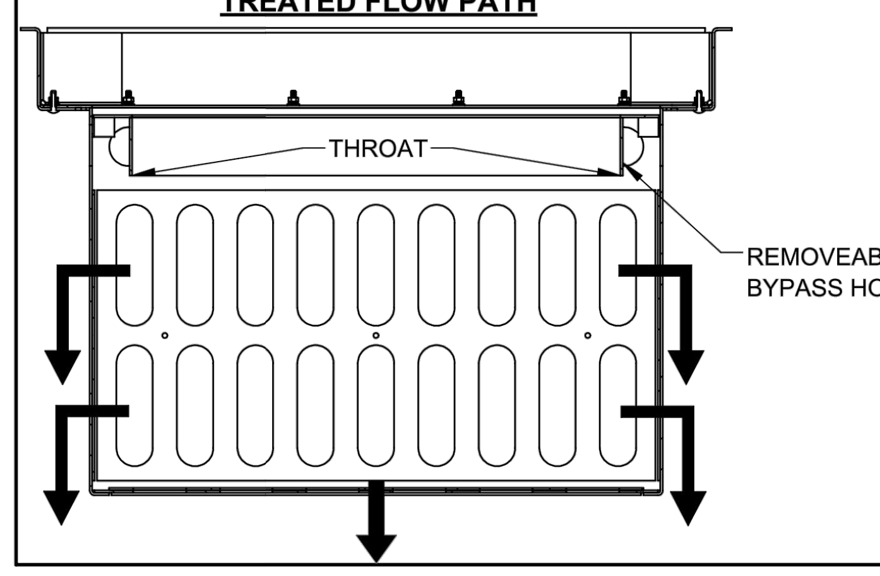
NOTES:

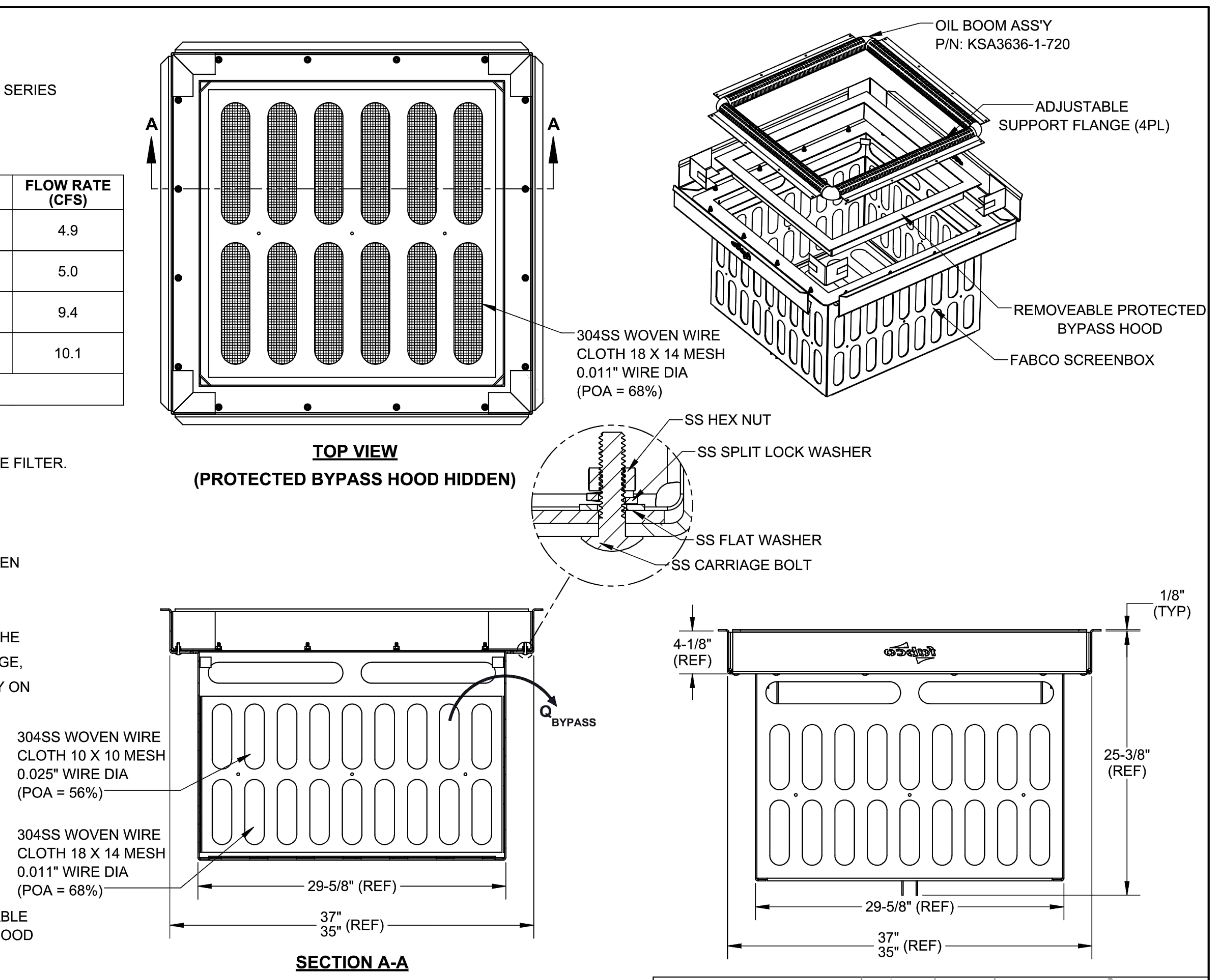
1. WEIGHT (EMPTY): 80 LBS MAX
2. MATERIAL:
   A) ADJUSTABLE FLANGES AND MAIN FRAME ASSEMBLY: ALUM., 5000 SERIES
   B) WIRE SCREENS: STAINLESS STEEL, 304 OR EQUAL
   C) SUPPORT HARDWARE: CRES 300 SERIES
3. A) PERFORMANCE CHARACTERISTICS (TYP):

OPENING DESCRIPTION	PERCENT OPEN AREA	WINDOWS AREA (SQ. IN)	OPEN AREA (SQ. IN)	FLOW RATE (CFS)
HOODED BYPASS	100%	200	200	4.9
TOP SCREEN	56%	395	221	5.0
MIDDLE SCREEN	68%	395	268.5	9.4
BOTTOM SCREEN	68%	363.5	247	10.1
DEBRIS CAPACITY: 8.2 CU-FT				

   B) TOTAL FILTERED FLOW RATE: 11000 GPM (24.5 CFS)
   C) FLOW RATE THROUGH BYPASS HOOD*: 6995 GPM (15.6 CFS)
   *NOTE THAT THIS IS THE REGULATING FLOW RATE THROUGH THE FILTER.
4. DESIGNED TO FIT CLEAR OPENING RANGE:
   A) MINIMUM SIZE: 35" X 35"
   B) MAXIMUM SIZE: 37" X 37"
5. RECOMMENDED MINIMUM VAULT DEPTH 2-IN BELOW BOTTOM SCREEN
6. TYPICAL INSTALLATION: REMOVE STORM GRATE, MEASURE CATCH BASIN CLEAR OPENING AND ADJUST FLANGES TO REST ON GRATE SUPPORT LEDGE, PLACE SCREEN-BOX IN THE DRAIN OPENING SO THE ADJUSTABLE FLANGES ARE RESTING ON THE GRATE SUPPORT LEDGE, INSTALL CORNER FILL PIECES, REINSTALL STORM GRATE DIRECTLY ON SCREEN-BOX SUPPORT FLANGES.

TREATED FLOW PATH





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UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS
BREAK SHARP EDGES .002 - .020
FILLETS .020 MAX
DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES:
DEC .00 ± .01
DEC .000 ± .005
FRACT ± 1/16
ANGLE ± 2°

PROJECT

MATERIAL SEE NOTES

	APPROVAL	DATE
DWN	R.W.	5/4/2020
CHKR		
ENGR	J.P.	5/4/2020
UPD		

FABCO INDUSTRIES, INC.
24 CENTRAL DRIVE
FARMINGDALE, NY 11735
WWW.FABCO-INDUSTRIES.COM

fabco industries inc

SCREENBOX,
NOM. C.S. 36" X 36"

SIZE B | DWG. NO. KSA3636-1-000 | REV A
SCALE: NONE | SHEET 1 OF 1

2 SC-1.1 *FABCO Screen Box*

Design Intent

1. Capture Dry Weather Flow of 31 gpm and utilize equalization basin to:
   a. Regulate flow to treatment plant.
   b. Allow TSS settlement as needed.
2. Capture runoff from $\frac{1}{2}$" Rainfall.
   a. Peak Flow = 4,300 gpm
   b. Maximum Volume from $\frac{1}{2}$" Rainfall over 24-hour period = 110,000 gallon.
   c. Utilize equalization basin to regulate flow to treatment plant and reduce TSS.

Dry Weather Flow Design Considerations

1. Total volume from 24 hours of Dry Weather Flow = 46,640 gallons. The equalization basin should be able to hold this volume as a minimum. This will allow a full 24 hours for maintenance, pump repairs, treatment plant maintenance or repairs.
2. The flow will pumped from the equalization basin to the treatment plant at an average rate of 31 gpm.
3. How to collect the base flow during larger storm events?
   a. Utilize concrete channel with diversion weir. Base flow will pond behind weir and be collected in catch basin below channel via a drainage grate.
   b. The catch basin will include two chambers. Chamber 1 will be directly below the channel and will include the drainage grate allowing the base flow to be captured in the structure.
   c. The wall between chamber 1 and 2 will include an orifice to control the flow into the pipe draining into the equalization basin. The orifice will be sized to control the flow to 31 gpm when the water level is at the top of the diversion weir. Flows above 31 gpm will overtop the diversion weir and bypass the Baseflow capture system.
   d. Chamber 2 will include an oversized pipe to gravity flow to the equalization basin.

Runoff from 1/2" Rainfall Design Considerations

1. The $\frac{1}{2}$" rainfall event over a 24-hour period results in two distinct factors for capture:
   a. Runoff Volume = 110,000 gallons.
   b. The Runoff Volume may be spread out over the entire 24-hour period or may be encountered over a shorter duration. The time variable must be accounted for in the capture system. The peak flow from the $\frac{1}{2}$" storm is 4,300 gpm.
2. The capture structure must be sized for the peak flow of 4,300 gpm while also capturing only the required volume of 110,000 gallons. A simple structure similar to the base flow structure can be utilized to capture the peak flow (larger orifice and pipe). However, how to control the volume is another issue.
   a. If the storm is the perfect model with only $\frac{1}{2}$" of rainfall with a peak runoff of 4,300 gpm and a runoff volume of 110,000 gallons, then the structure works and no other controls are necessary.
   b. If the storm is $\frac{1}{2}$" spread over a 24-hour period and the runoff volume is 110,000 gallons and the peak flow is less than 4,300 gpm, then the structure works and no other controls are necessary.
   c. If the storm is less than $\frac{1}{2}$", the structure will capture all flows and no other controls are necessary.
   d. If the storm is larger than $\frac{1}{2}$", the structure will continue to allow the peak flow through the orifice even after the maximum required volume has been collected. This will result in more treatment than required by the consent order and will result in more costs.
   e. How to stop or minimize flow after the 110,000 gallons have been captured during larger storms:
      - Metering system with automatic valves and controls. - Expensive
      - Manually controlled system. - Labor Intensive.
      - Separate the $\frac{1}{2}$" rainfall runoff flow/volume from the base flow/volume into separate basin. The basin will include a float operated slide gate valve that closes when the water level reaches the elevation corresponding with 110,000 gallons. The basin will also include an outlet structure that will control the flow out of the upper basin such that the 110,000 gallons drains into the lower equalization basin over a period of 24 hours. This will function similar to a standard detention basin. This will not completely stop flow after 110,000 gallons, but will minimize it. As water flows out of the upper basin and the water level lowers, the gate will open and allow more flow into the upper basin. However, once it reaches the elevation corresponding to 110,000 gallons the gate will close again.
   f. The upper basin will also serve the function of allowing settlement over a 24-hour period that will reduce the TSS of the flow that is most likely to contain the most TSS (the base flow shouldn't include a high level of TSS as it is a low flow and erosion and sediment transport will be minimal).

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep A Capture System Details

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

No.	Date	Description	By:
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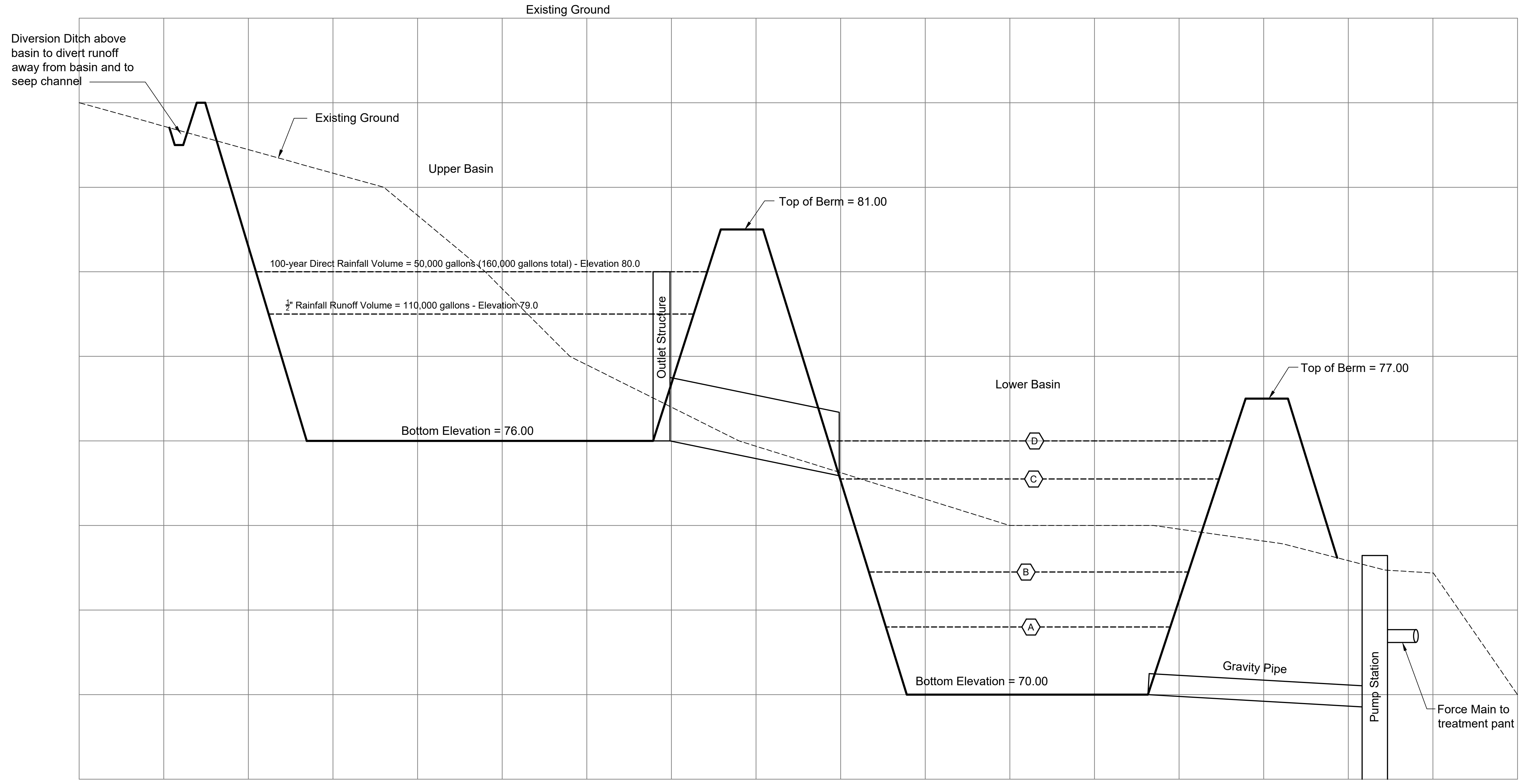
DRAWING: SC-1.1

PROJECT NUMBER: 45-20803



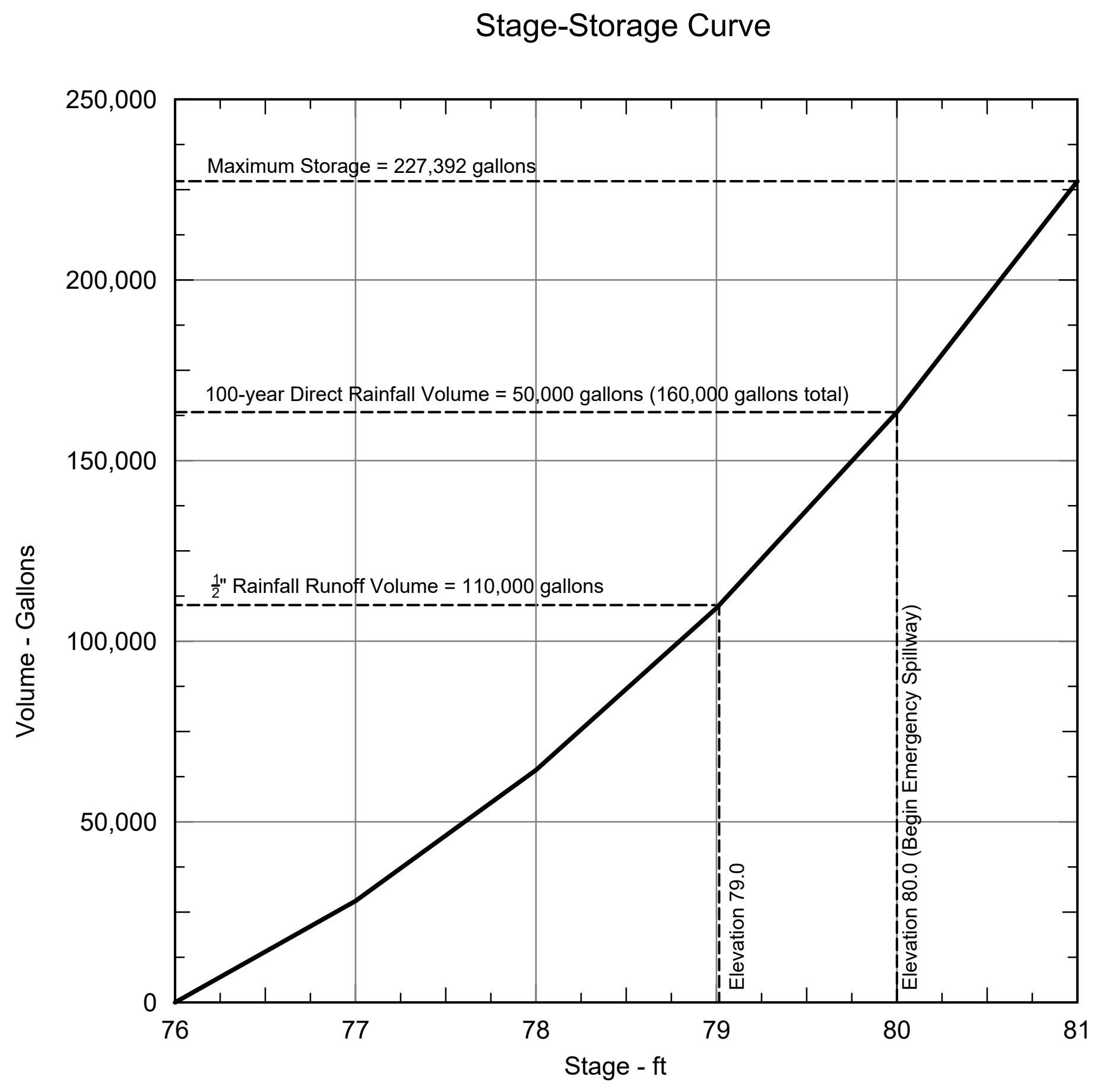
1
SC-1.2
Seep A – Schematic Flow Diagram

A 24-hr Dry Weather Flow = 44,640 gallons (volume required if pumps are not running for 24 hours)

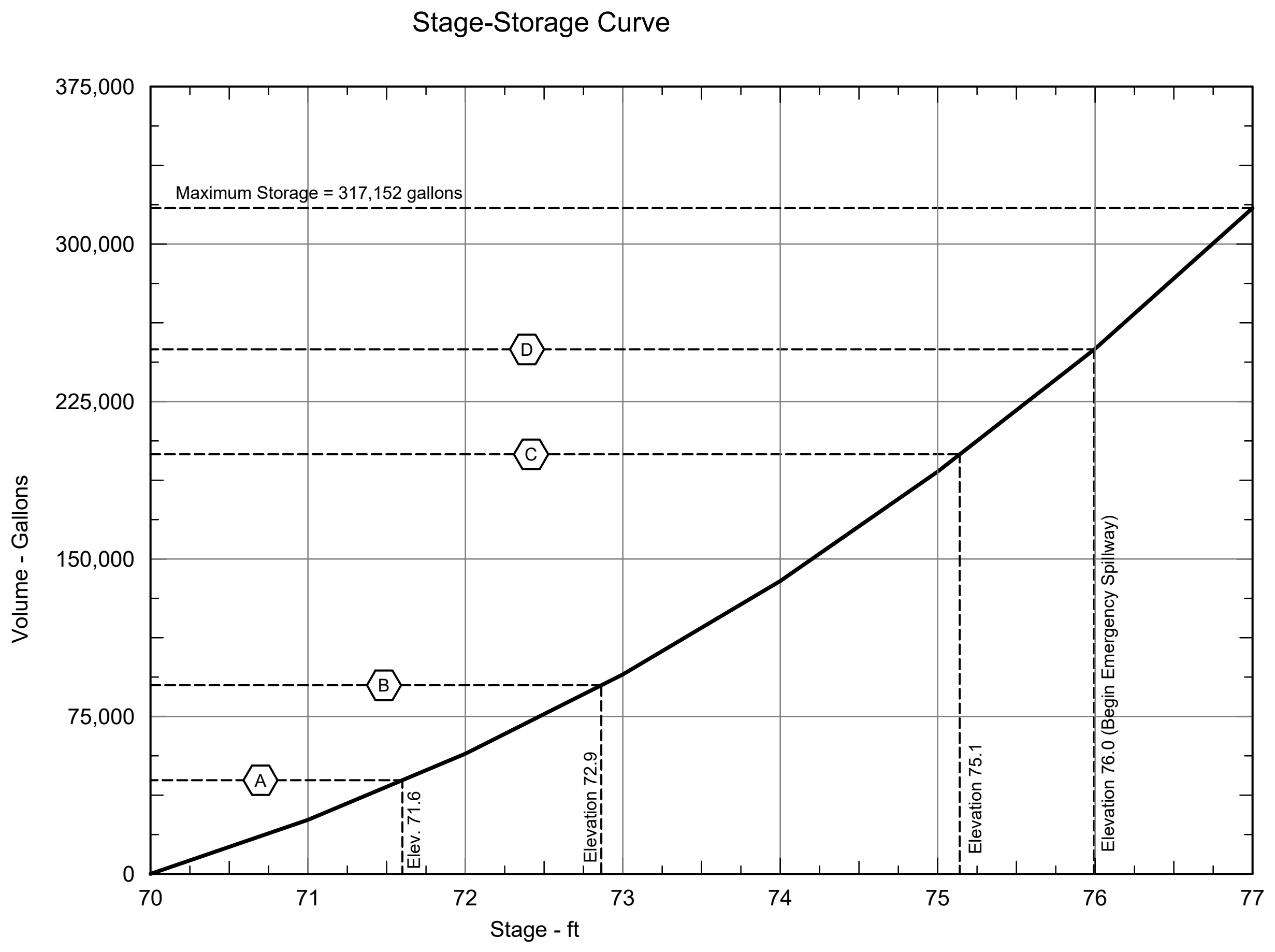
B 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) = Total = 89,840 gallons
Volume required (prior to release of $\frac{1}{2}$" runoff volume from Upper Basin) if pumps are not running for 24 hours during and 100-year storm occurs

C 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (110,000 gallons) = Total = 199,840 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin.

D 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (110,000 gallons) + 100-yr Direct Rainfall on Upper Basin (50,000 gallons) = Total = 249,840 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin and the Direct Rainfall volume is released from the upper to the lower basin.



2
SC-1.2
Seep A – Upper Basin – Stage–Storage Curve



3
SC-1.2
Seep A – Lower Basin – Stage–Storage Curve

A 24-hr Dry Weather Flow = 44,640 gallons (volume required if pumps are not running for 24 hours)

B 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) = Total = 89,840 gallons
Volume required (prior to release of $\frac{1}{2}$" runoff volume from Upper Basin) if pumps are not running for 24 hours during and 100-year storm occurs

C 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (110,000 gallons) = Total = 199,840 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin.

D 24-hr Dry Weather Flow (44,640 gallons) + 100-yr Direct Rainfall (45,200 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (110,000 gallons) + 100-yr Direct Rainfall on Upper Basin (50,000 gallons) = Total = 249,840 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin and the Direct Rainfall volume is released from the upper to the lower basin.

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep A Capture System Details

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

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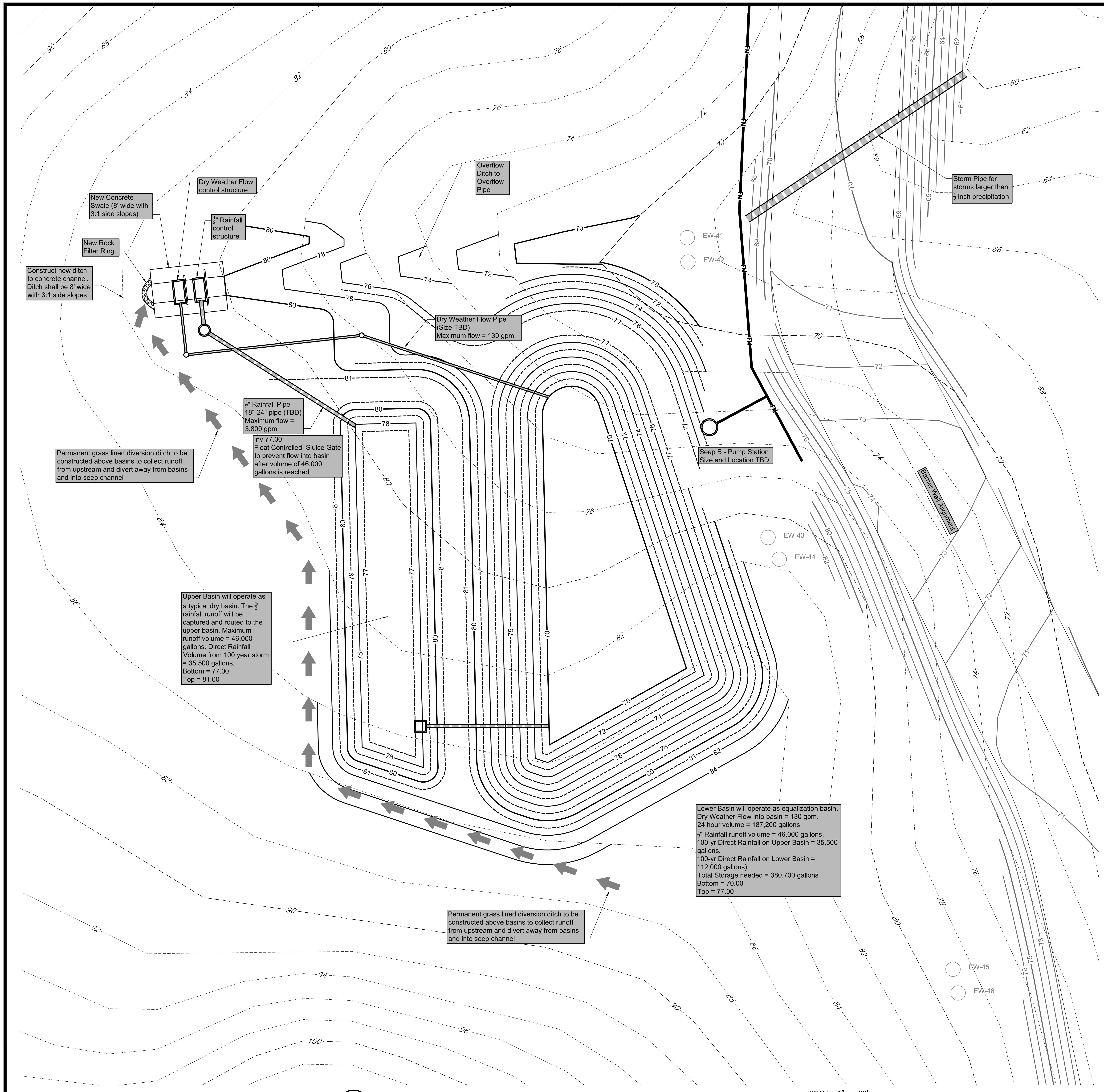
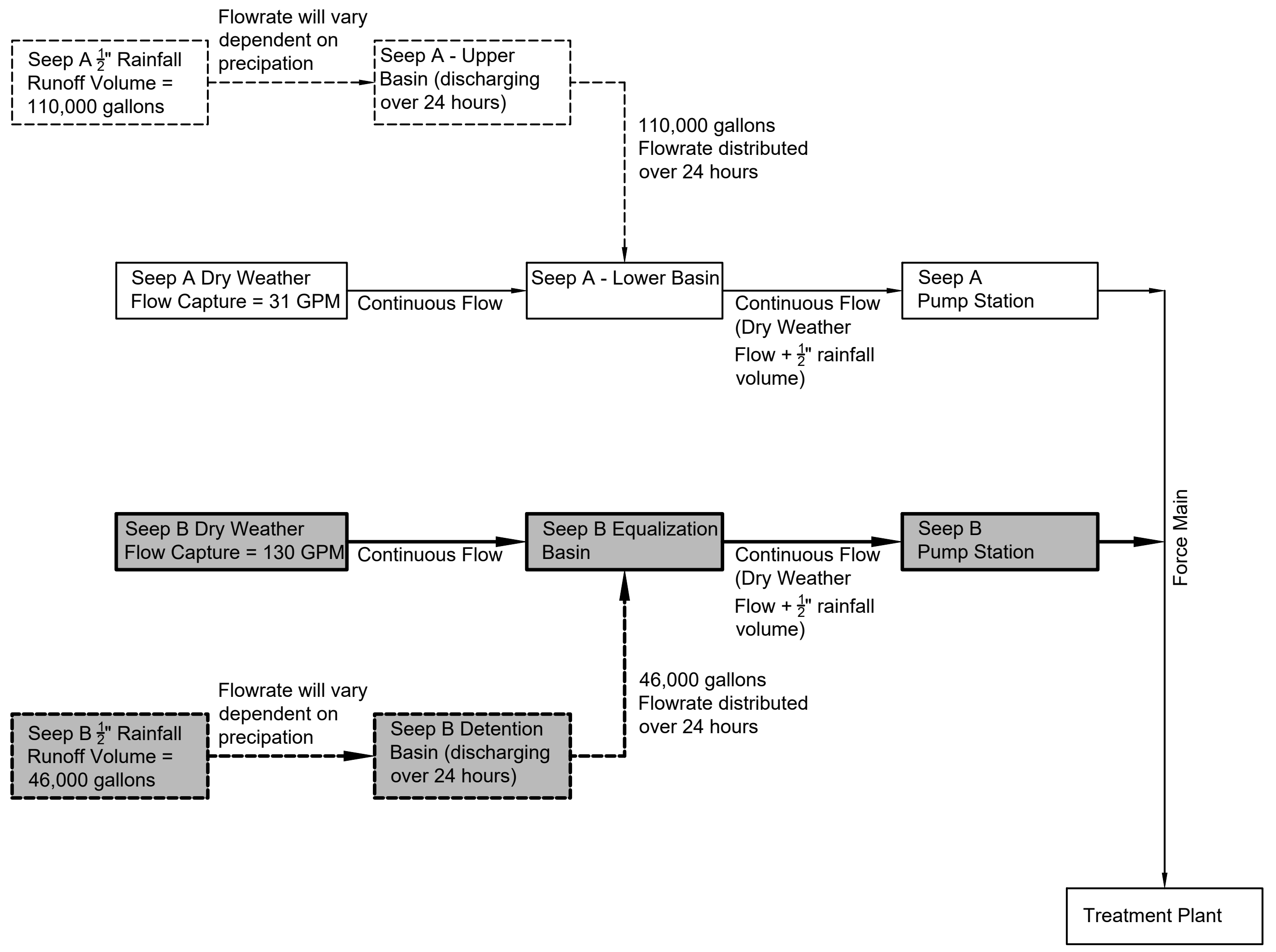
DRAWING: SC-1.2

PROJECT NUMBER: 45-20803



1 SC-2.0 Seep B – Capture System & Basin Grading Plan

SCALE: 1" = 20'
0' 20' 40'



GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep B Capture System Grading Plan

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB
REVIEWED BY: DKK
DESIGNED BY: BB
APPROVED BY:
SCALE: AS SHOWN
DATE: August 12, 2021

Revisions

No.	Date	Description	By:
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4			
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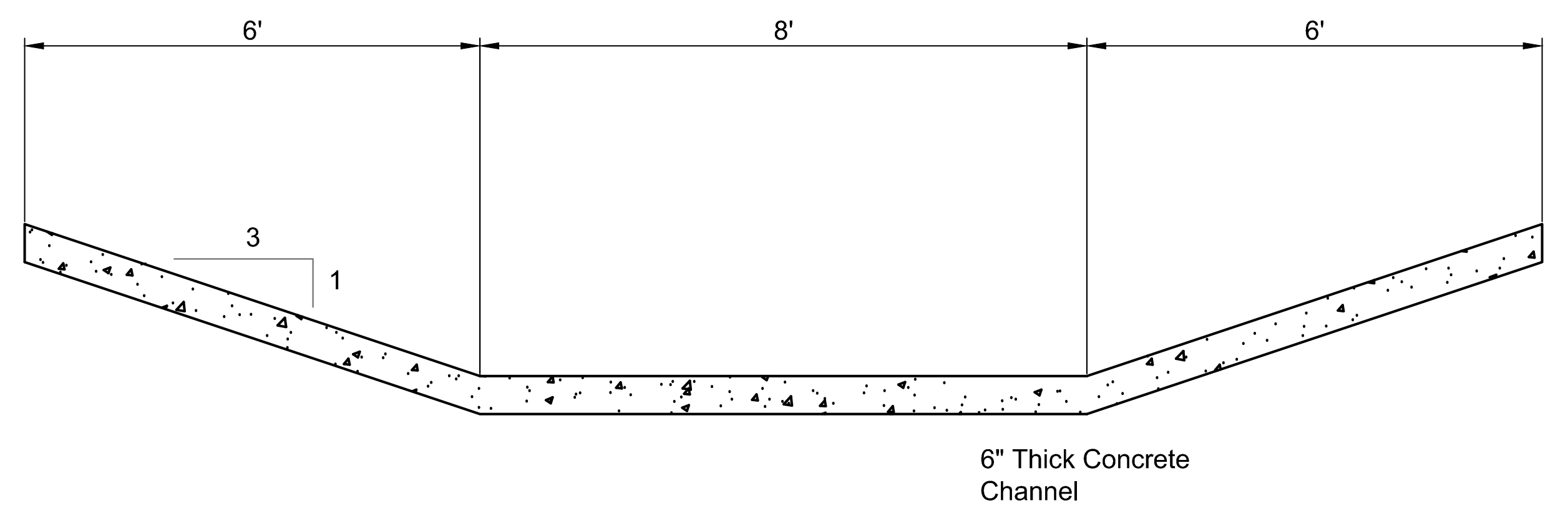
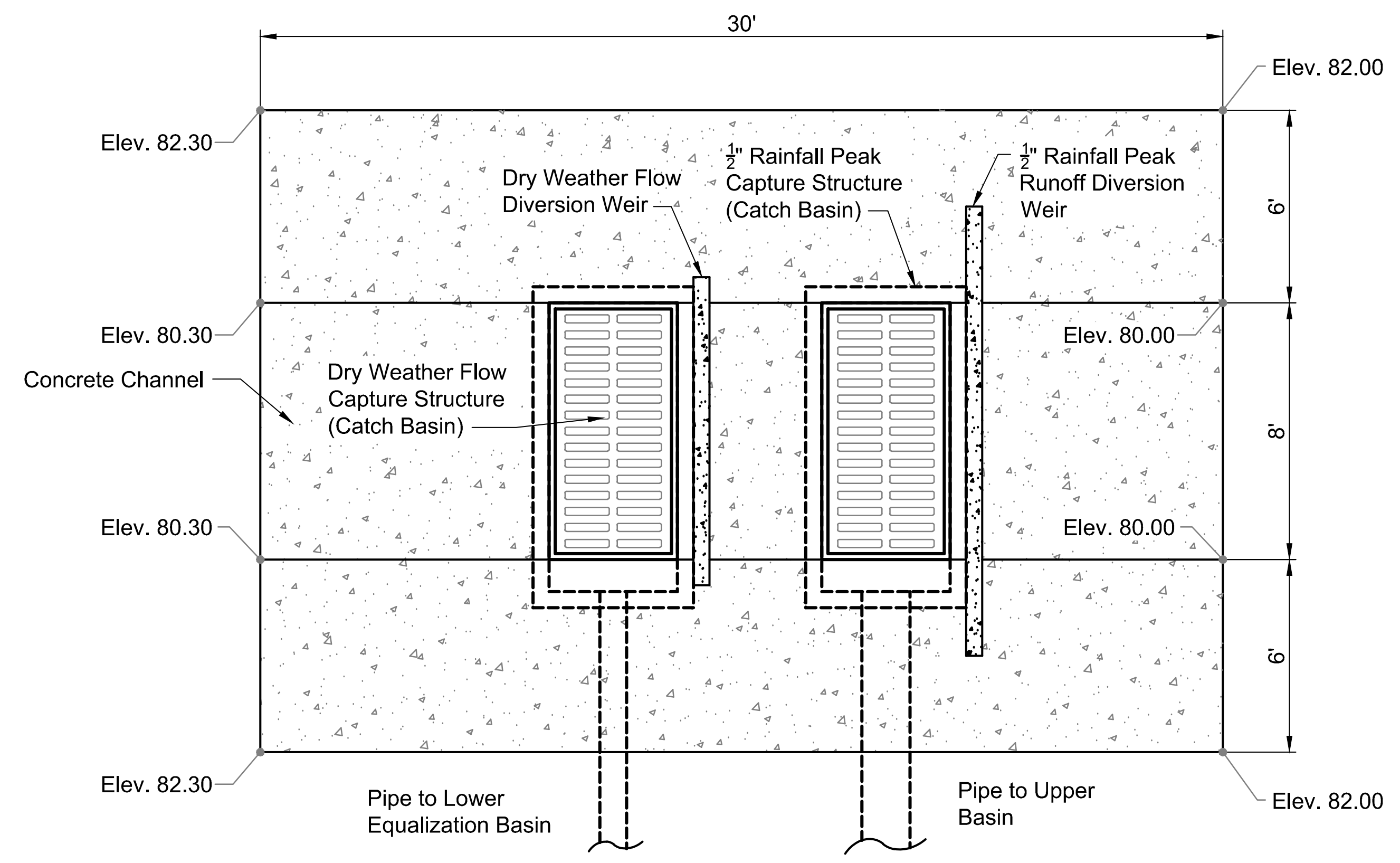
DRAWING: SC-2.0

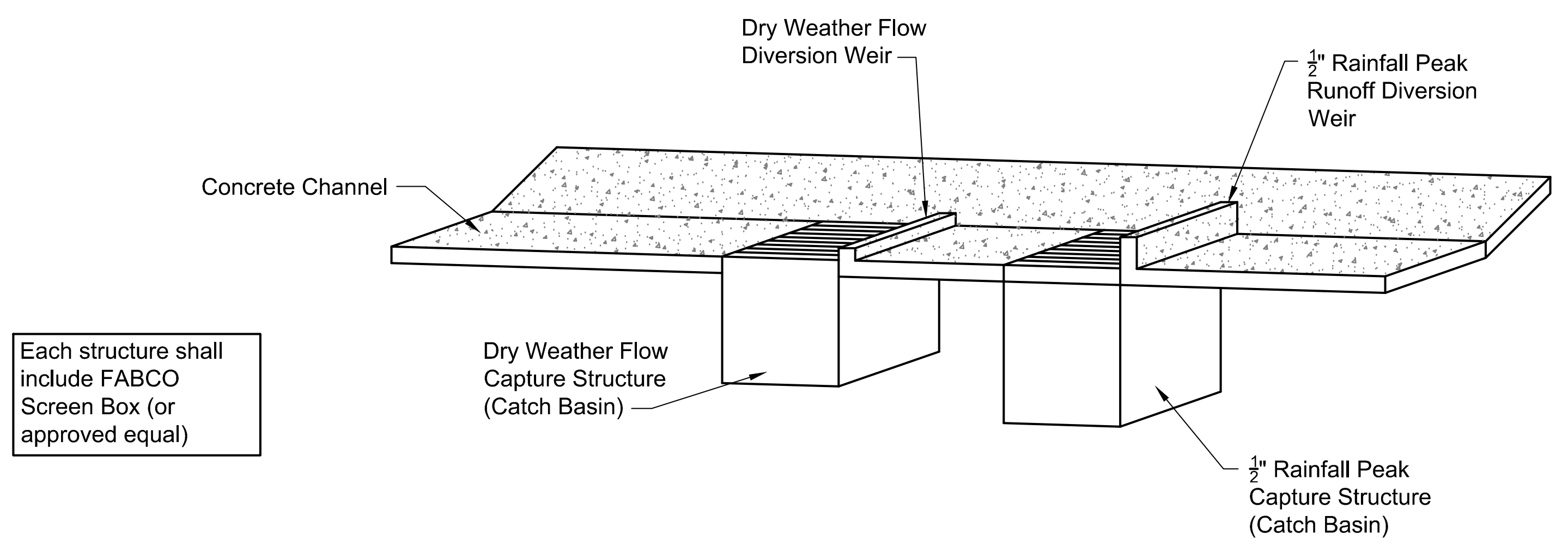
PROJECT NUMBER: 45-20803



Section A-A



Plan



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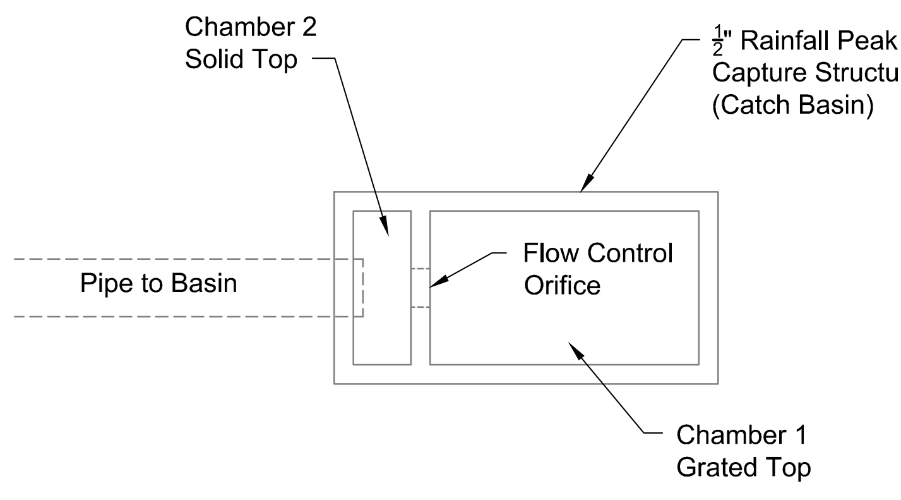
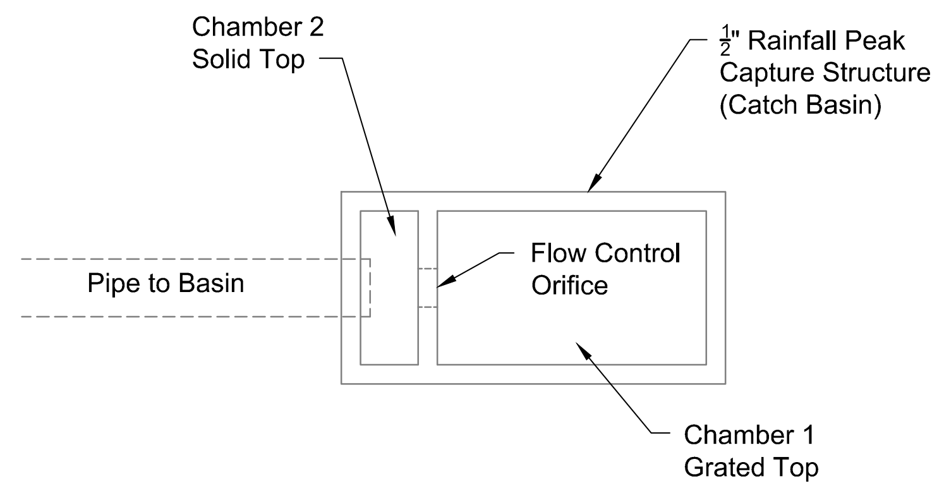
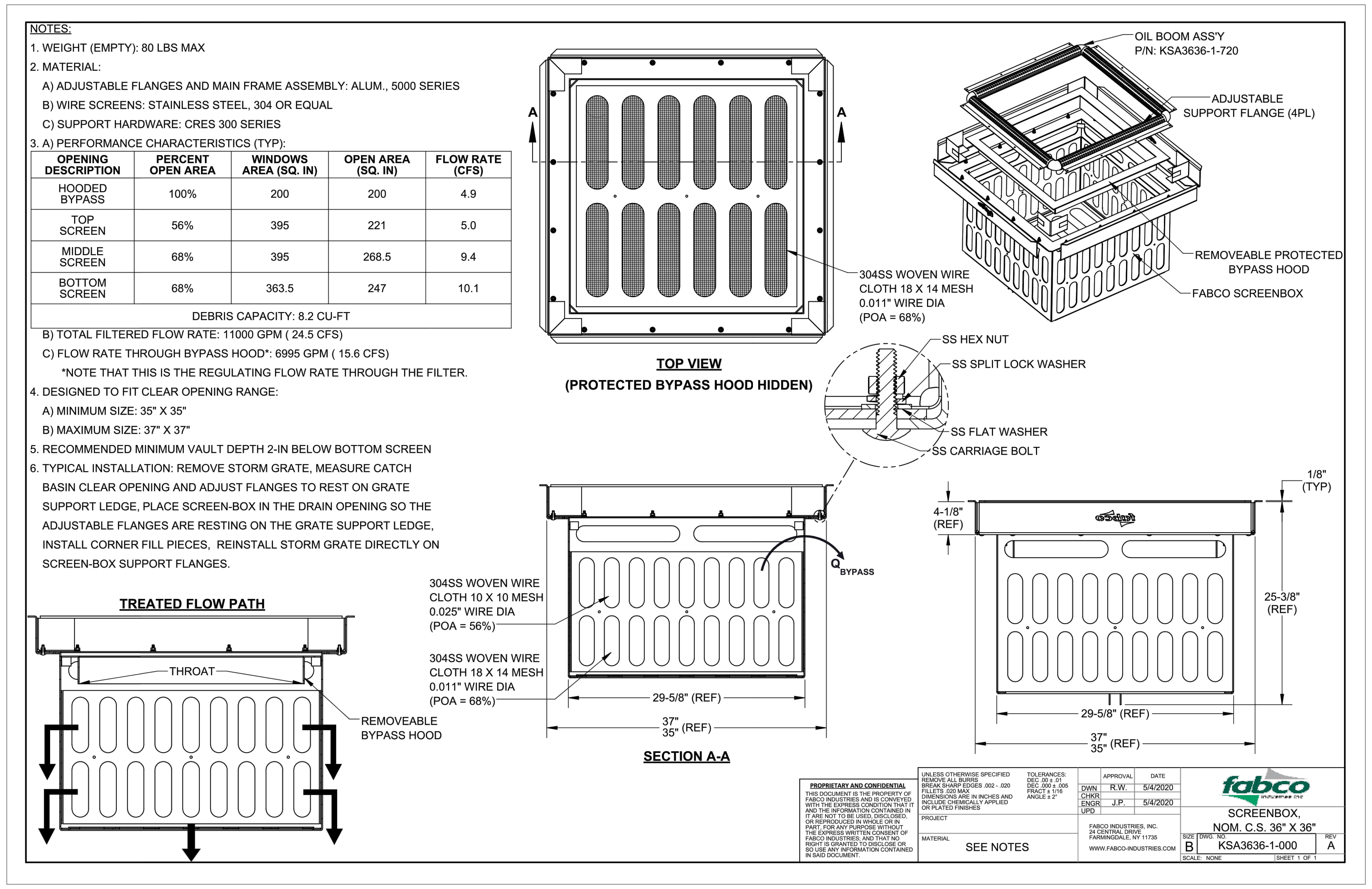


Dry Weather Flow Capture Structure - Plan View



½" Rainfall Flow Capture Structure - Plan View

1 SC-2.1 *Seep B – Capture System*



NOTES:

1. WEIGHT (EMPTY): 80 LBS MAX
2. MATERIAL:
   A) ADJUSTABLE FLANGES AND MAIN FRAME ASSEMBLY: ALUM., 5000 SERIES
   B) WIRE SCREENS: STAINLESS STEEL, 304 OR EQUAL
   C) SUPPORT HARDWARE: CRES 300 SERIES
3. A) PERFORMANCE CHARACTERISTICS (TYP):

OPENING DESCRIPTION	PERCENT OPEN AREA	WINDOWS AREA (SQ. IN)	OPEN AREA (SQ. IN)	FLOW RATE (CFS)
HOODED BYPASS	100%	200	200	4.9
TOP SCREEN	56%	395	221	5.0
MIDDLE SCREEN	68%	395	268.5	9.4
BOTTOM SCREEN	68%	363.5	247	10.1
DEBRIS CAPACITY: 8.2 CU-FT				

   B) TOTAL FILTERED FLOW RATE: 11000 GPM (24.5 CFS)
   C) FLOW RATE THROUGH BYPASS HOOD*: 6995 GPM (15.6 CFS)
   *NOTE THAT THIS IS THE REGULATING FLOW RATE THROUGH THE FILTER.
4. DESIGNED TO FIT CLEAR OPENING RANGE:
   A) MINIMUM SIZE: 35" X 35"
   B) MAXIMUM SIZE: 37" X 37"
5. RECOMMENDED MINIMUM VAULT DEPTH 2-IN BELOW BOTTOM SCREEN
6. TYPICAL INSTALLATION: REMOVE STORM GRATE, MEASURE CATCH BASIN CLEAR OPENING AND ADJUST FLANGES TO REST ON GRATE SUPPORT LEDGE, PLACE SCREEN-BOX IN THE DRAIN OPENING SO THE ADJUSTABLE FLANGES ARE RESTING ON THE GRATE SUPPORT LEDGE, INSTALL CORNER FILL PIECES, REINSTALL STORM GRATE DIRECTLY ON SCREEN-BOX SUPPORT FLANGES.

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REMOVE ALL BURRS
BREAK SHARP EDGES .002 - .020
FILLETS .020 MAX
DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES:
DEC .00 ± .01
DEC .000 ± .005
FRACT ± 1/16
ANGLE ± 2°

	APPROVAL	DATE
DWN	R.W.	5/4/2020
CHKR		
ENGR	J.P.	5/4/2020
UPD		

PROJECT

MATERIAL
SEE NOTES

FABCO INDUSTRIES, INC.
24 CENTRAL DRIVE
FARMINGDALE, NY 11735

WWW.FABCO-INDUSTRIES.COM

fabco industries inc

SCREENBOX,
NOM. C.S. 36" X 36"

SIZE B DWG. NO. KSA3636-1-000 REV A
SCALE: NONE SHEET 1 OF 1

2 SC-2.1 *FABCO Screen Box*

Design Intent

1. Capture Dry Weather Flow of 130 gpm and utilize equalization basin to:
   a. Regulate flow to treatment plant.
   b. Allow TSS settlement as needed.
2. Capture runoff from ½" Rainfall.
   a. Peak Flow = 3,800 gpm
   b. Maximum Volume from ½" Rainfall over 24-hour period = 46,000 gallon.
   c. Utilize equalization basin to regulate flow to treatment plant and reduce TSS.

Dry Weather Flow Design Considerations

1. Total volume from 24 hours of Dry Weather Flow = 187,200 gallons. The equalization basin should be able to hold this volume as a minimum. This will allow a full 24 hours for maintenance, pump repairs, treatment plant maintenance or repairs.
2. The flow will pumped from the equalization basin to the treatment plant at an average rate of 130 gpm.
3. How to collect the base flow during larger storm events?
   a. Utilize concrete channel with diversion weir. Base flow will pond behind weir and be collected in catch basin below channel via a drainage grate.
   b. The catch basin will include two chambers. Chamber 1 will be directly below the channel and will include the drainage grate allowing the base flow to be captured in the structure.
   c. The wall between chamber 1 and 2 will include an orifice to control the flow into the pipe draining into the equalization basin. The orifice will be sized to control the flow to 130 gpm when the water level is at the top of the diversion weir. Flows above 130 gpm will overtop the diversion weir and bypass the Baseflow capture system.
   d. Chamber 2 will include an oversized pipe to gravity flow to the equalization basin.

Runoff from 1/2" Rainfall Design Considerations

1. The ½" rainfall event over a 24-hour period results in two distinct factors for capture:
   a. Runoff Volume = 46,000 gallons.
   b. The Runoff Volume may be spread out over the entire 24-hour period or may be encountered over a shorter duration. The time variable must be accounted for in the capture system. The peak flow from the ½" storm is 3,800 gpm.
2. The capture structure must be sized for the peak flow of 3,800 gpm while also capturing only the required volume of 46,000 gallons. A simple structure similar to the base flow structure can be utilized to capture the peak flow (larger orifice and pipe). However, how to control the volume is another issue.
   a. If the storm is the perfect model with only ½" of rainfall with a peak runoff of 3,800 gpm and a runoff volume of 46,000 gallons, then the structure works and no other controls are necessary.
   b. If the storm is ½" spread over a 24-hour period and the runoff volume is 46,000 gallons and the peak flow is less than 3,800 gpm, then the structure works and no other controls are necessary.
   c. If the storm is less than ½", the structure will capture all flows and no other controls are necessary.
   d. If the storm is larger than ½", the structure will continue to allow the peak flow through the orifice even after the maximum required volume has been collected. This will result in more treatment than required by the consent order and will result in more costs.
   e. How to stop or minimize flow after the 46,000 gallons have been captured during larger storms:
      - Metering system with automatic valves and controls. - Expensive
      - Manually controlled system. - Labor Intensive.
      - Separate the ½" rainfall runoff flow/volume from the base flow/volume into separate basin. The basin will include a float operated slide gate valve that closes when the water level reaches the elevation corresponding with 46,000 gallons. The basin will also include an outlet structure that will control the flow out of the upper basin such that the 46,000 gallons drains into the lower equalization basin over a period of 24 hours. This will function similar to a standard detention basin. This will not completely stop flow after 46,000 gallons, but will minimize it. As water flows out of the upper basin and the water level lowers, the gate will open and allow more flow into the upper basin. However, once it reaches the elevation corresponding to 46,000 gallons the gate will close again.
   f. The upper basin will also serve the function of allowing settlement over a 24-hour period that will reduce the TSS of the flow that is most likely to contain the most TSS (the base flow shouldn't include a high level of TSS as it is a low flow and erosion and sediment transport will be minimal).

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep B Capture System Details

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

No.	Date	Description	By:
1			
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3			
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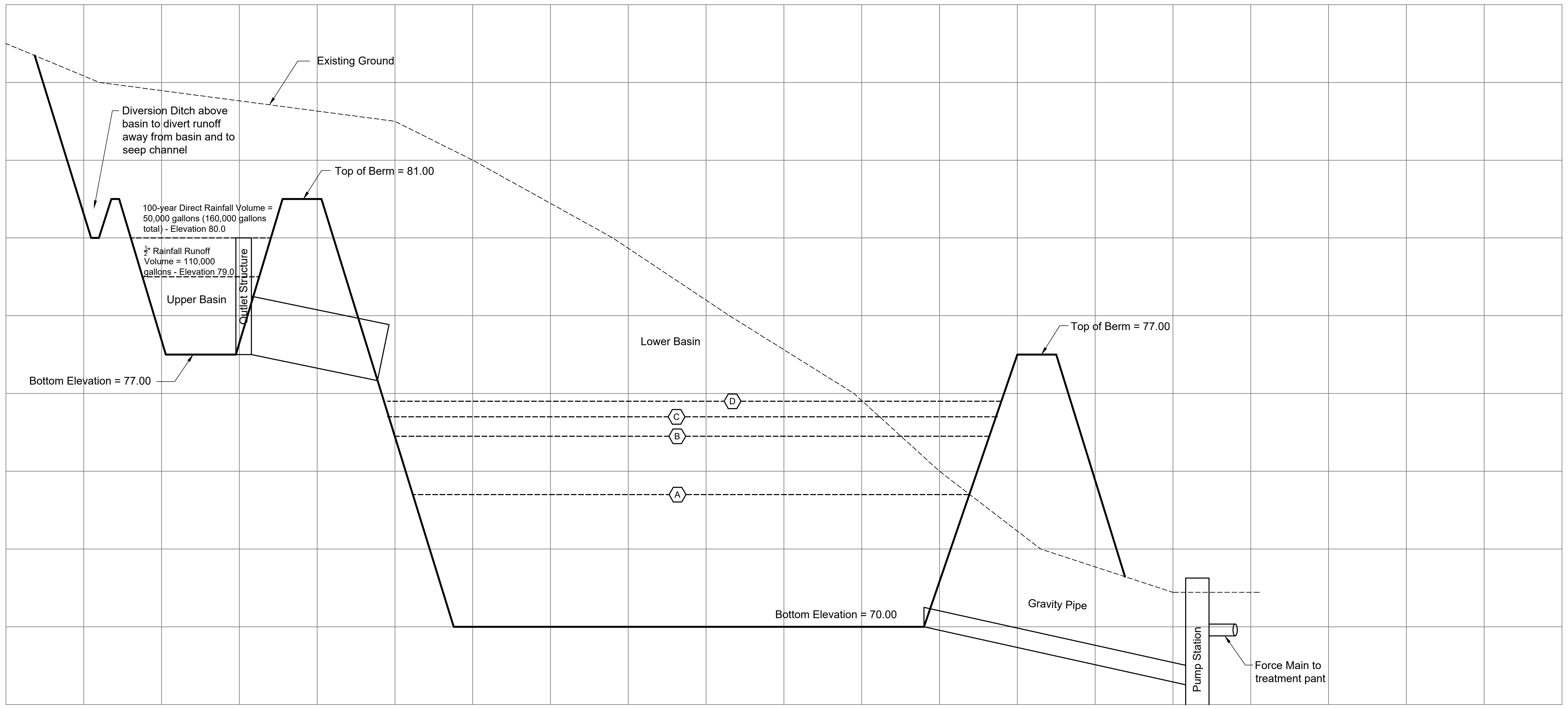
DRAWING: SC-2.1

PROJECT NUMBER: 45-20803



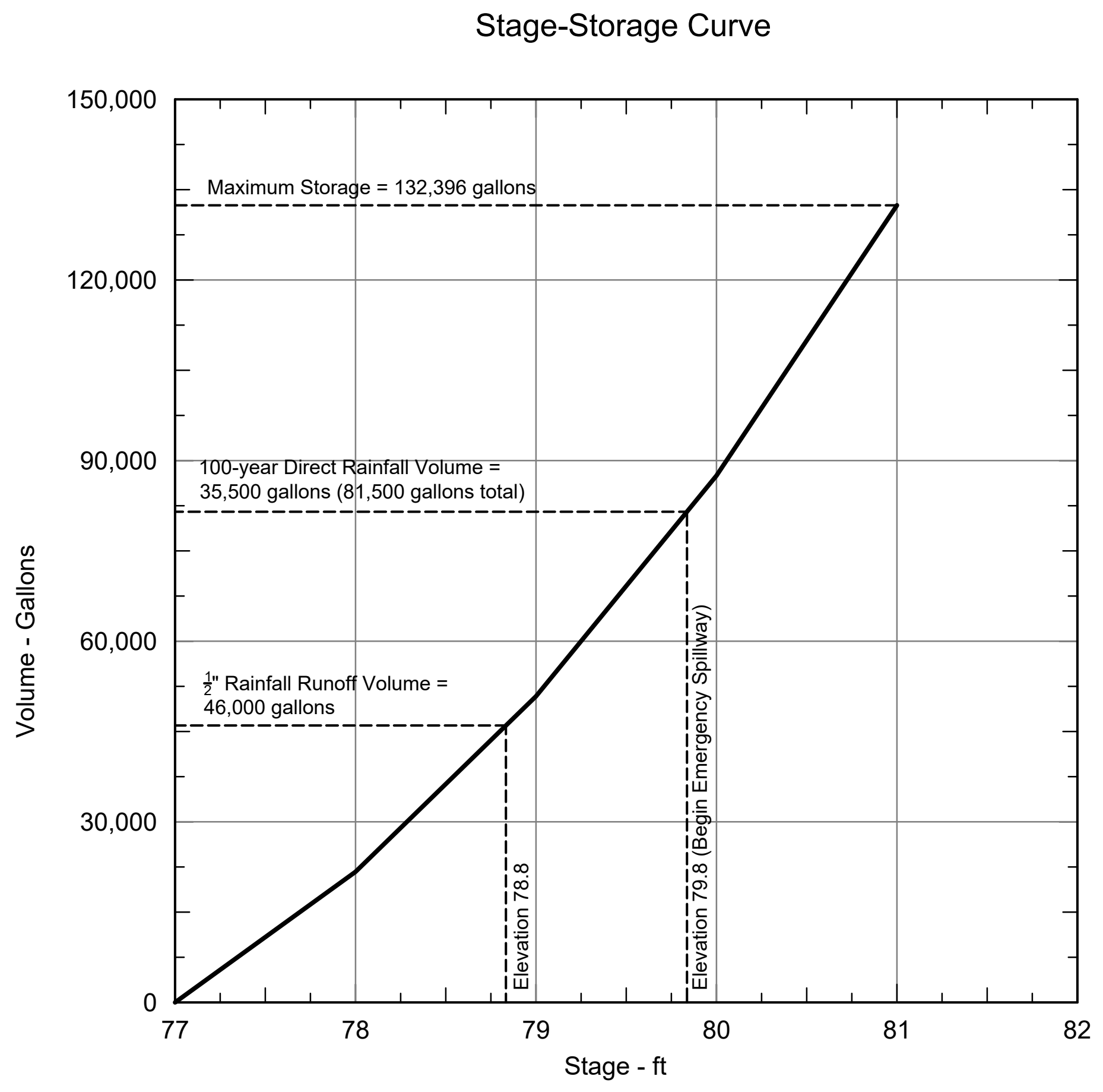
1 SC-2.2 Seep A – Schematic Flow Diagram

A 24-hr Dry Weather Flow = 187,200 gallons (volume required if pumps are not running for 24 hours)

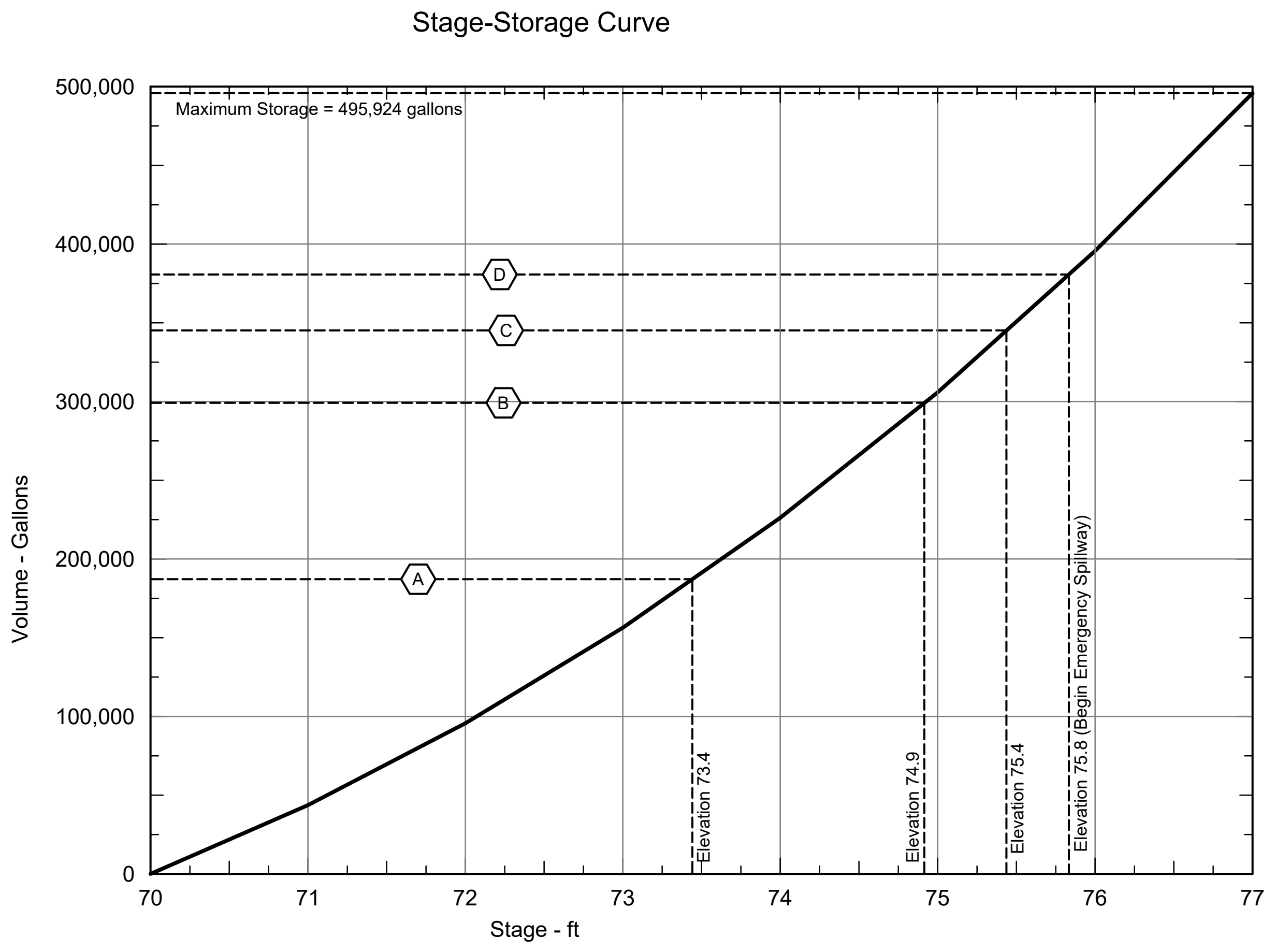
B 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) = Total = 299,200 gallons
Volume required (prior to release of $\frac{1}{2}$" runoff volume from Upper Basin) if pumps are not running for 24 hours during and 100-year storm occurs

C 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (46,000 gallons) = Total = 345,200 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin.

D 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (46,000 gallons) + 100-yr Direct Rainfall on Upper Basin (35,500 gallons) = Total = 380,700 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin and the Direct Rainfall volume is released from the upper to the lower basin.



2 SC-2.2 Seep B – Upper Basin – Stage–Storage Curve



3 SC-2.2 Seep B – Lower Basin – Stage–Storage Curve

A 24-hr Dry Weather Flow = 187,200 gallons (volume required if pumps are not running for 24 hours)

B 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) = Total = 299,200 gallons
Volume required (prior to release of $\frac{1}{2}$" runoff volume from Upper Basin) if pumps are not running for 24 hours during and 100-year storm occurs

C 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (46,000 gallons) = Total = 345,200 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin.

D 24-hr Dry Weather Flow (187,200 gallons) + 100-yr Direct Rainfall (112,000 gallons) + $\frac{1}{2}$" rainfall Runoff Volume (46,000 gallons) + 100-yr Direct Rainfall on Upper Basin (35,500 gallons) = Total = 380,700 gallons
Volume required if pumps are not running for 24 hours during and 100-year storm occurs and the $\frac{1}{2}$" rainfall runoff volume is completely released into the lower basin and the Direct Rainfall volume is released from the upper to the lower basin.

GEOS
Geotechnical, Environmental and Materials Engineers

Ex-Situ Seep Capture Design Plans
Seep B Capture System Details

Chemours Fayetteville Works
Fayetteville, North Carolina

DRAWN BY: BB	REVIEWED BY: DKK
DESIGNED BY: BB	APPROVED BY:

SCALE: AS SHOWN

DATE: August 12, 2021

Revisions

No.	Date	Description	By:
1			
2			
3			
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DRAWING: SC-2.2

PROJECT NUMBER: 45-20803

Appendix G
DEQ E-mail Communication
&
Engineering Report – Treatment of Groundwater and Upgradient Seeps Water

Subject: RE: Re: Seeps and GW NPDES Permit Application (Outfall 004)

From: Fields, Dianne L <DIANNE.L.FIELDS@chemours.com>
Sent: Thursday, August 12, 2021 11:21 AM
To: Grzyb, Julie; Chernikov, Sergei
Cc: Garon, Kevin P; Ruiter, J. B; Compton, Christel E
Subject: Re: Seeps and GW NPDES Permit Application (Outfall 004)

Julie and Sergei,

I am writing to provide you minor update on the flows specified in our Chemours Fayetteville Works NPDES Permit Application for the Groundwater Treatment System (submitted as Outfall 004 on June 13, 2021). In the application, the total average flow on Form 2D was 1.756 mgd (1,219 gallons per minute). We are maintaining a treatment system flow rate design of 1,500 gallons per minutes but have refined the anticipated flowrate of extracted black creek aquifer groundwater from a total of 800 gallons per minute to 830 gallons per minute as shown in the table below. We are therefore requesting that NCDEQ provide a permit based on this new flowrate.

Water Source	Approximate Flow Rate
Seeps A and B Baseflow◊	161 gpm
Seeps A and B Stormflow*	108 gpm
Groundwater from Surficial Aquifer◊	150 gpm
Groundwater from Black Creek Aquifer	830 gpm
Total Flow	**1,249 gpm**

* Seeps stormflow represents maximum increase over baseflow averaged over 24-hour period.
◊ Seeps baseflow and Shallow Groundwater may include some double counting. Seeps baseflow represents the 95th percentile instantaneous flow from each of Seeps A and B at location representative of the remedy capture location.

If you need amended documents, please let us know.

Respectfully,

Dianne

Dianne L Fields
Sr. Environmental Consultant

910-678-1384 office

919-628-8055 mobile

The Chemours Company
Fayetteville Works Plant

22828 NC Hwy 87 West
Fayetteville, NC 28306

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

ENGINEERING REPORT – TREATMENT OF GROUNDWATER AND UPGRADIENT SEEPS WATER

Prepared for

The Chemours Company FC, LLC
1007 Market Street
PO Box 2047
Wilmington, DE 19899

Prepared by

Geosyntec Consultants of NC, P.C.
2501 Blue Ridge Road, Suite 430
Raleigh, NC 27607

Geosyntec Project Number TR0795

June 2021

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ACRONYMS AND ABBREVIATIONS

BCA	Black Creek Aquifer
CO	Consent Order
GAC	granular activated carbon
GPM	gallons per minute
GWTS	groundwater treatment system
HDPE	high density polyethylene
HFPO-DA	hexafluoropropylene oxide-dimer acid
HRT	hydraulic retention time
mg/L	milligrams per liter
MTZ	mass transfer zone
NCDEQ	North Carolina Department of Environmental Quality
ND	Non-detect
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbons
PFAS	per- and polyfluoroalkyl substances
PFMOAA	perfluoro-1-methoxyacetic acid
PMPA	perfluoro-2-methoxypropanoic acid
STD	standard
TSS	total suspended solids
ug/L	micrograms per liter

1. INTRODUCTION AND BACKGROUND

This Engineering Report was prepared by Geosyntec Consultants of NC, P.C. (Geosyntec) for the Chemours Company FC, LLC (Chemours) to provide a description of the future treatment works to be installed for the collection and treatment of groundwater and surface water from locations along the proposed groundwater remedy alignment at the Chemours Fayetteville Works, North Carolina site (the Site). The groundwater remedy includes a barrier wall, water extraction network, and treatment system (Groundwater Treatment System or GWTS) is a requirement of the Addendum to the Consent Order paragraph 12 (CO Addendum) amongst Chemours, the North Carolina Department of Environmental Quality (NCDEQ), and Cape Fear River Watch entered by the court on October 12, 2020.

The goal of the GWTS is to achieve a removal efficiency of 99%, as measured by indicator parameters hexafluoropropylene oxide-dimer acid (HFPO-DA), perfluoro-2-methoxypropanoic acid (PMPA), and perfluoro-1-methoxyacetic acid (PFMOAA). The remedy is to commence operation by March 15, 2023 per paragraph 3(b) of the Addendum to the CO. To meet this requirement, Chemours intends to complete construction of the GWTS by April 1, 2022. Chemours will need to pump and treat the water collected by the remedy to protect the barrier wall's structural integrity. The GWTS therefore needs to be operational prior to the remedy's construction in June 2022.

This document provides the conceptual design and engineering assumptions for the GWTS, in accordance with the National Pollutant Discharge Elimination System (NPDES) permit application requirements. The permit application requires that Chemours identify effluent characteristics of those parameters identified in the *EPA Application Form 2D New Manufacturing, Commercial, Mining, and Silvicultural Operations That Have Not Yet Commenced Discharge of Process Wastewater* (EPA Form 2D).

1.1 Site History and Overview

The Site is located on NC Highway 87, 15 miles southeast of the City of Fayetteville, and south of the Bladen-Cumberland County line. The Site encompasses 2,177 acres of relatively flat undeveloped open land and sloping woodland bounded on the east by the Cape Fear River, on the west by NC Highway 87, and on the north and south by farmland. The ground on which the Site is situated slopes East towards the Cape Fear River. The proposed treatment facility is to be located on the southeastern portion of the Site just north of the William O. Huske Lock & Dam.

E.I. du Pont de Nemours and Company (DuPont) purchased the property in parcels from several families in 1970. The Site's first manufacturing area was constructed in the early

1970s. Currently, the Site manufactures plastic sheeting, fluorochemicals, and intermediates for plastics manufacturing. A former manufacturing area, which was sold in 1992, produced nylon strapping and elastomeric tape.

DuPont sold its Butacite® and SentryGlas® manufacturing units to Kuraray America, Inc. in June 2014; these are now a tenant operation. In July 2015, DuPont separated its specialty chemicals business into a new publicly traded company named The Chemours Company FC, LLC. With this separation, Chemours became the owner of the entire 2,177 acres of the Fayetteville Works along with the Fluoromonomers, Nafion® membranes, and Polymer Processing Aid (PPA) manufacturing units. The polyvinyl fluoride (PVF) resin manufacturing unit remained with DuPont as a tenant operation.

In addition to the manufacturing operations, Chemours operates two natural gas-fired boilers and a biological wastewater treatment plant for the treatment of DuPont and Kuraray process wastewater and sanitary wastewaters from DuPont, Kuraray, and Chemours.

1.2 Process Overview

Groundwater at the Site currently flows east towards the Cape Fear River. The extraction and conveyance portion of the treatment design proposes to capture the groundwater flow via the installation of a network of groundwater extraction wells and to capture the baseflow of seeps originating upgradient of the remedy and flows during rainfalls up to 0.5 inches in depth. The extracted groundwater and seeps water will then be collected and conveyed to be treated by the GWTS which is proposed to be located in the southeast corner of the Site. The proposed location is shown in Figure 1.

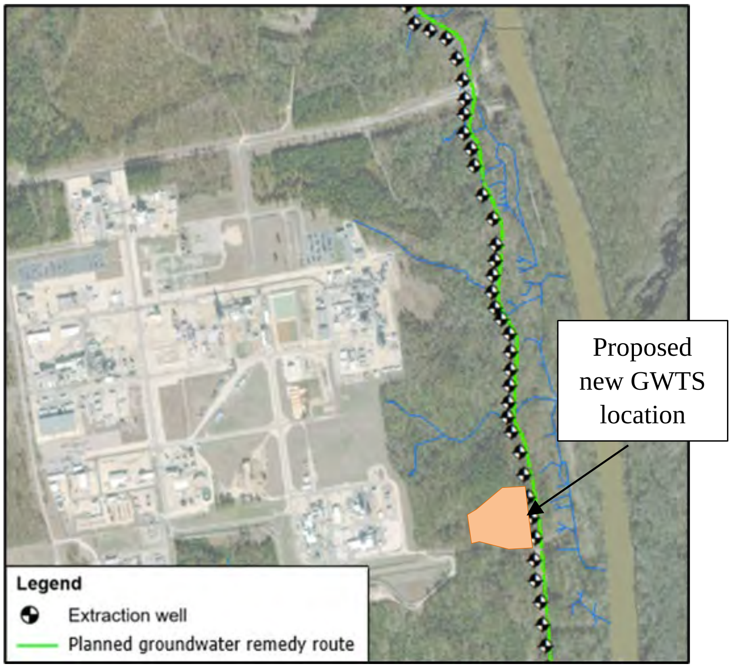

Figure 1: Remedy Alignment and Proposed Groundwater Treatment System Location

The GWTS will be comprised of a series of chemical and physical separation steps. Chemical oxidation and pH adjustment will first be employed to precipitate metals, such as iron, to prevent downstream contamination or fouling of the granulated activated carbon (GAC) media. The precipitated metals and other particles above an appropriate control threshold will be removed via ultrafiltration membranes or some other suitable separation technology. The filtered effluent will then be treated for per- and polyfluoroalkyl substances (PFAS) by GAC adsorption. The reject from the filtration and GAC systems will undergo dewatering through a thickening tank and filter press or centrifugation, from which the sludge cake will be disposed of offsite and the press water will be recycled to the influent of the thickening tanks. Periodic backwashing will extend membrane and carbon media life, and the carbon will be removed and replaced based on breakthrough monitoring of several three-vessel carbon trains in a lead-middle-lag arrangement. Associated design elements such as pumps, piping, electrical, instrumentation and control for interlocks, mechanical and civil/structural elements will be finalized during the detailed design phase. This design concept may be optimized based on ongoing benchtop studies and data acquisition.

2. DESIGN BASIS

2.1 Aquifer Location

The ground on which the Site is situated slopes east from the facility towards the Cape Fear River. The main groundwater aquifers therefore also flow towards the Cape Fear River. Furthermore, there are four seeps that also contribute surface water flow to the Cape Fear River, as identified in Figure 2.

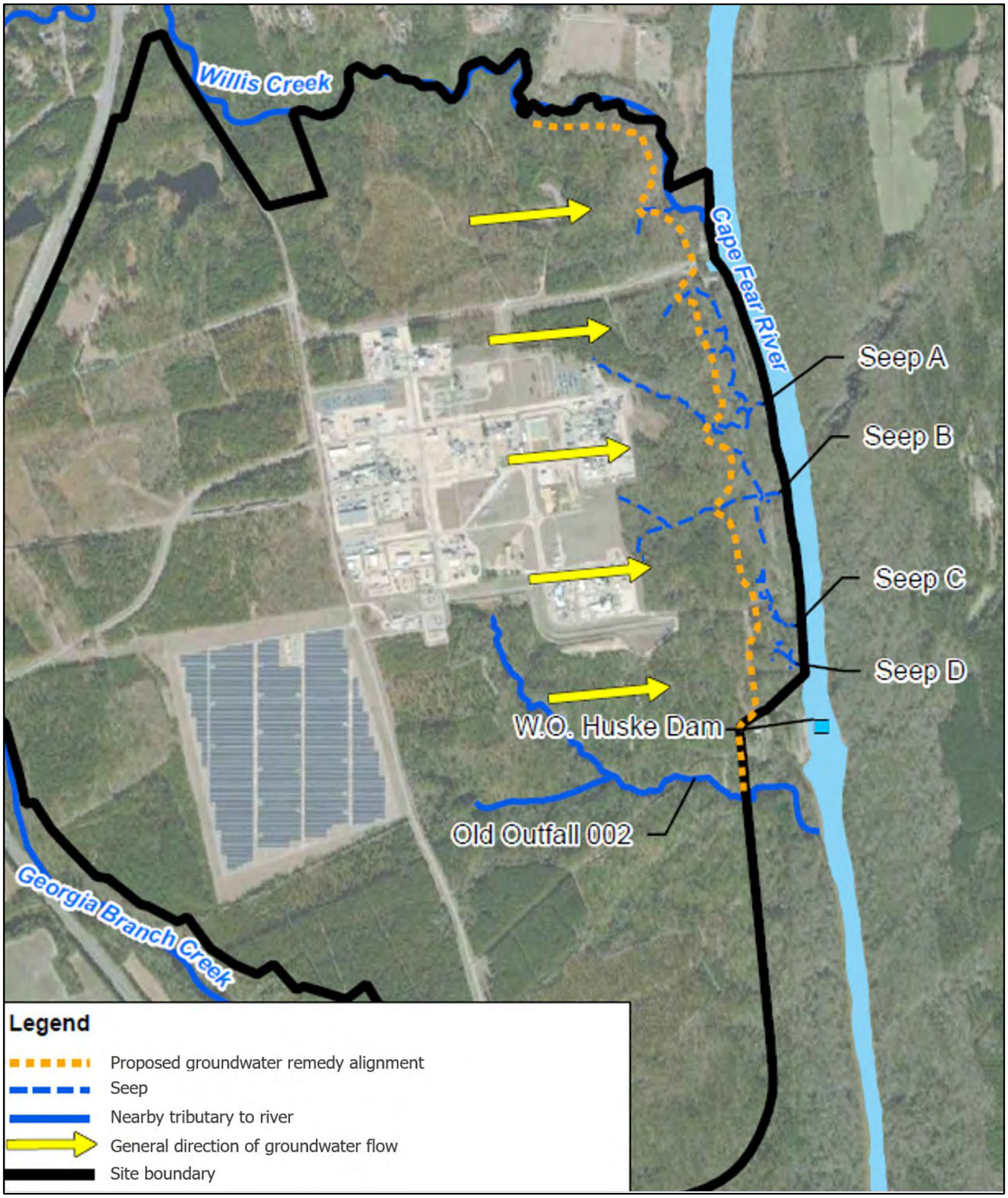

Figure 2: Groundwater Flow Direction and Seep Locations

The groundwater originates from two main aquifers, known as the Black Creek Aquifer (BCA) and the Surficial Aquifer. These two zones are separated by the Black Creek Confining Unit along most of the length of the proposed groundwater remedy alignment, and the BCA is underlain by the Upper Cape Fear Confining unit, which is a layer of competent clay.

The groundwater daylights near the Cape Fear riverbank as various seeps. There are four seeps (Seeps A through D), although only two of these are major hydraulic contributors (A and B) which will require collection for treatment. The estimated hydraulic loading in gallons per minute (gpm) from the two aquifers and four seeps, post remedy construction, is shown in Table 1.

Table 1: Hydraulic Loading of Representative Groundwater and Seep Sources

Water Source	**Approximate Flow Rate**
Seeps Baseflow◊	161 gpm
Seeps Stormflow*	108 gpm
Groundwater from Surficial Aquifer◊	150 gpm
Groundwater from Black Creek Aquifer	800 gpm
Total Flow	**1,219 gpm**

* Seeps stormflow represents maximum increase over baseflow averaged over 24-hour period.
◊ Seeps baseflow and Shallow Groundwater may include some double counting. Seeps baseflow represents the 95th percentile instantaneous flow from each of Seeps A and B at location representative of the remedy capture location.

Actual flows may vary from these model results due to variability in rainfall. The largest rainfall effect is expected to be seen in the seeps stormflow parameter in Table 1; the cited 108 gpm value is the 24-hour average flow for a 0.5 inch storm event. The seeps' baseflow quantity is also a conservative estimate (i.e. high-end). For this reason, the extraction system and the GWTS will be designed to handle reasonable expected flow variations and the GWTS currently has a planned capacity safety factor such that a maximum design flow of 1,500 gpm has been selected.

2.2 Influent Water Quality

The source water to the GWTS will be the extracted groundwater and captured seep water. The groundwater will be extracted from a series of approximately 60 extraction wells installed along the length of the proposed groundwater remedy alignment. Water will also be captured from seeps originating upgradient of the barrier wall (Seeps A and B). Since the GWTS has not yet been installed, the influent water quality presented in this report is from representative wells in the associated aquifers and the seeps. The currently available non-PFAS analytical data from the individual untreated groundwater and seep sources, or their closest analogs, has been collected and is summarized in the memorandum *Chemours Fayetteville Works – Groundwater and Seeps Water Quality Assessment* (Geosyntec, 2021). Relevant analytical data for the engineering design, including the PFAS data, is provided in Appendix A.

Groundwater sampling was completed at four representative groundwater wells and three seep locations. The seep locations are shown relative to the site in Figure 2. The groundwater wells are analogs for the various groundwater sources to be collected by the new extraction network along the groundwater remedy alignment, as described in Table 2. Two of the seep locations (Seep A at Wall Point and Seep B at Wall Point) are analogs for the seep baseflow and surface runoff that will be intercepted by the groundwater remedy. The samples collected at the location Seep A minor tributary are not analogs of seep water as the location was artificially disturbed prior to sample collection to introduce sediment into the sample. The results from Seep A minor tributary were, however, included in the engineering design as a safety factor.

Table 2: Representative Well and Seep Locations and Estimated Flowrates

Representative Water	Location Tag	Flowrate (gpd)	Flowrate (gpm)	Proportion (%)
Black Creek Aquifer at North	EW-1	668,794	464	47%
Black Creek Aquifer at South	EW-3	428,198	297	30%
Surficial Aquifer at North	PIW-5S	104,760	73	7%
Surficial Aquifer at South	PIW-10S	75,773	53	5%
Seep A minor tributary*	SEEPA-TR-N	31,522	22	2%
Seep A at Wall Point	SEEP-A-WALL	50,501	35	4%
Seep B at Wall Point	SEEP-B-WALL	67,133	47	5%

* Samples were artificially disturbed at SEEP-A-TR-N prior to collection to introduce turbidity.

The dataset used for the GWTS design is inclusive of untreated water data collected during sampling events from 2019 and 2020 and a series of 11 sampling events that occurred during March and April 2021. PFAS compounds were specifically sampled for on March 3, March 26 and April 28, 2021. Appendix A provides a detailed overview of the average, maximum, and minimum concentrations of all untreated water parameters sampled for treatment design. The water collected at these wells (EW-1, EW-3, PIW-5S and PIW-10S) and two seep locations (SEEP-A-WALL and SEEP-B-WALL) is assumed to be representative of the total groundwater and seep flow that will be extracted and treated by the GWTS.

In addition to PFAS analyses, a variety of supporting analytes such as total suspended solids (TSS), and metals (such as aluminum and iron) were sampled as they were considered key parameters of concern that would inform the pre-treatment system upstream of the PFAS removal stage. Flow-weighted composite concentrations for each parameter were developed for each of the groundwater and surface water groupings, as a design aid for the development of the influent design basis. The average, minimum and maximum mass loading of each untreated water parameter and Table 3+ compound was estimated using the average, minimum, and maximum concentrations from the analytical data and the flow rates in Table 1. Thus, the flow-weighted, mass-based composition for the untreated water groundwater sources was estimated by summing the mass loadings from PIW-5S, PIW-10S, EW-1, and EW-3. The flow-weighted average composition for the seeps was estimated by summing the mass loadings from SEEP-A-WALL, SEEP-B-WALL, and SEEP-A-TRN.

The projected concentrations in the combined influent to the GWTS were estimated from the flow-weighted concentrations groundwater and surface water groupings. Upon construction completion of the groundwater remedy, it is estimated that the total dry-weather groundwater and surface water flows will be 950 gpm and 161 gpm, respectively. The groundwater and surface water groupings were combined by flow-weighting the average, minimum, and maximum concentrations using these estimated post-construction flows. The design of the GWTS is based on the contaminant profile in Table 3.

Table 3: Influent Design Basis for the Groundwater Treatment System

Constituent	**Units**	**Projected Concentrations**			**Influent Design Basis**	
		Avg.	**Min.**	**Max.**	**Min.**	**Max.**
HFPO Dimer Acid	ug/L	12.2	8.22	18.9	4.11	28.3
PFMOAA	ug/L	64.3	17.5	192	8.73	288
PMPA	ug/L	13.2	8.38	22.5	4.19	33.8
Total table 3+ (20 compounds)	ug/L	139	54.9	352	27.4	528
Aluminum, total	mg/L	1.52	1.16	2.20	0.58	3.30
Bromide	mg/L	ND	ND	ND	ND	ND
Calcium, total	mg/L	4.07	3.74	4.55	1.87	6.82
Carbonate Alkalinity	mg/L	ND	ND	ND	ND	ND
Chloride, total[1]	mg/L	8.30	4.85	11.6	2.42	17.4
Fluoride, total	mg/L	0.11	0.11	0.11	0.06	0.17
Hardness	mg/L	ND	ND	ND	ND	ND

Constituent	Units	Projected Concentrations			Influent Design Basis	
		Avg.	Min.	Max.	Min.	Max.
Iron, total	mg/L	4.86	2.28	8.56	1.14	12.8
Magnesium, total	mg/L	2.37	2.27	2.53	1.13	3.80
Manganese, total	mg/L	0.08	0.06	0.15	0.03	0.23
pH	Std units	6.61	6.50	6.80	6.5	8.5
Phosphate	mg/L	ND	ND	ND	ND	ND
Sulfate (as SO4)	mg/L	24.7	13.3	33.9	6.66	50.9
Total Dissolved Solids	mg/L	78.5	66.8	93.3	33.4	140
Total Organic Carbon	mg/L	1.11	0.57	2.01	0.29	3.01
TSS[2]	mg/L	59.2	38.4	120	19.2	180

[1] SEEP-A-WALL and SEEP-B-WALL each had one observation above 30,000 milligrams per liter (mg/L) chloride. Data has been excluded and can be considered an outlier for the basis of design.

[2] Potentially 250 mg/L during peak storm events (see below). This also does not include the total suspended solids (TSS) contribution from solids generated during pretreatment.

2.3 Groundwater and Seeps Outfall

The treated groundwater and seeps water will be discharged to the Chemours Fayetteville Site Outfall 002 discharge line to the Cape Fear River. The average flow rate from the Outfall 002 is 18.025 million gallons per day. The water quality assessment accounted for the combination of loads from Outfalls 004 and 002. In addition, the water quality assessment accounted for the mixing zone analysis that was conducted for Outfall 002 that documented a river dilution of 8:1 (Geosyntec, 2019).

2.4 Influent Untreated Water Quality – Comparison to Water Quality Criteria

The groundwater and seep data for non-PFAS compounds were compared to North Carolina’s surface water quality criteria. This screening-level exercise was conservative as no treatment was assumed. Results are documented in a memorandum – *Chemours Fayetteville Works – Groundwater and Seeps Water Quality Assessment* (Geosyntec, 2021). After flow-weighting the groundwater and seeps’ concentrations, incorporating the load from Outfall 002, and applying an 8:1 dilution from the Outfall 002 mixing zone, heptachlor epoxide and polycyclic aromatic hydrocarbons (PAHs) warrant consideration as additional pollutants targeted for removal by the GWTS.

Heptachlor epoxide was only detected in one well (PIW-5S) and one seep (SEEP-A-WALL) at low levels. The PAH compounds were only detected at low levels in one (PIW-

5S) of the six untreated groundwater and seep sources. As detailed in the *Groundwater and Seeps Water Quality Assessment* (Geosyntec, 2021), Chemours will be resampling these locations to confirm the presence of these compounds.

However, if these compounds are occasionally present in the influent to the GWTS it is unlikely that they will pass-through the GWTS. Heptachlor epoxide is extremely well adsorbed by activated carbon due to its size, double bonds, and the presence of chlorine atoms in the structure. PAHs tend to have strong sorptive interactions with carbon due to their hydrophobic nature and size. Activated carbon itself is composed largely of graphene plates, and this molecular similarity strengthens the binding energies via π-π dispersive forces. A thorough review of the use of activated carbon (as well as other adsorbents) for removal of PAHs from water can be found in *Chemosphere* **148** (2016), 336-353. A number of other literature sources are also available that include adsorption equibria (i.e. isotherms), kinetics, and the combined effects in traditional packed bed adsorbers which give rise to dynamic capacities for various PAHs on activated carbons.

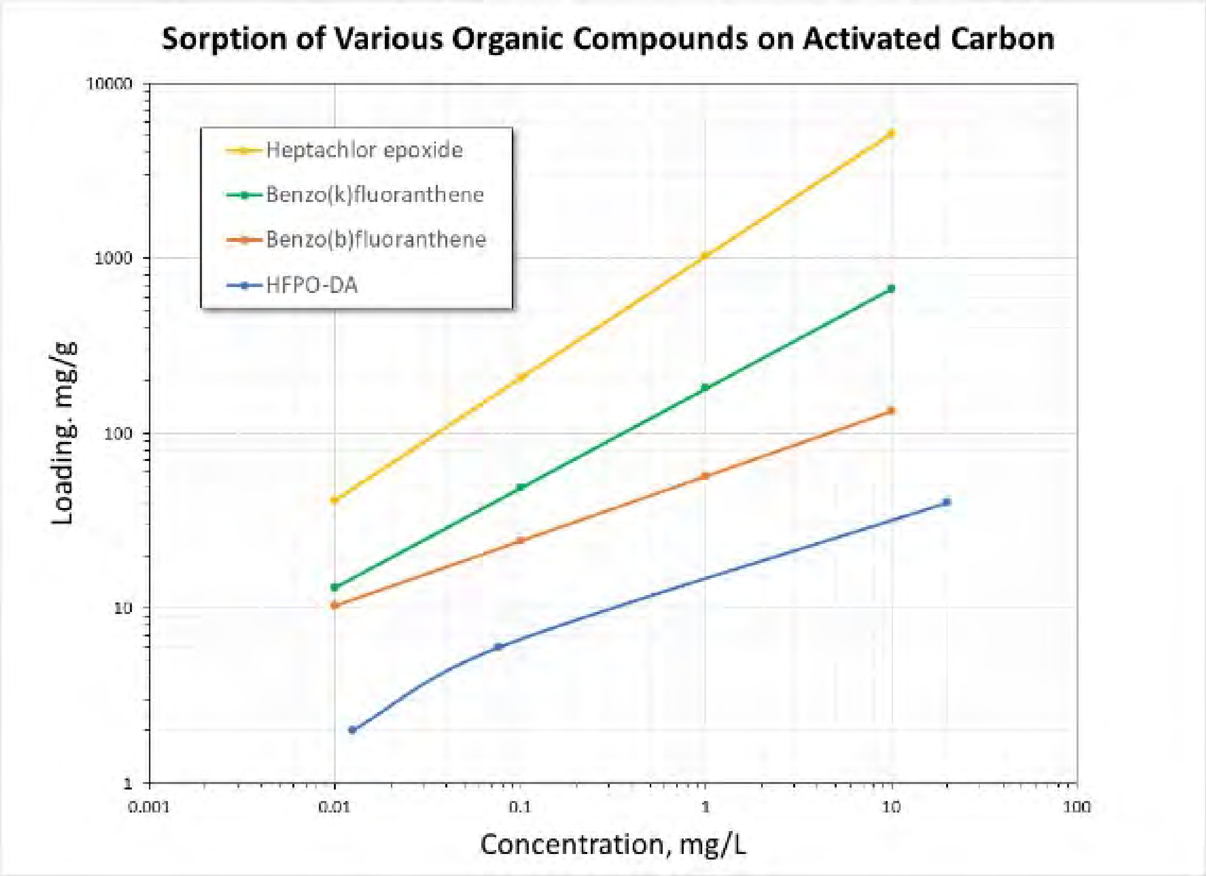

Figure 3: Comparison of Carbon Isotherms for Heptachlor Epoxide, two PHAs, and HFPO-DA. Data from "Carbon Adsorption Isotherms for Toxic Organics" (EPA-600/8-80-023, April 1980).

The PFAS compounds this system is designed to treat adsorb to carbon more weakly than PAHs, as shown in Figure 3. Additionally, they are present in the water at concentrations roughly two orders of magnitude higher than the PAHs (and roughly four orders of magnitude higher than the heptachlor epoxide) that may be present in the intake water.

As this treatment system will be run to prevent breakthrough of the three indicator PFAS, it is expected that heptachlor epoxide and the PAHs will be readily sorbed by the GAC and therefore are not expected to cause or contribute to exceedances of water quality criteria in the Cape Fear River if present in the wastewater.

2.5 Pilot Studies

Pilot studies have been completed by vendors to verify the effectiveness of their proposed pretreatment methods and confirm performance of their selected carbon media to remove the required constituents and loadings from representative feed water. Tests were performed using bulk water collected from the sources in Table 2, which was proportionally blended based on collected flow contribution. The vendors were also furnished influent water quality data for each source. These pilot studies are being used to inform the efficacy of proposed full-scale treatment design, including pretreatment dosing chemistry and residuals characterization (for solids separation and solids-handling designs).

2.6 Pumping & Conveyance Design

Groundwater modeling remedy development presently indicates a total of approximately 50 new BCA and extraction wells and 10 surficial aquifer extraction wells will be required to intercept groundwater. The combined maximum total flow rate produced from these wells is expected to be approximately 950 gpm.

Each well pump is expected to extract approximately 5 to 30 gpm and will be sized to have additional flow capacity for contingency. The extraction wells are currently planned as high-density polyethylene (HDPE) construction below finished grade, whereas the wellhead will be of polyvinyl chloride construction.

Each wellhead will then tee into their corresponding conveyance line (i.e., North or South Force mains), constructed of HDPE. Approximately two thirds of the required extraction wells will convey groundwater through the North Force main while the remaining third is conveyed via the South Force main. The conveyance lines will be sized to accommodate the total collected flow of the extraction with added contingency to allow for increased extraction rates if required. Extracted groundwater will be conveyed to a surge tank prior to being treated by the GWTS.

The seep flow will be impounded at or near seep capture locations (impoundment storage) to provide equalization storage during rainfall events and remove readily settleable/suspended solids prior to being conveyed to a break tank and treated by the GWTS.

The total maximum dry weather flow to the GWTS after the groundwater remedy is fully operational, including seep flow, is estimated to be 1,111 gpm. Total flow over a 24-hour period with rainfall is estimated to average 1,219 gpm (see Table 1). The design flow rate for the GWTS was selected to be 1,500 gpm to allow for increased groundwater extraction from the extraction wells and potential uncertainty in post-installation flow behavior from the seeps.

At the break tank, the influents from the extracted groundwater and the seeps will be combined. The effluent of the tank will then be drawn on demand by the GWTS. The impoundment storage will be dredged periodically, and solids characterized and disposed of at an appropriately designated facility.

3. PROPOSED TREATMENT DESIGN

3.1 Overall Narrative

Based on turnkey vendor proposals currently under consideration, the GWTS is assumed to be comprised of the following series of treatment units:

1. Metals oxidation;
2. Ultrafiltration (UF) or similar solids separation technology;
3. Granular Activated Carbon (GAC) adsorption;
4. Solids Handling & Dewatering; and
5. Ancillary processes for backwashing and residuals handling.

The influent oxidation system will be designed to help ensure complete oxidation of reduced iron species (or other dissolved metals), by means of pH adjustment and possible addition of inorganic coagulant and/or flocculant. Following oxidation, flow will proceed to the solids separation unit in which particle sizes above an appropriate control threshold will be removed. The filtrate will then be pumped to the GAC adsorption process, which will remove the PFAS and other contaminants from the water. Influent flow to the carbon beds may be pH adjusted to improve treatment performance. The GAC effluent will undergo further pH adjustment back to near-neutral conditions and then be discharged to the Cape Fear River via the pipe that conveys existing flows from Outfall 002 to the river.

The solids separation unit reject, solids separation unit cleaning, and GAC backwash water will collect in one or more thickener tanks. The thickened solids will be dewatered using a filter press or centrifuge. Sludge cake will be transferred into hoppers that will be trucked off-site for disposal at a permitted waste disposal facility. The dewatering filtrate will be returned to the head of the plant and blended with the influent downstream of the oxidation tanks. A backwash water tank will store a limited volume of treated water to supply GAC backwash, polymer dilution, and other process water requirements. A GAC backwash waste tank will collect backwash water and bleed it back into the treatment process downstream of the oxidation tanks. Process design considerations for each unit operation are further described in Section 3.2.

Based on vendor experience, Chemours' current operational experience at Outfall 003 elsewhere at the facility, and outcomes of past treatability pilot studies, it is anticipated that a treatment design consisting of these elements will successfully address treatment requirements. In addition, Chemours is currently performing treatability studies based on anticipated wastewater characteristics of the groundwater and seeps.

A conceptual process flow diagram (PFD) of the GWTS and the associated sludge handling system is shown in Figure 4.

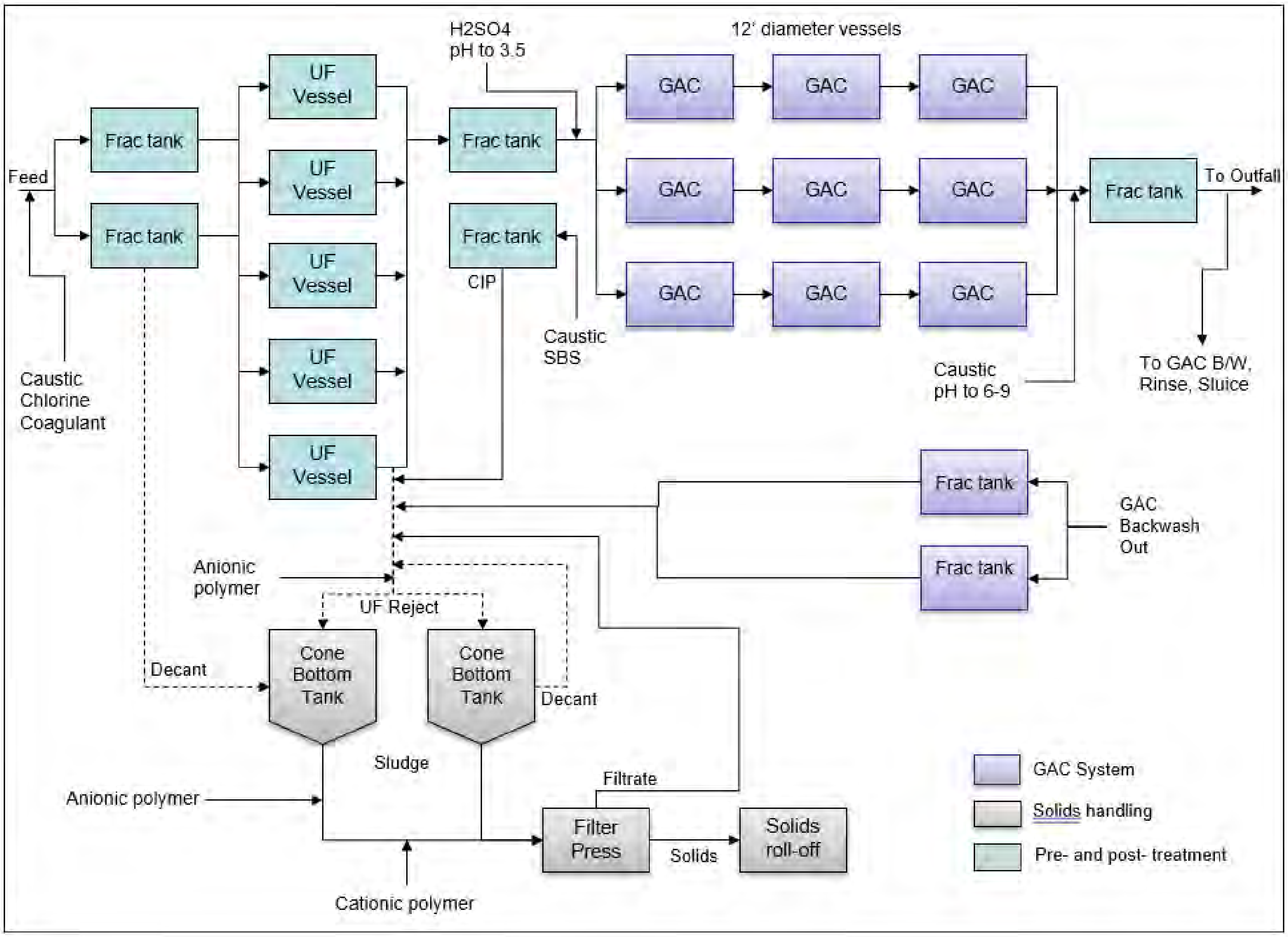

Figure 4: Conceptual Process Flow Diagram of Primary Treatment Train and Solids Recovery Process System

3.2 Individual Unit Operations

3.2.1 Metals Oxidation

One or more influent oxidation retention tanks will be selected to allow for a hydraulic retention time (HRT) of 30 minutes at the design flow of 1,500 gpm. The HRT has been selected to achieve the optimal pH range of 6.5 to 7.5 and allow for the oxidation and coagulation of ferrous iron (Fe^{2+}) to the less soluble ferric iron (Fe^{3+}). Multiple tanks may be configured in a duty, active-standby configuration, with the capability to take one or more tanks offline for maintenance and still process the total plant flow of 1,500 gpm.

Upstream of the tanks, chemical augmentation via an inorganic coagulant, sodium hydroxide, and sodium hypochlorite will be performed to adjust the pH, limit biofouling, and promote metals coagulation in the retention tanks. pH adjustment chemicals (sodium hydroxide and sulfuric acid) will be added to reach the target pH based on feedback from one or more pH probes.

3.2.2 Filtration

Effluent from the oxidation process is pumped to the solids separation operation, via two or more pumps in duty-standby configuration.

Ultrafiltration membranes or a similar solids separation process will be used to remove fine solids and turbidity down an appropriate control threshold upstream of the GAC beds to prevent fouling and extend runtimes between carbon backwashes or media replacement. The currently proposed UF system will be comprised of parallel banks of submerged membranes, provided as a prefabricated system, including the vessels, influent, effluent and backwash manifolds, automatic open/close valves, and any other ancillary equipment required.

The filtered effluent from the solids separation process will be directed to a pH adjustment tank where sulfuric acid can be dosed to lower the pH to approximately 3.5 prior to being transferred to the GAC system. This pH adjustment is expected to improve GAC performance and extend service life. The reject and backwash from the solids separation process will routed to the sludge handling system to be dewatered prior to disposal.

3.2.3 Granular Activated Carbon Adsorption

PFAS removal will be accomplished using GAC adsorption. Filtered effluent will be pumped from the pH adjustment tank to the GAC system and will enter three GAC adsorption trains, each designed to treat one third of the design flow (500 gpm). Each vessel will be configured as a down-flow process where water enters the top of the adsorber and exits through the bottom. In this configuration, adsorption of contaminants (i.e., PFAS) will begin in the upper portion of the GAC bed. The mass transfer zone (MTZ) will move from the top of the bed downwards as each portion of the bed becomes saturated with the contaminants. Eventually, breakthrough will occur wherein the effluent of the tower contains the contaminant. Multiple carbon adsorbers will be arranged in series to capture the breakthrough.

A three-column, lead/middle/lag, configuration per train is proposed for the GWTS. It is assumed that complete saturation of the lead column will occur prior to the initiation of a carbon changeout. During routine operation the lead column will act as the primary contaminant remover. The MTZ will travel from the top of the bed to the bottom until breakthrough of a contaminant of concern occurs. The spent GAC in the lead column will then be replaced with new GAC and the previous lead column will be placed in the lag column position. The expired GAC will be shipped offsite for disposal and if appropriate, regeneration of the carbon. The previous middle column will then become the lead column and the previous lag/third position column will become the second position column. It is expected that this operating the system in this manner will result in significant operations and maintenance savings without compromising removal efficiencies.

Preliminary sizing for this application indicates that a series of 12-foot diameter vessels that can hold 20,000 pounds of carbon each will provide for the required hydraulic loading rate and Empty Bed Contact Time for PFAS removal.

Effluent from the GAC trains will be transferred to a storage tank, where caustic will be dosed to the effluent upstream of the tank to adjust the pH back to neutral prior to discharge. This tank is sized to provide an appropriate retention time for the pH adjustment step.

The used backwash water will be collected and transferred to the thickening process for dewatering and disposal.

3.2.4 Solids Handling and Dewatering

The thickened sludge from the bottom of the thickening operation will be pumped to a filter press or similar technology for dewatering. The supernatant decanted from the top of the sludge thickening operation will be recycled to the influent of the initial chemical oxidation step for reprocessing.

3.3 Operability and Maintenance Considerations

Process equipment has been selected from established vendors who maintain available inventory of critical spare parts, and the turnkey service provider should also have access to spares inventory based on duplication of unit operations in their commercial fleet. The modular nature of the process train means that it is readily expanded or modified to adjust to future changes in process conditions or treatment requirements.

3.4 Process Monitoring

The treatment process will be instrumented to monitor process performance consistent with industry best practices. Process data will be recorded in a remotely accessible database with an extended storage capacity and uninterruptible power supply.

Regulatory compliance will be maintained by means of routine sampling and analytical testing of the untreated influent and treated water discharge points. Once a week, the influent to each train and the effluent of each vessel will be sampled and tested at the Site internal laboratory. Percent breakthrough is calculated for each PFAS indicator species. First PMPA, and then PFMOAA, breakthrough values are used to determine when a bed replacement is triggered. Generally once breakthrough begins to be observed in the middle vessel, the lead vessel’s media is changed out. The former lead vessel, filled with new media, then becomes the lag vessel, former lag becomes the middle vessel, and former middle vessel becomes the new lead vessel.

4. SUMMARY

In summary, the groundwater and seep flow associated with the proposed groundwater remedy will be collected and treated (by physical/chemical precipitation, filtration and carbon adsorption). It is anticipated that the environmental impacts associated with the groundwater and seep water will be significantly diminished and the treated water will exhibit a significant reduction in PFAS target compounds, total suspended solids and dissolved metals. PAHs, and heptachlor epoxide will also be treated if present. This will reduce the impact of these pollutants in the Cape Fear River.

5. REFERENCES

Geosyntec, 2019. Mixing Zone Report, Addendum, Chemours Fayetteville Works Outfall 002. October 2019.

Geosyntec, 2021. Memorandum to Chemours. Chemours Fayetteville Works – Groundwater and Seeps Water Quality Assessment. June 10, 2021.

APPENDIX A

Analytical Data for Groundwater & Seep Sources for the Engineering Design

Table A1: EW-1 Table 3+ Compound Summary

Location: EW-1

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	9	9	ND	ND	ND	ND	ND
Hfpo Dimer Acid	6	0	3.30	1.60	6.90	5.30	1.94
Hydro-EVE Acid	9	8	0.05	0.05	0.05	0.00	ND
Hydrolyzed PSDA	9	3	0.48	0.02	1.60	1.58	0.69
Hydro-PS Acid	10	9	0.03	0.03	0.03	0.00	ND
NVHOS	8	0	0.26	0.11	0.59	0.48	0.20
PEPA	10	0	0.48	0.06	1.70	1.65	0.61
PES	9	8	0.01	0.01	0.01	0.00	ND
PFECA B	9	9	ND	ND	ND	ND	ND
PFECA-G	10	10	ND	ND	ND	ND	ND
PFMOAA	10	0	34.20	13.00	74.00	61.00	24.13
PFO2HxA	10	0	10.64	2.90	32.00	29.10	10.08
PFO3OA	10	0	1.16	0.10	4.20	4.10	1.53
PFO4DA	10	8	1.04	0.08	2.00	1.92	1.36
PFO5DA	10	10	ND	ND	ND	ND	ND
PMPA	10	0	2.79	1.10	7.50	6.40	2.27
PS Acid	10	10	ND	ND	ND	ND	ND
R-EVE	9	3	0.13	0.04	0.35	0.32	0.13
R-PSDA	9	3	0.17	0.04	0.47	0.43	0.17
R-PSDCA	9	9	ND	ND	ND	ND	ND

Table A2: EW-1 Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	3	1	0.06	0.04	0.09	0.05	0.04
Bromide	12	12	ND	ND	ND	ND	ND
Calcium	3	0	2.70	2.60	2.80	0.20	0.10
Carbonate Alkalinity	0	0	--	--	--	--	--
Chloride	12	0	7.19	6.30	10.00	3.70	1.00
Fluoride	3	3	ND	ND	ND	ND	ND
Hardness	0	0	--	--	--	--	--
Iron	24	0	1.73	1.40	2.10	0.70	0.23
Magnesium	3	0	1.37	1.30	1.50	0.20	0.12
Manganese	23	0	0.02	0.02	0.03	0.01	0.00
pH	2	0	6.90	--	--	--	0.14
Phosphate	1	1	ND	ND	ND	ND	ND
Sulfate	12	0	15.08	14.00	17.00	3.00	1.00
Total Dissolved Solids	3	0	64.00	51.00	78.00	27.00	13.53
Total Organic Carbon	12	12	ND	ND	ND	ND	ND
Total Suspended Solids	3	0	8.80	5.90	13.00	7.10	3.72

*pH expressed in standard units

Legend:

ug/L = micrograms per liter

mg/L = milligrams per liter

Min = minimum

Max = maximum

Range = difference between max and min

Std Dev = standard deviation

Table A3: EW-3 Table 3+ Compound Summary

Location: EW-3

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	15	12	0.097	0.095	0.1	0.005	0.002645751
Hfpo Dimer Acid	10	0	13.03	9.30	16.00	6.70	2.15
Hydro-EVE Acid	15	0	0.75	0.42	1.10	0.68	0.20
Hydrolyzed PSDA	15	0	4.25	1.50	6.50	5.00	1.85
Hydro-PS Acid	15	0	0.51	0.16	0.98	0.82	0.36
NVHOS	13	0	1.52	0.43	4.80	4.37	1.36
PEPA	15	0	2.85	1.80	4.90	3.10	0.77
PES	15	11	0.00	0.00	0.01	0.00	0.00
PFECA B	15	15	ND	ND	ND	ND	ND
PFECA-G	15	15	ND	ND	ND	ND	ND
PFMOAA	15	0	132.13	27.00	470.00	443.00	129.07
PFO2HxA	15	0	32.53	14.00	91.00	77.00	20.87
PFO3OA	15	0	14.77	5.20	43.00	37.80	11.94
PFO4DA	15	0	6.76	1.20	20.00	18.80	6.66
PFO5DA	15	6	0.91	0.01	2.40	2.39	0.77
PMPA	15	0	8.41	5.70	12.00	6.30	1.78
PS Acid	15	8	0.42	0.23	0.56	0.33	0.12
R-EVE	15	2	0.73	0.17	1.20	1.03	0.33
R-PSDA	15	0	1.21	0.65	1.70	1.05	0.33
R-PSDCA	15	3	0.04	0.01	0.10	0.09	0.03

Table A4: EW-3 Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	3	0	0.75	0.41	1.40	0.99	0.56
Bromide	22	22	ND	ND	ND	ND	ND
Calcium	3	0	8.43	7.70	9.30	1.60	0.81
Carbonate Alkalinity	0	0	--	--	--	--	--
Chloride	22	0	12.42	3.00	16.00	13.00	2.67
Fluoride	4	3	0.32	0.32	0.32	--	--
Hardness	0	0	--	--	--	--	--
Iron	44	0	9.37	2.60	14.00	11.40	3.10
Magnesium	3	0	5.10	4.80	5.40	0.60	0.30
Manganese	43	0	0.20	0.16	0.25	0.09	0.02
pH	3	0	6.83	--	--	--	0.29
Phosphate	1	1	ND	ND	ND	ND	ND
Sulfate	22	0	59.95	14.00	72.00	58.00	12.44
Total Dissolved Solids	4	1	123.33	120.00	130.00	10.00	5.77
Total Organic Carbon	22	16	0.74	0.50	0.98	0.48	0.20
Total Suspended Solids	4	0	31.08	3.30	87.00	83.70	37.92

*pH expressed in standard units

Legend:

ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation

Table A5: PIW-10S Table 3+ Compound Summary
Location: PIW-10S

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	7	7	ND	ND	ND	ND	ND
Hfpo Dimer Acid	6	0	3.23	2.80	3.90	1.10	0.45
Hydro-EVE Acid	7	1	0.01	0.01	0.01	0.00	0.00
Hydrolyzed PSDA	7	7	ND	ND	ND	ND	ND
Hydro-PS Acid	7	0	0.11	0.09	0.15	0.06	0.02
NVHOS	6	1	0.03	0.02	0.04	0.01	0.01
PEPA	7	0	1.69	1.50	2.10	0.60	0.23
PES	7	7	ND	ND	ND	ND	ND
PFECA B	7	7	ND	ND	ND	ND	ND
PFECA-G	7	7	ND	ND	ND	ND	ND
PFMOAA	7	0	2.99	1.50	4.70	3.20	1.14
PFO2HxA	7	0	3.70	2.40	5.40	3.00	1.03
PFO3OA	7	0	0.70	0.45	0.99	0.54	0.20
PFO4DA	7	0	0.26	0.16	0.37	0.21	0.08
PFO5DA	7	2	0.02	0.01	0.03	0.02	0.01
PMPA	7	0	4.91	4.00	5.70	1.70	0.71
PS Acid	7	7	ND	ND	ND	ND	ND
R-EVE	7	0	0.15	0.09	0.20	0.11	0.04
R-PSDA	7	0	0.31	0.19	0.42	0.23	0.10
R-PSDCA	7	7	ND	ND	ND	ND	ND

Table A6: PIW-10S Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	4	0	0.84	0.62	1.20	0.58	0.28
Bromide	12	12	ND	ND	ND	ND	ND
Calcium	4	0	0.44	0.43	0.46	0.03	0.02
Carbonate Alkalinity	0	0	--	--	--	--	--
Chloride	12	0	4.13	3.10	5.50	2.40	0.66
Fluoride	3	3	ND	ND	ND	ND	ND
Hardness	0	0	--	--	--	--	--
Iron	24	13	0.52	0.04	2.60	2.56	0.78
Magnesium	4	0	0.60	0.58	0.61	0.03	0.01
Manganese	24	0	0.01	0.01	0.01	0.00	0.00
pH	3	0	6.77	--	--	--	0.25
Phosphate	0	0	--	0.00	0.00	--	--
Sulfate	12	0	9.94	9.00	11.00	2.00	0.67
Total Dissolved Solids	3	0	30.67	27.00	33.00	6.00	3.21
Total Organic Carbon	12	3	0.85	0.67	1.10	0.43	0.15
Total Suspended Solids	3	0	9.63	3.90	19.00	15.10	8.18

*pH expressed in standard units

Legend:
ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation

Table A7: PIW-5S Table 3+ Compound Summary

Location: PIW-5S

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	6	0	0.986666667	0.57	1.8	1.23	0.478567306
Hfpo Dimer Acid	5	0	33.80	25.00	41.00	16.00	5.97
Hydro-EVE Acid	6	0	1.55	0.82	2.00	1.18	0.40
Hydrolyzed PSDA	6	0	15.67	5.00	28.00	23.00	8.26
Hydro-PS Acid	6	0	1.25	0.58	1.40	0.82	0.33
NVHOS	5	0	0.70	0.65	0.77	0.12	0.04
PEPA	6	0	26.00	17.00	44.00	27.00	10.16
PES	6	6	ND	ND	ND	ND	ND
PFECA B	6	6	ND	ND	ND	ND	ND
PFECA-G	6	6	ND	ND	ND	ND	ND
PFMOAA	6	0	38.00	31.00	61.00	30.00	11.42
PFO2HxA	6	0	31.17	27.00	38.00	11.00	4.07
PFO3OA	6	0	8.58	7.50	10.00	2.50	0.97
PFO4DA	6	0	7.05	4.70	8.70	4.00	1.34
PFO5DA	6	0	5.23	1.90	6.60	4.70	1.76
PMPA	6	0	60.67	39.00	100.00	61.00	23.53
PS Acid	6	0	2.32	1.30	4.30	3.00	1.13
R-EVE	6	0	2.42	1.90	3.00	1.10	0.42
R-PSDA	6	0	3.70	2.90	4.70	1.80	0.63
R-PSDCA	6	0	0.05	0.04	0.07	0.03	0.01

Table A8: PIW-5S Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	2	0	0.91	0.86	0.96	0.10	0.07
Bromide	11	11	ND	ND	ND	ND	ND
Calcium	2	0	1.95	1.90	2.00	0.10	0.07
Carbonate Alkalinity	0	0	--	--	--	--	--
Chloride	11	0	5.80	5.40	6.30	0.90	0.28
Fluoride	2	2	ND	ND	ND	ND	ND
Hardness	0	0	--	--	--	--	--
Iron	22	0	0.79	0.04	12.00	11.96	2.52
Magnesium	2	0	0.82	0.79	0.84	0.05	0.04
Manganese	22	0	0.02	0.02	0.03	0.01	0.00
pH	2	0	6.75	--	--	--	0.35
Phosphate	0	0	--	0.00	0.00	--	--
Sulfate	11	0	22.36	20.00	24.00	4.00	1.63
Total Dissolved Solids	2	0	51.00	46.00	56.00	10.00	7.07
Total Organic Carbon	11	1	0.90	0.52	1.10	0.58	0.20
Total Suspended Solids	2	0	2.45	2.00	2.90	0.90	0.64

*pH expressed in standard units

Legend:

ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation

Table A9: SEEPA-TR-N Table 3+ Compound Summary

Location: SEEPA-TR-N

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	7	7	ND	ND	ND	ND	ND
Hfpo Dimer Acid	4	0	12.85	8.40	19.00	10.60	4.51
Hydro-EVE Acid	7	2	0.08	0.06	0.10	0.04	0.02
Hydrolyzed PSDA	7	4	0.05	0.03	0.08	0.05	0.03
Hydro-PS Acid	7	2	0.28	0.24	0.33	0.09	0.04
NVHOS	6	2	0.09	0.07	0.12	0.05	0.03
PEPA	7	2	4.52	2.90	6.80	3.90	1.68
PES	7	7	ND	ND	ND	ND	ND
PFECA B	7	7	ND	ND	ND	ND	ND
PFECA-G	7	7	ND	ND	ND	ND	ND
PFMOAA	7	2	6.20	5.00	7.90	2.90	1.16
PFO2HxA	7	2	12.54	9.70	16.00	6.30	2.49
PFO3OA	7	2	2.12	1.70	2.80	1.10	0.43
PFO4DA	7	2	1.44	1.20	1.80	0.60	0.25
PFO5DA	7	2	0.35	0.32	0.38	0.06	0.02
PMPA	7	2	13.02	9.10	17.00	7.90	3.36
PS Acid	7	7	ND	ND	ND	ND	ND
R-EVE	7	2	0.50	0.26	0.89	0.63	0.26
R-PSDA	7	2	0.96	0.48	1.60	1.12	0.47
R-PSDCA	7	4	0.01	0.00	0.01	0.00	0.00

Table A10: SEEPA-TR-N Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	2	0	14.14	0.27	28.00	27.73	19.61
Bromide	11	10	0.27	0.27	0.27	--	--
Calcium	2	0	1.30	1.00	1.60	0.60	0.42
Carbonate Alkalinity	0	0	--	--	--	--	--
Chloride	11	0	4.16	3.50	5.40	1.90	0.54
Fluoride	2	2	ND	ND	ND	ND	ND
Hardness	0	0	--	--	--	--	--
Iron	22	0	13.90	0.74	44.00	43.26	14.73
Magnesium	2	0	1.46	0.82	2.10	1.28	0.91
Manganese	22	0	0.17	0.05	0.55	0.50	0.12
pH	2	0	6.75	--	--	--	0.35
Phosphate	0	0	--	0.00	0.00	--	--
Sulfate	11	0	10.73	10.00	12.00	2.00	0.79
Total Dissolved Solids	2	0	106.00	42.00	170.00	128.00	90.51
Total Organic Carbon	11	0	12.88	5.30	24.00	18.70	5.74
Total Suspended Solids	2	0	1100.00	1100.00	1100.00	--	0.00

*pH expressed in standard units

Legend:

ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation

Table A11: SEEPA-WALL Table 3+ Compound Summary

Location: SEEPA-WALL

Table 3+ Compounds	**# of Results**	**# of Non-Detects**	**Average (ug/L)**	**Min (ug/L)**	**Max (ug/L)**	**Range (ug/L)**	**Std Dev (ug/L)**
EVE Acid	24	0	1.219166667	0.14	9.1	8.96	1.728462289
Hfpo Dimer Acid	11	0	28.36	19.00	41.00	22.00	5.94
Hydro-EVE Acid	24	0	1.60	0.14	3.50	3.36	0.72
Hydrolyzed PSDA	24	0	24.05	3.30	72.00	68.70	16.10
Hydro-PS Acid	29	3	1.35	0.01	3.50	3.49	0.57
NVHOS	23	0	1.03	0.23	1.70	1.47	0.44
PEPA	28	0	11.75	6.90	22.00	15.10	4.75
PES	24	24	ND	ND	ND	ND	ND
PFECA B	24	24	ND	ND	ND	ND	ND
PFECA-G	29	29	ND	ND	ND	ND	ND
PFMOAA	29	0	70.93	15.00	130.00	115.00	41.13
PFO2HxA	29	0	35.38	18.00	55.00	37.00	11.30
PFO3OA	29	0	11.44	4.40	18.00	13.60	4.16
PFO4DA	29	0	6.91	1.40	11.00	9.60	2.28
PFO5DA	29	1	4.47	0.25	7.10	6.85	1.54
PMPA	28	0	27.25	17.00	46.00	29.00	7.94
PS Acid	29	2	4.56	0.02	31.00	30.98	5.92
R-EVE	24	0	1.36	0.80	3.60	2.80	0.53
R-PSDA	24	0	2.47	0.32	8.30	7.98	1.42
R-PSDCA	24	5	0.06	0.02	0.12	0.10	0.02

Table A12: SEEPA-WALL Treatment Parameter Summary

Treatment Parameter	**# of Results**	**# of Non-Detects**	**Average (mg/L)**	**Min (mg/L)**	**Max (mg/L)**	**Range (mg/L)**	**Std Dev (mg/L)**
Aluminum	7	0	3.48	0.11	14.00	13.89	4.93
Bromide	12	12	ND	ND	ND	ND	ND
Calcium	7	0	3.14	1.31	6.40	5.09	2.24
Carbonate Alkalinity	5	5	ND	--	--	--	ND
Chloride	18	0	5.56	4.00	12.20	8.20	2.07
Fluoride	3	2	0.41	0.41	0.41	--	--
Hardness	0	0	--	--	--	--	--
Iron	27	0	1.63	0.07	21.40	21.33	4.10
Magnesium	7	0	0.89	0.51	1.50	0.99	0.36
Manganese	27	0	0.05	0.02	0.42	0.40	0.08
pH	3	0	6.77	--	--	--	0.25
Phosphate	5	4	1.00	1.00	1.00	--	--
Sulfate	16	0	14.88	8.60	30.30	21.70	5.96
Total Dissolved Solids	7	0	62.64	39.50	113.00	73.50	26.15
Total Organic Carbon	16	0	2.98	0.58	10.40	9.82	2.31
Total Suspended Solids	9	0	124.26	4.70	712.00	707.30	223.19

*pH expressed in standard units

Legend:

ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation

Table A13: SEEPB-WALL Table 3+ Compound Summary

Location: SEEPB-WALL

Table 3+ Compounds	# of Results	# of Non-Detects	Average (ug/L)	Min (ug/L)	Max (ug/L)	Range (ug/L)	Std Dev (ug/L)
EVE Acid	29	0	8.624137931	1.4	46	44.6	11.3600382
Hfpo Dimer Acid	17	0	37.47	25.00	85.00	60.00	18.93
Hydro-EVE Acid	29	0	3.30	0.85	11.00	10.15	2.77
Hydrolyzed PSDA	29	0	43.93	21.00	120.00	99.00	22.31
Hydro-PS Acid	33	2	1.63	0.49	4.70	4.21	1.32
NVHOS	28	0	3.57	1.80	8.50	6.70	1.88
PEPA	31	0	22.13	12.00	50.00	38.00	11.69
PES	29	25	0.07	0.01	0.21	0.20	0.10
PFECA B	29	27	0.11	0.05	0.17	0.12	0.09
PFECA-G	33	31	0.11	0.00	0.21	0.21	0.15
PFMOAA	33	0	118.08	4.80	200.00	195.20	80.31
PFO2HxA	33	0	34.76	11.00	50.00	39.00	13.64
PFO3OA	33	0	7.20	2.50	12.00	9.50	2.80
PFO4DA	33	0	1.95	0.79	7.70	6.91	1.20
PFO5DA	33	5	0.72	0.13	1.90	1.77	0.62
PMPA	31	0	47.19	32.00	87.00	55.00	17.18
PS Acid	33	1	7.56	0.04	31.00	30.96	8.97
R-EVE	29	0	4.38	2.00	13.00	11.00	3.45
R-PSDA	29	0	5.81	2.50	16.00	13.50	3.64
R-PSDCA	29	2	0.11	0.05	0.38	0.33	0.10

Table A14: SEEPB-WALL Treatment Parameter Summary

Treatment Parameter	# of Results	# of Non-Detects	Average (mg/L)	Min (mg/L)	Max (mg/L)	Range (mg/L)	Std Dev (mg/L)
Aluminum	6	0	0.80	0.39	1.45	1.06	0.46
Bromide	12	12	ND	ND	ND	ND	ND
Calcium	6	0	0.96	0.69	1.58	0.89	0.32
Carbonate Alkalinity	4	4	ND	--	--	--	ND
Chloride	20	0	7.67	5.00	16.20	11.20	2.97
Fluoride	3	3	ND	ND	ND	ND	ND
Hardness	0	0	--	--	--	--	--
Iron	26	0	0.85	0.37	3.75	3.38	0.68
Magnesium	6	0	0.82	0.67	1.31	0.64	0.25
Manganese	26	0	0.03	0.02	0.41	0.40	0.08
pH	3	0	6.67	--	--	--	0.29
Phosphate	4	4	ND	ND	ND	ND	ND
Sulfate	15	0	10.70	7.00	24.40	17.40	4.70
Total Dissolved Solids	6	0	46.33	26.00	74.00	48.00	15.64
Total Organic Carbon	15	0	3.92	2.60	5.50	2.90	0.87
Total Suspended Solids	10	0	93.60	11.00	300.00	289.00	113.50

*pH expressed in standard units

Legend:

ug/L = micrograms per liter
mg/L = milligrams per liter
Min = minimum
Max = maximum
Range = difference between max and min
Std Dev = standard deviation