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November 16, 2021

Ms. Tanowa Troupe, Secretary
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3797

Re: **Case No. 20-417-EL-BGN -**In the Matter of the Application of Grover Hill Wind, LLC for a Certificate of Environmental Compatibility and Public Need to Construct a Wind-Powered Electric Generation Facility in Paulding County, Ohio.

Fourth Supplemental Response to Third Data Request – Third Supplemental Response to Fifth Data Request – Second Supplemental Response to Sixth Data Request from Staff of the Ohio Power Siting Board - Geotechnical

Dear Ms. Troupe:

Attached please find Grover Hill Wind, LLC's ("Applicant") Supplemental Responses to the Third, Fifth, and Sixth Data Requests from Staff of the Ohio Power Siting Board ("OPSB Staff"). The Applicant provided these responses to OPSB Staff on November 16, 2021.

We are available, at your convenience, to answer any questions you may have.

Respectfully submitted,

/s/ *Christine M.T. Pirik*
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CERTIFICATE OF SERVICE

The Ohio Power Siting Board's e-filing system will electronically serve notice of the filing of this document on the parties referenced in the service list of the docket card who have electronically subscribed to these cases. In addition, the undersigned certifies that a copy of the foregoing document is also being served upon the persons below this 16th day of November, 2021.

/s/ Christine M.T. Pirik
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4894-0499-5843 v1 [73809-23]

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of Grover Hill Wind,	)	
LLC for a Certificate of Environmental Compatibility	)	
and Public Need to Construct a Wind-Powered Electric	)	Case No: 20-417-EL-BGN
Generation Facility in Paulding County, Ohio.	)	

GROVER HILL WIND, LLC 'S FOURTH SUPPLEMENTAL RESPONSE TO THE THIRD DATA REQUEST – THIRD SUPPLEMENTAL RESPONSE TO THE FIFTH DATA REQUEST – SECOND SUPPLEMENTAL RESPONSE TO THE SIXTH DATA REQUEST FROM THE STAFF OF THE OHIO POWER SITING BOARD

On May 3, 2021, as supplemented on June 7, 2021, Grover Hill Wind, LLC ("Applicant") filed an application ("Application") with the Ohio Power Siting Board ("OPSB") proposing to construct a wind-powered electric generation facility in Paulding County, Ohio ("Project"). Now comes the Applicant providing the following Supplemental Responses to the Third, Fifth, and Sixth Data Requests from the OPSB Staff regarding geotechnical information pertaining to the proposed Grover Hill Wind Project.

In response to questions from OPSB Staff, the Applicant had Westwood perform geotechnical studies for the Project Area. Attached please find the Geotechnical Investigation Report prepared by Westwood for the Applicant. In addition, the Applicant is revising it answer to Question 4 of Response to the Fifth Data Request that was filed on August 24, 2021, as follows:

4. **Grover Hill Wind, LLC initiated excavation of 6 wind turbine sites as early as December 2017. Which of those 6 wind turbine sites are included in this Application?**

   Response: Of the 6 wind turbine sites that were previously excavated, T26, T31, and T34 were included in the Application.

Respectfully submitted,

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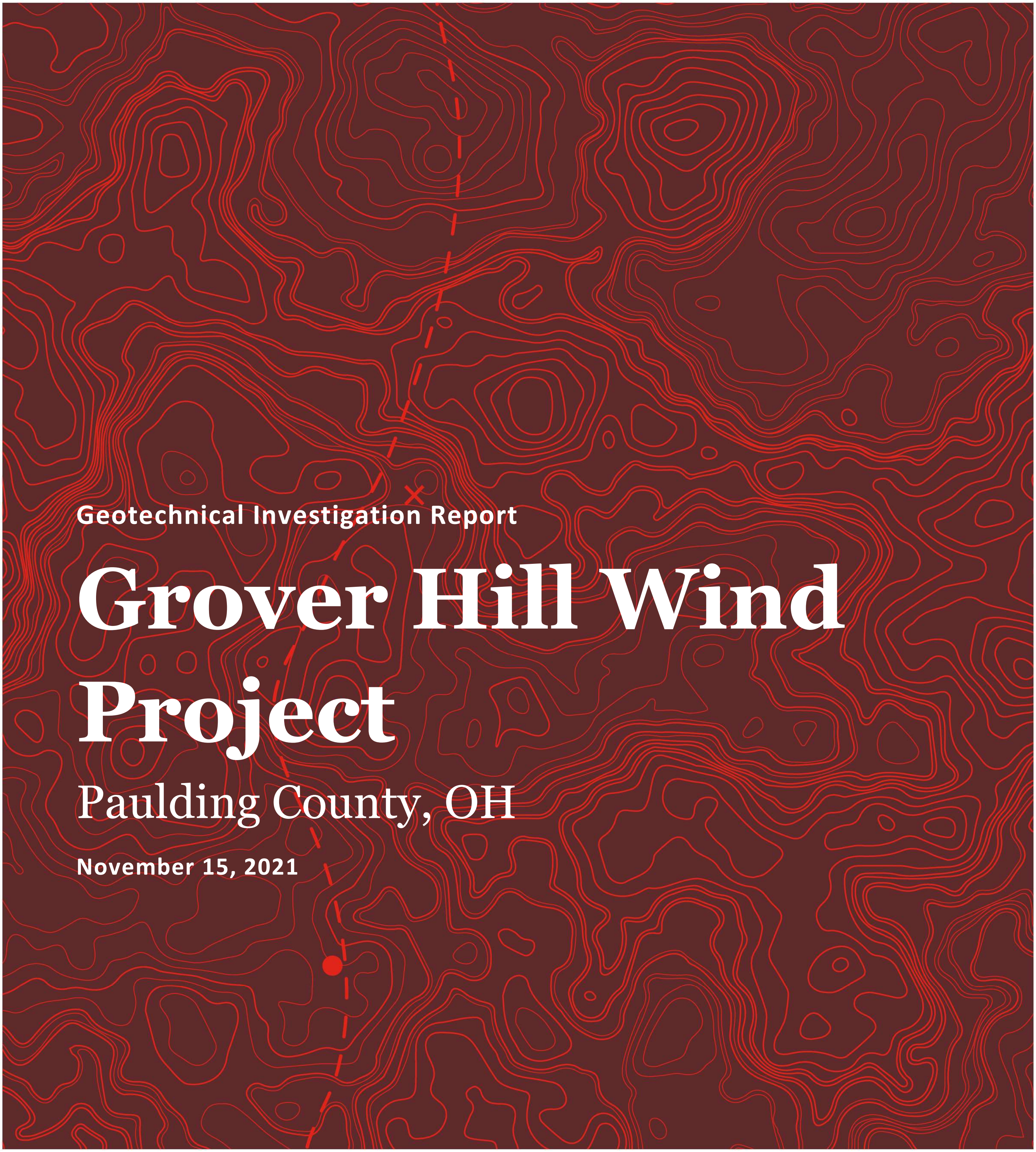

Geotechnical Investigation Report

Grover Hill Wind Project

Paulding County, OH

November 15, 2021

PREPARED FOR:

STARWOOD
ENERGY GROUP

PREPARED BY:

Westwood

Westwood

Geotechnical Investigation Report

Grover Hill Wind Project

Paulding County, OH

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11/15/2021

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Project Number: R0015695.00
Date: November 15, 2021

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Executive Summary

Westwood Professional Services (Westwood) is pleased to present this geotechnical investigation report to Starwood Energy Group, for the proposed Grover Hill Wind Project (Project) located in Paulding County, Ohio. The scope of work for this investigation included subsurface exploration, field and laboratory testing, engineering analysis, and preparation of this report for the proposed wind project. This investigation has generally revealed no subsurface conditions that would preclude development of the proposed project.

Based on the information obtained from 23 soil borings with standard penetration tests (SPT) advanced to depths of 30 to 40 feet below ground surface (bgs), the subsurface conditions at the site generally consist of 6 to 8 inches of topsoil overlying medium stiff to stiff fat clay to depths between 5 and 7 feet. Underlying the fat clay is stiff to hard lean clay with variable amount of sand and gravel extending to dolomite bedrock at depths between 16 and 30 feet. Two boring locations were offset by approximately 60 feet from the proposed wind turbine center point due to existing excavations in the ground that contained standing water. Additional explorations will be required at these locations during the pre-construction design phase if the existing excavations are to be used for the final wind turbine foundation.

Groundwater was encountered in 7 borings during drilling between 17 and 30 feet below grade, and was measured at depths between 6 and 19 feet below grade in piezometers installed at turbine borings 9 to 25 days after installation. Groundwater level fluctuations occur due to seasonal variation in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed; therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than those observed during the investigation.

The below summary of recommendations may be used for wind turbine foundation designs for the locations investigated. These recommendations assume wind turbines will bear on very stiff native clay:

- Minimum depth to groundwater = 6 feet (to be confirmed with additional readings)
- Foundation backfill density (moist) = 105 pcf
- Gross allowable bearing capacity, normal loads = 3,500 psf
- Gross allowable bearing capacity, extreme loads = 5,000 psf
- Differential settlement = 1.6 inches (approximately 0.17 degrees rotation)
- Rotational stiffness = 525 GN-m/rad.

The fat clay encountered below the topsoil is generally considered poor subgrade for gravel access roads. Access roads constructed on native clay subgrade compacted to 95% of the maximum dry density may be designed using a California bearing ratio (CBR) of 1.5%, assuming the subgrade is prepared in accordance with the recommendations in this report.

Shallow foundations may be used to support substation equipment. Mat and spread foundations should bear on non-frost susceptible structural fill extending a minimum of 3 feet below grade or to the maximum extent of the existing uncontrolled fill, whichever is greater. The design of large slab-on-grade equipment foundations and conventional spread foundations may be designed using a maximum allowable gross bearing capacity of 1,700 psf, and strip foundations may be designed using an allowable bearing capacity of 2,500 psf, when bearing on properly prepared subgrade.

This executive summary should be read in context of the entire report for full understanding of the subsurface conditions encountered and associated recommendations.

1.0 Introduction

This report presents the findings of the geotechnical investigation conducted by Westwood Professional Services (Westwood) for the proposed Grover Hill Wind Project (Project) located in Paulding County, Ohio, surrounding the Village of Grover Hill (Exhibit 1). The primary purpose of this report is to provide geotechnical test data and analysis to support the design and construction of the proposed Project. This investigation focuses on the proposed 23 wind turbine locations, two MET towers, collection substation, and O&M building. The services provided were in general conformance with the scope of work and assumptions outlined in Westwood's proposal dated August 3, 2021. This report is intended for exclusive use by Starwood Energy Group.

1.1 Project Description

Westwood understands that the proposed project will consist of 23 wind turbine generators (WTGs), with up to four different turbine models being considered. The proposed project will also consist of access roads, electrical collection system, MET towers, O&M building, and collector substation. Topography across the project site can be described as generally flat to lightly undulating. The present land use is predominately agricultural fields.

2.0 Methods

A geotechnical investigation program was completed by Westwood with field work performed between August 30th and October 20th, 2021. EnviroCore, Inc. was retained by Westwood to perform geotechnical drilling with standard penetration testing (SPT). Westwood and Soil Engineering Testing (SET) performed laboratory testing on soil samples collected during the investigation. A Westwood geotechnical representative coordinated the field work, logged the borings, collected samples, and performed the electrical resistivity testing. GeoView, Inc. was retained by Westwood to perform the geophysical survey. The field investigation consisted of the following scope of work:

- Conducting soil borings at 23 proposed wind turbine locations to a target depth of 60 ft below ground surface (bgs). If auger refusal was encountered prior to a depth of 30 ft, rock coring would be performed to a depth of 30 ft bgs.
- Conducting three soil borings at the proposed substation to a target depth of 35 ft bgs or auger refusal, whichever is shallower, with rock coring performed to a maximum depth of 25 ft at up to one boring location.
- Conducting one soil boring at the proposed O&M building to a target depth of 25 ft bgs or auger refusal, whichever is shallower.
- Conducting soil borings at the two proposed MET tower locations to a target depth of 25 ft bgs or auger refusal, whichever is shallower.
- Performing electrical resistivity surveys at nine locations, including eight at proposed turbine locations and one at the proposed substation location.
- Performing a geophysical survey using Multi-channel Analysis of Surface Waves (MASW) and seismic refraction tests at five turbine locations to measure shear wave velocities.
- Collecting soil samples at all boring locations for laboratory testing.

Geotechnical test locations are shown on Exhibit 1. Boring locations were provided by Starwood Energy Group based on the site layout available at the time of the field work. All test locations were staked by a Westwood engineer. Coordinates are provided on the boring logs.

2.1 Soil Borings

Soil borings were drilled using hollow stem augers and soil samples were obtained using an automatic hammer and split-spoon samplers in general accordance with ASTM D1586. Rock coring was performed in general conformance with ASTM D2113 (Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration). Standard penetration test (SPT) N-values are recorded on the boring logs and a summary is provided in Appendix B. A Westwood geotechnical representative logged the borings and collected the soil/rock samples. Bulk soil samples were also collected from shallow auger cuttings at the substation and several turbine locations for laboratory testing. Rock coring was performed after auger refusal to a maximum depth of 37 ft bgs. Soil and rock samples were shipped to Westwood and SET for laboratory testing. Soil boring logs are included in Appendix A. Two boring locations (T-26 and T-43) were cited inside of previously excavated foundation locations and had to be moved approximately 60 feet from the wind turbine center point.

Groundwater observation piezometers were installed within each of the boreholes. Piezometers consisted of 2 inch diameter PVC pipe installed to a depth of approximately 15 ft bgs with 3 ft of pipe stickup. The bottom 5 ft of pipe was screened and backfilled with sand then bentonite above the sand. Refer to Section 3.4 for additional information on groundwater observations.

2.2 Laboratory Testing

Laboratory tests were conducted on representative soil and rock samples to aid in classification and evaluation of the physical properties and engineering characteristics of the material. Soil samples were sent to Westwood and SET for testing, which included the following:

- Moisture content (ASTM D2216)
- Sieve analysis (ASTM D6913 and D7928)
- Atterberg limits (ASTM D4318)
- Standard Proctor moisture-density relationship (ASTM D698)
- Unconfined compression (ASTM D2166 & ASTM D7012)
- Consolidation (ASTM D2435)
- Chemical analysis (pH, Sulfates, Chlorides)
- California bearing ratio (CBR) (ASTM D1883)
- Thermal resistivity with dry-out curves (ASTM D5334)

A summary of laboratory testing results is included in Appendix C, and complete test reports are included in Appendix C.

Bulk samples collected for thermal resistivity tests were prepared near the as-received moisture contents and compacted to 90% of the standard Proctor maximum dry density, representing the compaction conditions typical of a backfilled utility trench, and subsequently dried out to zero moisture. Thermal resistivity measurements were taken at the compacted moisture content, zero moisture, and at several intermediate moisture contents during drying. Additional thermal resistivity testing was conducted on three relatively undisturbed Shelby tube samples, representing the in-situ thermal properties of the soil. Results of the thermal resistivity tests are discussed in Section 4.1.8 and test reports are included in Appendix C.

2.3 Electrical Resistivity Testing

Electrical resistivity measurements were taken at nine test locations, including one at the proposed substation and eight at proposed wind turbine locations, as shown on Exhibit 1. Tests were performed using the Wenner Four-Electrode Method and an AEMC Instruments Model 6470-B Multi-Function Digital Ground Resistance Tester, in general accordance with ASTM G57. At each wind turbine test location, resistivity tests were performed along two perpendicular profiles with a minimum electrode spacing of 5, 10, 20, 30, 50, and 100 feet. At the substation locations, resistivity tests were performed along two perpendicular profiles with a minimum electrode spacing of 5, 10, 20, 30, 50, 100, and 200 feet. Refer to Section 4.1.7 and the attached Appendix D for results of the electrical resistivity tests.

2.4 Geophysical Survey

GeoView, Inc. was retained by Westwood to characterize the seismic velocities using the Multispectral Analysis of Surface Waves (MASW) method at five turbine locations: T-14, T-25, T-29, T-31, and T-38. Subsurface seismic velocities obtained by the seismic survey were used to determine depth to bedrock/dense soil, the dynamic shear modulus (Section 4.1.4), and Poisson's ratio (Section 4.1.5) to aid in the calculation of subsurface rotational stiffness (Section 4.4.3). The complete methodology and results of this survey are presented in Appendix E.

3.0 Site Conditions

3.1 Regional Geology

The Grover Hill Wind Project is located within the Eastern Lake Section of the Central Lowland province (USGS, 1946) of the Interior Plains Physiographic Region. The Central Lowlands province is the largest physiographic province in the continuous US and is largely level. The Central Lowlands were subject to repeated Pleistocene glaciations, which define the landforms throughout the region (NPS, 2021). The present glacial topography at the project site is the product of the most recent glaciation event that ended approximately 10,000 years ago during the Late Wisconsin's glaciation event of the Pleistocene Epoch, where a massive continental ice sheet grew and gradually expanded southward. This created several finger-like lobes of glacial ice that engulfed the region and moved through the Superior basin. The project site is located within a geologic area known as the Maumee Lake Plain. During the Wisconsin glaciation, the project site was covered by Glacial Lake Maumee, an ancestor of present-day Lake Erie. As the glacier and lake slowly receded to the north, sediments were deposited along the path, resulting in the flat topography observed in the region today (Fullerton et. al., 2003).

The proposed project area is mapped within one geologic unit (Slucher *et al*, 2006), The Salina Group. The Salina Group formation is Silurian in age and primarily comprised of gray, thin bedded to laminated dolostone. Minor units of gypsum, shale, and anhydrite have also been identified within the formation. Refer to Exhibit 4 for mapped geologic units.

Based on Web Soil Survey data available through the United States Department of Agriculture (USDA, 2020), three major soil units and several minor units are mapped within the project area, as shown on Exhibit 3. The three major units include Paulding Clay, Latty Silty Clay, and the Nappanee Silty Clay

Loam. They Latty silty clay and Paulding clay are classified as clayey glaciolacustrine deposits over clayey till, and the Nappanee silty clay is classified as till. All three units contain lean clay and fat clay throughout the soil profile, generally with a majority fat clay in the upper 5 feet.

3.2 Geohazards

3.2.1 Karst

Karst features generally develop in areas with wet subsurface conditions and soluble rock that may dissolve over time to form underground caves and ground instability. Karst geology can be particularly hazardous as caves develop slowly, while failures are rapid, often causing several feet of subsidence. According to the USGS map of Karst Hazard Potential in the United States (USGS, 2014), the project site is mapped within an area of karst potential in the form of carbonate rocks buried under less than 50 ft of glacially derived insoluble sediments in a humid climate (Exhibit 5). The Ohio Department of Natural Resources (ODGS, 2006) maps the project site in a region containing Silurian- and Devonian-age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium; however, the project site is not mapped in a probable karst area.

Although karst formations are relatively common in Ohio, the majority of mapped probable karst areas are located in the far north-central and far south-central portions of the state (Exhibit 5; ODNR, 2006). Although sporadic regions of probable karst have been identified throughout the western portion of the state, the nearest mapped area of probable karst is approximately 50 miles east of the project site (ODGS, 2006). According to the Ohio Department of Natural Resources' Karst Interactive Map (ODGS, 2021), there are no verified or suspected karst sinkholes or other features identified near the project site. Furthermore, Dolomite is considered the least susceptible of the karst-prone geologic formations, as compared to limestone or anhydrous/evaporate formations (BGS, 2013).

Results of the field investigation indicate that the depth to dolomitic bedrock at WTG locations ranges between 16 ft and 30 ft bgs. At the 19 borings where rock coring was performed, one location experienced two 3-inch core barrel drops (T-25), and a 1- to 2-foot-thick seam of poorly graded sand with clay was encountered within the highly weathered bedrock at boring T-31. The core barrel drop and highly weathered bedrock encountered in these two boreholes may be the result of dissolution or extreme weathering. The majority of rock cores also exhibited relatively small (<2" diameter) dissolution features, known as pits and vugs. The seismic refraction survey (Appendix E) indicates a relatively horizontal bedrock plane with no major anomalies detected, such as pinnacles or crevices. Compression wave velocities measured at T-31 were lower than those measured at the other test locations, indicative of the high degree of weathering observed.

In general, the potential for development of surficial sinkholes on site is considered low due to the presence of relatively small dissolution features encountered and lack of mapped karst features in the region. Although no surface depressions, sinkholes, or large voids were observed during the field exploration, it is still possible that karst features exist beyond the extents of our explorations. A detailed karst/sinkhole study was beyond the scope of this investigation. Additional on-site testing and analysis may be performed to further evaluate the potential for karst features if the risk is considered unacceptable to the Owner. Supplemental borings with video logging may be performed at select WTG locations to better assess the risk of subsurface voids.

3.2.2 Seismicity

Ohio is not a historically active seismic region, as only 10 earthquake events with a magnitude greater than 2.5 on the Richter scale have been recorded within 50 miles of the site in the past 50 years. The nearest and most recent of these events was magnitude 2.6 earthquake that occurred in 2015, approximately 14 miles southwest of the project site. The largest of these events was a magnitude 4.5 event that occurred in 1986, approximately 33 miles south of the project site. According to a USGS ShakeMap available for the magnitude 4.5 earthquake, this event is expected to have been classified as a 3.0 to 4.0 on the Modified Mercalli Intensity scale at the project site, which is defined as an event that would induce a weak to light shaking with negligible to light potential for damage to structures (USGS, 2021).

According to the USGS, there are no active fault zones within the project boundary (USGS, 2021). The nearest mapped fault zone is the New Madrid seismic zone, located more than 200 miles southwest of the project site. The risk of liquefaction on site is also considered low due to the lack of historic seismic activity, clayey overburden soil, and shallow bedrock. See Section 4.3.2 for discussion on seismic design parameters.

3.2.3 Slope Stability/Landslides

Deep-seated slope failure can occur on steep natural slopes that experience heavy rainfall events and/or are subjected to large surcharge loads at the crest of the slope. While the project site is generally on relatively flat ground with minimal risk of slope instability, five proposed turbine locations (T-11, T-13, T-14, T-30, and T-31) are cited within 200 feet of a creek or irrigation channel. Northwest Ohio does not commonly experience slope failures, as most slope failures are mapped in the southeast portion of the site, northern Lake Erie shoreline, or along the Ohio River river bank (ODNR, 1995). Furthermore, no evidence of recent slope failure along the creek banks or irrigation channels was observed during on-site activities. The risk of landslides for these wind turbine locations may be considered low due to the lack of prior evidence of slope failure in the region, relatively flat topography, and the relatively high undrained shear strength of the soils on site. Reasonable crane walk and road setbacks should be established from the existing creeks or irrigation channels to allow for future erosion of the river banks without impacting the project site roads and turbine pads.

Any modifications to the existing slopes, including increased loads at the top of slope, removal of material from the toe of slope, and changes to surficial infiltration, can significantly affect slope stability. Discussion on fill slopes is provided in Section 4.2.3, but a detailed slope stability analysis was not a part of the scope of this investigation.

3.2.4 Expansive Soils

Based on USDA Soil Survey data, the majority of the shallow soil is classified as having moderate swell potential, although scattered pockets of soil with high potential exist throughout the site, including fat clay (CH) soil units (USDA, 2020). The U.S. Army Corps of Engineers Technical Manual (1983) maps the project site within a region where the occurrence of expansive materials are extremely limited. Although swelling soils will likely not affect the deeper WTG foundations and the humid climate will generally limit significant moisture fluctuations, shallow foundations may still be impacted by soil expansion following extreme droughts if bearing directly on high plasticity clay. Refer to sections 4.2.4 and 4.2.5 for recommendations on subgrade preparation and fill material to mitigate risk of soil expansion below foundations.

3.3 Subsurface Stratigraphy

Based on the conditions encountered at the soil boring locations within the Grover Hill Wind Project site, the general subsurface stratigraphic profile is described as follows:

- **Topsoil.** Topsoil on site generally ranges from 4 to 10 inches thick. The topsoil encountered was generally dark brown and clayey with moderate organics and active roots. Topsoil depths could be greater in some portions of the site, particularly in topographic low areas. A minimum topsoil thickness of 6 inches is recommended across the site.
- **Fill – Lean Clay with Sand (CL).** Lean clay fill was encountered at the three substation boring locations, extending between 2.5 and 5 feet below grade. The fill was generally grayish brown with a distinct odor, soft and stiff, damp, and contained variable amounts of sand.
- **Fat Clay, Sandy Fat Clay (CH).** Underlying the topsoil is fat clay deposits of glaciolacustrine origin, extending between 5 and 10 feet below grade. This clay is generally brown with some gray mottling, damp, and medium stiff to very stiff.
- **Glacial Till - Lean Clay, Lean Clay with Sand, Sandy Lean Clay, Clayey Sand (CL, SC).** Beneath the fat clay was stiff to hard glacial till lean clay with varying fractions of sand and gravel**.** The soil was typically brown to dark grayish brown and damp to wet. The sand and gravel fraction of this material was typically between 15 and 25%.
- **Bedrock – Dolomite.** Dolomitic bedrock was encountered at all boring locations across the site, generally occurring between 16 and 30 feet below grade. The upper 2- to 5-feet of the bedrock surface was typically highly weathered and transitioned into more competent bedrock with depth. Rock cores were typically light gray and had rock quality designation (RQD) values ranging from 0% to 100%, with the highest variability in RQD occurring in the initial 5 feet of coring. The majority of rock cores had RQD values greater than 60%, demonstrating fair to good rock quality with moderate to sound rock continuity. Most samples had a vuggy texture with evidence of minor dissolution. One boring (T-31) encountered the initial bedrock surface at 25 feet bgs before transitioning into poorly graded sand at 30 feet, and then back into rock at 35 feet.

More detailed descriptions of the subsurface conditions are provided on the boring logs found in Appendix A. Rock coring photo logs are also provided in Appendix A.

3.4 Groundwater

Boreholes were observed during and shortly after drilling for the presence and level of groundwater. Piezometers were also installed after completion of drilling and measured 2 to 4 weeks after installation. Depth to groundwater on site varied from 17 feet to greater than 30 feet below ground surface during drilling, and between 5.8 and 18.7 feet below ground surface from the piezometer monitoring. Depth to groundwater measured during drilling and after the piezometer monitoring trip are recorded Table 3.1 below. As demonstrated from the table, the water level during drilling, when encountered, was generally deeper compared to the longer-term water level measured in the piezometers.

Groundwater level fluctuations occur due to seasonal variation in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed; therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than those observed during the investigation. Additional groundwater depth measurements should be taken to further evaluate groundwater fluctuations over time. Refer to Sections 4.2.2 for recommendations regarding water control.

Table 3.1 Groundwater (GW) Depth Summary

Boring ID	GW Measured During Drilling (ft)	GW Measured in Piezometer (ft)	Time of Piezometer Reading After Installation (Days)
T-11	30	5.8	25
T-13	-	18.7	25
T-14	22	8.7	24
T-15	-	8.1	24
T-16	-	7.8	24
T-17	22	6.3	24
T-25	-	10.5	21
T-26	-	10.4	24
T-27	-	12.7	17
T-28	20	9.8	16
T-29	-	10.4	16
T-30	-	*	*
T-31	-	11.0	15
T-32	-	13.5	10
T-33	-	7.6	10
T-34	-	6.3	9
T-35	-	10.5	9
T-36	-	9.5	9
T-37	-	11.3	13
T-38	-	11.3	10
T-40	17	16.7	24
T-41	25	18.5	25
T-43	21	6.2	13

*Unable to check piezometer due to land access

4.0 Discussion and Recommendations

4.1 Soil Properties

4.1.1 Moisture and Density

The in situ gravimetric moisture content of the soil on site ranges from approximately 7% to 25%, with an average moisture content of 15%. Fat clay found in the upper 5 feet had an average moisture content of 21%, and the lean clay encountered between 5 and 20 feet had an average moisture content of 15%.

The in situ moist unit weight of clay on site ranged between 127 and 140 pcf in the upper 10 feet, corresponding to dry densities between 104 and 125 pcf.

For wind turbine foundation design purposes, the recommended long-term moist unit weight of the native soil backfill compacted to 95% of the standard Proctor maximum dry density is 105 pcf based on a dry density of 95 pcf and 10% residual moisture.

4.1.2 Shear Strength of Soil

Unconfined compressive strength tests were performed on 10 samples; two of which were collected between 5 and 7 feet and eight that were collected between 10 and 14.5 feet below grade. The samples collected between 5 and 7 feet demonstrated undrained shear strength between 1,250 and 2,000 psf, and samples collected between 10 and 14.5 feet demonstrated undrained shear strength between 3,000 and 10,000 psf. Based on these results, combined with correlations to the SPT blow counts and pocket penetrometer tests, a design undrained shear strength of 1,250 psf is recommended for the soil between 0 to 10 feet below grade, and a design undrained strength of 2,000 psf is recommended for the soil greater than 10 feet below grade.

4.1.3 Compressibility

One-dimensional consolidation testing was performed on relatively undisturbed samples collected between 10 and 12 feet below grade. Results of the testing demonstrated a compression index (C_c) up to 0.17, recompression index (C_r) up to 0.05, and an average over-consolidation ratio (OCR) equal to 10. These values were used in determining the estimated maximum consolidation settlement of the wind turbine foundations.

Based on correlations to the moisture content, Atterberg limits, and consistency of the fat clay in at the substation borings, a C_c of 0.25, C_r of 0.025, and OCR of 5 is recommended for design of shallow foundations bearing below the fill at the substation.

4.1.4 Dynamic Shear Modulus

The dynamic shear modulus was evaluated based on shear wave velocity measurements taken during the geophysical investigation. Wind loading of a WTG induces a cyclic tower vibration, which is then transferred through the tower base into the underlying foundation subgrade. Should the subgrade stiffness be insufficient, the magnitude of the tower vibration can become excessive, potentially reducing the efficiency of the WTG system, and in extreme cases, induce large fatigue loads resulting in tower buckling long-term. A sufficiently stiff foundation and bearing soil is necessary to adequately reduce this vibration, and the dynamic shear modulus is needed to analyze the rotational stiffness.

The dynamic shear modulus was estimated via measurements of shear wave velocity, which can be directly correlated to shear modulus. Multi-channel analysis of surface waves (MASW) tests performed at five proposed WTG locations on site measured shear wave velocities between approximately 300 to 1,000 ft/s within the upper 20 feet of the subsurface, and between 2,000 to 3,000 ft/s below 20 feet. Using a design shear wave velocity of 600 ft/s for the clay at the assumed wind turbine bearing depth, the estimated small strain shear modulus is approximately 1,400 ksf. In evaluating the response to extreme wind loads, the design shear modulus for a clayey soil should be taken as approximately 40% of the small strain shear modulus recommended above, assuming 1 x 10^{-3} shear strain level for wind loading (Det Norske Veritas Copenhagen, 2002), or the foundation designer may choose a different reduction factor appropriate for anticipated foundation strain. Refer to Section 4.4.3 for discussion on applying the dynamic soil parameters to foundation rotational stiffness.

4.1.5 Poisson's Ratio

Poisson's ratio is a unit-less material parameter defined as the ratio of transverse strain and axial strain for a material under loading. The parameter measures the phenomenon in which a material tends to expand or contract in a direction orthogonal to the direction of compression or tension. Poisson's ratio is often used to relate various elastic parameters of a given material and is a factor in calculating the rotational stiffness of a wind turbine foundation system.

Poisson's ratio was calculated using the S-wave and P-wave velocities measured during the geophysical survey (Appendix E). The S-wave and P-wave velocities can be correlated to the shear modulus and bulk modulus, respectively. These elastic parameters were then used to calculate the Poisson's ratio at various depth increments at four turbine locations. Poisson's ratio for the soil units generally ranged between 0.43 and 0.49, typical of clay. A Poisson's ratio of 0.45 is recommended for design.

4.1.6 California Bearing Ratio

The field strength of access road subgrade may be assessed using the California Bearing Ratio (CBR). Two shallow soil samples were collected between 1 ft and 4 ft bgs at proposed turbine locations (T-37, and T-41). The samples were classified as sandy fat clay and fat clay (CH) which are representative of the shallow subgrade encountered throughout the site. Test results demonstrated a CBR ranging between 0.9 and 1.5 for samples compacted to 90% of the standard Proctor maximum dry density (MDD), and between 1.4 and 1.9 for samples compacted to 95% of the MDD. A design CBR of 1.5 is recommended for road subgrade compacted to 95% of the standard Proctor MDD. Refer to Section 4.7 for recommendations on access road design.

4.1.7 Electrical Resistivity

Electrical resistivity measurements were collected at the proposed substation footprint and at eight wind turbine boring locations using the Wenner Four-Electrode Method in accordance with ASTM G57 using electrode spacings between 2 feet and 200 feet. Electrical resistivity generally varies with material type and moisture content, and ranges on site between 11 ohm-meters (Ω-m) and 241 Ω-m based on test results. Resistivity general increased with depth, with the largest readings occurring at the largest spacing. These observed values are generally in agreement with typical published values for clay and limestone (Palacky, 1987). Results of the electrical resistivity tests are presented in Appendix D. Refer to Section 2.3 for additional information on the electrical resistivity test method.

4.1.8 Thermal Resistivity

Thermal resistivity dry-out curves were developed for shallow soil samples collected at five proposed turbine locations and the substation location (T-14, T-25, T-27, T-31, T-33, and SUB-03) with all samples collected between 1 and 4 feet bgs. Bulk samples were re-compacted at the natural moisture content to 90% of the standard Proctor maximum dry density. Shelby tube samples were also collected at each location and tested at their natural density. The thermal resistivity of the soil varied with soil type, moisture content, and density, and ranged from 81°C·cm/W (T-81, natural moisture content) to 261°C·cm/W (SUB-03, dry) for the re-compacted samples, and ranged from 72°C·cm/W (SUB-03, natural moisture content) to 180°C·cm/W (T-14, dry) for the relatively undisturbed samples. Results of the thermal resistivity tests are included in Appendix C. The underground cable designer shall choose an appropriate thermal resistivity (rho) value for trench backfill with consideration to soil drying due to environmental factors as well as cable heat generation.

4.1.9 Soil Corrosivity

The chemical constituent test results indicate that the soil is neutral with a pH ranging from 7.5 to 7.8. Soluble sulfates were measured as high as 1,590 mg/kg, but were generally below 400 mg/kg. Soluble chlorides measured as high as 18 mg/kg. Chloride exposure is considered to be class C1, and sulfate exposure is considered moderate with concrete exposure class S1 (ACI, 2014). Test results are presented in Appendix C and summarized in the Lab Test Summary Table.

4.2 General Earthwork Considerations

4.2.1 Clearing and Grubbing

Prior to site grading activities, existing vegetation, trees, large roots, topsoil, uncontrolled fill, old foundations, and abandoned underground utilities should be removed from the proposed structural (foundation) areas and areas to receive fill. Areas disturbed during demolition and clearing should be properly backfilled and compacted as described in Section 4.2.6. Uncontrolled fill was encountered at the substation area to depths between 2.5 and 5 feet below grade which should be fully removed and replaced with structural fill below foundations.

Topsoil or organic material should not be used for structural fill and should be stockpiled away from native excavated soil. This material may be used as fill in non-structural areas outside of the foundation, assembly area, access road, crane pad, and crane walk areas where soil strength and compressibility would not impact site infrastructure or construction.

4.2.2 Excavations and Water Control

Overburden soil at the site can generally be excavated with conventional excavation equipment, such as backhoes, dozers, loaders, or scrapers. Bedrock is not expected to impact excavations less than 15 feet below grade. Excavations should be constructed using safe side slopes unless adequately shored and/or braced as necessary for construction and safety. Per Occupational Safety and Health Administration (OSHA) Part 1926, the soil on site may generally be inferred to be a Type B material unless the excavation is below groundwater in which the soil should be considered Type C. It is the responsibility of the competent field personnel to verify *in situ* conditions during construction. Excavations should be constructed in conformance with applicable federal, state, and local standards. Refer to Section 3.2.3 for additional discussion on the stability of excavation faces.

Groundwater was measured in piezometers installed at all but one of the wind turbine boring locations (T-30), due to an inability to check on the piezometer level because of land access. Groundwater measurements are provided in the boring logs in Appendix A, and summarized in Table 3.1 and the SPT and RQD summary in Appendix B. Some dewatering of excavations will likely be required due to the shallow groundwater levels at most turbine locations, although the clay soil profile may generally limit the total amount of groundwater infiltration into the excavations. Water and snow should be prevented from accumulating in foundation excavations at the time of foundation material placement. Sumps and portable pumps can generally be used to control water within these excavations for relatively short time periods, although more robust dewatering systems (such as well points) may be required where higher infiltration rates are encountered due to saturated sand seams. Excavations should be kept free of standing water and snow during foundation construction. The foundation subgrade should be inspected by the construction-phase geotechnical engineer, or their representative, after excavation and before placement of materials to verify water control.

4.2.3 Permanent Cut and Fill Slopes

Cut and fill slopes in native soil may be designed at an inclination of 3H:1V or flatter. Fill slopes should be constructed in horizontal lifts in accordance with the recommendations in Section 4.2.5 and 4.2.6. Although not anticipated, slopes greater than 5 feet in height should be benched into the existing slope to prevent movement between the fill and native soils. A 2 foot deep by 8 foot wide keyway should be cut down into native soil at the toe of fill slopes, extending back under the toe of the fill. As fill placement progresses up the existing slope, benches should be cut into the existing slope to bond the mass of the fill to the existing ground. Benches should generally follow the existing ground slope, with a minimum of 3 feet high and approximately 10 feet wide. Benches should be approved by the construction phase geotechnical engineer prior to placement of fill. Positive drainage is required at benched areas and at the toe of fill to remove surface water and minimize soil saturation. Appropriate erosion control measures (e.g., vegetation or erosion control matting) should be implemented immediately after cut and fill slopes are constructed to reduce the potential for significant erosion. See figure 4.1 for a detail of the benching requirements.

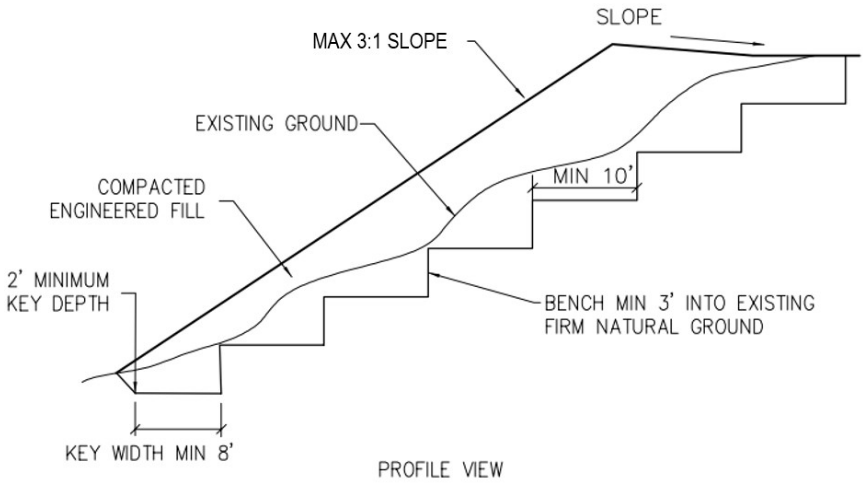

Figure 4.1 Benching detail for fill slopes greater than 5 ft

Steeper cut and fill slopes may be acceptable if adequate erosion control and/or reinforcement are utilized. Additional testing and/or analyses should be performed for steeper slopes, and the geotechnical engineer should be consulted if steeper slopes are desired. Vehicles, cranes, material storage, and foundations should be located a safe distance (as determined by the construction phase geotechnical engineer) from the top of steep slopes to avoid slope instability. Detailed global slope stability analyses are beyond the scope of this investigation, but should be performed as needed once design grades and site specific surcharge loading (e.g., cranes, component storage, etc.) information becomes available.

4.2.4 Subgrade Preparation

After clearing and grubbing, exposed areas to receive fill, including the subgrade below shallow foundation over-excavations (i.e. substation and laydown yard) and road aggregate, should be scarified to a minimum depth of 8 inches, moisture conditioned to within 0% to +4% percent of optimum moisture, and re-compacted to 95% of the standard Proctor maximum dry density (ASTM D698). Subgrade should also be inspected by the construction-phase geotechnical engineer, or their representative, to ensure adequate bearing capacity and water control.

Disturbance to subgrades prepared for foundations, access roads, and other areas to be filled should be minimized. Repeated traffic loading and excessive moisture due to surface water runoff, seepage, or precipitation may degrade subgrade soil. Where unsuitable subgrade is encountered, such as areas with soft soil, the unsuitable subgrade should be over-excavated as recommended by the construction-phase geotechnical engineer and replaced with structural fill in accordance with Section 4.2.6. Refer to Section 4.5.1 for wind turbine foundation subgrade preparation recommendations and Section 4.6.1 for substation foundation subgrade preparation.

4.2.5 Fill Placement and Compaction

The native soil encountered throughout the site may be used as general fill for road embankments and wind turbine assembly areas, and may be suitable for backfilling around and above foundations, provided that organics, frozen soil, foreign material, and rock fragments larger than 6 inches in diameter are removed and all compaction requirements are met. Backfill material within 1 foot of all foundations should have no particle sizes greater than 1 inch. Cobbles and boulders, if encountered, should be removed from general fill. The moisture content of the fill should be adjusted, as necessary, to achieve compaction. See Table 4.1 below for additional recommendations.

Table 4.1 Fill and Backfill Material Recommendations.

Material	Uses	Loose Lift Thickness	Required Compaction(2)	Moisture Content(2)
Imported select structural fill(1)	Fill below turbine foundations, , or crane pad over-excavations	≤ 12" with heavy compaction equipment	≥ 98%	±3% of optimum moisture
General Fill - Non-organic native clay	Foundation backfill, embankments, access road subgrade, and general site grading	≤ 9" with heavy compaction equipment	≥ 95%	0% to +4% of optimum moisture
		≤ 6" with hand compaction equipment		
Native topsoil and organic soil	Landscaping non-structural areas	N/A	N/A	N/A

[1] *See Section 4.2.6 for detailed select structural fill recommendations*

[2] *Relative to the standard Proctor maximum dry density and optimum moisture content (ASTM D698)*

4.2.6 Excavation Below Subgrade Procedures

Disturbance to subgrades prepared for foundations, access roads, crane walks, crane pads, and areas to be filled should be minimized. Fine-grained clayey soils are particularly sensitive to disturbance from repeated traffic loading and excessive moisture due to surface water runoff, seepage, or precipitation, which are likely to degrade subgrade soil. Care should be taken to limit disturbance to subgrade soils across the site and prevent ponding water by promoting positive drainage. Where unsuitable turbine foundation subgrade is encountered, as discussed in Sections 4.5.1 and 4.5.3, excavation of subgrade and replacement with suitable structural fill or alternative subgrade improvement techniques may be required.

If soft/loose, disturbed, or otherwise unsuitable turbine foundation bearing soil is encountered, as determined by quality control testing described in Section 4.5.1, the subgrade should be scarified, moisture conditioned, and re-compacted to 98% of the standard Proctor maximum dry density and within 3% of optimum moisture content. Over-excavations below foundations should extend laterally beyond all edges of the footing. The lateral extent should be at least 12 inches per foot (1H:1V) of over-excavation depth below foundation base elevation. All over-excavations should be sloped or shored as required by OSHA regulations to provide stability and safe working conditions. All over-excavations should be free of water and snow prior to backfilling.

Excavations below WTG foundation and crane pad subgrade should be backfilled with select structural fill, as described in Section 4.5.1. Select structural fill should consist of well-graded aggregate with less than 10 percent fines, such as Ohio DOT Specification 703.11 for structural backfill. Imported select structural fill should be sampled, tested, and approved by the construction phase geotechnical engineer prior to use on site.

4.3 General Foundation Considerations

4.3.1 Lateral Resistance

A friction factor of 0.40 may be used for the ultimate frictional resistance to lateral sliding along the base of concrete footings founded on properly compacted subgrade. We recommend a factor of safety of 1.5 or greater to determine the allowable frictional resistance to lateral sliding.

4.3.2 Seismic Considerations

At the time of this report the State of Ohio has adopted the 2015 International Building Code with amendments (International Code Council, 2015). The maximum considered earthquake spectral response accelerations are presented in Table 4.2 below (ATC, 2019).

Table 4.2 Seismic Design Parameters

Parameter	Design Value
Reference	2015 IBC
Site Class	C
Coordinates (Lat., Long.)	40.99138, - 84.510207
Mapped Spectral Acceleration for Short (0.2 sec) Periods – S_s	0.144 g
Mapped Spectral Acceleration for 1-second Periods – S_1	0.063 g
Acceleration-Based Site Coefficient – F_a	1.2
Velocity-Based Site Coefficient – F_v	1.7
Max. Considered Spectral Response Acceleration – S_{MS}	0.173 g
Max. Considered Spectral Response Acceleration – S_{M1}	0.107 g
Design Spectral Response Acceleration (Short Periods) – S_{DS}	0.115 g
Design Spectral Response Acceleration (1-second Period) – S_{D1}	0.071 g
Peak Ground Acceleration, PGA	0.074 g

4.3.3 Frost Depth

Frost action can result in differential heaving and a reduction in soil strength during periods of thaw. The degree of frost action is based on frost depth, availability of water, and frost-susceptibility of shallow soil. The most severe effects of frost heave occur when ice lenses form in the voids of soil containing fine particles (i.e., silt and clay). Shallow foundations (or the structures they support) can be damaged if the foundations bear above soils that experience frost heave. The bearing capacity of soil is also reduced during periods of thaw, which can reduce the lateral capacity of pile foundations and cause bearing capacity and/or settlement issues for shallow foundations bearing above the frost depth.

The recommended design frost depth for the area is 3 ft (Bowles, 1996). Critical foundations and pipes should be placed a minimum of 3 ft below final grade or on non-frost susceptible soil extending to a depth of 3 ft for protection against frost, unless they are designed to accommodate the effects of frost.

4.4 Wind Turbine Foundation Design Parameters

Westwood understands that up to four different wind turbine models are being considered for the project. No preliminary foundation designs or turbine loading documents were provided prior to preparation of this report, and therefore for the basis of this analysis it was assumed turbines will be supported on 75 foot diameter octagonal or circular spread footings bearing 13 feet below grade. The recommendations provided in this report should be re-evaluated after preliminary foundation designs and loading documents are available, including alternate buoyant foundation designs for turbines bearing below the expected groundwater depth. Refer to Section 3.4 for specific turbine locations with shallow groundwater. Soil parameters recommended for use in turbine spread foundation design are discussed in Section 4.1.

4.4.1 Bearing Capacity

Design of wind turbine spread footing foundations supported on suitable subgrade may be designed for a maximum allowable gross bearing capacity of 3,500 psf for normal loading conditions and 5,000 psf for extreme loading conditions at all turbine locations. This bearing capacity likely exceeds the actual bearing pressures that may develop from a spread footing foundation design used for this site. The recommended allowable bearing pressure is based on a factor of safety of 3.0 for normal wind loading conditions and 2.25 for extreme loading conditions. An effective bearing area of 45 feet by 60 feet was assumed. Normal loading bearing capacity is controlled by the assumed maximum allowable settlement tolerance (Section 4.4.2) and extreme loading is controlled by bearing capacity failure.

4.4.2 Differential Settlement

Differential settlement or rotation of the foundation was evaluated under normal operating loads. Normal operating loads result in an eccentrically loaded foundation with a higher bearing pressure than the dead load condition. Under normal operating loads the leeward side of the foundation carries the majority of the load compared to the windward side of the foundation, causing differential settlement or rotation of the foundation.

Results of the consolidation settlement analyses indicate that the assumed turbine foundation, consisting of a 75-foot diameter spread footing embedded 13 feet bgs with a gross bearing pressure of 3,500 psf will experience a total settlement of approximately 1.6 inches and a differential rotation of 0.17 degrees across the foundation width, which is within the assumed maximum allowable differential foundation tilt of 0.17 degrees.

4.4.3 Rotational Stiffness

Based on the calculated dynamic shear modulus, as described in Section 4.1.4, the anticipated rotational stiffness of the foundation is expected to be 525 GN-m/rad, which is presumed greater than the minimum requirement established by the turbine manufacturer. Therefore, with the assumed turbine foundation geometry and manufacturers requirement, the foundation should provide adequate rotational stiffness with no special considerations or enhancements. Rotational stiffness should be re-evaluated by the foundation designer once foundation dimensions, strain levels, and rotational stiffness requirements are known.

4.4.4 Buoyancy

The depth to groundwater was evaluated with short-term observations in boreholes during drilling and in piezometers several weeks after installation, as discussed in section 3.4. Results of groundwater measurements performed at each wind turbine boring location are provided in Table 3.1. The minimum depth to groundwater measured was approximately 6 feet, with most locations ranging between 8 and 12 feet. Additional groundwater depth measurements should be taken prior to final foundation design to confirm design depth tot groundwater and evaluate the potential for zoning parts of the site for different design groundwater depths. It should be noted that turbine T-30 was inaccessible during the piezometer moniroting trip and therefore does not have groundwater measurements after drilling. Although the depth to groundwater was not measured at this location during the follow-up monitoring trip, the depth to groundwater at the other locations suggests groundwater is likely shallow throughout the site.

Foundations bearing below groundwater should be designed to resist overturning while accounting for buoyant forces. The foundation designer may consider providing at least two different foundation designs based on varying depths to groundwater. Refer to Sections 3.4 and 4.2.2 for additional discussion regarding groundwater, and Table 3.1 for groundwater depths for turbine foundation design. Additional groundwater measurements are recommended to confirm seasonal groundwater fluctuation at each turbine location prior to final foundation design.

4.5 Wind Turbine Foundation Considerations

4.5.1 Subgrade Preparation and Testing

Wind turbine foundations should bear on the native stiff to hard lean clay, or native bedrock (although not anticipated), as discussed in Section 4.2.6. Based on the conditions encountered during this investigation, the soil beneath the anticipated turbine foundation bearing depths typically exhibits sufficient properties to support spread foundations.

Foundation subgrade should consist of a uniform bearing material, such that the foundation does not bear on part soil and part rock. Care should be taken during foundation excavations to minimize disturbance of the subgrade. If encountered, soft/loose soil, frozen soil, and rock fragments larger than 6 inches should be removed. Field inspection and quality control of the subgrade may identify the need for additional subgrade modification. The foundation subgrade should be inspected by a qualified geotechnical engineer, or their representative, after excavation and before placement of materials to confirm conditions. Static cone penetrometer (SCP) testing is recommended to confirm subgrade soil strength and identify areas of softer clay. SCP testing should be performed at a minimum of five (5) locations on the foundation bearing surface, one in each quadrant and one in the middle. Testing should extend a minimum of 3 feet below the surface. Foundation subgrade consisting of clay should exceed a minimum undrained shear strength of 2,000 psf. If foundation subgrade consists predominantly of sand, Westwood should be contacted for further evaluation. Field inspection and quality control of the subgrade may identify the need for additional subgrade modification. Westwood should be notified in the event that unsuitable subgrade conditions are encountered.

The foundation subgrade should be protected against freezing and snow/water accumulation after inspection and prior to foundation placement. To facilitate turbine foundation construction and to protect the subgrade, a minimum 2- to 3 inch–thick layer of lean concrete (mud mat) over the subgrade is recommended. During winter construction, heating of the subgrade may be necessary to protect the subgrade from freezing.

Dolomite bedrock was encountered at a depth less than 30 ft bgs at all of the proposed WTG foundations. The depth to bedrock ranged from approximately 16 ft to 30 ft bgs. Bedrock was not encountered within anticipated foundation bearing depths (less than 13 ft bgs) at any of the WTG borings. The SPT and RQD Summary attached in Appendix B summarizes depth to bedrock at each boring location. Excavations into bedrock are not anticipated for the wind turbines, but rock rippability is discussed in the seismic study report in Appendix E.

4.5.2 Ground Improvement

Although poor subgrade was not encountered below the anticipated foundation bearing depth at any of the turbine borings, the possibility still exists for undetected soft to medium stiff clay within the turbine footprint at these locations. The foundation subgrade should be tested at all turbine locations prior to construction of the foundation per the recommendations outlined in Section 4.5.1 to confirm soil conditions. After subgrade testing at these locations, any unsuitable subgrade encountered should be remediated prior to construction of the foundations. Pending the depth of poor subgrade soil, the foundation may also bear deeper, below the weak material. Although not anticipated, over-excavation and replacement can become prohibitively expensive at improvement depths greater than 4 to 6 feet, and deep soil improvement techniques may be required.

4.5.3 Previously Excavated Foundations

Prior to the start of this field investigation, Westwood understands that there was excavation at two proposed WTG sites to approximate depths ranging from 5 ft to 10 ft at T-26 and T-43. Westwood also understands that these excavations have remained open for several months, leaving the exposed subgrade susceptible to degradation from ponding water, freeze/thaw cycles, growth of vegetation, and erosion/scour. At the time of the investigation, both excavations were observed containing standing water and were inaccessible. These two locations were explored with geotechnical soil borings conducted outside of the excavation areas, approximately 60 feet from the turbine center point. Supplemental testing should be performed at T-26 and T-43, as well as any other locations where the proposed turbine is not within at most 50 feet of the original SPT soil boring or CPT sounding performed by Westwood. Supplemental testing at these locations shall include soil boring, CPT soundings, and/or static cone penetration (SCP) tests performed within the proposed foundation footprint during the pre-construction design phase.

4.6 Substation and O&M Foundations

4.6.1 Shallow Foundations

Results of the investigation suggest that shallow spread/strip footings and mat foundations may be feasible at the proposed substation and O&M building; however, a minimum of 3 feet of native soil should be over-excavated and replaced with non-frost susceptible structural fill up to the foundation footing, as discussed in section 4.2.4 and 4.2.5. Any uncontrolled fill encountered at the substation below the 3-foot excavation should also be removed and replaced with imported structural fill. Assuming these recommendations are followed, design of conventional spread footing foundations (i.e. 10 feet by 20 feet) may use an allowable bearing capacity of 1,700 psf. Strip footing foundations (i.e. 4 feet by 20 feet) may use an allowable bearing capacity of 2,500 psf. All shallow foundations should be embedded at least 1 foot below grade and on subgrade prepared as described above

A total estimated settlement of less than 1 inch is anticipated for shallow foundations bearing on properly prepared subgrade. Differential settlement can generally be assumed to be ½ to ¾ of the total settlement. Proper drainage should be provided around foundations to minimize the potential for soil collapse and associated foundation movement. Shallow foundations should be reinforced as necessary to reduce the potential for damage caused by differential movement.

A vertical modulus of subgrade reaction of 75 pounds per cubic inch (pci) may be used for mat foundations bearing on a compacted structural fill. This vertical modulus of subgrade reaction represents a 1 foot square foundation and should be modified as needed for larger foundation sizes.

4.6.2 Drilled Pier/Shafts

Various substation structures/equipment may also be supported on concrete piers/shafts. Piers should have a minimum diameter of 18 inches and should extend at least 6 feet bgs for adequate frost protection.

4.6.2.1 Axial Capacity

Deep foundations will develop their capacity through a combination of skin friction and end bearing when in compression and skin friction alone when in uplift. Table 4.3 provides recommended skin friction and end bearing values for the design of drilled pier foundations based on the conditions encountered in the substation borings. Skin friction and end bearing values provided are ultimate and do not include a safety factor. A minimum safety factor of 2 is recommended for skin friction and 3 for end bearing.

Table 4.3 Axial Capacity Design Parameters for Substation

Depth (ft)	Effective Unit Weight (pcf)	Ultimate Skin Friction (psf)	Ultimate End Bearing (psf)
0 – 4	Ignore due to variable fill/seasonal moisture changes		
4 – 7	125	600	10,000
7 – 20	63	800	20,000
20 – 40	103	-	150,000

4.6.2.2 Lateral Capacity

The lateral response of the piers and drilled shafts may be modeled using the software program LPile by Ensoft, Inc or MFAD by FAD Tools. The recommended LPile input parameters for design of drilled piers at the proposed substation are provided in Table 4.4 below, and parameters for use in MFAD are provided in Table 4.5.

Table 4.2 Lateral Capacity Design Parameters for Substations (LPile)

Depth (ft)	LPile Soil Model	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Lateral Modulus, k (pci)	Uniaxial Comp. Strength (psi)
0 – 2	Ignore due to seasonal moisture changes				
2 – 7	Stiff Clay (w/o free water)	125	1,250	Default	-
7 – 20	Stiff Clay (w/o free water)	63	2,500	Default	-
20 – 35	Strong Rock (Vuggy Limestone)	103	-	Default	2,500

Table 4.3 Lateral Capacity Design Parameters for Substations (MFAD)

Depth (ft)	Soil Model	Total Unit Weight (pcf)*	Undrained Shear Strength of Rock Cohesion (ksf)	Friction Angle (deg)	Modulus of Deformation (ksi)	Rock/Concrete Bond Strength (ksf)
0 – 2	Ignore due to seasonal moisture changes					
2 – 7	Soil - Clay	125	1.25	-	0.8	-
7 – 20	Soil - Clay	125	2.5	-	1.5	-
20 – 40	Rock	165	3.5	38	1,000	30

*Depth to groundwater should be modeled as 7 feet.

4.7 Access Roads/Laydown Yard

Access roads to accommodate construction equipment and deliveries will be required during construction. The access roads will also facilitate long-term operation and maintenance of the facility. These roads will be subjected to heavy loads, but only for limited duration and frequency. The suitability of the shallow site soil for use as access roads will depend primarily on the strength and moisture condition of the soil at the time the traffic occurs. The shallow soil on site below the root zone is generally considered poor to moderate subgrade for gravel access roads. In general 12 to 15 inches of aggregate may be suitable to support construction traffic depending on subgrade moisture, strength, compaction effort, and soil type. Less aggregate, such as 6 to 10 inches, may be used if the subgrade is chemically or mechanically stabilized (e.g., with cement or a mid-strength geotextile reinforcement). Refer to Section 4.1.6 for recommended CBR value for access road and laydown yard design. Access road design criteria, such as traffic loads, were not known at the time of this report. The geotechnical/civil engineer should be contacted for road section design.

Low strength material and precipitation are the limiting conditions for access roads. Strengthening the subgrade with crushed rock, geosynthetics, or other suitable material, and/or mixing the base material with additives such as cement or quick lime will minimize damage to the subgrade.

Establishing adequate side ditches and other surface water control features will help to reduce damage caused by surface water and saturated road subgrade conditions.

It is expected that aggregate-surfaced access roads and laydown yards will require ongoing maintenance to keep them in a serviceable condition, regardless of the aggregate thickness and subgrade preparation. It is not practical to design an aggregate section of adequate thickness that prevents ongoing maintenance. Ruts, depressions, and soft subgrade should be repaired as needed to facilitate traffic. Additional aggregate may be placed in ruts and depressions, or the entire aggregate section and soft subgrade may be removed and replaced with a new aggregate section.

For access roads and laydown yards, surface vegetation root zones, highly organic surface soil, and other soft or otherwise unsuitable material should be stripped and the surface graded to provide positive drainage. In order to identify potentially unsuitable soil, the subgrade should be compacted and subsequently proof-rolled with a fully loaded tandem axle or tri-axle truck with a minimum gross weight of 25 tons and minimum axle loading of 10 tons. Subgrade preparation should be monitored by a representative of the construction-phase geotechnical engineer at the time of construction. At locations where pumping or unacceptable rutting of the subgrade occurs (greater than 1.5 inches), the soft soil should be scarified, moisture conditioned, and re-compacted, or removed and replaced with properly compacted fill in accordance with Section 4.2.4.

4.8 Crane Walks

The crane walks are expected to typically follow the existing access roads on site and shortest route between turbine locations. Trafficability of the shallow site soil will depend, primarily, on the moisture content of the soil at the time of crane walks. The subgrade soil should be graded to direct surface water off of, and away from, the crane walk surfaces, compacted to provide adequate ground bearing capacity, and smooth drum-rolled to seal the surface. Ditches may be required in select locations to maintain existing drainage patterns. Traffic, other than cranes, should be avoided over the prepared crane walk surface. In order to identify potentially unsuitable soil and assist in compaction, the crane walk subgrade should be prepared and proof-rolled with a large front-end loader carrying three to four crane mats on the forks just prior to crane usage to verify conditions. Additional testing, such as using a Static Cone Penetrometer (SCP), should also be considered to confirm adequate bearing capacity. If the soil becomes wet following rainfall, the surficial soil should be allowed to dry and re-tested before equipment traffic can be supported. Crane mats or other approved measures may be required for crane travel over soft soil, shallow drain tiles, buried pipeline crossings, or intermittent waterways.

4.9 Crane Pads

In general, crane pads will be located at turbine locations along permanent access roads. Following removal of all vegetation and organic topsoil, crane pads may consist of native subgrade and/or compacted structural fill. After stripping and cutting to the design subgrade elevation, and prior to placement of new fill, the exposed subgrade of the crane pad should be compacted and proof-rolled to identify soft/loose areas. Proof-rolling should be performed with a large front-end loader carrying three to four crane mats on the forks. Proof-rolls are considered failing if rutting greater than 1 inch or “pumping” of the soil is observed. Care should be taken to proof-roll the entire length and width of crane pad subgrade and final surface. If conditions change between the proof-roll and time of crane loading, such as saturated soil due to rainfall, the crane pads should be proof-rolled again.

The strength of the native soil beneath the crane pad should also be tested with a Static Cone Penetrometer (SCP) due to the shallow clayey soil present across the site. Tests should be performed at a variety of locations within the crane pad footprint. The SCP cone index should be recorded at 6 inch increments to a depth of at least 3 ft below the subgrade surface. If structural fill is used on the crane pad, the subgrade surface is below the engineered fill. The SCP tests are considered passing if correlations indicate that the undrained shear strength (Su) and corresponding bearing capacity averaged over the 3 foot depth of testing is sufficient to support the crane pad loads.

Crane loads were not available at the time of this report, and a detail crane pad design should be performed during final design to determine specific SCP test criteria. If the test criteria are not met, subgrade improvements will be required to achieve adequate bearing capacity. It is expected that the shallow (<5 ft depth) in situ soil at some turbine locations may not meet the minimum allowable bearing capacity based on the conditions observed during the investigation. Remediation methods include, but are not limited to, scarification, moisture conditioning, and re-compaction of the weak soil, lime/cement stabilization, and over-excavation of the weak subgrade and replacement with structural fill. The exact depth and type of subgrade improvement will depend on site-specific conditions observed at the time of crane pad construction.

Structural fill placed over the subgrade should be compacted to a minimum 95 percent of the maximum dry density as determined by the Standard Proctor (ASTM D698). Crane pads and crane walks should be evaluated by the design engineer once site-specific crane load data become available. Crane pads and crane walks should be designed by a geotechnical engineer licensed in the State of Ohio.

4.10 Construction Considerations

To a large degree, satisfactory foundation and earthwork performance depends on construction quality control; therefore, subgrade preparation, subgrade compaction, proof-rolling, cut slopes, and placement and compaction of fill and backfill material should be observed and tested by qualified personnel. In addition, qualified staff who are experienced with the foundation design requirements should monitor and document foundation preparation and construction activities. A qualified geotechnical engineer should also inspect cut faces in rock to evaluate overall stability.

5.0 Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for the exclusive use by Starwood Energy Group, for the Grover Hill Wind Project. The primary focus of this report was recommendations for site grading activities, wind turbine foundation design, substation foundations, MET tower foundations, O&M building foundations, and access roads.

The borings are representative of the subsurface conditions at the sampled locations and intervals, and therefore do not necessarily reflect strata variations that may exist between sampled locations and intervals. If variations from the subsurface conditions described in this study are noted during construction, recommendations in this report must be re-evaluated. Any user of this report should verify all boring locations against the final location of the respective infrastructure to determine if infrastructure has moved prior to using the recommendations provided by Westwood. In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing by Westwood. Westwood is not responsible for any claims, damages, or liability associated with the interpretation of subsurface data by others.

After plans for the facility are developed in sufficient detail and project-specific wind turbine foundation load documents and preliminary foundation designs are available, Westwood should be consulted regarding additional subsurface information required to arrive at final recommendations for design and construction. The current recommendations are based on previous projects that are similar in size, however the loads experienced by the subsurface and foundations will likely be different due to specific turbine parameters.

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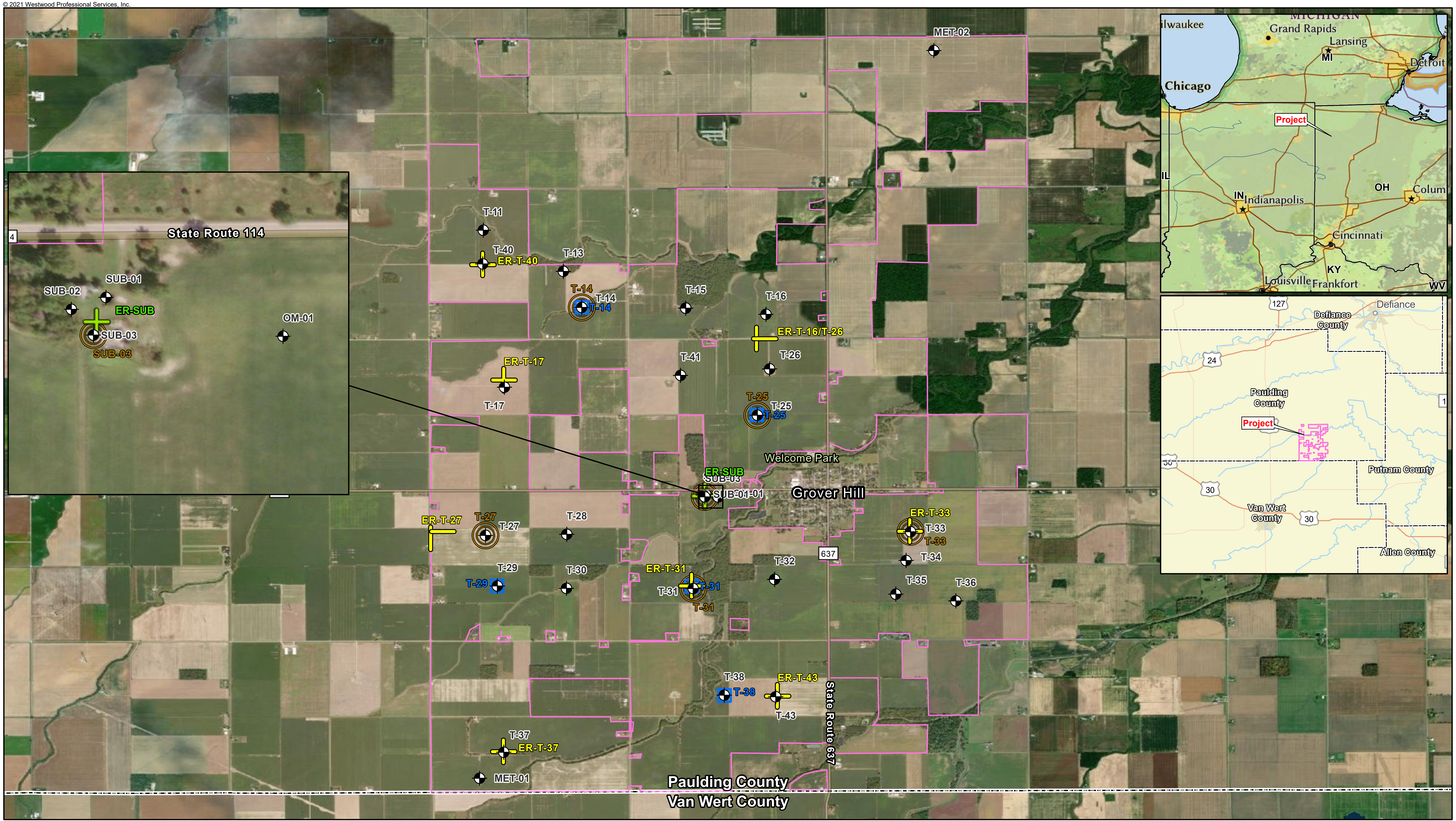
Exhibits



Data Source(s): Westwood (2021); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau (2020).

Legend

- ▭ Project Boundary
- ⊕ Boring Location
- ✚ 100ft ER Test Location
- ✚ 200ft ER Test Location
- ━ 100ft ER Test Location (E/W)
- ┃ 100ft ER Test Location (N/S)
- ◎ Thermal Resistivity Test Location
- ☐ Seismic Test
- ─ Named Census Road
- ┅ County Boundary

N

0 3,200 Feet

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Paulding County, Ohio

Project Overview Map

EXHIBIT 1

October 29, 2021

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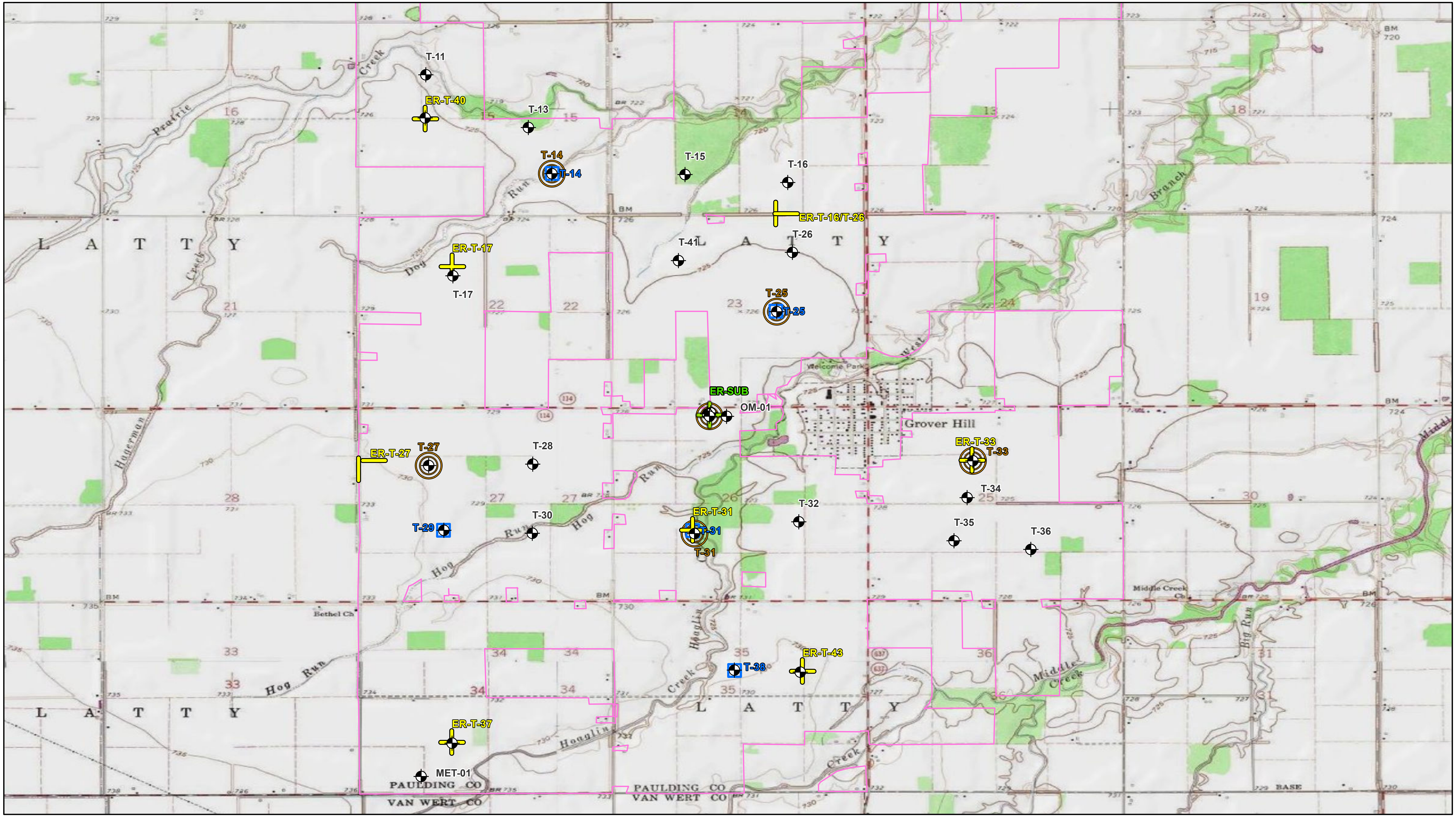

Data Source(s): Westwood (2021); ESRI WMS USA Topo Basemap (Accessed 2021); Census Bureau (2019).

Legend

- Project Boundary
- Boring Location
- 100ft ER Test Location
- 200ft ER Test Location
- 100ft ER Test Location (E/W)
- 100ft ER Test Location (N/S)
- Thermal Resistivity Test Location
- Seismic Test

N

0 3,200 Feet

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USGS Topography Map

EXHIBIT 2

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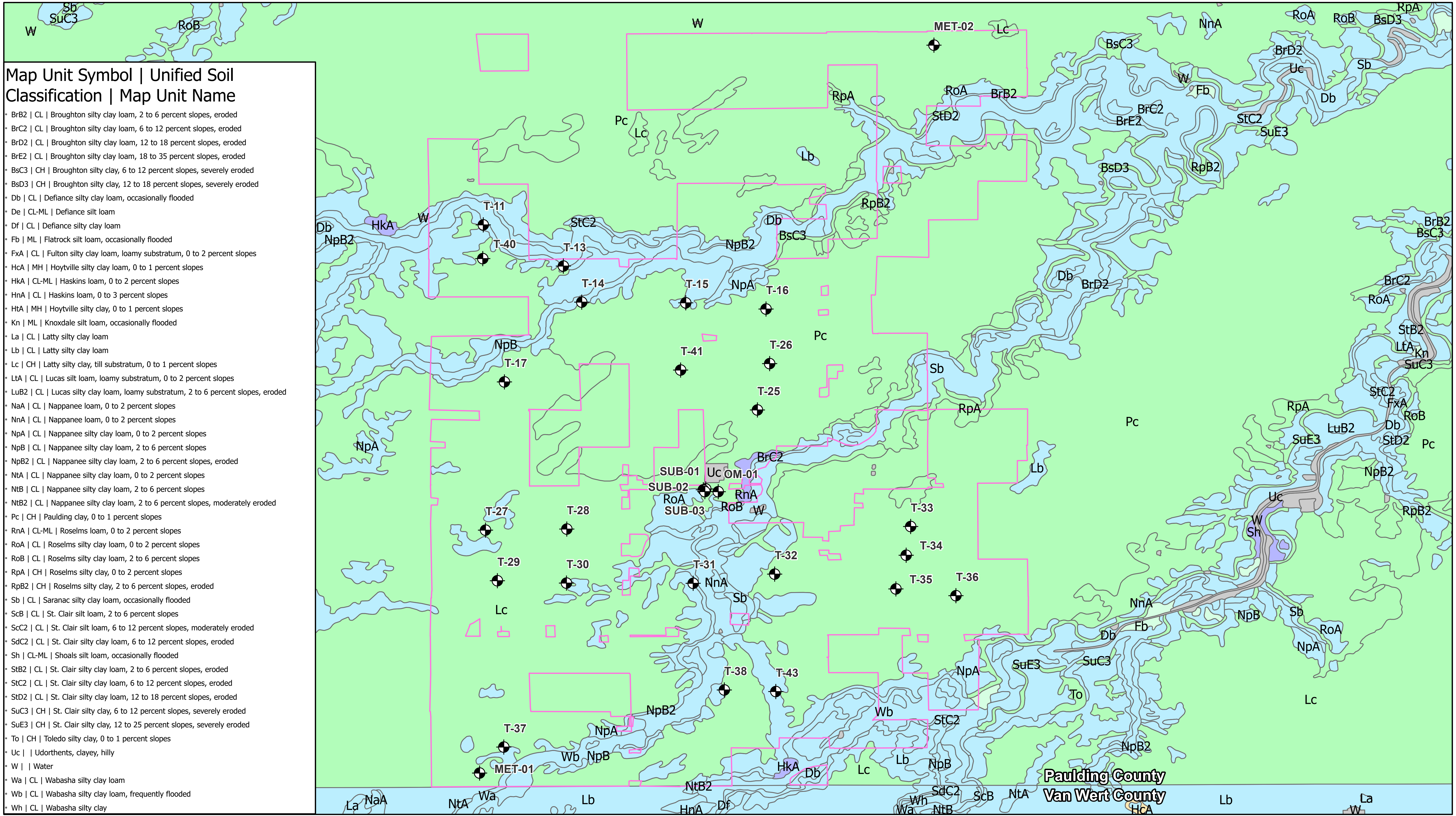

Map Unit Symbol | Unified Soil Classification | Map Unit Name

- BrB2 | CL | Broughton silty clay loam, 2 to 6 percent slopes, eroded
- BrC2 | CL | Broughton silty clay loam, 6 to 12 percent slopes, eroded
- BrD2 | CL | Broughton silty clay loam, 12 to 18 percent slopes, eroded
- BrE2 | CL | Broughton silty clay loam, 18 to 35 percent slopes, eroded
- BsC3 | CH | Broughton silty clay, 6 to 12 percent slopes, severely eroded
- BsD3 | CH | Broughton silty clay, 12 to 18 percent slopes, severely eroded
- Db | CL | Defiance silty clay loam, occasionally flooded
- De | CL-ML | Defiance silt loam
- Df | CL | Defiance silty clay loam
- Fb | ML | Flatrock silt loam, occasionally flooded
- FxA | CL | Fulton silty clay loam, loamy substratum, 0 to 2 percent slopes
- HcA | MH | Hoytville silty clay loam, 0 to 1 percent slopes
- HkA | CL-ML | Haskins loam, 0 to 2 percent slopes
- HnA | CL | Haskins loam, 0 to 3 percent slopes
- HtA | MH | Hoytville silty clay, 0 to 1 percent slopes
- Kn | ML | Knoxdale silt loam, occasionally flooded
- La | CL | Latty silty clay loam
- Lb | CL | Latty silty clay loam
- Lc | CH | Latty silty clay, till substratum, 0 to 1 percent slopes
- LtA | CL | Lucas silt loam, loamy substratum, 0 to 2 percent slopes
- LuB2 | CL | Lucas silty clay loam, loamy substratum, 2 to 6 percent slopes, eroded
- NaA | CL | Nappanee loam, 0 to 2 percent slopes
- NnA | CL | Nappanee loam, 0 to 2 percent slopes
- NpA | CL | Nappanee silty clay loam, 0 to 2 percent slopes
- NpB | CL | Nappanee silty clay loam, 2 to 6 percent slopes
- NpB2 | CL | Nappanee silty clay loam, 2 to 6 percent slopes, eroded
- NtA | CL | Nappanee silty clay loam, 0 to 2 percent slopes
- NtB | CL | Nappanee silty clay loam, 2 to 6 percent slopes
- NtB2 | CL | Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded
- Pc | CH | Paulding clay, 0 to 1 percent slopes
- RnA | CL-ML | Roselms loam, 0 to 2 percent slopes
- RoA | CL | Roselms silty clay loam, 0 to 2 percent slopes
- RoB | CL | Roselms silty clay loam, 2 to 6 percent slopes
- RpA | CH | Roselms silty clay, 0 to 2 percent slopes
- RpB2 | CH | Roselms silty clay, 2 to 6 percent slopes, eroded
- Sb | CL | Saranac silty clay loam, occasionally flooded
- ScB | CL | St. Clair silt loam, 2 to 6 percent slopes
- ScC2 | CL | St. Clair silt loam, 6 to 12 percent slopes, moderately eroded
- SdC2 | CL | St. Clair silty clay loam, 6 to 12 percent slopes, eroded
- Sh | CL-ML | Shoals silt loam, occasionally flooded
- StB2 | CL | St. Clair silty clay loam, 2 to 6 percent slopes, eroded
- StC2 | CL | St. Clair silty clay loam, 6 to 12 percent slopes, eroded
- StD2 | CL | St. Clair silty clay loam, 12 to 18 percent slopes, eroded
- SuC3 | CH | St. Clair silty clay, 6 to 12 percent slopes, severely eroded
- SuE3 | CH | St. Clair silty clay, 12 to 25 percent slopes, severely eroded
- To | CH | Toledo silty clay, 0 to 1 percent slopes
- Uc | | Udorthents, clayey, hilly
- W | | Water
- Wa | CL | Wabasha silty clay loam
- Wb | CL | Wabasha silty clay loam, frequently flooded
- Wh | CL | Wabasha silty clay

Data Source(s): Westwood (2021); Census Bureau (2019); U.S. Department of Agriculture, Natural Resources Conservation Service (2021).

Legend

- ▭ Project Boundary
- ⊕ Boring Location

Unified Soil Classification

- ▨ No Classification Available
- 🟩 CH
- ▨ CL
- ▨ CL-ML
- ▨ MH
- ▨ ML

N

0 2,500 Feet

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Surficial Soils Map

EXHIBIT 3

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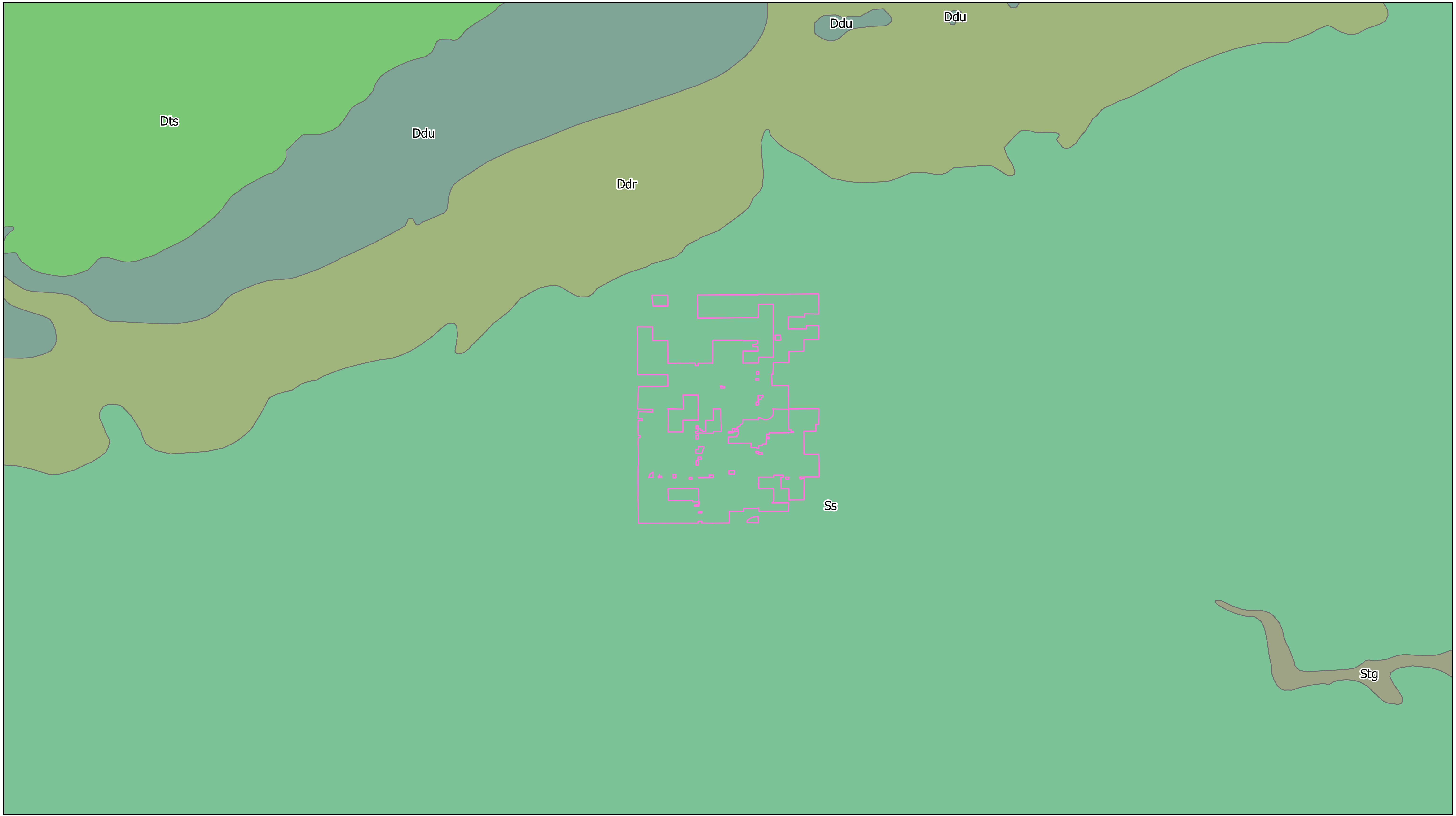

Data Source(s): Westwood (2021); Iowa NAIP Imagery (2019); Census Bureau (2020); USGS (2018).

Legend

☐ Project Boundary

Geologic Unit Symbol | Geologic Unit Name | Geologic Unit Age

🟧 Ddr | Detroit River Group | Phanerozoic - Paleozoic - Devonian
🟪 Ddu | Dundee Limestone | Phanerozoic - Paleozoic - Devonian
🟩 Dts | Traverse Group | Phanerozoic - Paleozoic - Devonian
🟦 Ss | Salina Group | Phanerozoic - Paleozoic - Silurian
🟥 Stg | Tymochtee and Greenfield Formations, Undivided | Phanerozoic - Paleozoic - Silurian - Wenlock

N

0 2 Miles

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Local Geology Map
EXHIBIT 4

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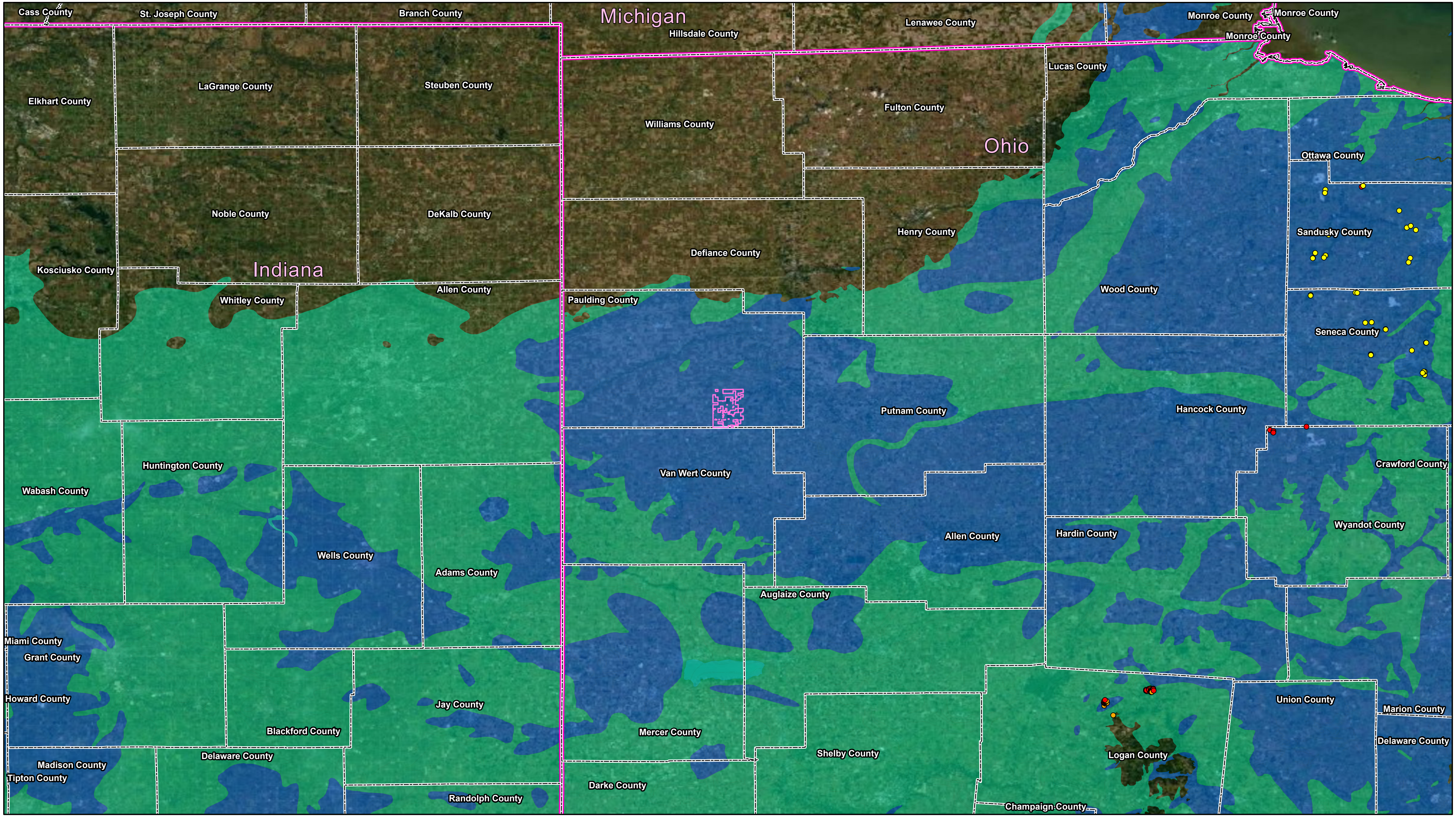

Data Source(s): Westwood (2021); ESRI WMS National Geographic & World Streets Basemaps (Accessed 2021); Census Bureau (2020).

Legend

- ● Karst - Field Verified
- ● Karst - Suspect-FieldVisited
- ● Karst - Suspect-NotVisited
- 🟦 Spring
- ▭ Project Boundary
- ▬ State Boundary
- 🟦 Carbonate rocks at or near the land surface in a humid climate
- 🟩 Carbonate rocks buried under >50 ft of glacially derived insoluble sediments in a humid climate
- 🟦 Carbonate rocks buried under ≤50 ft of glacially derived insoluble sediments in a humid climate

N

Miles
0 12

Grover Hill Wind

Paulding County, Ohio

Karst Map
EXHIBIT 5

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Appendix A

Soil Boring Logs

General Notes – Boring Log
Unified Soil Classification System (USCS)

Sample Description Format

Group Name (Group Symbol), Percent and Range of Particle Sizes, Plasticity, Color, Density/Consistency, Moisture, Additional Comments, Geologic Origin (Stratigraphic Unit)

Grain Size Terminology

Soil Fraction		Particle Size	U.S. Standard Sieve Size
Boulders		Larger than 12”	Larger than 12”
Cobbles		3” to 12”	3” to 12”
Gravel:	Coarse	¾” to 3”	3/4” to 3”
	Fine	4.75mm to ¾”	no. 4 to ¾”
Sand:	Coarse	2.00 mm to 4.75 mm	no. 10 to no. 4
	Medium	0.42 mm to 2.00 mm	no. 40 to no. 10
	Fine	0.075 mm to 0.42 mm	no. 200 to no 40.
Silt		0.005 mm to 0.075 mm	Smaller than no. 200
Clay		Smaller than 0.005 mm	Smaller than no. 200

Plasticity characteristics differentiate between silt and clay

Percentages of Gravel Relative Proportions of Cohesionless Soils

Sand and Fines (Optional)

Proportional Term	Defining Range By Percentage of Weight
Trace	0% - 5%
Few	5% - 10%
Little	15% - 25%
Some	30% - 45%
Mostly	50% - 100%

Relative Density and Consistency

Noncohesive		**Cohesive**		
Relative Density	N-Value	N-Value	Consistency	Pp-tons/sq.ft
		< 2	Very Soft	0.0 to 0.25
Very Loose	0-4	2-4	Soft	0.25 to 0.50
Loose	4-10	4-8	Medium Stiff	0.50 to 1.0
Medium Dense	10-30	8-15	Stiff	1.0 to 2.0
Dense	30-50	15-30	Very Stiff	2.0 to 4.0
Very Dense	Over 50	Over 30	Hard	Over 4.0

The penetration resistance, N, is the summation of the number of blows required to advance two successive 6” penetrations of the 2” split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30” and is seated to a depth of 6” before commencing the standard penetration test.

Abbreviations

Drilling and Sampling

HSA	Hollow-Stem Auger
SSA	Solid-Stem Auger
HA	Hand Auger
CWR	Clear-Water Rotary
MR	Mud Rotary
AR	Air Rotary
SC	Spin-Casing
DC	Drive-Casing
SS	2” Split-Barrel Sampler
MC	Modified California Ring Sampler
ST	2” Thin-Walled Tube Sampler
ST 3	3” Thin-Walled Tube Sampler
PS	Piston Sampler
AS	Auger Cuttings Sample
RS	Rotary Cuttings Sample
SC	Soil Core
RC	Rock Core

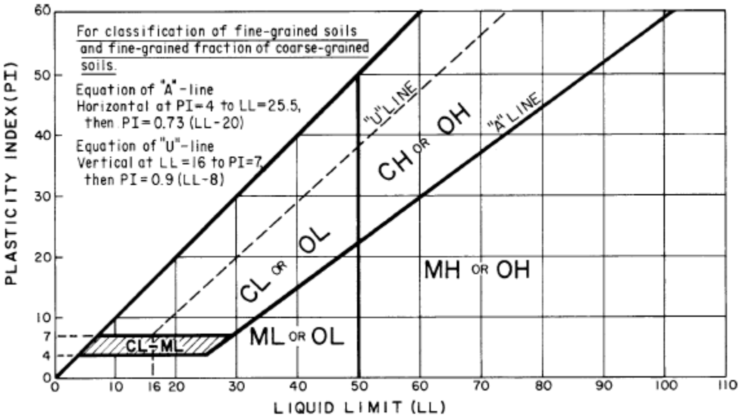


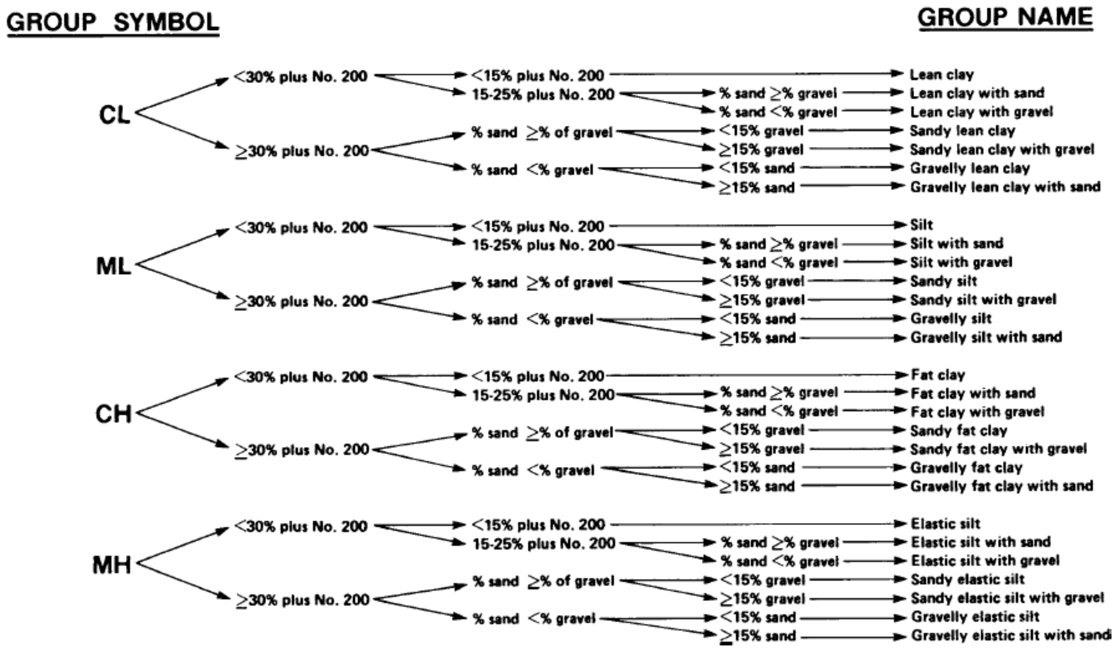
FIG. 4 Plasticity Chart

(from ASTM D 2487)

Sample Description Abbreviations

br.	Brown	tr.	Trace
gr.	Gray	ltl.	Little
yel.	Yellow	ls.	Limestone
lt.	Light	sh.	Shale
dk.	Dark	qtz.	Quartz
blk.	Black	dol.	Dolomite
gvl.	Gravel	ss.	Sandstone
sd.	Sand	lg.	Igneous
si.	Silt	meta.	Metamorphic
cl.	Clay		
f.	Fine	PP	Pocket Penetrometer
m.	Medium		
c.	Coarse		
v.	Very	Tv	Torvane

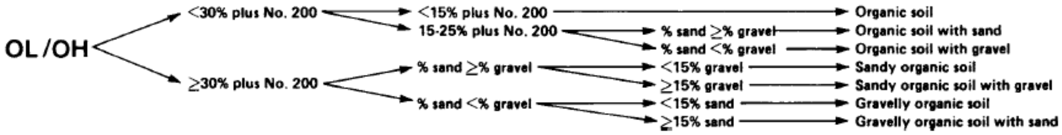
Unified Soil Classification System
(Visual-Manual Procedure)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)

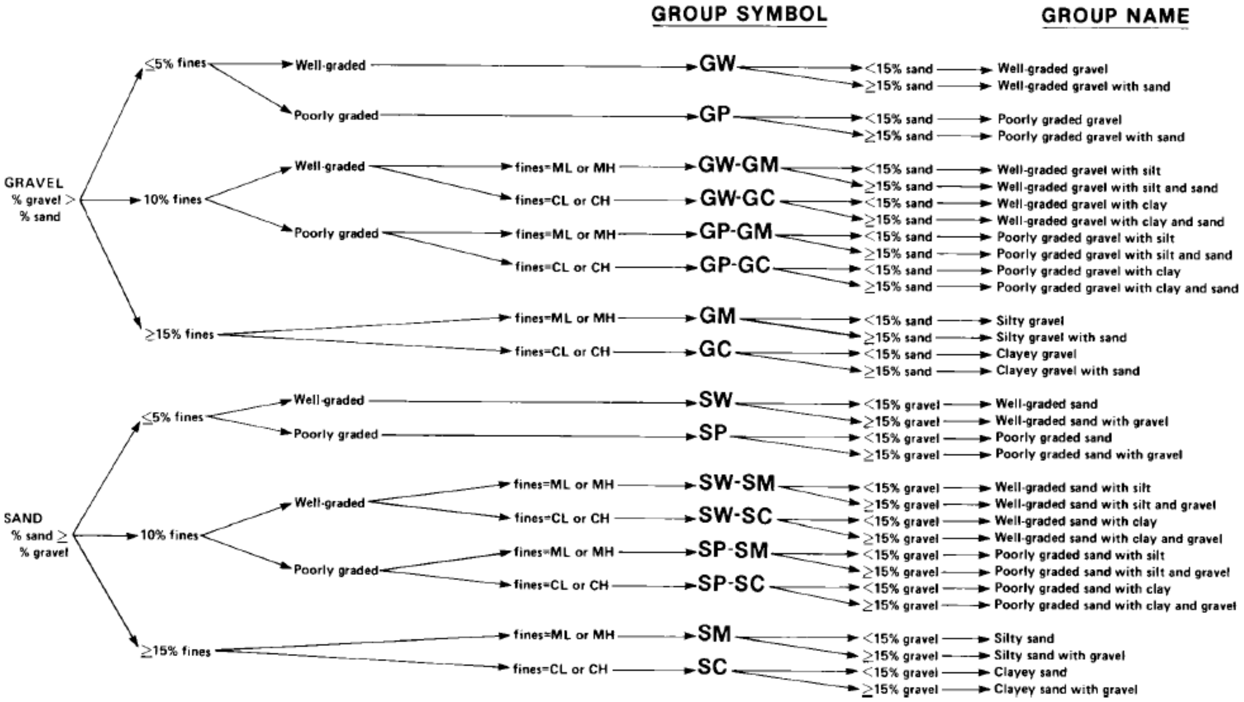
(From ASTM 2488)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

(From ASTM 2488)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

(From ASTM 2488)

General Notes – Description of Rock Core

General

Rock descriptions may include these components in the sequence in which they are listed:

1. Lithology
2. Rock Core Continuity
3. Field hardness
4. Weathering of rock mass
5. Color
6. Texture
7. Bedding or foliation
8. Discontinuities
9. Solution cavities
10. Other characteristics
11. Rock Quality Designation (RQD) (usually noted in separate column on log)

Lithology

Identify the rock classification (type) and mineralogic/textural modifiers; and, if possible, accepted formation names. The principal constituent is written in capital letters, e.g., SANDSTONE, Calcareous SHALE; Biotite GRANITE; Amygdaloidal BASALT.

Rock (Core) Continuity

Any break in a rock core whether or not it has undergone relative displacement (including natural and mechanical breaks):

- Extremely Fractured – Core segments less than 1 inch long
- Moderately Fractured – Core segments 1 to 4 inches long
- Slightly Fractured – Core segments 4 to 8 inches long
- Sound – Core segments greater than 8 inches long

Field Hardness

A measure of resistance to scratching or abrasion:

Very Hard (VH)	Cannot be scratched with a knife or sharp pick.
Hard (H)	Can be scratched with knife or pick only with difficulty.
Moderately Hard (MH)	Can be readily scratched with knife or pick.
Medium (M)	Can be grooved or gouged 1/16 inch deep by firm pressure on knife or pick point.
Soft (S)	Can be gouged or grooved easily with knife or pick point.
Very Soft (VS)	Can be carved with knife or excavated with pick point.

Weathering of Rock Mass

The degree of alteration produced by chemical and/or mechanical processes:

Fresh (FR)	No visible sign of alteration; perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered (SW)	Discoloration of rock material and discontinuity surfaces.
Moderately Weathered (MW)	Less than half the rock material is decomposed to soil. Some fresh or discolored rock as continuous framework or corestones.
Highly Weathered (HW)	More than half the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock as corestones or discontinuous framework.
Saprolite (SP)	All rock material disintegrated to soil. The original mass structure is still largely intact.
Residual Soil (RS)	All rock material converted to soil. Volume of mass has changed, but material has not been significantly transported.

Color

Rock color is described as basic colors or combinations such as gray, green-gray, red, red-brown; or modified such as light gray or dark brown.

Texture

General physical appearance or character of a rock, including geometric aspects and arrangement of particles or crystals. Use the following grain size ranges to describe the rock:

Fine-grained	Grains barely visible to the unaided eye, up to 1/16 inch in diameter.
Medium-grained	Grains between 1/16 and 3/16 inch in diameter.
Coarse-grained	Grains between 3/16 and ¼ inch in diameter
Very coarse-grained	Grains larger than ¼ inch in diameter.

Bedding or Foliation

The relative thickness of the beds, or the frequency of layering or bedding planes:

Laminar	< 1/16 inch
Extremely Thin	1/16 to ¾ inch
Very Thin	¾ to 2½ inches
Thin	2½ to 8 inches
Medium	8 to 24 inches
Thick	24 to 80 inches
Very Thick	80 to 240 inches
Extremely Thick	> 240 inches
Massive	No stratification observed
Occasional	Occurring less than once per foot
Frequently	Occurring more than once per foot
Interbedded	Alternating beds of different composition varying in thickness, and in approximately equal amounts

Discontinuities

Natural breaks separating the intact rock material into discrete units:

Joint	Simple fracture, along which no displacement, has occurred. May occur as group of parallel joints called a Set. May also occur as Bedding joints, Cleavage joints or Foliation joints forming parallel to the respective features.
Shear	Fracture, along which differential movement has occurred. Surfaces may be slickensided (polished or striated).
Fault	Major fracture, along which there has been appreciable displacement.
Shear or Fault Zone	Band or zone of parallel, closely space fractures, along which differential movement has occurred.

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General Notes – Description of Rock Core

Discontinuities - Orientation

Orientation of a rock discontinuity is generally described as dip angle relative to horizontal:

Horizontal	0 - 5
Low Angle	5 - 35
Moderately Dipping	35 - 55
High Angle	55 - 85
Vertical	85 - 90

Discontinuities - Spacing

The distance between discontinuities normal to the plane of the fractures in a single system:

Extremely Close	< 3/4 inch
Very Close	3/4 to 2½ inches
Close	2½ to 8 inches
Moderate	8 to 24 inches
Wide	24 to 80 inches
Very Wide	80 inches to 20 feet
Extremely Wide	< 20 feet

Discontinuities - Roughness

The texture of the discontinuity surface:

Rough
Smooth
Slickensided (polished)
Stepped
Planar
Undulating

Discontinuities - Weathering

A description of the state of weathering of the rock comprising the walls of a discontinuity:

Fresh	No visible sign of weathering of the rock material.
Discolored	The color of the original rock material is changed. Indicate degree of change from original color. Note if color change is limited to particular mineral constituents.
Decomposed	The rock is weathered to the condition of a soil in which the original fabric is still intact, but some or all of the mineral grains are decomposed.
Disintegrated	The rock is weathered to the condition of a soil in which the original fabric is still intact. The rock is friable, but the mineral grains are not decomposed.

Discontinuities - Aperture

A description of the "gap" between the walls of a discontinuity. For rock core logging, the following descriptive terminology is used:

Tight	Core pieces on either side of a discontinuity can be fitted together by hand so that no visible void spaces remain.
Open	Core pieces on either side of a discontinuity cannot be fitted tightly together and voids are visible.

Note:
A completely healed fracture or vein is not considered to be a discontinuity and is not included when describing rock core fracturing or calculating RQD. However, it may be described as a special set of discontinuities and include a record of the altitude (dip), spacing, thickness, type of filling, and any observed alteration.

Discontinuities - Infilling

This is material separating adjacent rock walls of discontinuities, e.g., calcite, chlorite, clay, silt, fault gouge, or breccia. The discontinuity infilling description may include the mineralogy type, thickness, and hardness of the infilling material, the relative amount of infilling (Stained, Coated, Lined, Partially Filled), water content, evidence of shear displacement, wall roughness, fracturing, or crushing of wall rock.

Solution Cavities

Approximate size of openings produced by direct solution by water penetrating pre-existing interstices:

Pit	Barely visible up to ¼ inch	Solution features may be open, crystal lined, or partially or completely filled with hydrothermal minerals, clay, silt, or ore.
Vug	¼ to 2 inches	
Cavity	2 inches to 2 feet	
Cave	> 2 feet	

Other Characteristics

Supplemental characteristics of the rock being described are used where applicable. Such characteristics are the formation name, the presence of solution cavities or voids, secondary mineralization, filling within rock discontinuities, fossils, zones of nodules, brecciation, and swelling or slaking behavior.

Core Recovery

Core recovery is the length of core recovered from a corehole in relation to the length of core drilled in a given core run, expressed as a percentage.

Rock Quality Designation (RQD)

Rock Quality Designation (RQD) is defined as the sum in inches of all pieces of moderately weathered or less weathered rock core, 4 inches in length or longer, divided by the total length in inches of the core drilled in a given core run, expressed as a percentage. If the core is broken by handling or drilling procedures, the pieces of core are fitted together and counted as one piece, provided they constitute the required 4-inch length. Where the core recovery is greater than 100 percent, RQD values are adjusted to account for the portion of the core left in the hole from the previous run. Length determination is measured down the centerline of the core. RQD determination is conducted on cores 1.875 inches in diameter and greater.

90 - 100	Excellent
75 - 90	Good
50 - 75	Fair
25 - 50	Poor
0 - 25	Very Poor

References

- ASTM D4879 Standard Guide for Geotechnical Mapping of Large Underground Openings in Rock
- ASTM D5878 Standard Guides for Using Rock-Mass Classification Systems for Engineering Purposes
- ASTM D6032 Test Method for Determining Rock Quality Designation (RQD) of Rock Core

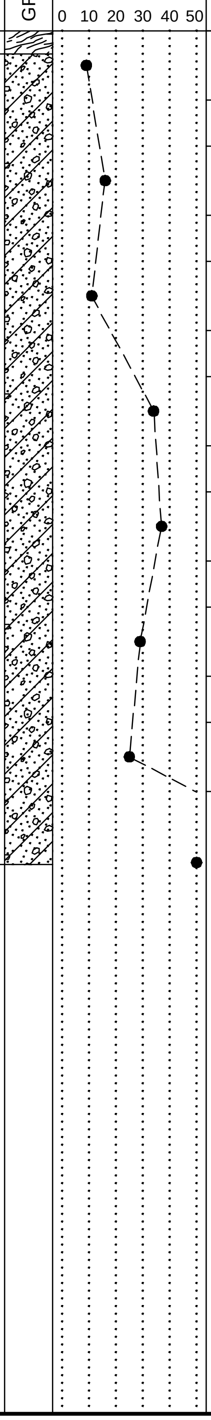
Westwood

SOIL BORING LOG

BORING NO. MET-01

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 40.991335 Long: -84.510171	Surface Elev. (ft): ---	Total Depth (ft bgs): 18.1	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/15/21	Date Completed: 9/15/21	Water Depth (ft bgs) DNE



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	N VALUE (BLOWS)	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	3 4 5		**TOPSOIL** - organics. **LEAN CLAY w/ SAND (CL)** - brown w/ gray, damp, very stiff.			4.5+						Coordinates are NAD83 Datum.
02 SS	100	9 7 9					4.5+						
03 SS	100	6 4 7	5	- yellowish brown			2.0 3.5						
04 SS	100	8 15 19		- hard	CL		4.5+ 4.5+						
05 SS	100	7 15 22	10	- gray w/ orange mottling			4.5+						
06 SS	100	9 12 17					4.5+						
07 SS	100	9 12 13	15	- trace light gray rock fragments			4.5						
08 SS	0	50/1		**BORING TERMINATED DUE TO AUGER REFUSAL.**									
			20										
			25										

WW_BORING LOG_PP_GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

Checked By:	Date:	Approved By:	Date:	Firm:
T. Lopez	10/28/21	B. Kravitz	10/28/21	Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

Westwood

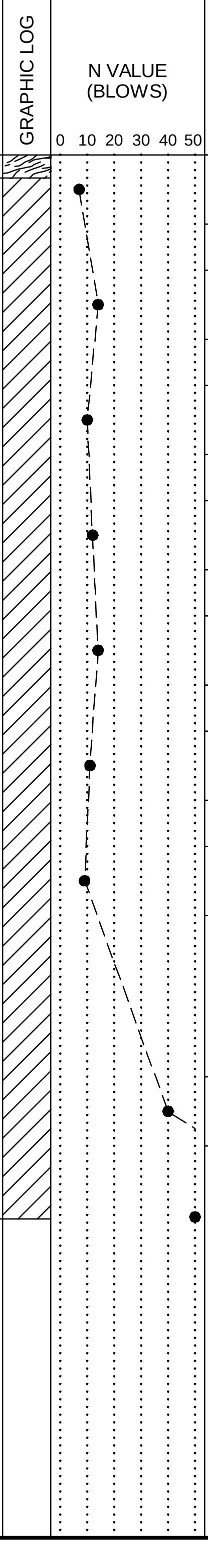
SOIL BORING LOG

BORING NO. MET-02

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.061575 Long: -84.466346	Surface Elev. (ft): ---	Total Depth (ft bgs): 23.5	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/15/21	Date Completed: 9/15/21	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	SAMPLE BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	100	3 3 4		**TOPSOIL** - organics. **LEAN CLAY (CL)** - dark grayish brown, damp, stiff.	CL	4.0						Coordinates are NAD83 Datum.
02 SS	100	4 6 8		- very stiff, orange mottling		3.5 3.5						
03 SS	100	4 4 6	5			2.0 3.5						
04 SS	100	5 5 7		- black iron oxide staining		2.0 2.5						
05 SS	100	5 7 7	10	- brown		2.0 2.0						
06 SS	100	5 5 6				3.0 3.5						
07 SS	100	4 4 5	15	- gray, orange mottling		3.0 3.5		18.8	36	20		
08 SS	67	19 20 20	20			2.5 4.0						
09 SS	100	50/1		- light gray rock fragments								
			25	**BORING TERMINATED DUE TO AUGER REFUSAL.**								



Checked By: T. Lopez	Date: 10/28/21	Approved By: B. Kravitz	Date: 10/28/21	Firm: Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

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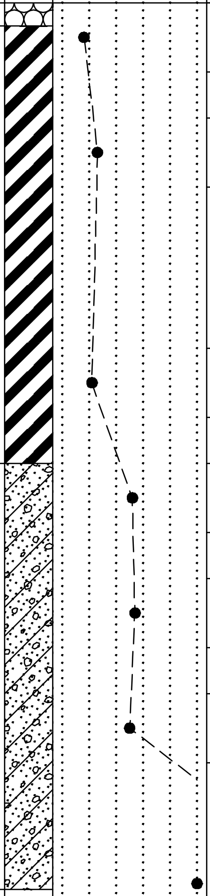
SOIL BORING LOG

BORING NO. OM-01

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.018484 Long: -84.487155	Surface Elev. (ft): ---	Total Depth (ft bgs): 19.3	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/7/21	Date Completed: 9/7/21	Water Depth (ft bgs) DNE



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	3 3 5		**TOPSOIL** - organics. **FAT CLAY w/ SAND (CH)** - brown, damp, very stiff.		4.0						Coordinates are NAD83 Datum.
02 SS	89	8 6 7		- gray mottling		4.5						
01 ST			5		CH		1.7	22.4	50	30		
04 SS	89	2 4 7				3.0 4.5						
05 SS	100	3 10 16	10	**LEAN CLAY w/ SAND (CL)** - brown, damp to moist, hard.		* 4.5						
06 SS	100	5 12 15		- gray		4.5+ 4.5+		12.3	30	16	75	
07 SS	100	5 12 13	15		CL	4.5+ 4.5+						
08 SS	0	50/3										
			20	**BORING TERMINATED DUE TO AUGER REFUSAL.**								
			25									

WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

Checked By: T. Lopez	Date: 10/28/21	Approved By: B. Kravitz	Date: 10/28/21	Firm: Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

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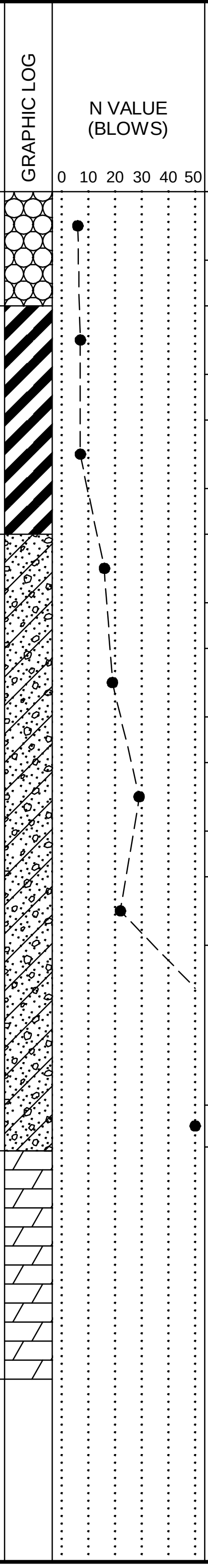
SOIL BORING LOG

BORING NO. SUB-01

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.018748 Long: -84.488357	Surface Elev. (ft): ---	Total Depth (ft bgs): 26.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/2/21	Date Completed: 9/2/21	Water Depth (ft bgs) DNE



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	2 3 3		**FILL - LEAN CLAY w/ SAND** - 7" topsoil, dark grayish brown, damp, stiff.		3.5 4.5						Coordinates are NAD83 Datum.
02 SS	72	2 3 4		**FAT CLAY (CH)** - brown, damp, stiff.		2.5 3.0						
03 SS	94	2 3 4	5	- gray mottling	CH	2.0 3.25						
04 SS	100	3 4 12		**LEAN CLAY w/ SAND (CL)** - brown, damp, hard.		4.0 4.5						
05 SS	100	3 7 12	10			4.5+ 4.5+						
06 SS	78	4 13 16		- gray		4.5+ 4.5+						
07 SS	100	4 9 13	15		CL	4.5+ 4.5+						
			20									
08 SS	91	5 50/5				4.5+ 4.5+						
01 RC	100 (97)			**DOLOMITE** - light gray, slight to sound rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture.								
			25									
				BORING TERMINATED AT THE END OF ROCK CORING.								

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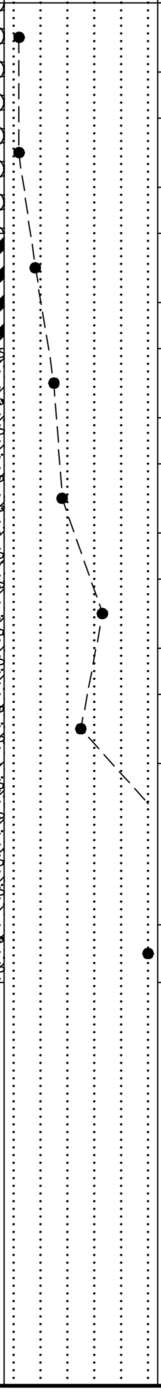
SOIL BORING LOG

BORING NO. SUB-02

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.018667 Long: -84.488592	Surface Elev. (ft): ---	Total Depth (ft bgs): 21.3	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/2/21	Date Completed: 9/2/21	Water Depth (ft bgs): DNE



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	78	1 1 1		**FILL - LEAN CLAY w/ SAND** - 7" topsoil, very dark grayish brown, damp, soft.		○	1.25 1.5						Coordinates are NAD83 Datum.
02 SS	44	1 1 1				○	1.25 1.5						
03 SS	89	2 3 5	5	**FAT CLAY (CH)** - brown, damp, very stiff, gray mottling.	CH	▨	3.5 3.5						
04 SS	94	4 7 8		**LEAN CLAY w/ SAND (CL)** - brown, damp, hard.	CL	▨	4.5+ 4.5+						
05 SS	100	4 6 12	10			▨	4.5+ 4.5+						
06 SS	100	6 13 20		- reddish brown, black iron oxide staining, few gravel		▨	4.5+ 4.5+						
07 SS	100	6 10 15	15	- gray		▨	4.5+ 4.5+						
08 SS	100	10 14 50/3	20			▨	4.5+ 4.5+						
			25	**BORING TERMINATED DUE TO AUGER REFUSAL.**									

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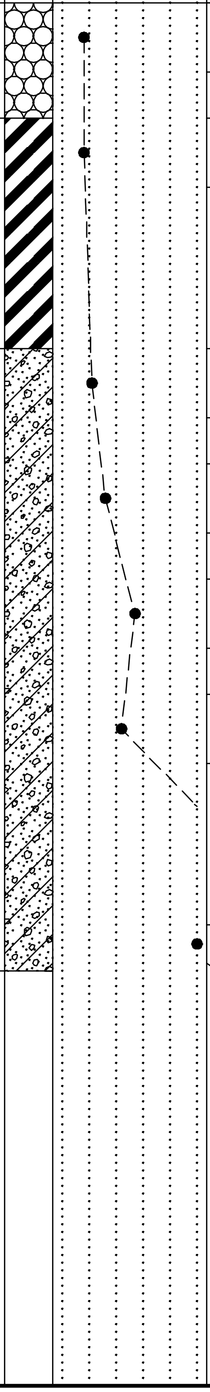
SOIL BORING LOG

BORING NO. SUB-03

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.018492 Long: -84.488442	Surface Elev. (ft): ---	Total Depth (ft bgs): 20.8	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/2/21	Date Completed: 9/2/21	Water Depth (ft bgs): DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	33	3 4 4		**FILL - LEAN CLAY w/ SAND** - 4" topsoil, very dark grayish brown, damp, stiff.		*						Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs.
AU												
02 SS	78	3 4 4		**FAT CLAY (CH)** - brown, damp, stiff.	CH	2.75 3.25		24.2	63	38	86	pH = 7.6 Sat. ER** = 3,300 Moist ER** = 2,000
02 ST			5				2.46	22.2	54	32		
04 SS	100	3 3 8		**LEAN CLAY w/ SAND (CL)** - brown, damp, very stiff.	CL	3.25 4.0						
05 SS	100	3 6 10	10	- hard		4.5 4.5+						
06 SS	89	5 11 16		- gray		4.5+ 4.5+						
07 SS	83	3 10 12	15			4.5+ 4.5+						
08 SS	80	6 50/4	20	- light gray rock fragments		4.5+ 4.5+						
				BORING TERMINATED DUE TO AUGER REFUSAL.								
			25									** ER = Electrical Resistivity measured in Ohm-cm



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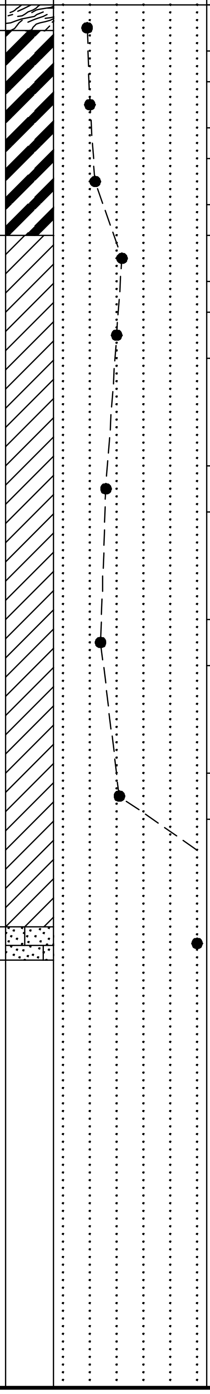
SOIL BORING LOG

BORING NO. T-11

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.044232 Long: -84.509817	Surface Elev. (ft): ---	Total Depth (ft bgs): 31.1	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 8/30/21	Date Completed: 8/30/21	Water Depth (ft bgs): 5.8

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	94	3 4 5		**TOPSOIL** - 10", organics.		4.5+ 4.5+						Coordinates are NAD83 Datum.
				FAT CLAY (CH) - brown, damp, very stiff.								
02 SS	72	4 5 5			CH	4.5 4.5						
03 SS	83	3 5 7	5	- gray mottling		4.5+ 4.5+		17.9	54	29		Water after drilling at 5.8 ft. Level measured from piezometer 25 days after piezometer installed.
04 SS	100	6 8 14		**LEAN CLAY (CL)** - dark grayish brown, damp, hard.		4.5+ 4.5+						
05 SS	100	4 7 13	10	- black iron oxide staining		4.5+ 4.5+						
01 ST							3.12	15.5	27	12		
07 SS	83	5 8 8	15	- gray		4.5+ 4.5+						
					CL							
08 SS	83	3 6 8	20			3.75 4.5+						
09 SS	94	5 10 11	25			4.5+ 4.5+						
10 SS	85	27 39 50/1	30	**WEATHERED ROCK** - sandy/silty, gray, wet, hard.								Water during drilling at 30 ft.
				BORING TERMINATED DUE TO AUGER REFUSAL.								
			35									
			40									



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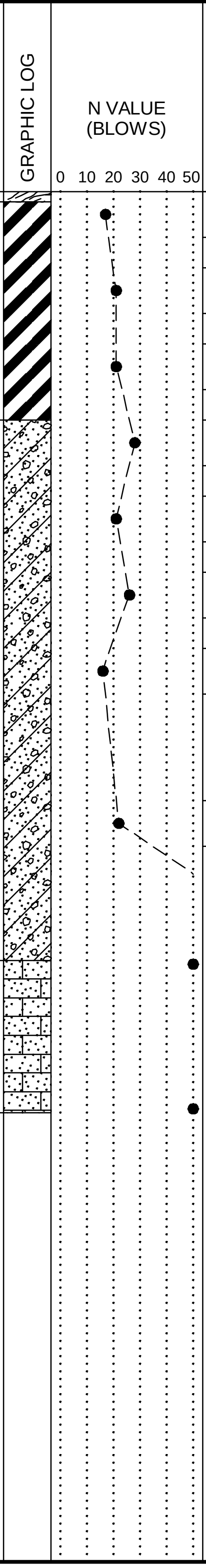
SOIL BORING LOG

BORING NO. T-13

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio	Boring Location: Lat: 41.040257 Long: -84.502092	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.3	Borehole Dia. (in): 3.25	
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 8/30/21	Date Completed: 8/30/21	Water Depth (ft bgs): 18.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	3 8 9		**TOPSOIL** - 4", organics. **FAT CLAY (CH)** - brown, damp, stiff to hard.		2.25 4.5						Coordinates are NAD83 Datum.
02 SS	61	5 8 13		- lens of softer clay	CH	1.5 4.5+						
03 SS	100	4 9 12	5	- lens of softer clay		2.0 4.5+						
04 SS	100	7 11 17		**LEAN CLAY w/ SAND (CL)** - dark grayish brown, damp, hard. - black iron oxide staining		4.5+ 4.5+						
05 SS	94	4 9 12	10			4.5+ 4.5+						
06 SS	89	5 10 16				4.5+ 4.5+						
07 SS	89	4 6 10	15	- gray	CL	4.5 4.5						
08 SS	94	5 10 12	20			4.25 4.5		19.6	30	14	78	Water after drilling at 18.7 ft. Level measured from piezometer 25 days after piezometer installed.
09 SS	100	27 50/3	25	**WEATHERED ROCK** - sandy/silty, gray, wet, hard.								
10 SS	67	50/3	30	**BORING TERMINATED DUE TO AUGER REFUSAL.**								
			35									
			40									



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SOIL BORING LOG

BORING NO. T-14

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.036778 Long: -84.500319	Surface Elev. (ft): ---	Total Depth (ft bgs): 37.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/1/21	Date Completed: 9/1/21	Water Depth (ft bgs): 8.7

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	78	3 3 4	3.0 3.5					
AU					21.7	54	35	92
02 SS	61	2 2 3	3.25 3.5					
03 SS	67	2 2 4	1.5 2.25					
04 SS	89	2 4 6	4.5+ 4.5+					
05 SS	78	3 9 13	4.5+ 4.5+					
06 SS	100	4 14 15	4.5+ 4.5+		11.4			75
07 SS	89	4 9 10	4.5+ 4.5+					
08 SS	100	4 7 8	3.75 4.0		17.2	43	22	97
09 SS	50	5 6 10						
01 RC	72 (13)							
02 RC	87 (73)							

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40

LITHOLOGIC DESCRIPTION

TOPSOIL - 3", brown, organics.

FAT CLAY (CH) - brown, damp, very stiff. (USCS: CH)

- gray mottling, stiff

LEAN CLAY w/ SAND (CL) - brown, damp, very stiff. (USCS: CL)

- hard, black iron oxide staining

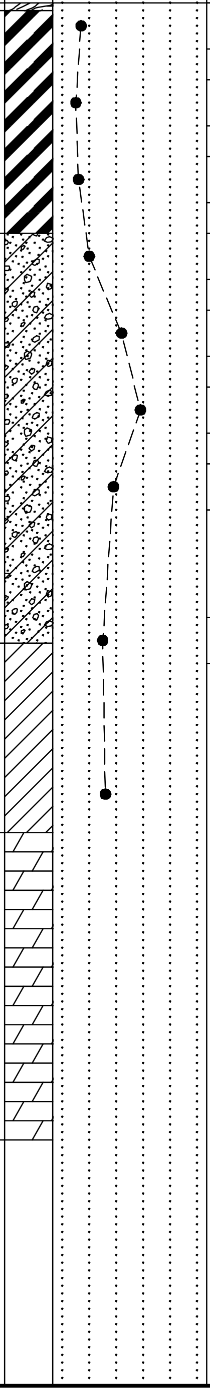
- dark grayish brown

LEAN CLAY (CL) - gray, damp, very stiff. (USCS: CL)

- wet

DOLOMITE - light gray, moderate rock continuity, moderate rock hardness, fresh to slight weathering, interbedded clay layers, vuggy texture.

BORING TERMINATED AT THE END OF ROCK CORING.



COMMENTS

Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs.
pH = 7.7
Sat. ER** = 3,100
Moist ER** = 1,100

Water after drilling at 8.7 ft. Level measured from piezometer 24 days after piezometer installed.

Water during drilling at 22 ft.

** ER = Electrical Resistivity measured in Ohm-cm

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Westwood

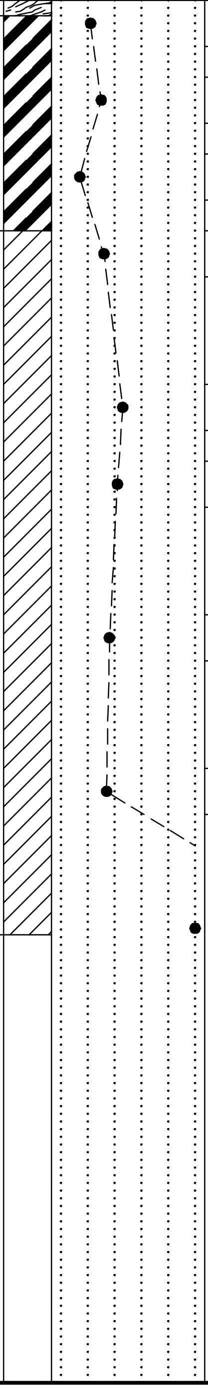
SOIL BORING LOG

BORING NO. T-15

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.03671 Long: -84.490286	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.4	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/1/21	Date Completed: 9/1/21	Water Depth (ft bgs): 8.1

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	78	3 5 6		**TOPSOIL** - 6", organics. **FAT CLAY (CH)** - brown, damp, very stiff.		4.5 4.5						Coordinates are NAD83 Datum.
02 SS	78	3 5 10		- gray mottling	CH	4.5 4.5+		20				
03 SS	56	2 3 4	5			2.75 2.75						
04 SS	94	5 7 9		**LEAN CLAY (CL)** - brown, damp, hard. - sand lens		4.5+ 4.5+						Water after drilling at 8.1 ft. Level measured from piezometer 24 days after piezometer installed.
01 ST			10				4.17	18.2	29	14		
06 SS	83	4 9 14		- dark grayish brown, black iron oxide staining		4.5+ 4.5+						
07 SS	89	4 7 14	15			4.5+ 4.5+						
					CL							
08 SS	89	8 8 10	20	- trace gravel		4.5+ 4.5+						
09 SS	89	6 7 10	25	- moist sand lenses		4.5+ 4.5+						
10 SS	0	50/5	30									
				BORING TERMINATED DUE TO AUGER REFUSAL.								



Depth in feet: 5, 10, 15, 20, 25, 30, 35, 40

WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

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Westwood

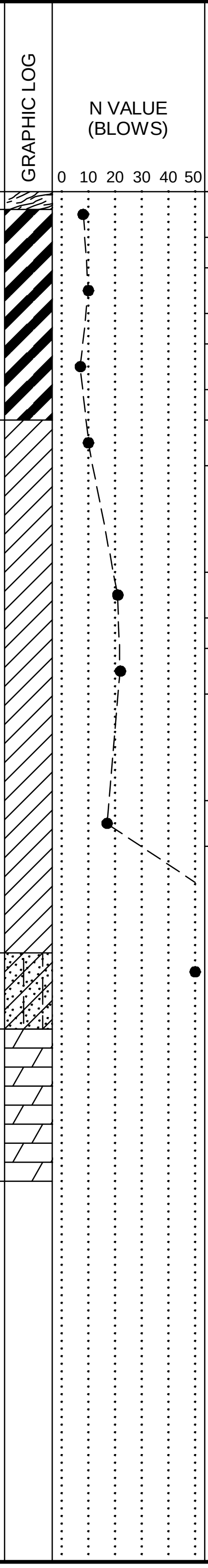
SOIL BORING LOG

BORING NO. T-16

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project, Paulding County, Ohio
Boring Location: Lat: 41.036112 Long: -84.482544
Surface Elev. (ft): ---
Total Depth (ft bgs): 32.5
Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.
Drilling Method: Hollow Stem Auger, Auto-Hammer SPT
Personnel: Logger - C. Acker, Driller - A. Mitchell
Date Started: 9/1/21
Date Completed: 9/1/21
Water Depth (ft bgs): 7.8

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	100	3 3 5		**TOPSOIL** - 7", organics.		3.0 3.25						Coordinates are NAD83 Datum.
				FAT CLAY (CH) - brown, damp, very stiff, orange mottling.	CH							
02 SS	50	3 4 6				3.5 4.5						
03 SS	72	2 3 4	5			3.0 3.0						
04 SS	67	4 4 6		**LEAN CLAY (CL)** - brown, damp, very stiff.	CL	4.5+ 4.5+						Water after drilling at 7.8 ft. Level measured from piezometer 24 days after piezometer installed.
01 ST			10				4.67	14.0	31	16		
06 SS	100	4 9 12		- dark grayish brown, hard		4.5+ 4.5+						
07 SS	72	4 11 11	15			4.5+ 4.5+						
08 SS	89	5 8 9	20	- gray		4.5+ 4.5+						
09 SS	67	5 25 50/3	25	**SANDY SILTY CLAY (CL-ML)** - gray, damp, hard.	CL-ML			7.3	16	5	65	
01 RC	100 (77)		30	**DOLOMITE** - light gray, moderate to sound rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture.								
			35 40	**BORING TERMINATED AT THE END OF ROCK CORING.**								



Checked By: T. Lopez
Date: 10/28/21
Approved By: B. Kravitz
Date: 10/28/21
Firm: Westwood Professional Services (952) 937-5150
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Westwood

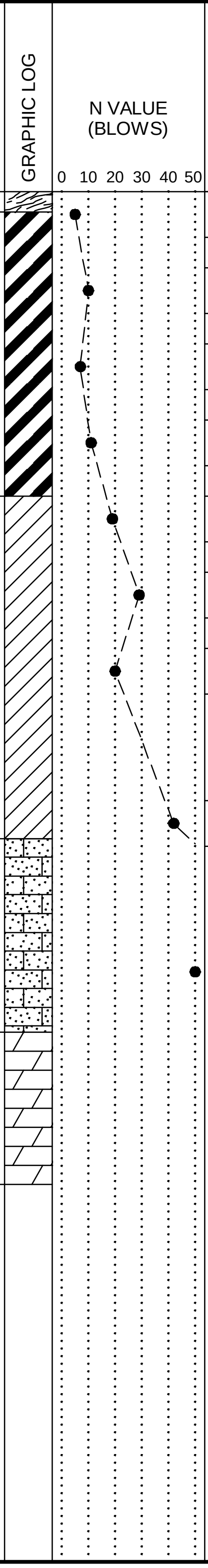
SOIL BORING LOG

BORING NO. T-17

Page 1 of 1

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Grover Hill Wind Project Paulding County, Ohio	Lat: 41.029879 Long: -84.507776	---	32.6	3.25

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Envirocore, Inc.	Hollow Stem Auger Auto-Hammer SPT	Logger - C. Acker Driller - A. Mitchell	8/31/21	8/31/21	6.3



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	100	2 2 3		**TOPSOIL** - 8", organics. **FAT CLAY (CH)** - brown, damp, very stiff.		2.25 2.75						Coordinates are NAD83 Datum.
02 SS	61	3 4 6				3.25 3.5						
03 SS	78	3 3 4	5	- gray mottling	CH	4.5+ 4.5+						Water after drilling at 6.3 ft. Level measured from piezometer 24 days after piezometer installed.
04 SS	83	2 4 7				3.5 3.5						
05 SS	78	2 7 12	10	**LEAN CLAY (CL)** - brown, damp, very stiff. - trace gravel - gray, hard		3.25 3.5						
06 SS	94	6 12 17				4.5+ 4.5+		9.3	32	17		
07 SS	72	3 9 11	15		CL	4.5+ 4.5+						
08 SS	100	13 29 13	20			4.5+ 4.5+						
				WEATHERED ROCK - sandy/silty, gray, damp to moist, hard.								Water during drilling at 22.3 ft.
09 SS	67	8 14 50/3	25									
01 RC	87 (50)		30	**DOLOMITE** - light and dark gray, moderate to sound rock continuity, moderate rock hardness, fresh to slight weathering.			603					
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									

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Westwood

SOIL BORING LOG

BORING NO. T-25

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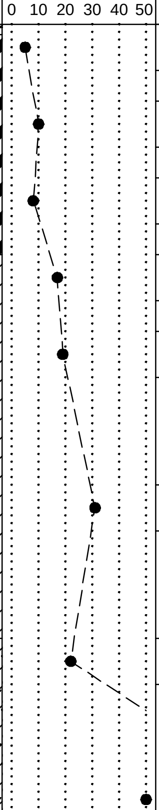
Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Grover Hill Wind Project Paulding County, Ohio	Lat: 41.026373 Long: -84.483374	---	31.0	3.25

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Envirocore, Inc.	Hollow Stem Auger Auto-Hammer SPT	Logger - C. Acker Driller - A. Mitchell	9/2/21	9/2/21	10.5

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	83	2 2 3	2.25 2.25					
AU					23.8	68	44	93
02 SS	39	4 5 5	4.5+ 4.5+					
03 SS	89	3 4 4	3.75 4.0					
04 SS	94	4 6 11	4.5+ 4.5+					
05 SS	94	3 9 10	4.5+ 4.5+					
02 ST				8.12	13.1	29	15	
07 SS	100	6 11 20	4.5+ 4.5+					
08 SS	100	4 10 12	4.5+ 4.5+		11.0			
09 SS	67	50/6						
01 RC	87 (68)			197				

DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS
0	**TOPSOIL** - 4", organics.	
	FAT CLAY (CH) - brown, damp, very stiff. - hard - gray mottling	CH
	LEAN CLAY (CL) - brown, damp, hard. - black iron oxide staining - dark grayish brown	CL
20	**SANDY SILTY CLAY (CL-ML)** - gray, damp, hard.	CL-ML
	DOLOMITE - light gray, moderate to sound rock continuity, moderate rock hardness, fresh to slight weathering, vertical fractures, vuggy texture.	
	BORING TERMINATED AT THE END OF ROCK CORING.	



COMMENTS

Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs.
pH = 7.6
Sat. ER** = 2,100
Moist ER** = 900

Water after drilling at 10.5 ft. Level measured from piezometer 21 days after piezometer installed.

- 3" drop in drilling bit at 29 ft
- 3" drop in drilling bit at 30.5 ft

** ER = Electrical Resistivity measured in Ohm-cm

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WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

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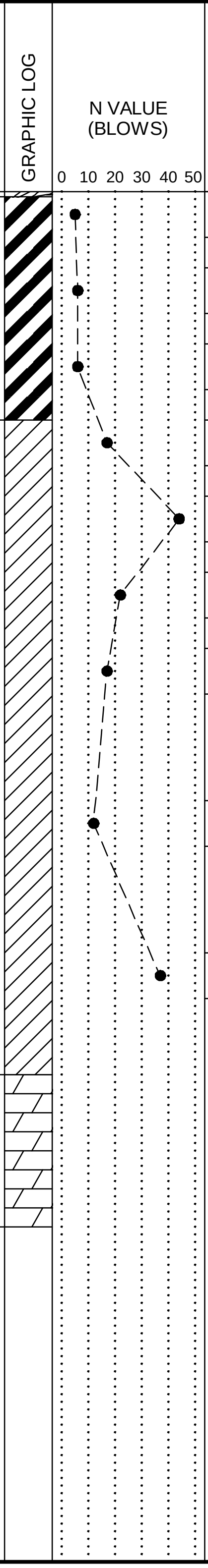
SOIL BORING LOG

BORING NO. T-26

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio	Boring Location: Lat: 41.030845 Long: -84.482194	Surface Elev. (ft): ---	Total Depth (ft bgs): 34.0	Borehole Dia. (in): 3.25	
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 9/1/21	Date Completed: 9/1/21	Water Depth (ft bgs): 10.4

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	72	1 2 3		**TOPSOIL** - 2", organics. **FAT CLAY (CH)** - brown, damp, stiff.		1.75 1.75						Coordinates are NAD83 Datum.
02 SS	44	2 3 3			CH	2.75 3.25						
03 SS	94	2 3 3	5	- gray mottling		2.25 4.25						
04 SS	94	4 7 10		**LEAN CLAY (CL)** - dark grayish brown, damp, hard.		4.5+ 4.5+						
05 SS	89	4 10 34	10			4.5+ 4.5+						Water after drilling at 10.4 ft. Level measured from piezometer 24 days after piezometer installed.
				- gravel grain in shoe								
06 SS	17	4 7 15				2.75 4.5+						
07 SS	83	3 6 11	15			4.5+ 4.5+						
					CL							
08 SS	67	3 5 7	20	- very stiff		4.5+ 4.5+						
09 SS	89	8 15 22	25	- hard, white to light gray gravel lens		4.5 4.5+						
01 RC	97 (75)		30	**DOLOMITE** - light gray, moderate to sound rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture.								
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									



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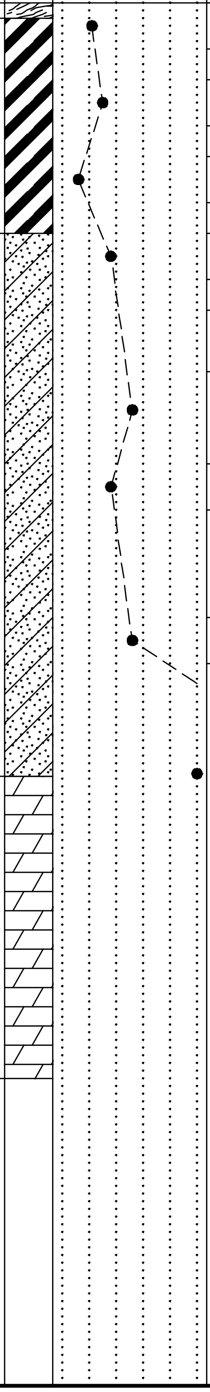
SOIL BORING LOG

BORING NO. T-27

Page 1 of 1

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Grover Hill Wind Project Paulding County, Ohio	Lat: 41.014775 Long: -84.509602	---	35.0	3.25

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Envirocore, Inc.	Hollow Stem Auger Auto-Hammer SPT	Logger - T. Lopez Driller - A. Mitchell	9/8/21	9/8/21	12.7



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	100	3 5 6		**TOPSOIL** - organics.		4.5 4.5						Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs. pH = 7.7 Sat. ER** = 2,600 Moist ER** = 2,100
AU				**FAT CLAY (CH)** - brown, damp, very stiff.				17.9	50	32	86	
02 SS	94	6 8 7			CH	4.5 4.5						
03 SS	67	3 3 3	5	- medium stiff		0.5 1.0						
04 SS	89	4 7 11		**SANDY LEAN CLAY (CL)** - brown, damp, very stiff.		2.0 2.5						
01 ST			10	- hard		4.5+ 4.5+	9.78	12.2	28	13		
06 SS	100	16 12 14		- few gravel								Water after drilling at 12.7 ft. Level measured from piezometer 17 days after piezometer installed.
07 SS	100	4 6 12	15		CL	4.5 4.5+						
08 SS	100	6 12 14	20			4.5+						
09 SS	100	50/2	25	**DOLOMITE** - light gray, sound rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture.								
01 RC	100 (93)											
02 RC	100 (88)		30									
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									** ER = Electrical Resistivity measured in Ohm-cm

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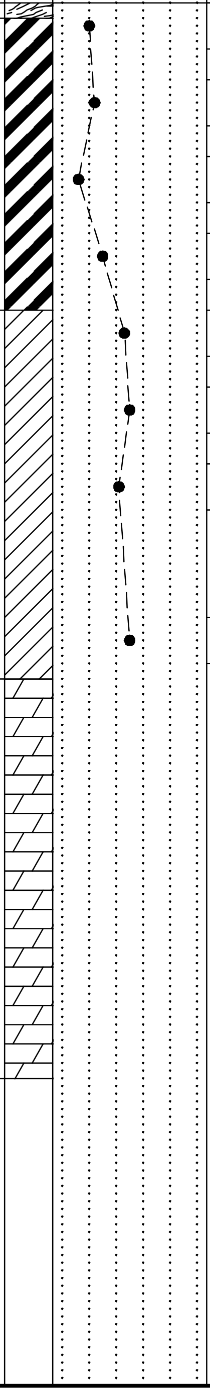
SOIL BORING LOG

BORING NO. T-28

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.01488 Long: -84.501761	Surface Elev. (ft): ---	Total Depth (ft bgs): 35.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/7/21	Date Completed: 9/7/21	Water Depth (ft bgs) 9.8

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	100	3 5 5		**TOPSOIL** - organics. **FAT CLAY (CH)** - brown, damp, very stiff, slight orange mottling.	CH	4.5 4.5						Coordinates are NAD83 Datum.
02 SS	100	5 6 6				3.5 4.5						
03 SS	89	4 3 3	5	- stiff		1.0 1.0						
04 SS	100	3 5 10		- very stiff		4.5 4.5						
05 SS	100	5 10 13	10	**LEAN CLAY (CL)** - brown, damp, hard.	CL	4.5 4.5						Water after drilling at 9.8 ft. Level measured from piezometer 16 days after piezometer installed.
06 SS	100	5 10 15		- dark grayish brown		4.5+						
07 SS	94	4 10 11	15	- gray		4.5+						
08 SS	100	2 14 11	20	- wet, very stiff		3.0		12.4	30	15		Water during drilling at 20 ft.
01 RC	86 (53)			**DOLOMITE** - light gray, slight to sound rock continuity, hard rock hardness, fresh to slight weathering, vuggy texture.								
02 RC	100 (100)		25									
03 RC	90 (78)		30									
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									



WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

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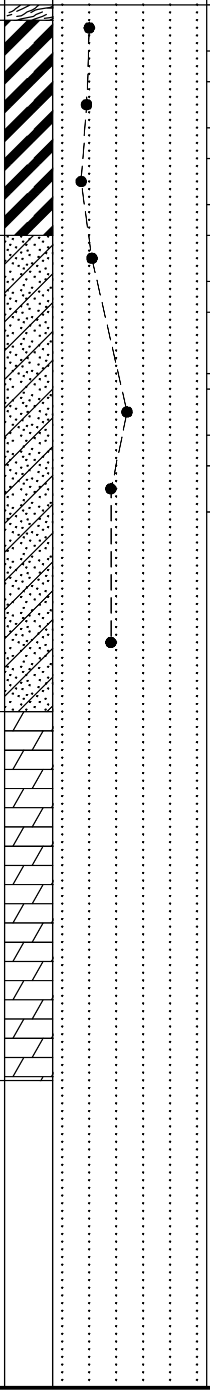
SOIL BORING LOG

BORING NO. T-29

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio	Boring Location: Lat: 41.009893 Long: -84.508457	Surface Elev. (ft): ---	Total Depth (ft bgs): 35.0	Borehole Dia. (in): 3.25	
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/9/21	Date Completed: 9/9/21	Water Depth (ft bgs): 10.4



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	94	3 4 6		**TOPSOIL** - organics. **FAT CLAY (CH)** - brown, damp, very stiff.	CH	4.0 4.5						Coordinates are NAD83 Datum.
02 SS	100	3 4 5				2.0 2.5						
03 SS	72	3 3 4	5			3.5 3.5						
04 SS	89	4 4 7		**SANDY LEAN CLAY (CL)** - brown, damp, very stiff.	CL	3.0 3.5						
01 ST			10	- hard		4.5 4.5	6.26	12.2	31	15		Water after drilling at 10.4 ft. Level measured from piezometer 16 days after piezometer installed.
06 SS	100	6 10 14				4.5 4.5						
07 SS	100	4 8 10	15	- few gravel		4.5 4.5						
08 SS	89	4 9 9	20									
01 RC	100 (45)		25	**DOLOMITE** - light gray, slight rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture, mottling.								
02 RC	95 (83)		30									
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									

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SOIL BORING LOG

BORING NO. T-30

Page 1 of 1

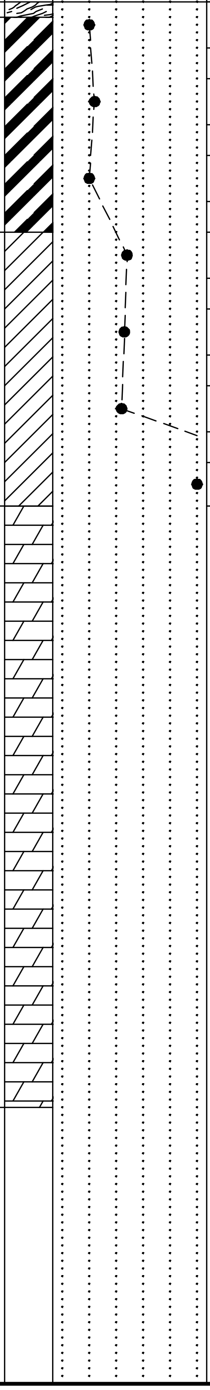
Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio	Boring Location: Lat: 41.009667 Long: -84.501794	Surface Elev. (ft): ---	Total Depth (ft bgs): 36.0	Borehole Dia. (in): 3.25	
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/7/21	Date Completed: 9/8/21	Water Depth (ft bgs): ---

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	100	5 5 5	3.5 4.0					
02 SS	100	6 6 6	3.0 4.5					
03 SS	100	3 5 5	1.5 2.0					
04 SS	100	5 10 14	4.5+					
05 SS	100	5 10 13	4.5+					
06 SS	78	10 10 12	4.5+					
07 SS	47	3 6 50/5	4.5 4.5					
01 RC	100 (73)			1110				
02 RC	100 (67)							
03 RC	100 (80)							
04 RC	70 (52)							

LITHOLOGIC DESCRIPTION	USCS
TOPSOIL - organics.	
FAT CLAY (CH) - brown, damp, very stiff. - damp to moist, stiff	CH
LEAN CLAY (CL) - brown w/ gray and orange mottling, moist, hard, few sand. - gray	CL
DOLOMITE - light gray, slight rock continuity, moderate rock hardness, fresh to slight weathering, vuggy texture. - clay infilling	
BORING TERMINATED AT THE END OF ROCK CORING.	

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40

COMMENTS: Coordinates are NAD83 Datum.



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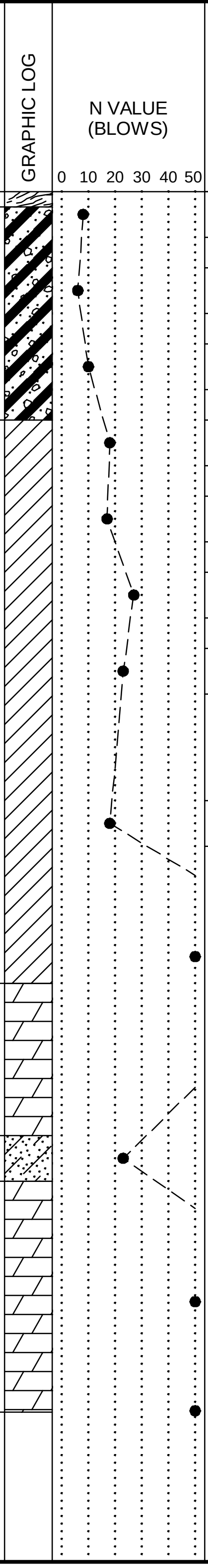
SOIL BORING LOG

BORING NO. T-31

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.009645 Long: -84.489572	Surface Elev. (ft): ---	Total Depth (ft bgs): 42.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/8/21	Date Completed: 9/8/21	Water Depth (ft bgs): 11.0

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	61	3 4 4		**TOPSOIL** - organics.		4.5						Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs. pH = 7.4 Sat. ER** = 2,700 Moist ER** = 1,000
AU				**FAT CLAY w/ SAND (CH)** - brown, damp, very stiff.	CH			18.1	53	36	82	
02 SS	78	3 2 4				2.5 3.0						
03 SS	89	3 4 6	5	- gray and orange mottling		4.5 4.5						
04 SS	100	4 7 11		**LEAN CLAY (CL)** - brown, damp to moist, hard.	CL	4.5 4.5						
05 SS	100	6 6 11	10			4.5+ 4.5+						Water after drilling at 11 ft. Level measured from piezometer 15 days after piezometer installed.
06 SS	100	6 10 17				4.5+ 4.5+						
07 SS	100	4 8 15	15	- gray		4.5+ 4.5+						
08 SS	100	5 8 10	20			4.5+ 4.5+						
09 SS	100	50/3	25									
01 RC	20 (0)		30	**DOLOMITE** - light gray, extremely fractured, moderate rock hardness, highly weathered, vuggy texture.								
10 SS	100	11 10 13		**POORLY GRADED SAND w/ CLAY (SP-SC)** - dark gray, wet, medium dense, few gravel.	SP-SC			10.8			6	
02 RC	29 (0)		35	**DOLOMITE** - light gray, extremely fractured, moderate rock hardness, highly weathered, vuggy texture.								
11 SS	55	10 50/5										
12 SS	100	50/1	40	**BORING TERMINATED DUE TO AUGER REFUSAL.**								** ER = Electrical Resistivity measured in Ohm-cm



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T. Lopez	10/28/21	B. Kravitz	10/28/21	Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

Westwood

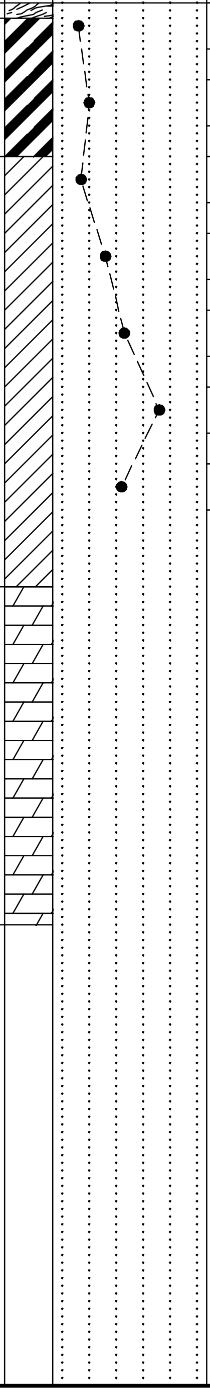
SOIL BORING LOG

BORING NO. T-32

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.010532 Long: -84.481711	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/13/21	Date Completed: 9/13/21	Water Depth (ft bgs): 13.5

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	94	2 3 3		**TOPSOIL** - organics. **FAT CLAY (CH)** - brown, damp, very stiff.	CH	3.0 3.0						Coordinates are NAD83 Datum.
02 SS	89	5 5 5				4.5+ 4.5+						
03 SS	89	4 3 4	5	**LEAN CLAY (CL)** - brown w/ orange mottling, damp, stiff.	CL	1.0 1.0		24.6	49	28		
04 SS	100	3 5 11		- hard		4.0 4.5						
05 SS	100	5 10 13	10			4.5 4.5						
06 SS	22	8 18 18		- gray		4.5+ 4.5+						Water after drilling at 13.5 ft. Level measured from piezometer 10 days after piezometer installed.
07 SS	100	7 9 13	15			4.5 4.5						
01 RC	100 (63)		20	**DOLOMITE** - light gray, slight rock continuity, medium to moderate rock hardness, fresh to slight weathering, clay infilling.								
02 RC	100 (85)		25									
			30	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			35									
			40									



Checked By:	Date:	Approved By:	Date:	Firm:
T. Lopez	10/28/21	B. Kravitz	10/28/21	Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

Westwood

SOIL BORING LOG

BORING NO. T-33

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Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.015127 Long: -84.468594	Surface Elev. (ft): ---	Total Depth (ft bgs): 32.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/13/21	Date Completed: 9/13/21	Water Depth (ft bgs) 7.6

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	100	2 3 3	3.5 4.0					
AU					21.6	57	38	88
02 SS	100	3 3 4	3.0 3.5					
03 SS	100	2 2 1	1.5 2.5					
04 SS	100	3 7 10	1.5 2.5					
05 SS	78	7 10 13	3.0 3.5					
06 SS	100	4 10 14	3.5 3.5					
07 SS	100	7 12 12	3.0 3.5		14.1			
08 SS	100	10 11 15	4.0 4.5					
01 RC	100 (68)							
02 RC	100 (75)							

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40

N VALUE (BLOWS): 0 10 20 30 40 50

LITHOLOGIC DESCRIPTION	USCS
TOPSOIL - organics.	
FAT CLAY (CH) - brown, damp, stiff. - medium stiff	CH
LEAN CLAY (CL) - gray, moist, stiff, few sand. - very stiff	CL
DOLOMITE - light gray, slight rock continuity, medium to moderate rock hardness, fresh to slight weathering, clay infilling.	
BORING TERMINATED AT THE END OF ROCK CORING.	

COMMENTS

Coordinates are NAD83 Datum.
Bulk sample taken from auger cuttings 1-4 ft bgs.
pH = 7.5
Sat. ER** = 1,300
Moist ER** = 900

Water after drilling at 7.6 ft. Level measured from piezometer 10 days after piezometer installed.

** ER = Electrical Resistivity measured in Ohm-cm

WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

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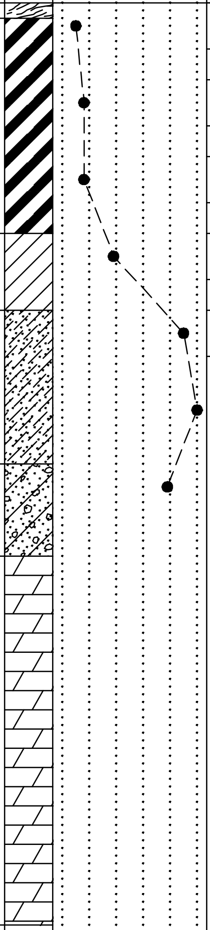
SOIL BORING LOG

BORING NO. T-34

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.012353 Long: -84.469027	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/14/21	Date Completed: 9/14/21	Water Depth (ft bgs) 6.3

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	94	3 2 3		**TOPSOIL** - organics. **FAT CLAY (CH)** - gray w/ orange mottling, damp, stiff.		2.5 2.5						Coordinates are NAD83 Datum.
02 SS	100	4 3 5		- brown	CH	3.5 3.5						
03 SS	100	4 3 5	5	- gray		1.0 1.75						Water after drilling at 6.3 ft. Level measured from piezometer 9 days after piezometer installed.
04 SS	100	4 7 12		**LEAN CLAY (CL)** - gray, damp to moist, hard, few sand.	CL	4.5						
05 SS	100	12 27 18	10	**CLAYEY SAND (SC)** - gray, damp to moist, dense.		* 4.0		9.2			24	
06 SS	56	15 25 25		- very dense	SC							
07 SS	67	12 15 24	15	**LEAN CLAY w/ SAND (CL)** - gray, damp to moist, hard.	CL							
01 RC	88 (58)			**DOLOMITE** - light gray, slight rock continuity, medium rock hardness, fresh to slight weathering, vuggy texture.			517					
02 RC	100 (67)		20									
03 RC	100 (83)		25									
			30	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			35									
			40									



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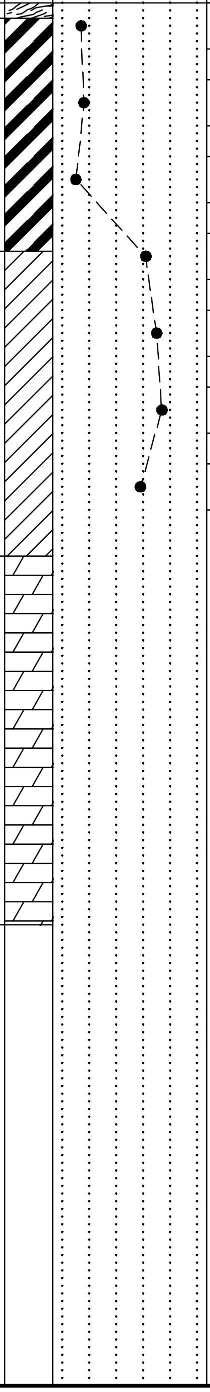
SOIL BORING LOG

BORING NO. T-35

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.009103 Long: -84.470016	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/14/21	Date Completed: 9/14/21	Water Depth (ft bgs) 11.1

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	2 3 4		**TOPSOIL** - organics. **FAT CLAY (CH)** - brown, damp, stiff.		4.5						Coordinates are NAD83 Datum.
02 SS	100	4 3 5		- orange and gray mottling		3.0 3.5						
03 SS	83	2 2 3	5	- gray, medium stiff	CH	1.5 1.5						
04 SS	94	8 10 21		**LEAN CLAY (CL)** - gray, damp, stiff.		1.5 1.5						
05 SS	89	10 13 22	10	- hard, iron oxide staining		4.5						Water after drilling at 10.5 ft. Level measured from piezometer 9 days after piezometer installed.
06 SS	100	10 14 23			CL	4.5+						
07 SS	100	6 10 19	15			4.5+						
01 RC	100 (21)			**DOLOMITE** - light gray, moderate rock continuity, medium to moderate rock hardness, fresh to slight weathering, horizontal fractures, vuggy texture.								
02 RC	100 (83)		20									
03 RC	100 (95)		25									
			30	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			35									
			40									



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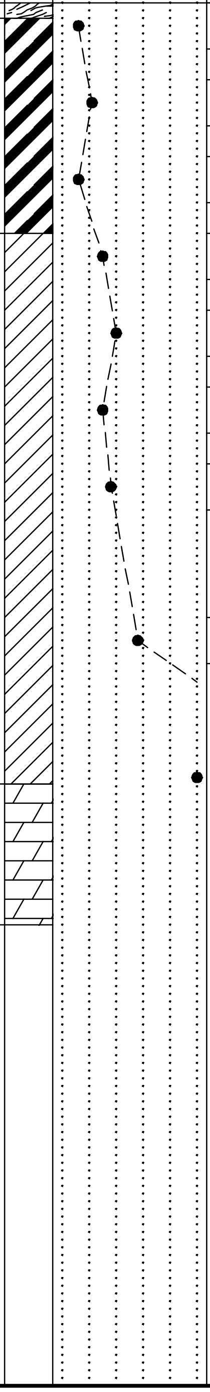
SOIL BORING LOG

BORING NO. T-36

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.00845 Long: -84.464226	Surface Elev. (ft): ---	Total Depth (ft bgs): 30.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/14/21	Date Completed: 9/14/21	Water Depth (ft bgs) 9.5

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	89	2 3 3	**TOPSOIL** - organics. **FAT CLAY (CH)** - brown, damp, stiff.		4.0						Coordinates are NAD83 Datum.
02 SS	100	6 5 6	- orange and gray mottling	CH	4.5						
03 SS	100	3 3 3	- gray, medium stiff		1.0 1.0						
04 SS	89	4 6 9	**LEAN CLAY (CL)** - gray, damp, very stiff.		3.5 4.0						
05 SS	100	4 9 11	- hard		4.5 4.5						Water after drilling at 9.5 ft. Level measured from piezometer 9 days after piezometer installed.
06 SS	100	5 7 8			4.5+ 4.5+						
07 SS	100	5 8 10		CL	4.5						
08 SS	100	6 13 15			4.5						
09 SS	100	50/5	**DOLOMITE** - light gray, moderate rock continuity, medium to moderate rock hardness, fresh to slight weathering, horizontal fractures, vuggy texture.								
01 RC	100 (78)										
			BORING TERMINATED AT THE END OF ROCK CORING.								



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SOIL BORING LOG

BORING NO. T-37

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 40.993843 Long: -84.507839	Surface Elev. (ft): ---	Total Depth (ft bgs): 35.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/9/21	Date Completed: 9/10/21	Water Depth (ft bgs): 11.3

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	67	2 2 3	4.5+ 4.5+					
AU					18.7	60	39	69
02 SS	89	4 6 6	4.5 4.5+					
03 SS	100	3 4 5	4.5					
04 SS	100	4 10 15	3.0 4.5					
01 ST				6.22	12.7	31	15	
06 SS	100	6 11 20						
07 SS	89	6 14 37						
01 RC	100 (20)							
02 RC	100 (23)							
03 RC	100 (63)							
04 RC	83 (70)							

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40

LITHOLOGIC DESCRIPTION

TOPSOIL - organics.

SANDY FAT CLAY (CH) - brown, damp, very stiff. (USCS: CH)

SANDY LEAN CLAY (CL) - brown, damp, very stiff. (USCS: CL)

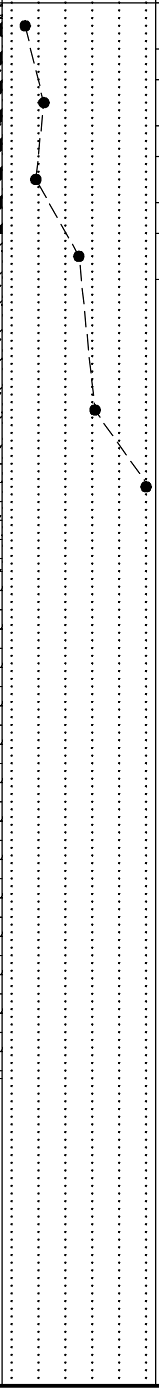
- hard

WEATHERED ROCK - sandy/silty, gray, moist, hard.

DOLOMITE - light gray, moderate rock continuity, medium to moderate rock hardness, fresh to slight weathering, vertical fractures, vuggy texture.

BORING TERMINATED AT THE END OF ROCK CORING.

GRAPHIC LOG



COMMENTS

Coordinates are NAD83 Datum. Bulk sample taken from auger cuttings 1-4 ft bgs.
pH = 7.5
Sat. ER** = 2,200
Moist ER** = 1,300

Water after drilling at 11.3 ft. Level measured from piezometer 13 days after piezometer installed.

** ER = Electrical Resistivity measured in Ohm-cm

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SOIL BORING LOG

BORING NO. T-38

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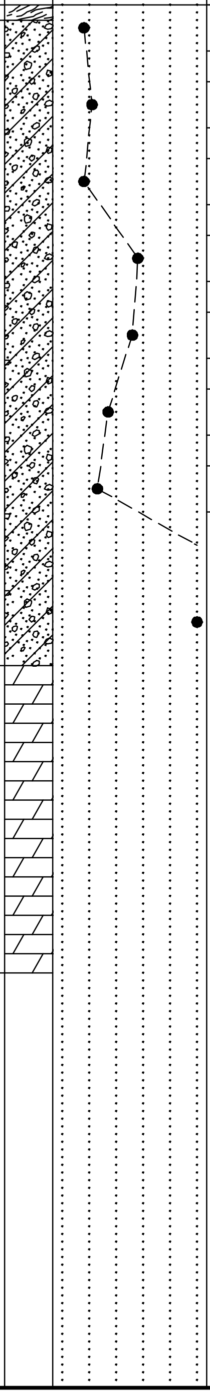
Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio	Boring Location: Lat: 40.999352 Long: -84.486567	Surface Elev. (ft): ---	Total Depth (ft bgs): 31.5	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/10/21	Date Completed: 9/13/21	Water Depth (ft bgs) 11.3



SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	72	3 4 4		**TOPSOIL** - organics. **LEAN CLAY w/ SAND (CL)** - brown, damp, very stiff.		4.0*						Coordinates are NAD83 Datum.
02 SS	78	6 5 6				4.5+ 4.5+						
03 SS	78	3 4 4	5	- yellowish brown, gravel lens		4.5+						
04 SS	100	6 12 16		- hard		4.5						
05 SS	100	6 10 16	10	- gray, reddish brown iron oxide staining	CL	4.5						
06 SS	100	4 7 10				4.5*						Water after drilling at 11.3 ft. Level measured from piezometer 10 days after piezometer installed.
07 SS	89	3 6 7	15	- very stiff		4.0 4.5		18.7	36	18		
08 SS	100	50/2	20	- trace light gray rock fragments								
01 RC	100 (100)		25	**DOLOMITE** - light gray, slight to sound rock continuity, moderate rock hardness, fresh to slight weathering, horizontal fractures.								
02 RC	100 (100)		30									
			35	**BORING TERMINATED AT THE END OF ROCK CORING.**								
			40									

Checked By: T. Lopez	Date: 10/28/21	Approved By: B. Kravitz	Date: 10/28/21	Firm: Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

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SOIL BORING LOG

BORING NO. T-40

Page 1 of 1

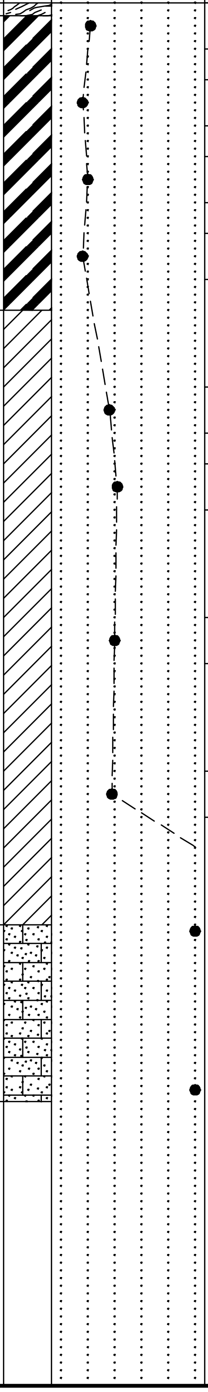
Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Grover Hill Wind Project Paulding County, Ohio	Lat: 41.04118 Long: -84.50984	---	35.8	3.25

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Envirocore, Inc.	Hollow Stem Auger Auto-Hammer SPT	Logger - C. Acker Driller - A. Mitchell	8/31/21	8/31/21	16.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	83	4 5 6		**TOPSOIL** - 5", organics. **FAT CLAY (CH)** - brown, damp, very stiff.		3.25 3.5						Coordinates are NAD83 Datum.
02 SS	39	4 3 5		- gray mottling		2.25 2.25						
03 SS	78	3 4 6	5		CH	3.25 3.25						
04 SS	83	3 3 5				4.5 4.5						
01 ST			10	**LEAN CLAY (CL)** - dark grayish brown, damp, hard.			4.30	19.4	41	23		
06 SS	83	4 7 11				4.5+ 4.5+						
07 SS	89	5 8 13	15			4.5+ 4.5+						Water after drilling at 16.7 ft. Level measured from piezometer 24 days after piezometer installed.
08 SS	89	5 8 12	20	- few sand	CL	4.5+ 4.5+						
09 SS	94	4 8 11	25			4.5+ 4.5+						
10 SS	100	50/5	30	**WEATHERED ROCK** - sandy/silty, gray, damp, hard.								
11 SS	67	21 50/3	35									
				BORING TERMINATED DUE TO AUGER REFUSAL.								
			40									

GRAPHIC LOG

N VALUE (BLOWS)



Checked By:	Date:	Approved By:	Date:	Firm:
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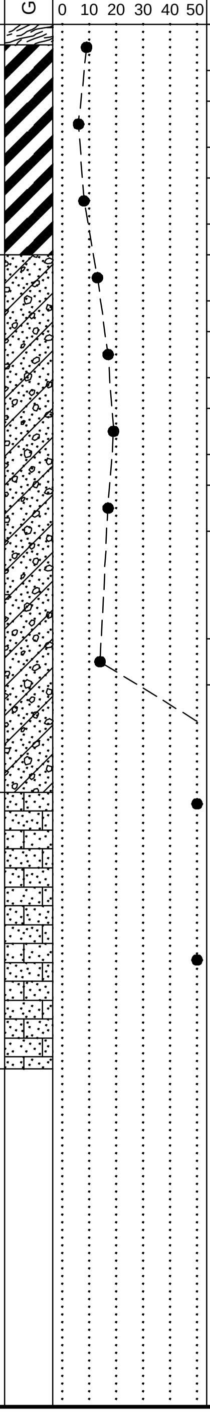
SOIL BORING LOG

BORING NO. T-41

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 41.030223 Long: -84.490782	Surface Elev. (ft): ---	Total Depth (ft bgs): 34.0	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - C. Acker Driller - A. Mitchell	Date Started: 8/31/21	Date Completed: 8/31/21	Water Depth (ft bgs) 18.5



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
01 SS	89	3 4 5		**TOPSOIL** - 8", organics.		2.25 2.5					
AU				**FAT CLAY (CH)** - brown, damp, very stiff.	CH			22.0	60	39	88
02 SS	61	3 3 3		- gray mottling		2.0 3.5					
03 SS	100	3 4 4	5	- few to little sand		3.0 3.75					
04 SS	83	3 6 7		**LEAN CLAY w/ SAND (CL)** - brown, damp, very stiff.	CL	4.5+ 4.5+		16.1			75
05 SS	94	2 6 11	10			3.5 4.5+					
06 SS	78	4 8 11		- gray, hard		4.5+ 4.5+					
07 SS	94	4 7 10	15			4.5+ 4.5+					
08 SS	67	4 6 8	20			4.5+ 4.5+					
09 SS	78	30 50/3	25	**WEATHERED ROCK** - sandy/clayey, gray, rock fragments, wet, hard.							
10 SS	0	30 50/5	30								
			35	**BORING TERMINATED DUE TO AUGER REFUSAL.**							
			40								

COMMENTS

Coordinates are NAD83 Datum.
Bulk sample taken from auger cuttings 1-4 ft bgs.
pH = 7.8
Sat. ER** = 5,500
Moist ER** = 1,500

Water after drilling at 18.5 ft. Level measured from piezometer 25 days after piezometer installed.

Water during drilling at 25 ft.

** ER = Electrical Resistivity measured in Ohm-cm

Checked By:	Date:	Approved By:	Date:	Firm:
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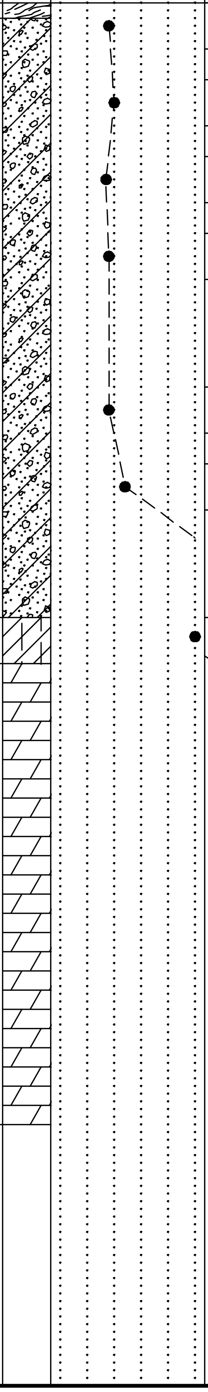
SOIL BORING LOG

BORING NO. T-43

Page 1 of 1

Facility/Project Name: Grover Hill Wind Project Paulding County, Ohio		Boring Location: Lat: 40.9992 Long: -84.481601	Surface Elev. (ft): ---	Total Depth (ft bgs): 36.5	Borehole Dia. (in): 3.25
Drilling Firm: Envirocore, Inc.	Drilling Method: Hollow Stem Auger Auto-Hammer SPT	Personnel: Logger - T. Lopez Driller - A. Mitchell	Date Started: 9/10/21	Date Completed: 9/10/21	Water Depth (ft bgs) 6.2



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS)	POCKET PEN (TSF) (* = brittle failure)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
01 SS	83	4 7 11		**TOPSOIL** - organics. **LEAN CLAY w/ SAND (CL)** - brown, damp, hard. - gray mottling				4.5+ 4.5+						Coordinates are NAD83 Datum.
02 SS	100	6 11 9						4.5+ 4.5+						
03 SS	100	4 7 10	5					4.5+ 4.5+						
04 SS	100	4 7 11						4.5+ 4.5+						Water after drilling at 6.2 ft. Level measured from piezometer 13 days after piezometer installed.
01 ST			10		CL									
06 SS	100	4 8 10						4.5+ 4.5+						
07 SS	100	4 8 16	15					4.5 4.5						
08 SS	120	4 9 50/3	20	**SILTY CLAY (CL-ML)** - dark grayish brown, wet, stiff.	CL-ML			1.0 1.5		21.2	19	7	90	
01 RC	95 (57)		25	**DOLOMITE** - light gray, slight rock continuity, moderate rock hardness, fresh to slight weathering, horizontal fractures, vuggy texture.										Water during drilling at 21 ft.
02 RC	100 (100)		30											
03 RC	100 (43)		35											
			40	**BORING TERMINATED AT THE END OF ROCK CORING.**										

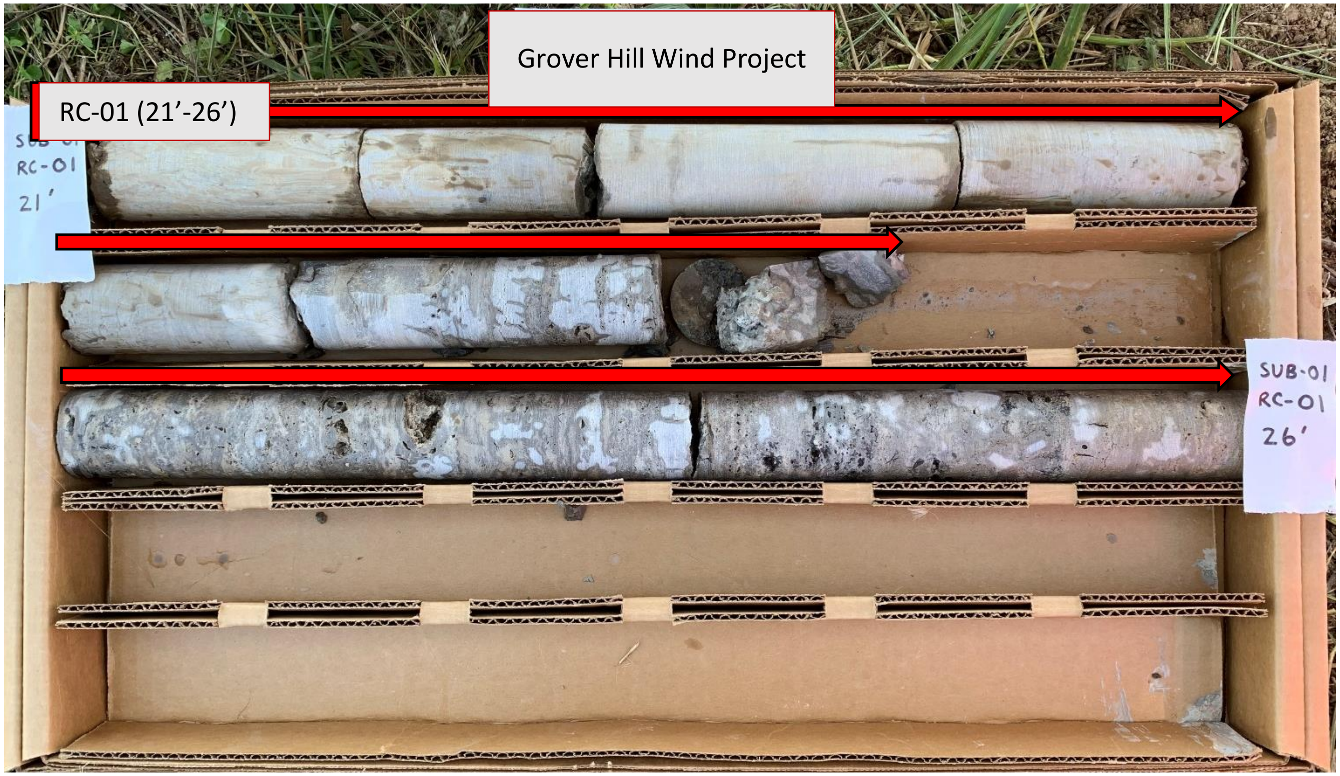
WW_BORING LOG_PP GROVER HILL WIND PROJECT_BORING LOGS.GPJ RMT_CORP.GDT 0015695.00 10/29/21

Checked By:	Date:	Approved By:	Date:	Firm:
T. Lopez	10/28/21	B. Kravitz	10/28/21	Westwood Professional Services (952) 937-5150 12701 Whitewater Drive, Suite 300 Minnetonka, MN 55343

ROCK CORE PHOTO

BORING NO. SUB-01

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.018748° Long: -84.488357°	**Surface Elev. (ft):** 727	**Total Depth (ft bgs):** 26.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: C. Acker Driller: A. Mitchell	**Date Started:** 9/2/2021	**Date Completed:** 9/2/2021	**Water Depth (ft bgs):** DNE



Westwood

ROCK CORE PHOTO

BORING NO. T-14

Project Name:
Grover Hill Wind Project
Paulding County, Ohio

Boring Location:
Lat: 41.036778°
Long: -84.500319°

Surface Elev. (ft):
721

Total Depth (ft bgs):
37.0

Borehole Dia. (in):
3.25

Drilling Firm:
Envirocore, Inc.

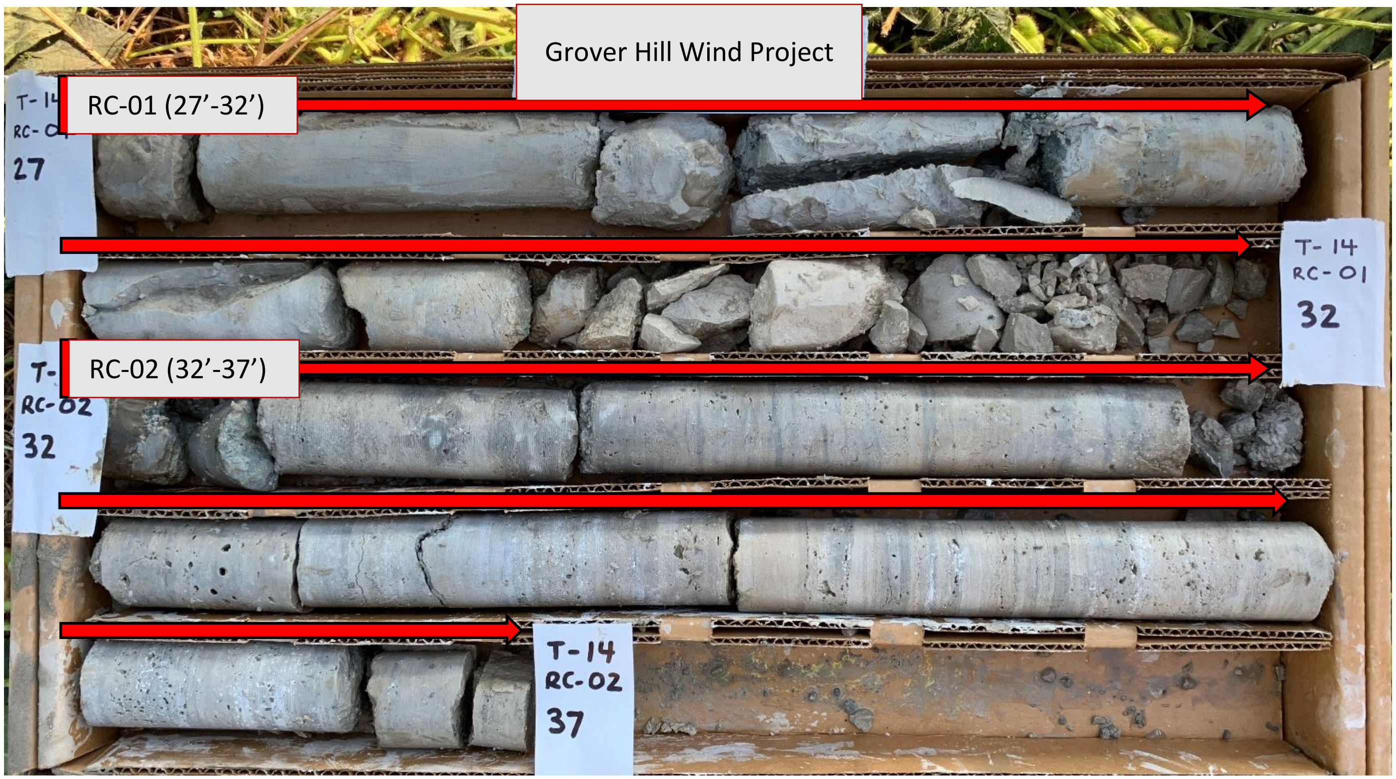
Drilling Method:
RC - Rock Core

Personnel:
Logger: C. Acker
Driller: A. Mitchell

Date Started:
9/1/2021

Date Completed:
9/1/2021

Water Depth (ft bgs):
8.7



Westwood

ROCK CORE PHOTO

BORING NO. T-16

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.036112° Long: -84.482544°	**Surface Elev. (ft):** 724	**Total Depth (ft bgs):** 32.5	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: C. Acker Driller: A. Mitchell	**Date Started:** 9/1/2021	**Date Completed:** 9/1/2021	**Water Depth (ft bgs):** 7.8

Westwood

ROCK CORE PHOTO

BORING NO. T-17

Project Name:
Grover Hill Wind Project
Paulding County, Ohio

Boring Location:
Lat: 41.029079°
Long: -84.507776°

Surface Elev. (ft): 727

Total Depth (ft bgs): 32.6

Borehole Dia. (in): 3.25

Drilling Firm: Envirocore, Inc.

Drilling Method: RC - Rock Core

Personnel:
Logger: C. Acker
Driller: A. Mitchell

Date Started: 8/31/2021

Date Completed: 8/31/2021

Water Depth (ft bgs): 6.3

Westwood

ROCK CORE PHOTO

BORING NO. T-25

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.026373° Long: -84.483374°	**Surface Elev. (ft):** 725	**Total Depth (ft bgs):** 31.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: C. Acker Driller: A. Mitchell	**Date Started:** 9/2/2021	**Date Completed:** 9/2/2021	**Water Depth (ft bgs):** 10.5

Westwood

ROCK CORE PHOTO

BORING NO. T-26

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.030845° Long: -84.482194°	**Surface Elev. (ft):** 725	**Total Depth (ft bgs):** 34.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: C. Acker Driller: A. Mitchell	**Date Started:** 9/1/2021	**Date Completed:** 9/1/2021	**Water Depth (ft bgs):** 10.4

Westwood

ROCK CORE PHOTO

BORING NO. T-27

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.014775° Long: -84.509602°	**Surface Elev. (ft):** 730	**Total Depth (ft bgs):** 35.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/8/2021	**Date Completed:** 9/8/2021	**Water Depth (ft bgs):** 12.7

Westwood

ROCK CORE PHOTO

BORING NO. T-28

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.014880° Long: -84.501761°	**Surface Elev. (ft):** 729	**Total Depth (ft bgs):** 35.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/7/2021	**Date Completed:** 9/7/2021	**Water Depth (ft bgs):** 9.8

Westwood

ROCK CORE PHOTO

BORING NO. T-28

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.014880° Long: -84.501761°	**Surface Elev. (ft):** 729	**Total Depth (ft bgs):** 35.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/7/2021	**Date Completed:** 9/7/2021	**Water Depth (ft bgs):** 9.8

Westwood

ROCK CORE PHOTO

BORING NO. T-29

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.009893° Long: -84.508457°	**Surface Elev. (ft):** 730	**Total Depth (ft bgs):** 35.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/9/2021	**Date Completed:** 9/9/2021	**Water Depth (ft bgs):** 10.4

Westwood

ROCK CORE PHOTO

BORING NO. T-30

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.009667° Long: -84.501794°	**Surface Elev. (ft):** 728	**Total Depth (ft bgs):** 36.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/7/2021	**Date Completed:** 9/8/2021	**Water Depth (ft bgs):**

Westwood

ROCK CORE PHOTO

BORING NO. T-30

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.009667° Long: -84.501794°	**Surface Elev. (ft):** 728	**Total Depth (ft bgs):** 36.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/7/2021	**Date Completed:** 9/8/2021	**Water Depth (ft bgs):**

Westwood

ROCK CORE PHOTO

BORING NO. T-31

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.009645° Long: -84.489572°	**Surface Elev. (ft):** 730	**Total Depth (ft bgs):** 42.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/8/2021	**Date Completed:** 9/8/2021	**Water Depth (ft bgs):** 11.0

Westwood

ROCK CORE PHOTO

BORING NO. T-32

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.010532° Long: -84.481711°	**Surface Elev. (ft):** 727	**Total Depth (ft bgs):** 30.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/13/2021	**Date Completed:** 9/13/2021	**Water Depth (ft bgs):** 13.5

Westwood

ROCK CORE PHOTO

BORING NO. T-33

Project Name: Grover Hill Wind Project Paulding County, Ohio	**Boring Location:** Lat: 41.015127° Long: -84.468594°	**Surface Elev. (ft):** 725	**Total Depth (ft bgs):** 32.0	**Borehole Dia. (in):** 3.25

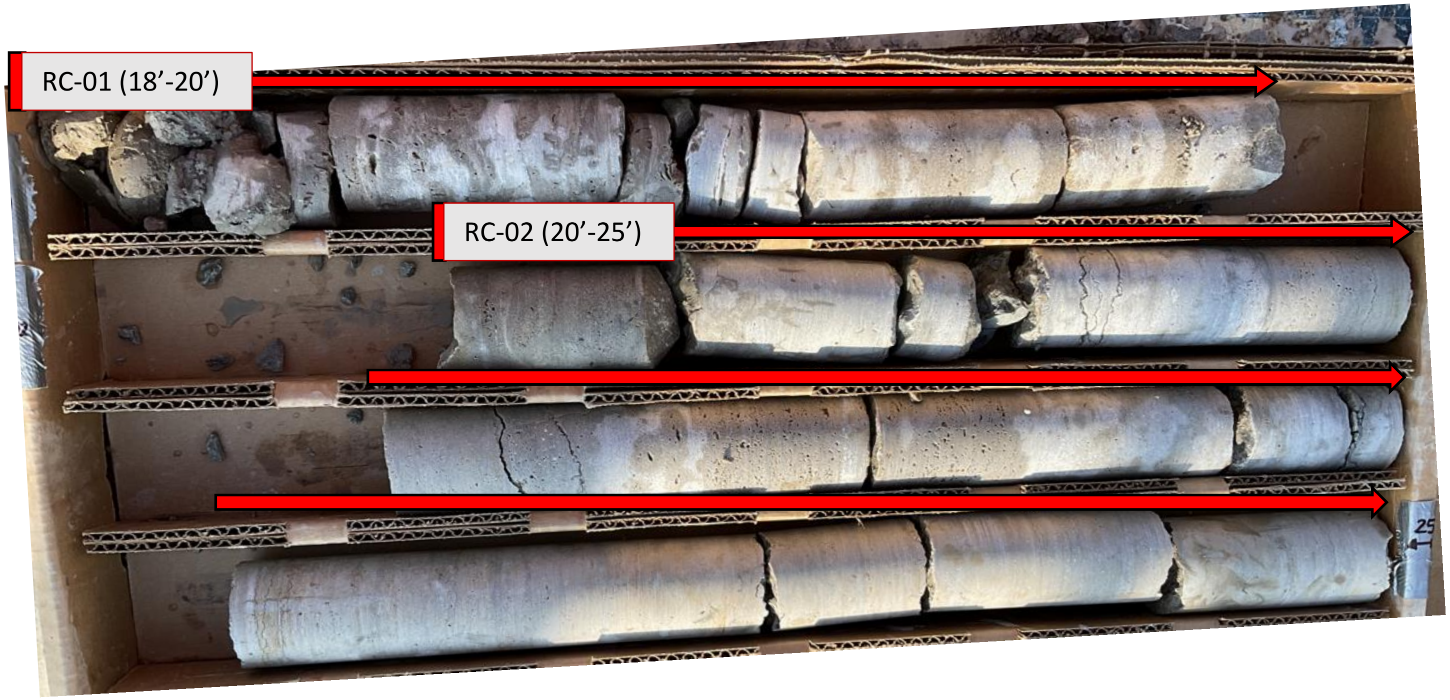
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/13/2021	**Date Completed:** 9/13/2021	**Water Depth (ft bgs):** 7.6

Westwood

ROCK CORE PHOTO

BORING NO. T-34

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.012353° Long: -84.469027°	**Surface Elev. (ft):** 725	**Total Depth (ft bgs):** 30.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/14/2021	**Date Completed:** 9/14/2021	**Water Depth (ft bgs):** 6.3



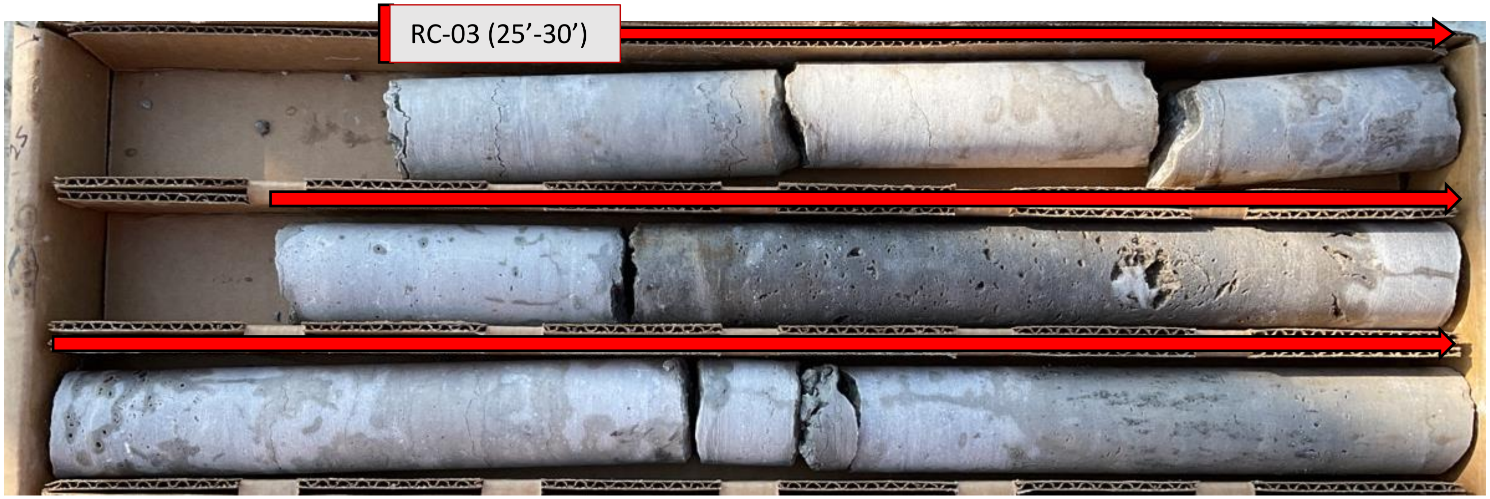
Westwood

ROCK CORE PHOTO

BORING NO. T-34

Project Name: Grover Hill Wind Project Paulding County, Ohio	**Boring Location:** Lat: 41.012353° Long: -84.469027°	**Surface Elev. (ft):** 725	**Total Depth (ft bgs):** 30.0	**Borehole Dia. (in):** 3.25

Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/14/2021	**Date Completed:** 9/14/2021	**Water Depth (ft bgs):** 6.3



Westwood

ROCK CORE PHOTO

BORING NO. T-35

Project Name:
Grover Hill Wind Project
Paulding County, Ohio

Boring Location:
Lat: 41.009103°
Long: -84.470016°

Surface Elev. (ft):
727

Total Depth (ft bgs):
30.0

Borehole Dia. (in):
3.25

Drilling Firm:
Envirocore, Inc.

Drilling Method:
RC - Rock Core

Personnel:
Logger: T. Lopez
Driller: A. Mitchell

Date Started:
9/14/2021

Date Completed:
9/14/2021

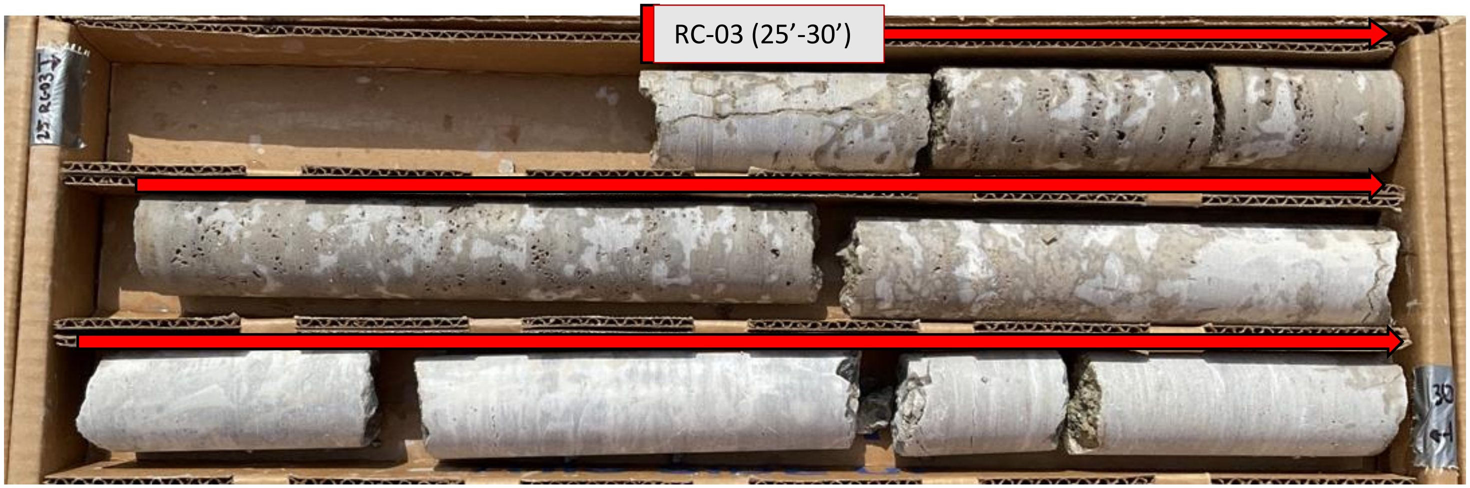
Water Depth (ft bgs):
11.1

Westwood

ROCK CORE PHOTO

BORING NO. T-35

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.009103° Long: -84.470016°	**Surface Elev. (ft):** 727	**Total Depth (ft bgs):** 30.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/14/2021	**Date Completed:** 9/14/2021	**Water Depth (ft bgs):** 11.1



Westwood

ROCK CORE PHOTO

BORING NO. T-36

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 41.008450° Long: -84.464226°	**Surface Elev. (ft):** 727	**Total Depth (ft bgs):** 30.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/14/2021	**Date Completed:** 9/14/2021	**Water Depth (ft bgs):** 9.5

Westwood

ROCK CORE PHOTO

BORING NO. T-37

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 40.993843° Long: -84.507839°	**Surface Elev. (ft):** 732	**Total Depth (ft bgs):** 35.0	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/9/2021	**Date Completed:** 9/10/2021	**Water Depth (ft bgs):** 11.3

Westwood

ROCK CORE PHOTO

BORING NO. T-38

Project Name:
Grover Hill Wind Project
Paulding County, Ohio

Boring Location:
Lat: 40.999352°
Long: -84.486567°

Surface Elev. (ft):
728

Total Depth (ft bgs):
31.5

Borehole Dia. (in):
3.25

Drilling Firm:
Envirocore, Inc.

Drilling Method:
RC - Rock Core

Personnel:
Logger: T. Lopez
Driller: A. Mitchell

Date Started:
9/10/2021

Date Completed:
9/13/2021

Water Depth (ft bgs):
11.3

Westwood

ROCK CORE PHOTO

BORING NO. T-43

Project Name:
Grover Hill Wind Project
Paulding County, Ohio

Boring Location:
Lat: 40.999200°
Long: -84.481601°

Surface Elev. (ft):
730

Total Depth (ft bgs):
36.5

Borehole Dia. (in):
3.25

Drilling Firm:
Envirocore, Inc.

Drilling Method:
RC - Rock Core

Personnel:
Logger: T. Lopez
Driller: A. Mitchell

Date Started:
9/10/2021

Date Completed:
9/10/2021

Water Depth (ft bgs):
6.2

ROCK CORE PHOTO

BORING NO. T-43

Project Name: Grover Hill Wind Project Paulding County, Ohio		**Boring Location:** Lat: 40.999200° Long: -84.481601°	**Surface Elev. (ft):** 730	**Total Depth (ft bgs):** 36.5	**Borehole Dia. (in):** 3.25
Drilling Firm: Envirocore, Inc.	**Drilling Method:** RC - Rock Core	**Personnel:** Logger: T. Lopez Driller: A. Mitchell	**Date Started:** 9/10/2021	**Date Completed:** 9/10/2021	**Water Depth (ft bgs):** 6.2


RC-03 (31.5’-36.5’)

Appendix B

SPT and RQD Summary Table

Westwood

SPT N-Value and (RQD) Summary
Grover Hill Wind Project - Paulding County, Ohio

	T-11	T-13	T-14	T-15	T-16	T-17	T-25	T-26	T-27	T-28	T-29	T-30	T-31	T-32
Latitude:	41.04423	41.04026	41.03678	41.03671	41.03611	41.02908	41.02637	41.03085	41.01478	41.01488	41.00989	41.00967	41.00965	41.01053
Longitude:	-84.50982	-84.50209	-84.50032	-84.49029	-84.48254	-84.50778	-84.48337	-84.48219	-84.50960	-84.50176	-84.50846	-84.50179	-84.48957	-84.48171
Depth (ft)														
0-1.5	9	17	7	11	8	5	5	5	11	10	10	10	8	6
2.5-4	10	21	5	15	10	10	10	6	15	12	9	12	6	10
5-6.5	12	21	6	7	7	7	8	6	6	6	7	10	10	7
7.5-9	22	28	10	16	10	11	17	17	18	15	11	24	18	16
10-11.5	20	21	22	-	-	19	19	44	-	23	-	23	17	23
12.5-14	-	26	29	23	21	29	-	22	26	25	24	22	27	36
15-16.5	16	16	19	21	22	20	31	17	18	21	18	100	23	22
20-21.5	14	22	15	18	17	42	22	12	26	25	18	(73)	18	(63)
25-26.5	21	100	16	17	100	100	100	37	100	(53)	(45)	(67)	100	(51)
30-31.5	100	100	(13)	100	(77)	(30)	(68)	(75)	(90)	(100)	(88)	(80)	23	
35-36.5			(73)						(88)	(78)		(52)	100	
40-41.5													100	
*Depth To Rock (ft)	30	25	27	30	27	25	25	29	25	22	23	16	26	19
**Depth To Groundwater (ft)	5.8	18.7	8.7	8.1	7.8	6.3	10.5	10.4	12.7	9.8	10.4	-	11.0	13.5

	T-33	T-34	T-35	T-36	T-37	T-38	T-40	T-41	T-43	MET-01	MET-02	SUB-01	SUB-02	SUB-03
Latitude:	41.01513	41.01235	41.00910	41.00845	40.99384	40.99935	41.04098	41.03022	40.99920	40.99134	41.06158	41.01875	41.01867	41.01849
Longitude:	-84.46859	-84.46903	-84.47002	-84.46423	-84.50784	-84.48657	-84.50987	-84.49078	-84.48160	-84.51017	-84.46635	-84.48836	-84.48859	-84.48844
Depth (ft)														
0-1.5	6	5	7	6	5	8	11	9	18	9	7	6	2	8
2.5-4	7	8	8	11	12	11	8	6	20	16	14	7	2	8
5-6.5	3	8	5	6	9	8	10	8	17	11	10	7	8	
7.5-9	17	19	31	15	25	28	8	13	18	34	12	16	15	11
10-11.5	23	45	35	20	-	26	-	17	-	37	14	19	18	16
12.5-14	24	50	37	15	31	17	18	19	18	29	11	29	33	27
15-16.5	24	39	29	18	51	13	21	17	24	25	9	22	25	22
20-21.5	26	(58)	(21)	28	(20)	100	20	14	100	100	40	100	100	100
25-26.5	(68)	(67)	(83)	100	(23)	(100)	19	100	(57)		100	(97)		
30-31.5	(75)	(83)	(95)	(78)	(63)	(100)	100	100	(100)					
35-36.5					(70)		100		(43)					
40-41.5														
*Depth To Rock (ft)	22	18	18	25	18	21	30	25	19	18	23	21	21	21
**Depth To Groundwater (ft)	7.6	6.3	11.1	9.5	11.3	11.3	16.7	18.5	6.2	DNE	DNE	DNE	DNE	DNE

*Depth to rock is an estimate and gradual transitions between soil and rock make it challenging to define a top of rock surface. Excavations may still encounter challenges above this depth.

** Depth to groundwater from piezometer measurements between 2 and 4 weeks after installation

Legend

Fat Clay	Lean Clay	Granular	Weathered Rock	Bedrock

(##) = Rock Quality Designation (RQD)
REF = SPT Refusal
*Depth to rock considered very dense weathered rock or continuous SPT refusal

Appendix C

Laboratory Testing Report

Westwood

Laboratory Soil Test Data Summary

Grover Hill Wind Project - Paulding County, OH

BORING ID	SAMPLE ID	SAMPLE DEPTH (ft)	USCS CLASSIFICATION(2)(3)(4)	GRAIN-SIZE DISTRIBUTION(1)(4)				NATURAL MOISTURE CONTENT (%)	ATTERBERG LIMITS		pH	SULFATE IONS (mg/kg)	CHLORIDE IONS (mg/kg)	MOIST UNIT WEIGHT (pcf)	DRY DENSITY (pcf)	UNCONFINED COMPRESSION STRENGTH (tsf)	SOIL BOX ELECTRICAL RESISTIVITY (Ω-cm)		STANDARD PROCTOR		THERMAL RESISTIVITY (90% Compaction)	
				% Gravel	% Sand	% Silt	% Clay		LL	PI							As-Received	Saturated	MAX DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	As-Received (°C-cm/W)	Dry (°C-cm/W)
MET-02	SS-07	15-16.5	Lean Clay (CL)					18.8	36	20												
OM-01	ST-01	5-7	Fat Clay w/ Sand (CH)					22.4	50	30				127.3	104.0	1.7						
OM-01	SS-06	12.5-14	**Lean Clay w/ Sand (CL)**	2	23	75		12.3	30	16												
SUB-03	BULK	1-4	**Fat Clay (CH)**	3	11	39.0	47.0	24.2	63	38	7.6	84.1	13.7				3,300	2,000	97.2	23.5	104	261
SUB-03	ST-01	2-4	Fat Clay (CH)					23.4													72	166
SUB-03	ST-02	5-7	Fat Clay (CH)					22.2	54	32				131.4	107.5	2.46						
T-11	SS-03	5-6.5	Fat Clay (CH)					17.9	54	29												
T-11	ST-01	12.5-14	Lean Clay (CL)					15.5	27	12				131.3	113.7	3.12						
T-13	SS-08	20-21.5	**Lean Clay w/ Sand (CL)**	2	20	78		19.6	30	14												
T-14	BULK	1-4	**Fat Clay (CH)**	0	8	51.9	40.1	21.7	54	35	7.7	145	13.2				3,100	1,100	104.9	19.5	80	188
T-14	ST-01	2-4	Fat Clay (CH)					23.0													76	180
T-14	SS-06	12.5-14	Lean Clay w/ Sand (CL)	4	21	75		11.4														
T-14	SS-08	20-21.5	**Lean Clay (CL)**	0	3	97		17.2	43	22												
T-15	SS-02	2.5-4	Fat Clay (CH)					20.0														
T-15	ST-01	10-12	Lean Clay (CL)					18.2	29	14				135.3	114.5	4.17						
T-16	ST-01	10-12	Lean Clay (CL)					14.0	31	16				137.6	120.7	4.67						
T-16	SS-09	25-26.5	**Sandy Silty Clay (CL-ML)**	5	30	65		7.3	16	5												
T-17	SS-06	12.5-14	Lean Clay (CL)					9.3	32	17												
T-25	BULK	1-4	**Fat Clay (CH)**	0	7	37.2	55.8	23.8	68	44	7.6	397	18.0				2,100	900	98.1	12.7	101	228
T-25	ST-01	2-4	Fat Clay (CH)					23.2													74	153
T-25	ST-02	12.5-14.5	Lean Clay (CL)					13.1	29	15				140.7	124.4	8.12						
T-25	SS-08	20-21.5	Sandy Silty Clay (CL-ML)					11.0														
T-27	BULK	1-4	**Fat Clay (CH)**	1	13	43.2	42.8	17.9	50	32	7.7	88.2	10.0				2,600	2,100	102.1	21.0	106	237
T-27	ST-02	10-12	Sandy Lean Clay (CL)					12.2	28	13				140.6	125.3	9.78						
T-28	SS-08	20-21.5	Lean Clay (CL)					12.4	30	15												
T-29	ST-01	10-12	Sandy Lean Clay (CL)					12.2	31	15				131.8	117.5	6.26						
T-31	BULK	1-4	**Fat Clay w/ Sand (CH)**	0	18	45.3	36.7	18.1	53	36	7.4	1590	10.6				2,700	1,000	108.8	18.6	83	190
T-31	SS-10	31-32.5	Poorly Graded Sand w/ Clay (SP-SC)	11	83	6		10.8														
T-32	SS-03	5-6.5	Lean Clay (CL)					24.6	49	28												
T-33	BULK	1-4	**Fat Clay (CH)**	0	12	42.4	45.6	21.6	57	38	7.5	46.2	< 9.2				1,300	900	103.2	20.8	81	169
T-33	ST-01	2-4	Fat Clay (CH)					20.9														
T-33	SS-07	15-16.5	Lean Clay (CL)					14.1														
T-34	SS-05	10-11.5	Clayey Sand (SC)	5	71	24		9.2														
T-37	BULK	1-4	**Sandy Fat Clay (CH)**	1	30	69		18.7	60	39	7.5	47.3	17.6				2,200	1,300	101.1	21.1		
T-37	ST-01	10-12	Sandy Lean Clay (CL)					12.7	31	15				135.2	120.0	6.22						
T-38	SS-07	15-16.5	Lean Clay w/ Sand (CL)					18.7	36	18												
T-40	ST-01	10-12	Lean Clay (CL)					19.4	41	23				131.6	110.2	4.30						
T-41	BULK	1-4	**Fat Clay (CH)**	0	12	88		22.0	60	39	7.8	79.3	< 9.2				5,500	1,500	102.0	20.5		
T-41	SS-04	7.5-9	Lean Clay w/ Sand (CL)	5	20	75		16.1														
T-43	SS-08	20-21.5	**Silty Clay (CL-ML)**	0	10	90		21.2	19	7												

Footnotes:

(1) % Gravel = part. greater than 4.75 mm (#4 sieve); % Sand = part. between 0.075 mm (#200 sieve) and 4.75 mm (#4 sieve); % Silt = part. between 0.002 mm and 0.075 mm (#200 sieve); % Clay = part. smaller than 0.002 mm.

(2) Some samples were combined to achieve sufficient volume and were taken from same soil stratum.

(3) Visual classification, informed where possible by laboratory testing

(4) Represents soil fraction captured in split spoon, does not include cobbles/large gravel that may have been in profile.

Created by: C. Acker
Checked by: B. Kravitz

Westwood

1 Systems Drive
Appleton, WI 54914

main (920) 735-6900

LABORATORY TESTS OF SOILS

ASTM: D2216, D4318, D6913

Project: Grover Hill Wind Energy - Grover Hill, OH
Report To: Starwood Energy Group
Date: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

			Moisture	Atterberg Limits			Percent Passing	
Boring	**Depth**	**Sample**	**Content**	**LL**	**PL**	**PI**	**#4**	**#200**
T-11	5-6.5	SS-03	17.9%	53.7	24.6	29.1		
T-13	20-21.5	SS-08	19.6%	30.2	16.0	14.2	98	78
T-14	12.5-14	SS-06	11.4%				96	75
T-14	20-21.5	SS-08	17.2%	43.3	21.3	22.0	100	97
T-15	2.5-4	SS-02	20.0%					
T-16	25-26.5	SS-09	7.3%	16.3	10.9	5.4	95	65
T-17	12.5-14	SS-06	9.3%	31.6	14.6	17.0		
T-25	20-21.5	SS-08	11.0%					
T-28	20-21.5	SS-08	12.4%	29.9	14.8	15.1		
T-31	31-32.5	SS-10	10.8%				89	6
T-32	5-6.5	SS-03	24.6%	49.2	21.0	28.1		
T-33	15-16.5	SS-07	14.1%					
T-34	10-11.5	SS-05	9.2%				95	24
T-38	15-16.5	SS-07	18.7%	36.2	17.8	18.4		
T-41	7.5-9	SS-04	16.1%				95	75
T-43	20-21.5	SS-08	21.2%	19.4	12.7	6.7	100	90
MET-02	15-16.5	SS-07	18.8%	36.0	16.4	19.6		
OM-01	12.5-14	SS-06	12.3%	30.3	14.2	16.1	98	75
T-11	12.5-14	ST-01	15.5%	26.8	14.9	11.9		
T-14	2-4	ST-01	23.0%					
T-15	10-12	ST-01	18.2%	29.4	15.6	13.8		
T-16	10-12	ST-01	14.0%	31.3	15.7	15.5		
T-25	2-4	ST-01	23.2%					
T-25	12.5-14.5	ST-02	13.1%	29.3	14.7	14.5		
T-33	2-4	ST-01	20.9%					
T-40	10-12	ST-01	19.4%	41.0	18.6	22.5		
SUB-03	2-4	ST-01	23.4%					
SUB-03	5-7	ST-02	22.2%	54.2	22.1	32.1		

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LABORATORY TESTS OF SOILS

ASTM: G187, D4972, D2974 Method C

Project: Grover Hill Wind Energy - Grover Hill, OH

Report To: Starwood Energy Group

Date: 9/29/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

			Electrical Resistivity								
			As-Received				Saturated				
Boring	Depth	Sample	Moist%	Temp. °C	Resistance (Ohms)	Resistivity (Ohms-cm)*	Moist%	Temp. °C	Resistance (Ohms)	Resistivity (Ohms-cm)*	pH
T-14	1-4'	BULK	21.9	22.6	4,700	3,100	32.2	22.8	1,700	1,100	7.7
T-25	1-4'	BULK	22.8	23.7	3,100	2,100	36.1	22.6	1,400	900	7.6
T-27	1-4'	BULK	20.5	23.1	3,900	2,600	37.7	23.5	3,100	2,100	7.7
T-31	1-4'	BULK	18.1	23.1	4,000	2,700	45.3	22.8	1,500	1,000	7.4
T-33	1-4'	BULK	21.6	22.2	2,000	1,300	40.9	23.2	1,400	900	7.5
T-37	1-4'	BULK	18.3	22.5	3,300	2,200	40.4	23.6	1,900	1,300	7.5
T-41	1-4'	BULK	15.2	22.6	8,300	5,500	35.7	23.2	2,200	1,500	7.8
SUB-03	1-4'	BULK	24.1	22.1	5,000	3,300	40.5	23.0	3,000	2,000	7.6

* Soil box factor = 0.67

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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Report To: Starwood Energy Group
Date: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021
Tests Performed: Grain Size Analysis, Atterberg Limits

Boring No.	Sub-03	T-14
Sample No.	Bulk	Bulk
Depth	1-4'	1-4'
USCS Classification:	LEAN CLAY, dark grayish brown (CL)	FAT CLAY, dark grayish brown (CH)
USDA/ NRCS Classification:	Clay	Silty Clay

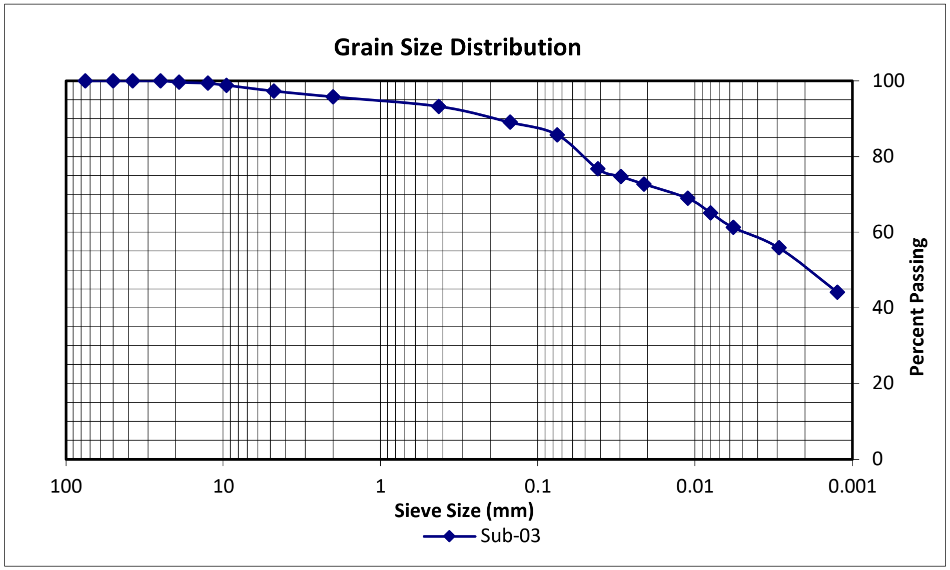
TEST RESULTS;

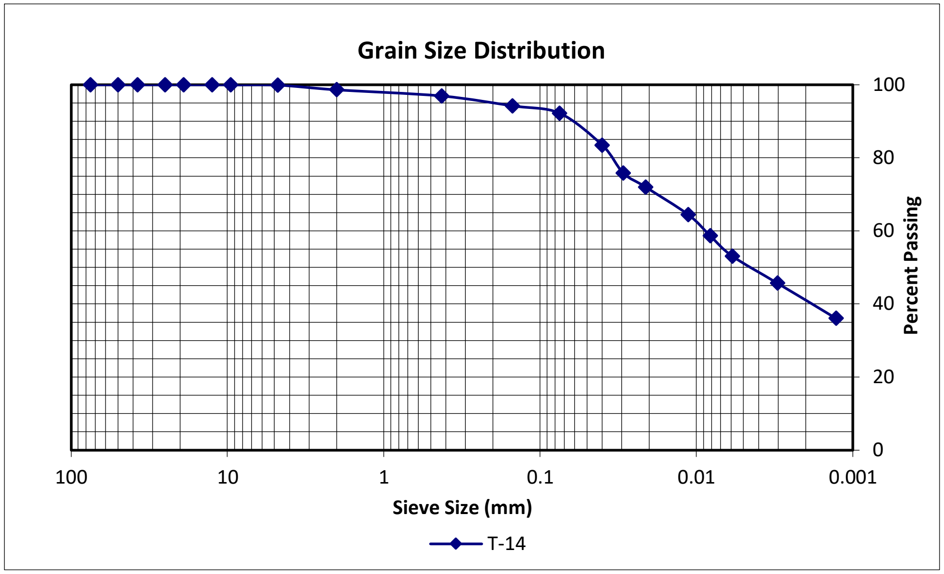
Grain Size Analysis (ASTM:D6913 & D7928)

SIEVE SIZE	% PASSING	
1-1/2" (37.5 mm)	100	100
3/4" (19 mm)	100	100
3/8" (9.5 mm)	99	100
#4 (.475 mm)	97	100
#10 (2.0 mm)	96	99
#40 (.425 mm)	93	97
#100 (.15 mm)	89	94
#200 (.075 mm)	86	92
.050 mm	79.0	86.0
.020 mm	72.3	71.2
.005 mm	59.9	50.8
.002 mm	47.0	40.1

Atterberg Limits (ASTM: D4318)

Liquid Limit, LL (%)	63.2	53.6
Plastic Limit, PL (%)	25.1	18.9
Platicity Index (%)	38.1	34.7





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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Report To: Starwood Energy Group
Date: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021
Tests Performed: Grain Size Analysis, Atterberg Limits

Boring No.	T-25	T-27
Sample No.	Bulk	Bulk
Depth	1-4'	1-4'
USCS Classification:	FAT CLAY, brown (CH)	FAT CLAY, dark grayish brown (CH)
USDA/ NRCS Classification:	Clay	Clay

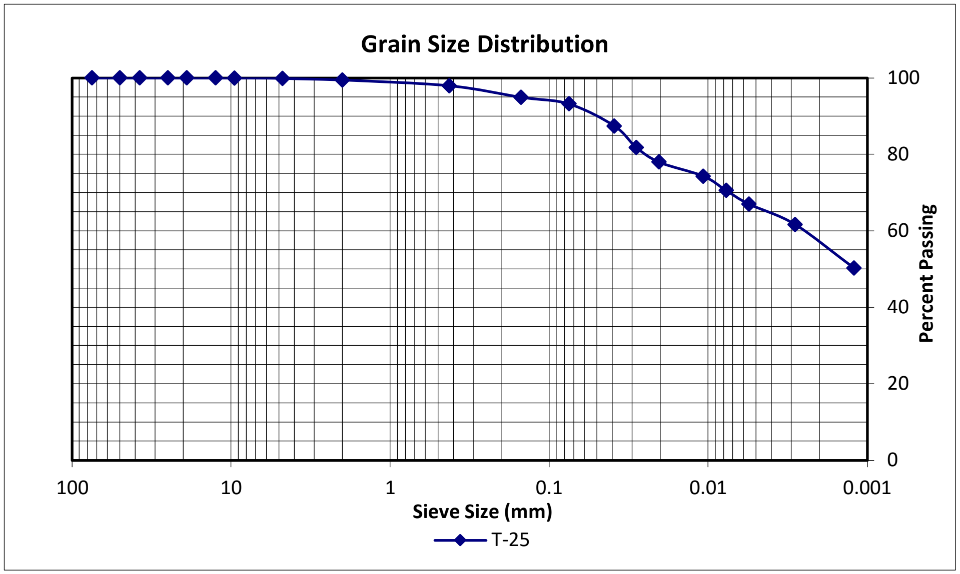
TEST RESULTS;

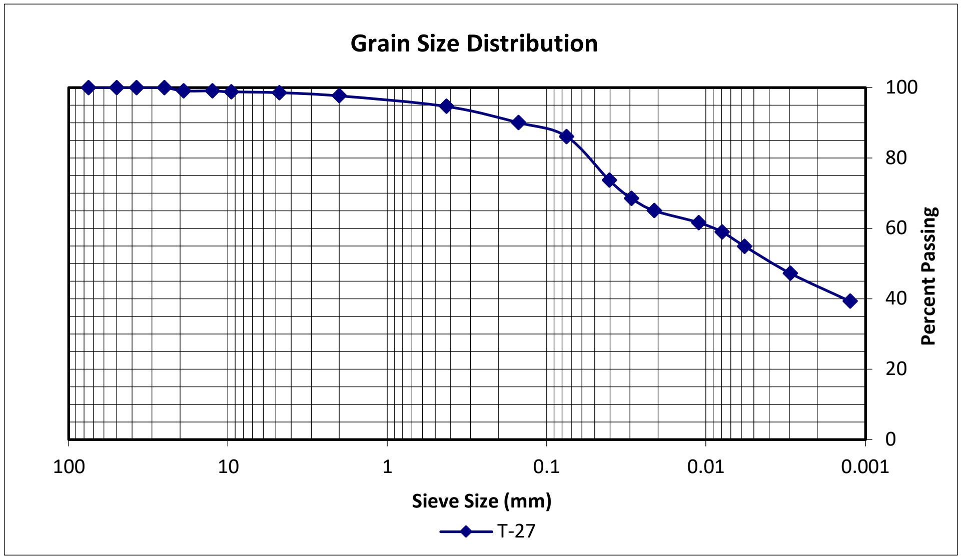
Grain Size Analysis (ASTM:D6913 & D7928)

SIEVE SIZE	% PASSING	
1-1/2" (37.5 mm)	100	100
3/4" (19 mm)	100	99
3/8" (9.5 mm)	100	99
#4 (.475 mm)	100	99
#10 (2.0 mm)	99	98
#40 (.425 mm)	98	95
#100 (.15 mm)	95	90
#200 (.075 mm)	93	86
.050 mm	89.2	77.1
.020 mm	77.9	64.7
.005 mm	65.9	52.9
.002 mm	55.8	42.8

Atterberg Limits (ASTM: D4318)

Liquid Limit, LL (%)	67.9	50.4
Plastic Limit, PL (%)	24.2	18.2
Platicity Index (%)	43.7	32.2





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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH

Report To: Starwood Energy Group

Date: 10/5/2021

Westwood Prj. No.	R0015695.00
Date Delivered:	9/22/2021
Tests Performed:	Grain Size Analysis, Atterberg Limits

Boring No.	T-31	T-33
Sample No.	Bulk	Bulk
Depth	1-4'	1-4'
USCS Classification:	FAT CLAY w/ SAND, brown (CH)	FAT CLAY, very dark grayish brown (CH)
USDA/ NRCS Classification:	Clay Loam	Clay

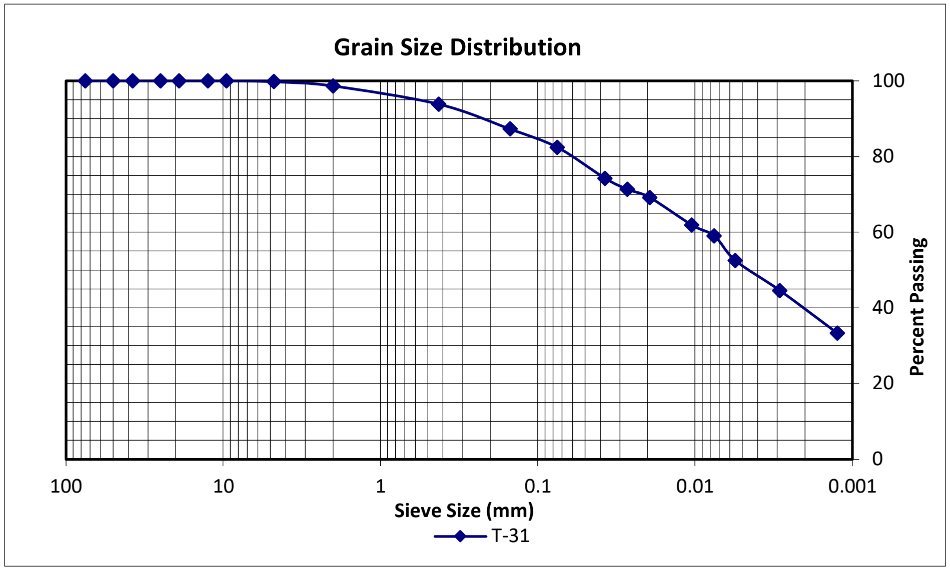
TEST RESULTS;

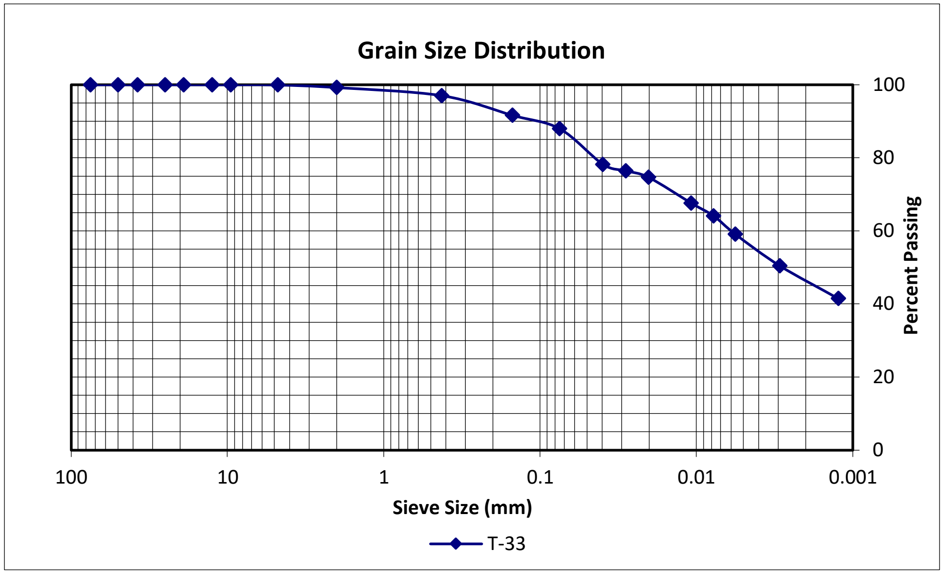
Grain Size Analysis (ASTM:D6913 & D7928)

SIEVE SIZE	% PASSING	
1-1/2" (37.5 mm)	100	100
3/4" (19 mm)	100	100
3/8" (9.5 mm)	100	100
#4 (.475 mm)	100	100
#10 (2.0 mm)	99	99
#40 (.425 mm)	94	97
#100 (.15 mm)	87	92
#200 (.075 mm)	82	88
.050 mm	77.0	81.1
.020 mm	69.7	74.5
.005 mm	50.9	57.1
.002 mm	36.7	45.6

Atterberg Limits (ASTM: D4318)

Liquid Limit, LL (%)	53.2	56.8
Plastic Limit, PL (%)	17.6	18.9
Platicity Index (%)	35.5	37.9





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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Report To: Starwood Energy Group
Date: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021
Tests Performed: Grain Size Analysis and Atterberg Limits

Boring No.	T-41	T-37
Sample No.	Bulk	Bulk
Depth	1-4'	1-4'
USCS Classification:	FAT CLAY, brown (CH)	SANDY FAT CLAY, very dark grayish brown (CH)

TEST RESULTS;

Grain Size Analysis (ASTM:D1140 & D6913)

SIEVE SIZE	% PASSING	
1-1/2" (37.5 mm)	100	100
3/4" (19 mm)	100	100
3/8" (9.5 mm)	100	100
#4 (.475 mm)	100	99
#10 (2.0 mm)	99	98
#40 (.425 mm)	96	93
#100 (.15 mm)	91	79
#200 (.075 mm)	88	69

Atterberg Limits (ASTM: D4318)

Liquid Limit, LL (%)	60.3	56.6
Plastic Limit, PL (%)	21.3	19.6
Platicity Index (%)	39.0	37.0

MOISTURE-DENSITY CURVE

Project:	Grover Hill Wind Energy - Grover Hill, OH	**Westwood Prj. No.:**	R0015695.00
Report To:	Starwood Energy Group	**Date:**	9/27/2021

Boring Number: Sub-03 **Depth:** 1-4'

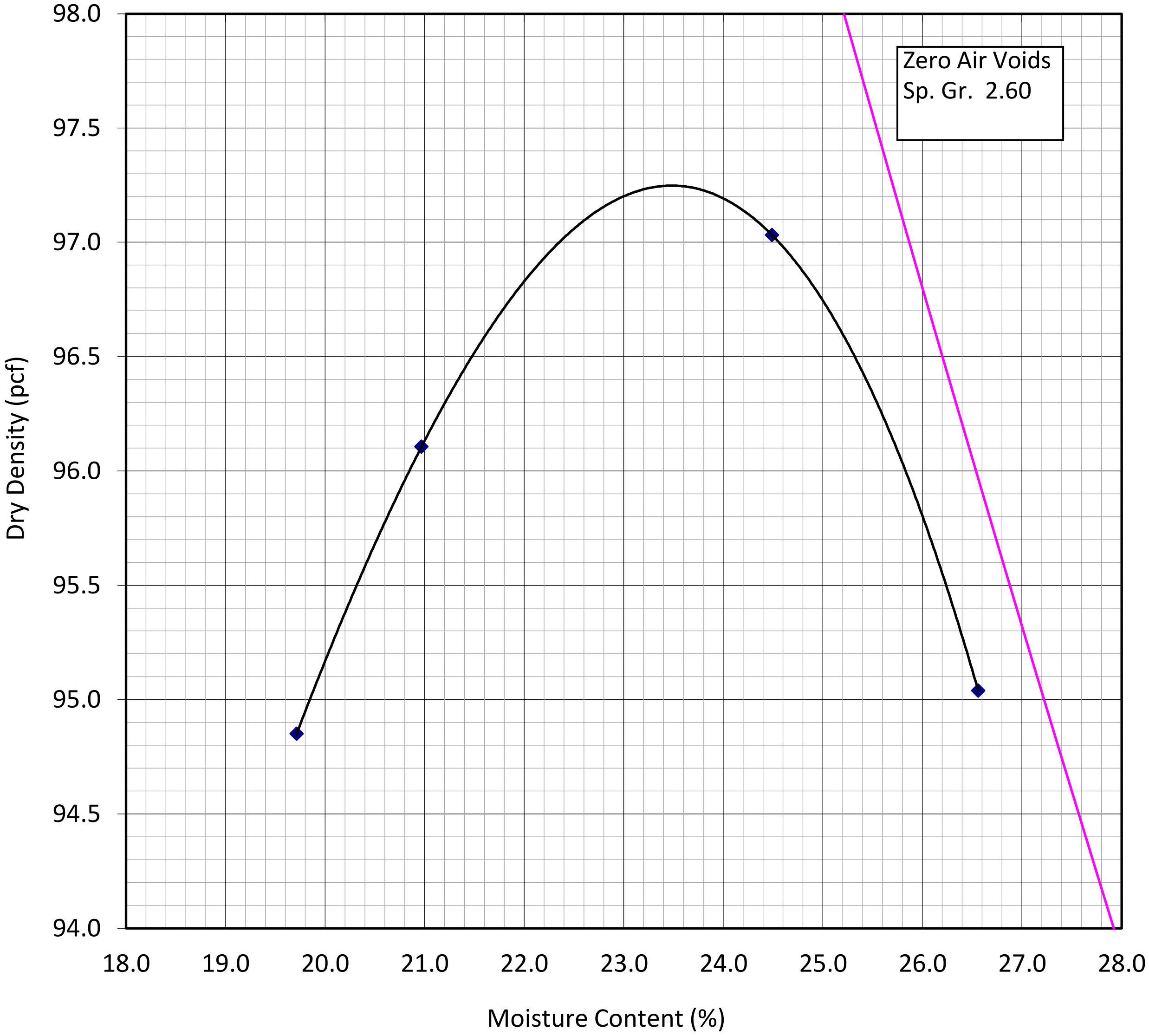
Unified Soils Classification (ASTM:D2487): LEAN CLAY, dark grayish brown (CL)

Tests Method: Standard ASTM:D698, Method B

Preparation: Wet **Automatic Hammer**

Max. Dry Density (pcf): 97.2 **Optimum Moisture (%):** 23.5

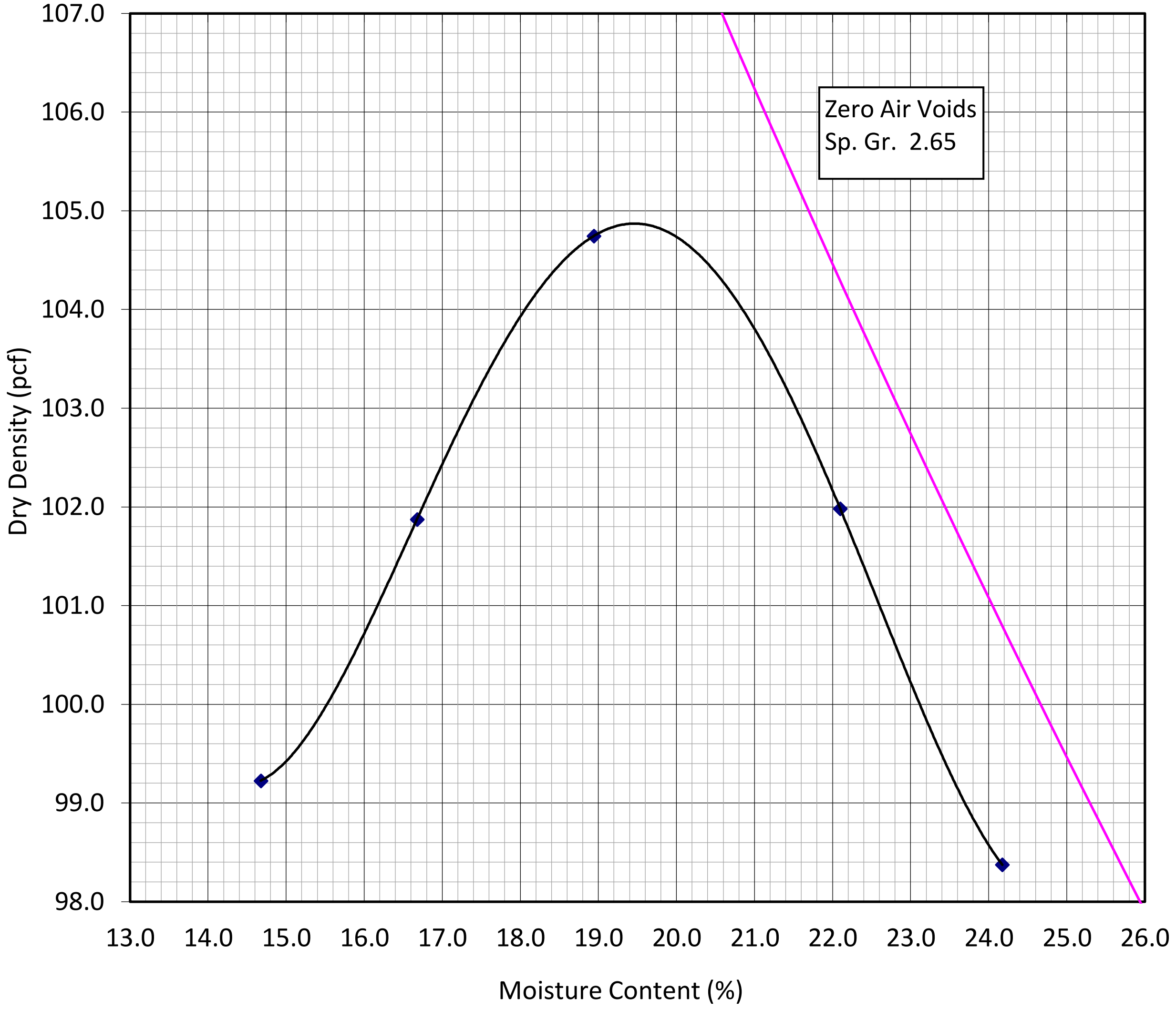
As-received Moisture (%): 24.2



MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH **Westwood Prj. No.:** R0015695.00
Report To: Starwood Energy Group **Date:** 9/27/2021

Boring Number: T-14 **Depth:** 1-4'
Unified Soils Classification (ASTM:D2487): FAT CLAY, dark grayish brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet **Automatic Hammer**
Max. Dry Density (pcf): 104.9 **Optimum Moisture (%):** 19.5
As-received Moisture (%): 21.7

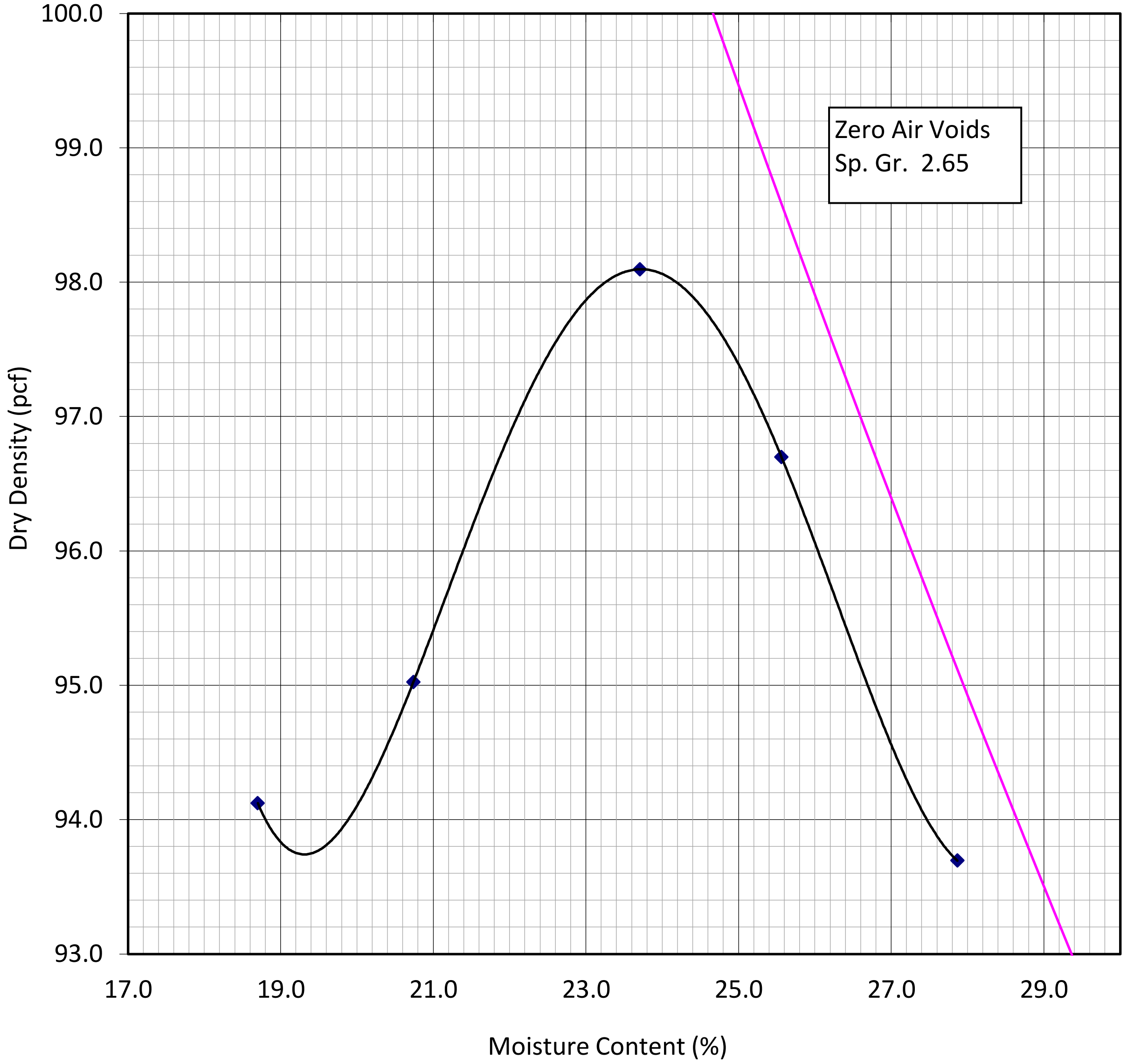


Westwood

MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH
Westwood Prj. No.: R0015695.00
Report To: Starwood Energy Group
Date: 9/27/2021

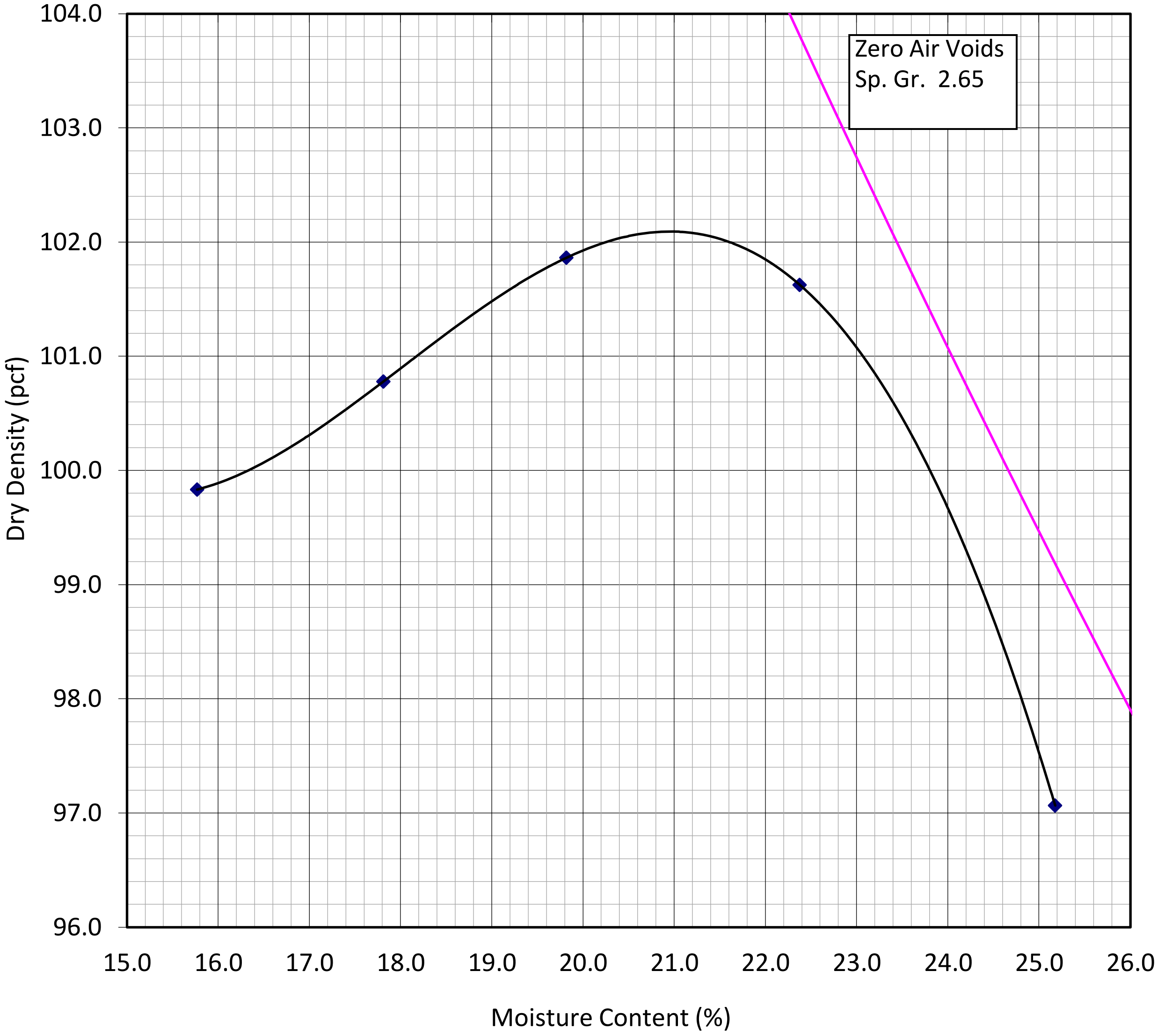
Boring Number: T-25
Depth: 1-4'
Unified Soils Classification (ASTM:D2487): FAT CLAY, brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet
Automatic Hammer
Max. Dry Density (pcf): 98.1
Optimum Moisture (%): 12.7
As-received Moisture (%): 23.8



MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH
Westwood Prj. No.: R0015695.00
Report To: Starwood Energy Group
Date: 10/6/2021

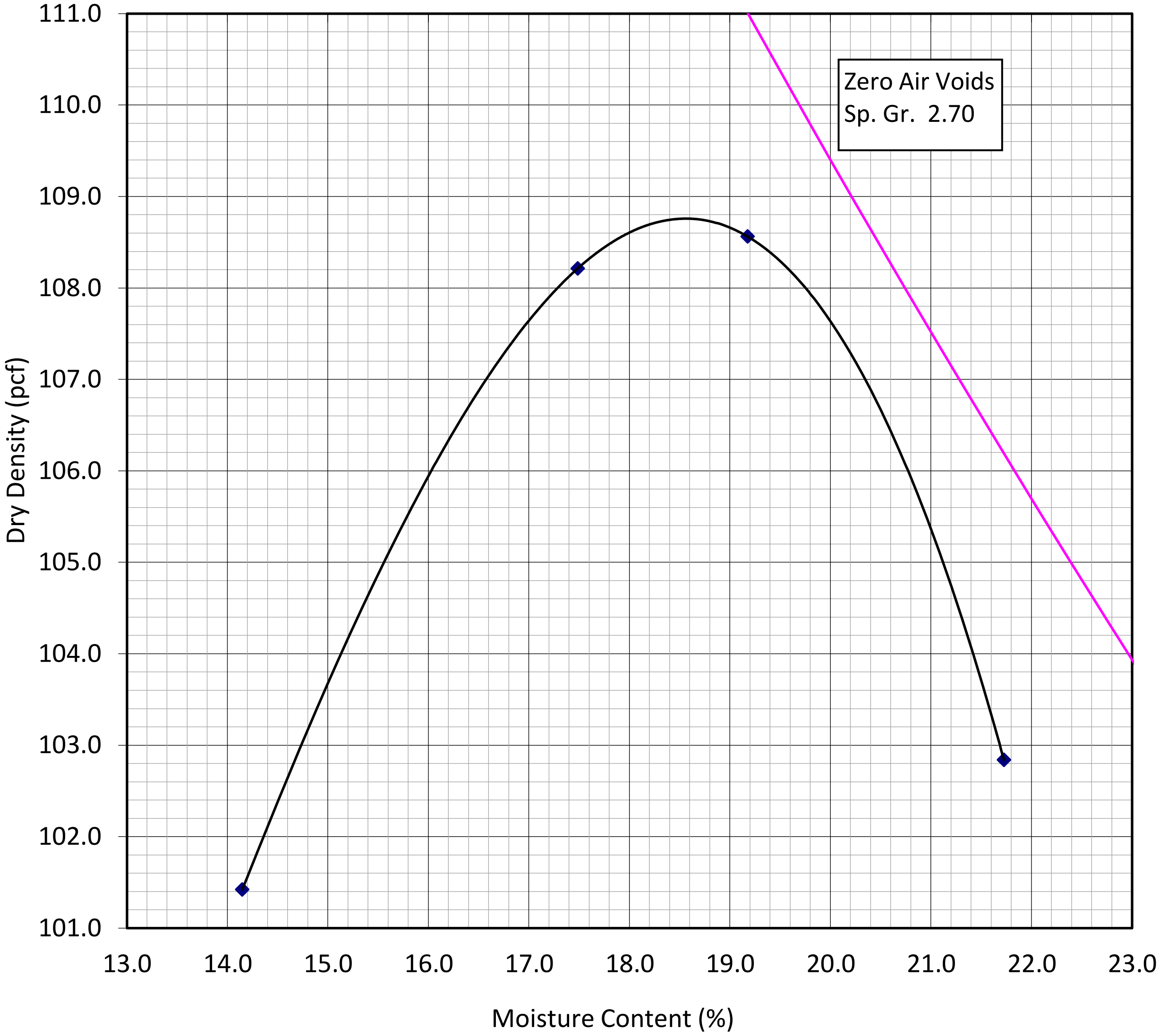
Boring Number: T-27
Depth: 1-4'
Unified Soils Classification (ASTM:D2487): FAT CLAY, dark grayish brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet
Automatic Hammer
Max. Dry Density (pcf): 102.1
Optimum Moisture (%): 21.0
As-received Moisture (%): 17.9



MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH
Westwood Prj. No.: R0015695.00
Report To: Starwood Energy Group
Date: 10/6/2021

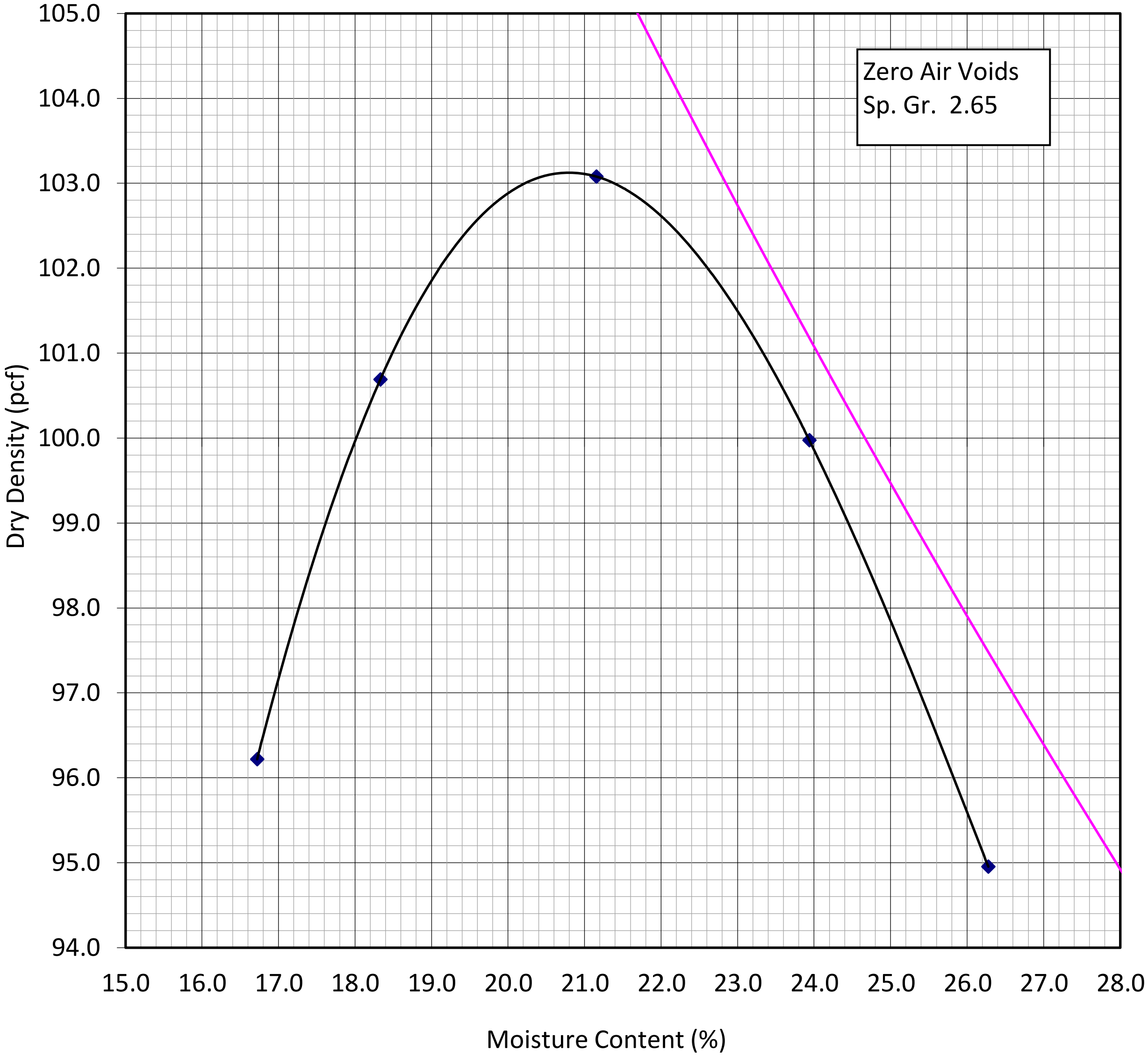
Boring Number: T-31
Depth: 1-4'
Unified Soils Classification (ASTM:D2487): FAT CLAY w/ SAND, brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet
Automatic Hammer
Max. Dry Density (pcf): 108.8
Optimum Moisture (%): 18.6
As-received Moisture (%): 18.1



MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH
Westwood Prj. No.: R0015695.00
Report To: Starwood Energy Group
Date: 10/6/2021

Boring Number: T-33
Depth: 1-4'
Unified Soils Classification (ASTM:D2487): FAT CLAY, very dark grayish brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet
Automatic Hammer
Max. Dry Density (pcf): 103.2
Optimum Moisture (%): 20.8
As-received Moisture (%): 21.6



MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH **Westwood Prj. No.:** R0015695.00

Report To: Starwood Energy Group **Date:** 10/5/2021

Boring Number: T-37 **Depth:** 0

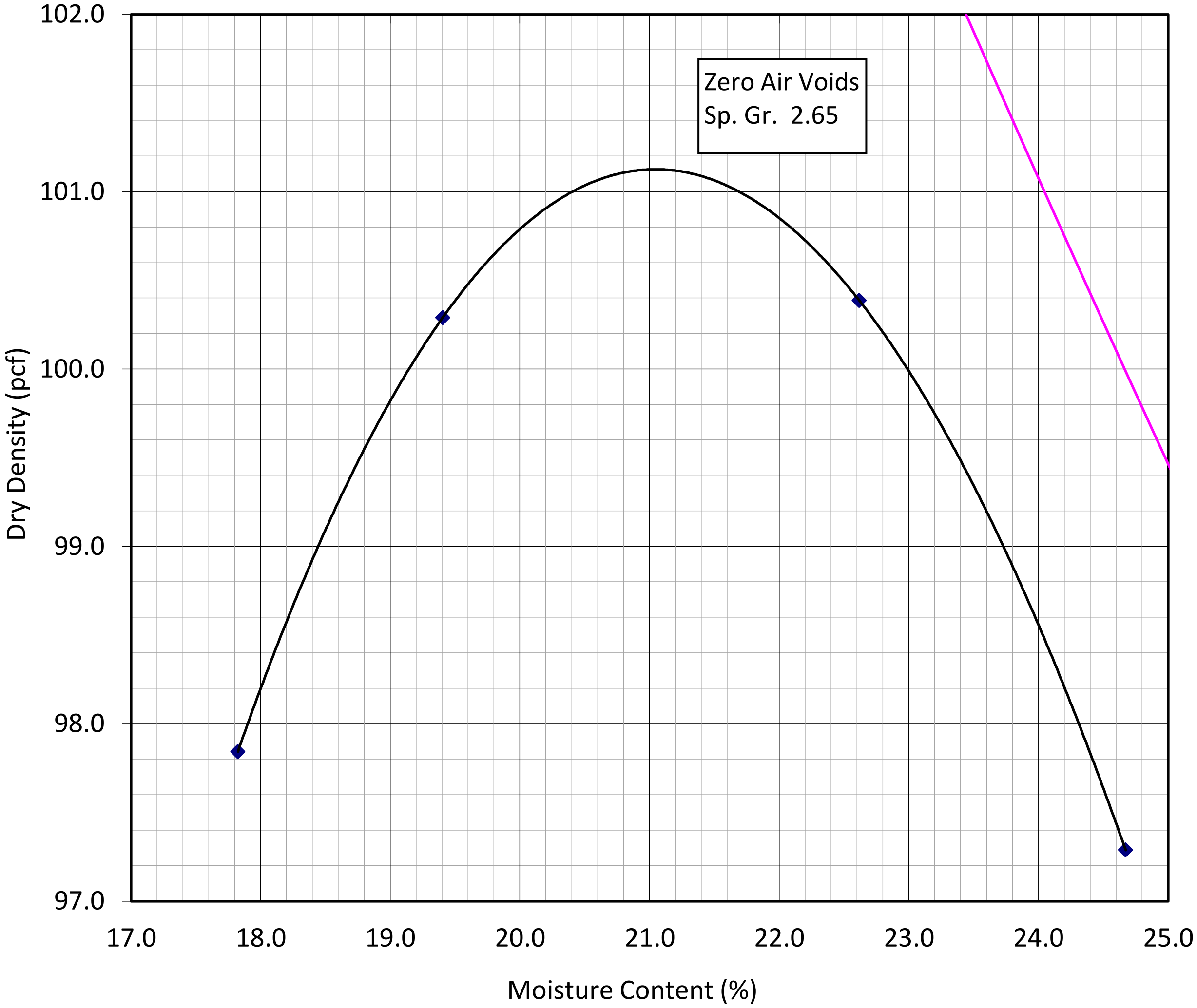
Unified Soils Classification (ASTM:D2487): SANDY FAT CLAY, very dark grayish brown (CH)

Tests Method: Standard ASTM:D698, Method B

Preparation: Wet **Automatic Hammer**

Max. Dry Density (pcf): 101.1 **Optimum Moisture (%):** 21.1

As-received Moisture (%): 18.7

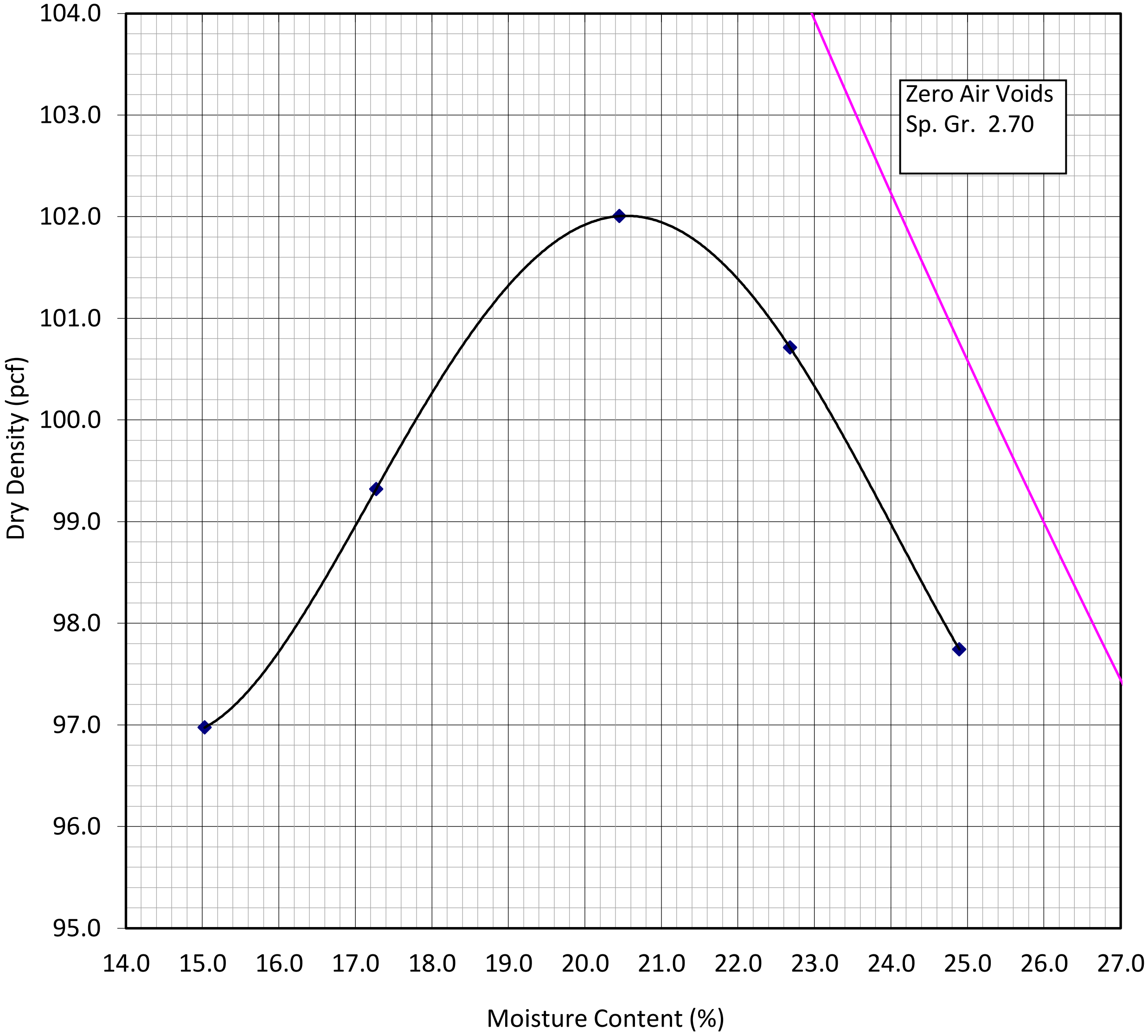


MOISTURE-DENSITY CURVE

Project: Grover Hill Wind Energy - Grover Hill, OH **Westwood Prj. No.:** R0015695.00
Report To: Starwood Energy Group **Date:** 10/5/2021

Boring Number: T-41 **Depth:** 1-4'

Unified Soils Classification (ASTM:D2487): FAT CLAY, brown (CH)
Tests Method: Standard ASTM:D698, Method B
Preparation: Wet **Automatic Hammer**
Max. Dry Density (pcf): 102.0 **Optimum Moisture (%):** 20.5
As-received Moisture (%): 22.0



Westwood

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REPORT OF: THERMAL RESISTIVITY

ASTM; D5334

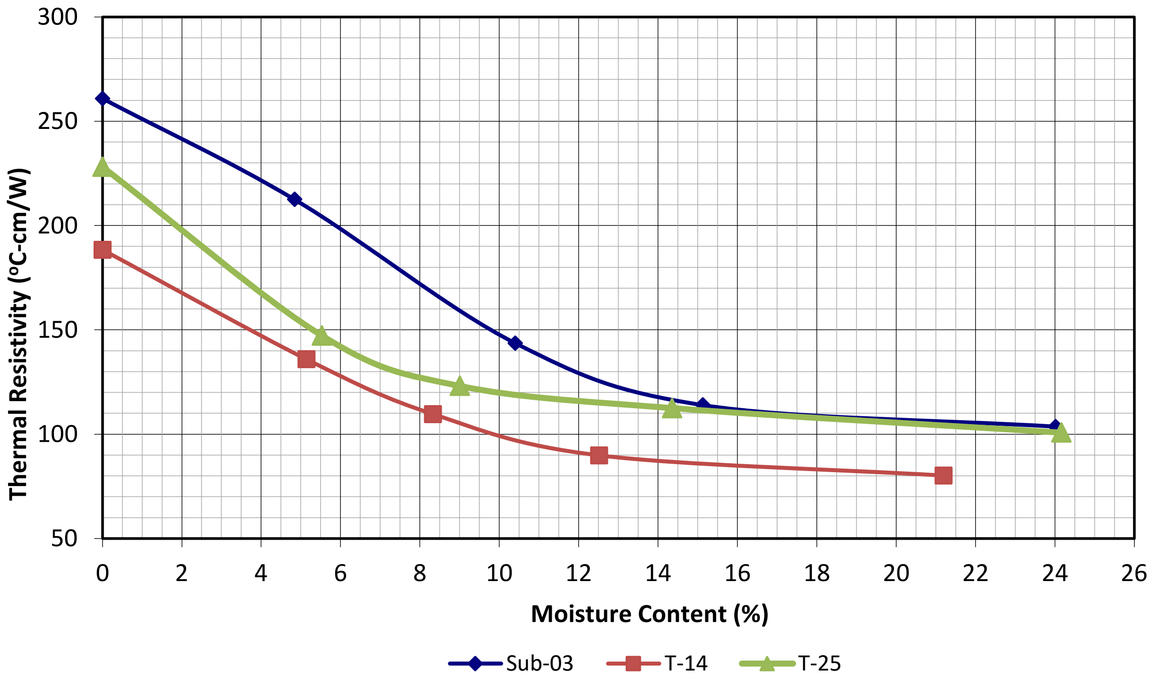
Project: Grover Hill Wind Energy - Grover Hill, OH

Report To: Starwood Energy Group

Westwood Project No. R0015695.00 **Date:** 9/27/2021

					Initial Condition			Thermal Resistivity Results	
Reconstiuted Specimen	Boring	Depth	Soil Type	Proctor Method	Sample Comp. (%)	Dry Density (pcf)	Moisture Content (%)	Moisture (%)	Thermal Resistivity (^{o}C-cm/W)
Sub-03	Sub-03	1-4'	CL	ASTM: D698, B	90	87.3	24.0	0	261
								4.8	213
								10.4	144
								15.1	114
								24.0	104
T-14	T-14	1-4'	CH	ASTM: D698, B	90	93.9	21.2	0	188
								5.1	136
								8.3	110
								12.5	90
								21.2	80
T-25	T-25	1-4'	CH	ASTM: D698, B	90	87.8	24.1	0.0	228
								5.5	147
								9.0	123
								14.4	113
								24.2	101

Thermal Dryout Curve (Moisture Content vs. Resistivity)



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REPORT OF: THERMAL RESISTIVITY

ASTM; D5334

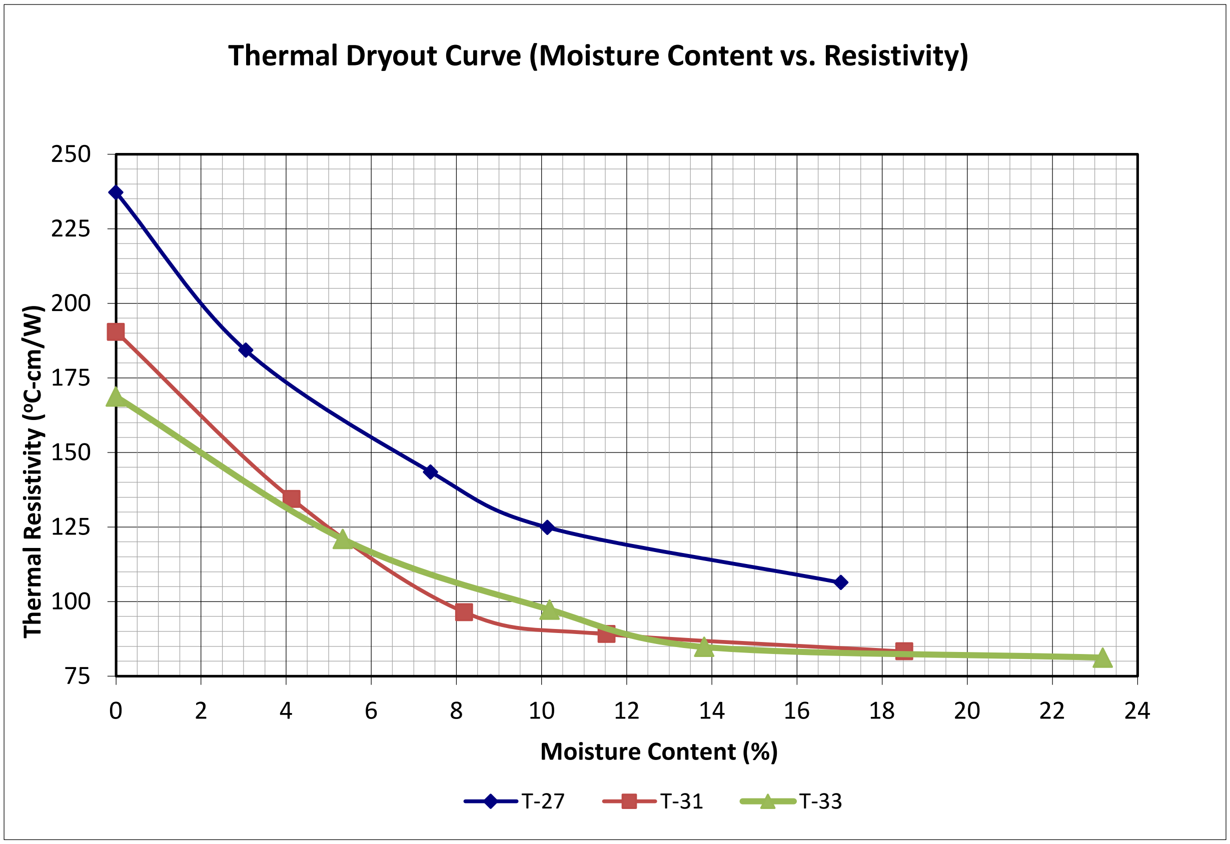
Project: Grover Hill Wind Energy - Grover Hill, OH

Report To: Starwood Energy Group

Westwood Project No. R0015695.00

Date: 10/8/2021

					Initial Condition			Thermal Resistivity Results	
Reconstiuted Specimen	Boring	Depth	Soil Type	Proctor Method	Sample Comp. (%)	Dry Density (pcf)	Moisture Content (%)	Moisture (%)	Thermal Resistivity (°C-cm/W)
T-27	T-27	1-4'	CH	ASTM: D698, B	90	91.9	17.0	0	237
								3.0	184
								7.4	143
								10.1	125
								17.0	106
T-31	T-31	1-4'	CH	ASTM: D698, B	90	97.8	18.5	0	190
								4.1	134
								8.2	96
								11.5	89
								18.5	83
T-33	T-33	1-4'	CH	ASTM: D698, B	89	92.2	23.4	0.0	169
								5.3	121
								10.2	97
								13.8	85
								23.2	81



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REPORT OF: THERMAL RESISTIVITY

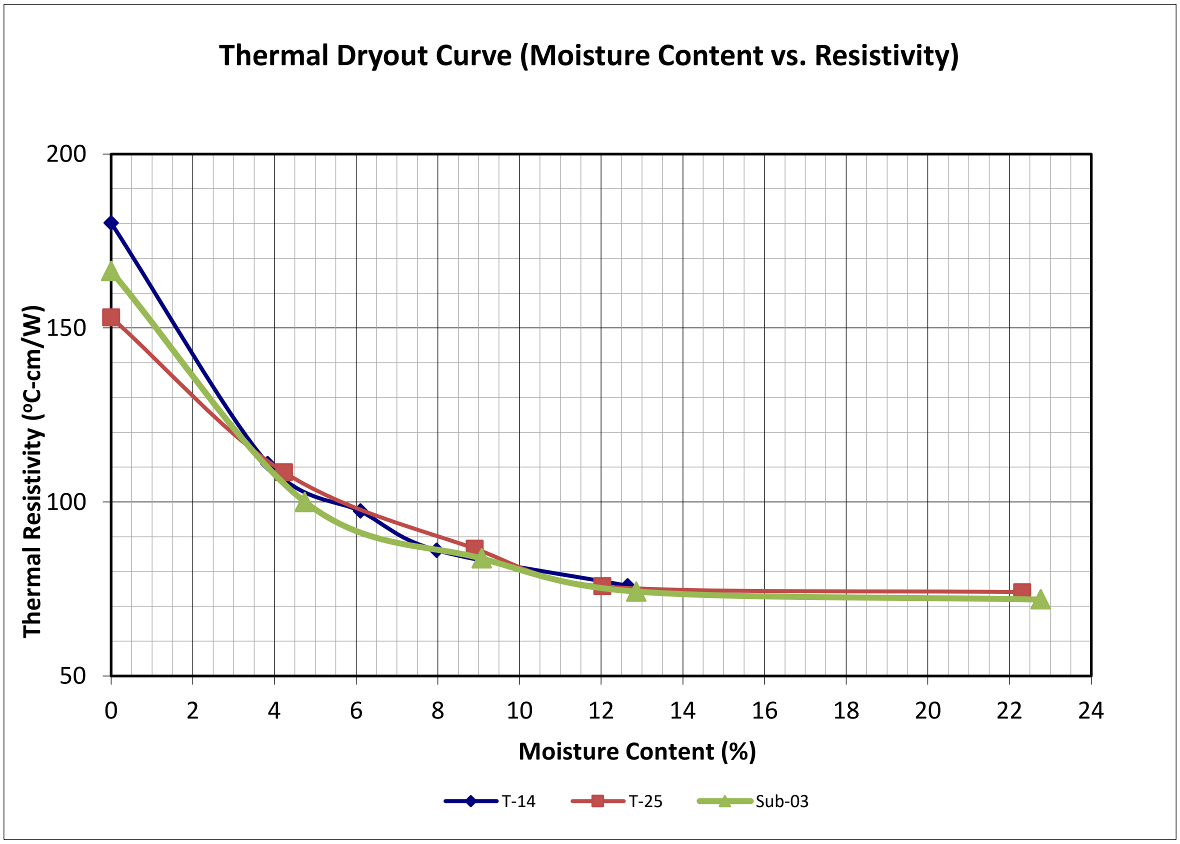
ASTM; D5334

Project: Grover Hill Wind Energy - Grover Hill, OH

Report To: Starwood Energy Group

Westwood Project No. R0015695.00 **Date:** 10/6/2021

				Initial Condition		Thermal Resistivity Results	
Boring	Depth	Sample Type	Soil Type	Dry Density (pcf)	Moisture Content (%)	Moisture (%)	Thermal Resistivity (^{o}C-cm/W)
T-14	2-4'	Undisturbed	CH	102.9	21.1	0	180
						3.8	111
						6.1	97
						8.0	86
						12.6	76
T-25	2-4'	Undisturbed	CH	104.2	22.3	0	153
						4.2	109
						8.9	87
						12.0	76
						22.3	74
Sub-03	2-4'	Undisturbed	CL	103.2	23.5	0.0	166
						4.7	100
						9.1	84
						12.9	74
						22.8	72



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REPORT OF: CALIFORNIA Bearing Ratio (ASTM D1883)

PROJECT: Grover Hill Wind Energy - Grover Hill, OH

CLIENT: Starwood Energy Group

WESTWOOD PROJECT NO. R0015695.00

DATE: 10/5/2021

Boring No.	T-37
Depth:	1-4'
Sample No:	Bulk
Classification:	SANDY FAT CLAY, very dark grayish brown (CH)
Date Received:	9/20/2021

Laboratory Moisture-Density

Proctor Type: Standard (D698) **Method:** B

Max. Dry Density (pcf): 101.1 **Optimum Moisture Content (%):** 21.1

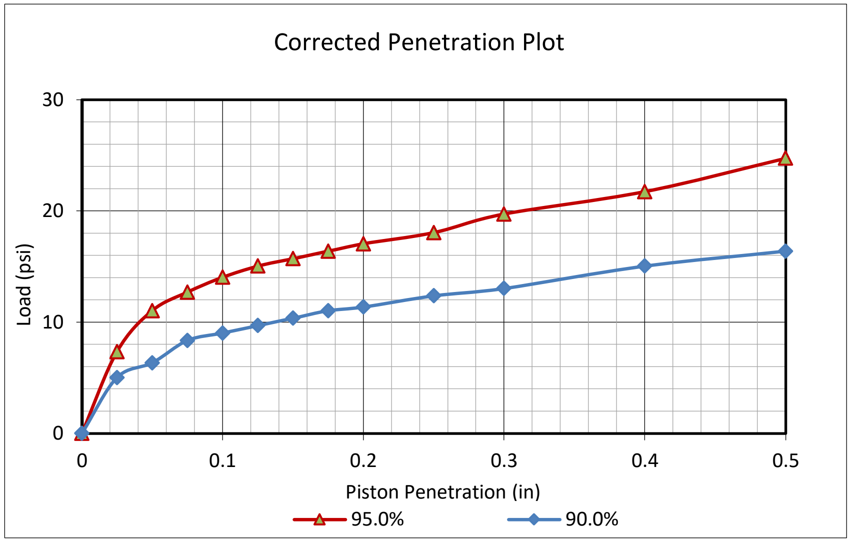
As-Recieved Moisture Content (%): 18.7

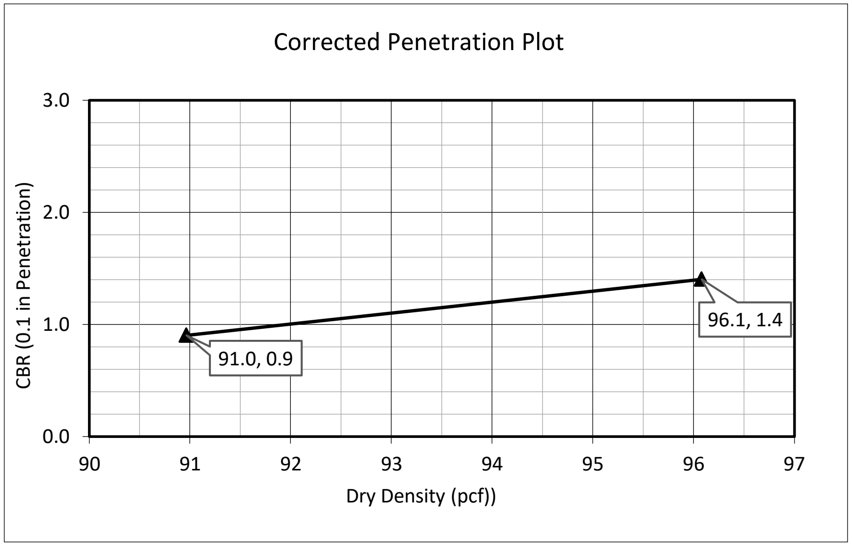
Penetration Sample Data

Surcharge Weight (lbs)	10
Condition Upon Penetration:	Saturated
Soaking Period:	4 days

Specimen	**A**	**B**
Relative Compaction	90.0%	95.0%
Number of Layers	3	3
Blows/ Layer	n/a	n/a
Moisture Content Before Soaking	20.0	20.0
Moisture Content After Soaking, Top 1"	38.0	35.3
Moisture Content After Soaking, Avg.	30.7	27.5
Dry Density Before Soaking	91.0	96.1
Dry Density After Soaking	86.7	91.1
Swell After Soaking (%)	5.1	4.9
Corrected CBR @ 0.1 in Penetration	0.9	1.4
Corrected CBR @ 0.2 in Penetration	0.8	1.1

Remarks: Specimens were fabricated at the as-received gravel content of 0% and compacted to approximately 90% and 95% of maximum Proctor density at the as-received moisture content.





Westwood

1 Systems Drive
Appleton, WI 54914

main (920) 735-6900

REPORT OF: CALIFORNIA Bearing Ratio (ASTM D1883)

PROJECT: Grover Hill Wind Energy - Grover Hill, OH

CLIENT: Starwood Energy Group

WESTWOOD PROJECT NO. R0015695.00

DATE: 9/29/2021

Boring No.	T-41
Depth:	1-4'
Sample No:	Bulk
Classification:	FAT CLAY, brown (CH)
Date Received:	9/8/2021

Laboratory Moisture-Density

Proctor Type: Standard (D698) **Method:** B

Max. Dry Density (pcf): 102 **Optimum Moisture Content (%):** 20.5

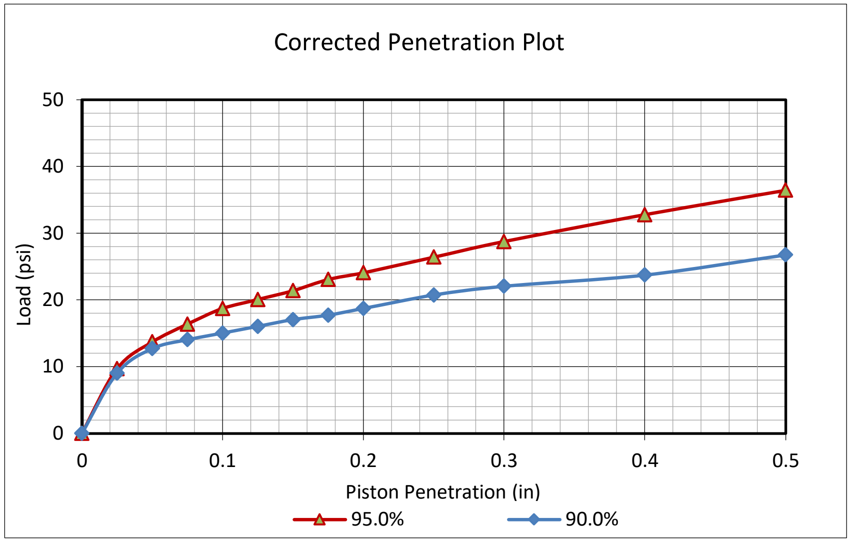
As-Recieved Moisture Content (%): 22.0

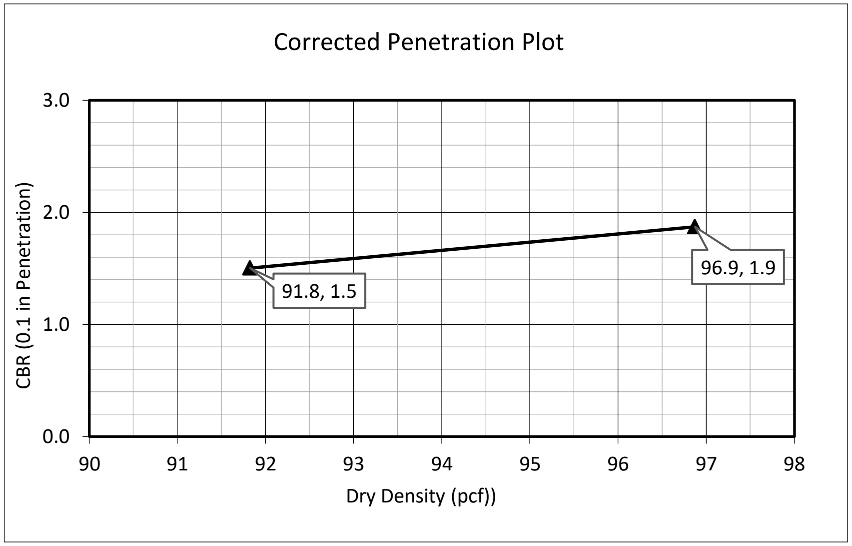
Penetration Sample Data

Surcharge Weight (lbs)	10
Condition Upon Penetration:	Saturated
Soaking Period:	4 days

Specimen	**A**	**B**
Relative Compaction	90.0%	95.0%
Number of Layers	3	3
Blows/ Layer	n/a	n/a
Moisture Content Before Soaking	21.5	21.5
Moisture Content After Soaking, Top 1"	29.5	29.4
Moisture Content After Soaking, Avg.	27.6	26.9
Dry Density Before Soaking	91.8	96.9
Dry Density After Soaking	90.6	93.6
Swell After Soaking (%)	2.7	3.1
Corrected CBR @ 0.1 in Penetration	1.5	1.9
Corrected CBR @ 0.2 in Penetration	1.2	1.6

Remarks: Specimens were fabricated at the as-received gravel content of 1% and compacted to approximately 90% and 95% of maximum Proctor density at the as-received moisture content.





Westwood

1 Systems Drive
Appleton, WI 54914

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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Client: Starwood Energy Group **DATE:** 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

Boring Number:	T-11	T-15	T-16
Sample Number:	ST-01	ST-01	ST-01
Sample Depth:	12.5-14'	10-12'	10-12'
Soil Description:	LEAN CLAY, dark brown, (CL)	LEAN CLAY, brown, (CL)	LEAN CLAY, very dark grayish brown, (CL)

Tests Performed: Unconfined Compression, Moisture/Density

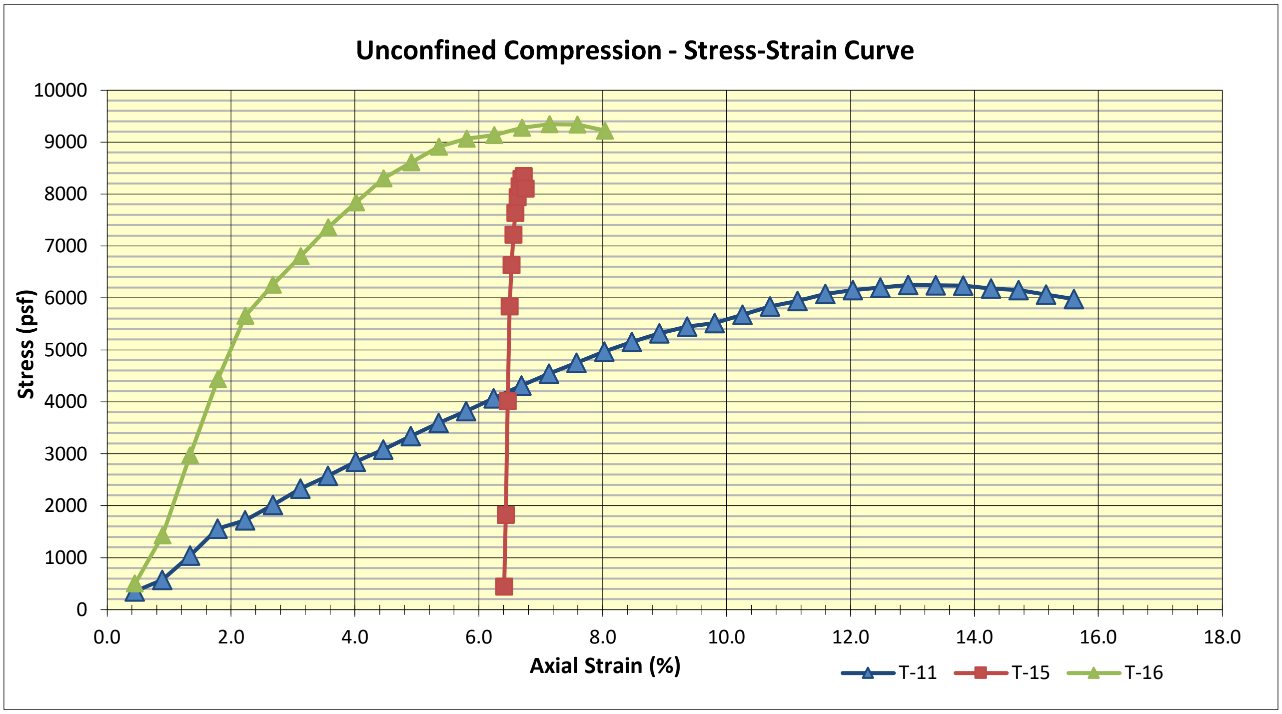
TEST RESULTS:

Unconfined Compressive Strength (ASTM:D2166):

Maximum Value:	6249 psf	8343 psf	9343 psf
	3.12 tsf	4.17 tsf	4.67 tsf

Moisture/Density Determination of Cohesive Soils (ASTM: D2216)

Dry Density:	113.7 pcf	114.5 pcf	120.6 pcf
Moisture Content:	15.5 %	18.2 %	14.0 %
In-Situ Density	131.3 pcf	135.3 pcf	137.6 pcf



Westwood

1 Systems Drive
Appleton, WI 54914

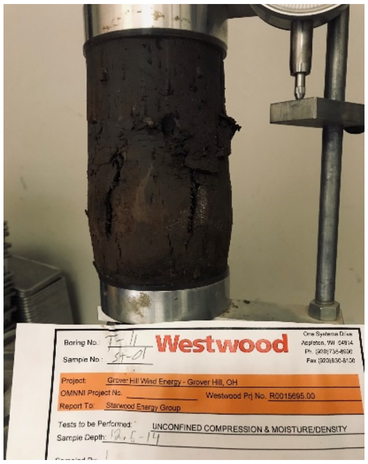
main (920) 735-6900

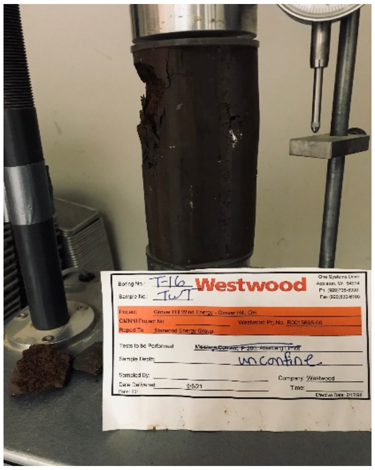
REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Client: Starwood Energy Group
DATE: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

Boring Number:	T-11	T-15	T-16
Sample Number:	ST-01	ST-01	ST-01
Sample Depth:	12.5-14'	10-12'	10-12'
Soil Description:	LEAN CLAY, dark brown, (CL)	LEAN CLAY, brown, (CL)	LEAN CLAY, very dark grayish brown, (CL)





REMARKS: The above samples were obtained during soil boring operations.

Westwood

1 Systems Drive
Appleton, WI 54914

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REPORT OF: LABORATORY TESTS OF SOILS

Project: Grover Hill Wind Energy - Grover Hill, OH
Client: Starwood Energy Group
DATE: 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

Boring Number:	T-25	T-40	SUB-03
Sample Number:	ST-02	ST-01	ST-02
Sample Depth:	12.5-14.5'	10-12'	5-7'
Soil Description:	LEAN CLAY, very dark gray, (CL)	LEAN CLAY, very dark grayish brown, (CL)	FAT CLAY, dark grayish brown, (CH)
Tests Performed:	Unconfined Compression, Moisture/Density		

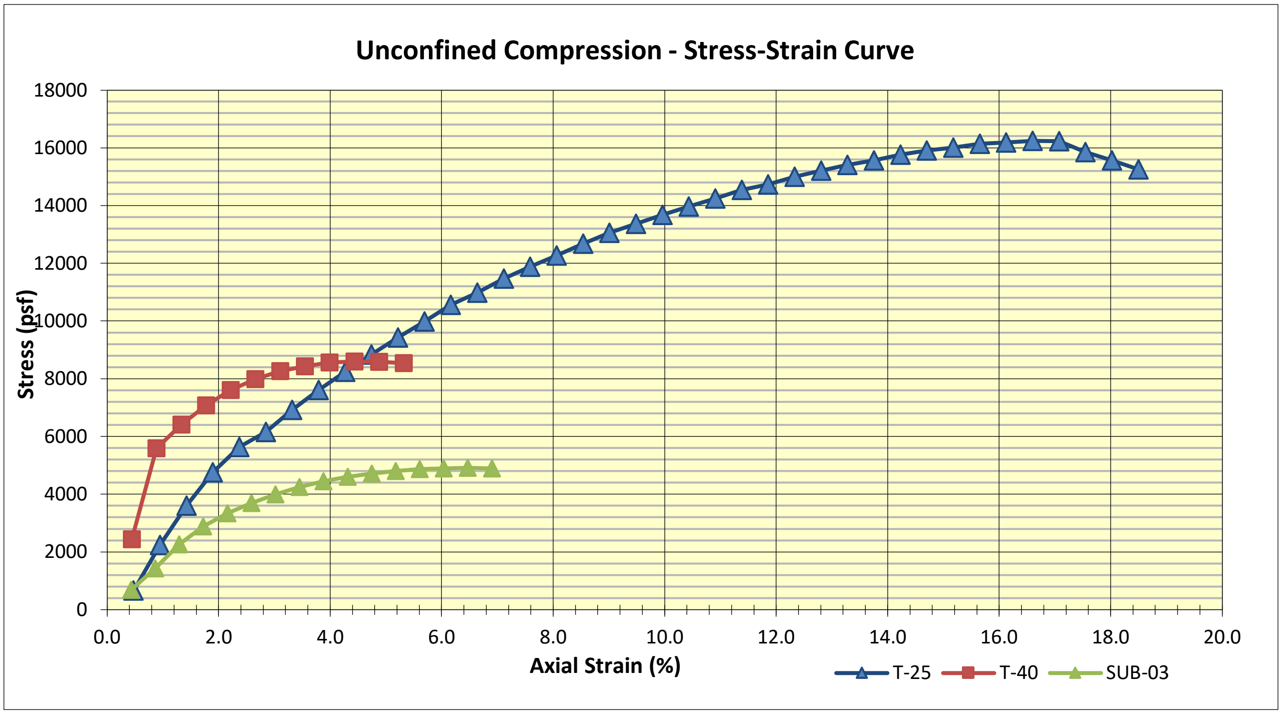
TEST RESULTS:

Unconfined Compressive Strength (ASTM:D2166):

Maximum Value:	16239 psf	8599 psf	4914 psf
	8.12 tsf	4.30 tsf	2.46 tsf

Moisture/Density Determination of Cohesive Soils (ASTM: D2216)

Dry Density:	124.4 pcf	110.3 pcf	107.5 pcf
Moisture Content:	13.1 %	19.4 %	22.2 %
In-Situ Density	140.7 pcf	131.6 pcf	131.4 pcf



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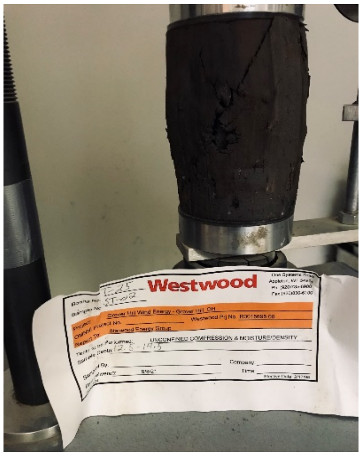
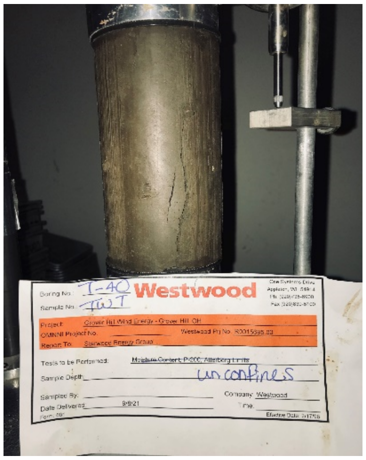
REPORT OF: LABORATORY TESTS OF SOILS

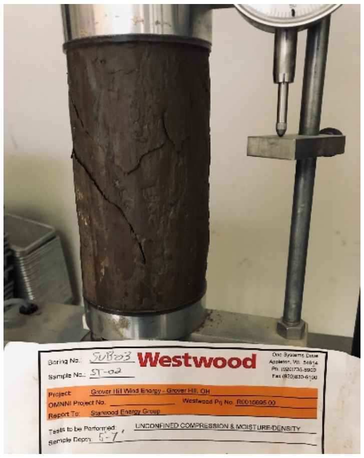
Project: Grover Hill Wind Energy - Grover Hill, OH
Client: Starwood Energy Group **DATE:** 10/5/2021

Westwood Prj. No. R0015695.00
Date Delivered: 9/8/2021

Boring Number:	T-25	T-40	SUB-03
Sample Number:	ST-02	ST-01	ST-02
Sample Depth:	12.5-14.5'	10-12'	5-7'
Soil Description:	LEAN CLAY, very dark gray, (CL)	LEAN CLAY, very dark grayish brown, (CL)	FAT CLAY, dark grayish brown, (CH)







REMARKS: The above samples were obtained during soil boring operations.

Laboratory Test Summary

Project: Grover Hill — Job: 13378

Client: Westwood Surveying & Engineering — Date: 10/1/2021

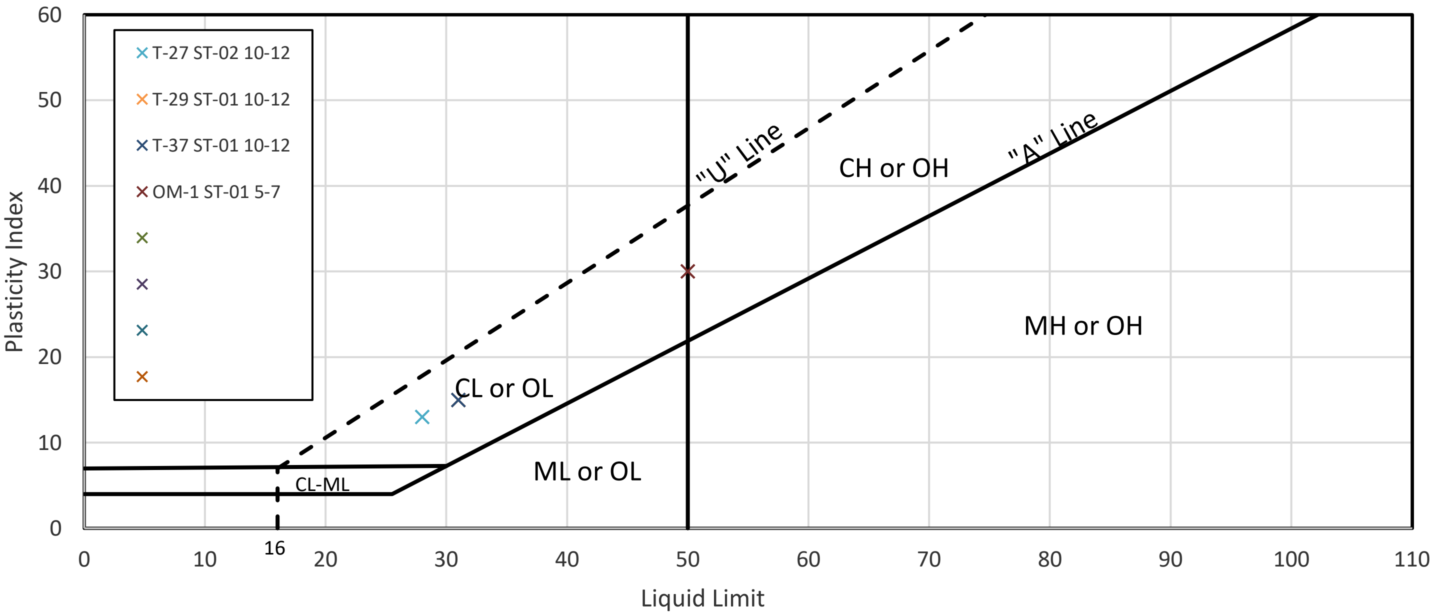
Sample Information & Classification

Boring #	T-27	T-29	T-37	OM-1				
Sample #	ST-02	ST-01	ST-01	ST-01				
Depth (ft)	10-12	10-12	10-12	5-7				
Sample Type	TWT	TWT	TWT	TWT				
Material Classification	Sandy Lean Clay (CL)	Sandy Lean Clay (CL)	Sandy Lean Clay w/a little gravel (CL)	Fat Clay w/sand (CH)				

Atterberg Limits (ASTM:D4318)

Liquid Limit	28	31	31	50				
Plastic Limit	15	16	16	20				
Plasticity Index	13	15	15	30				

Plasticity Chart (ASTM:D2487)



Unconfined Stress/Strain Curves

ASTM: D2166

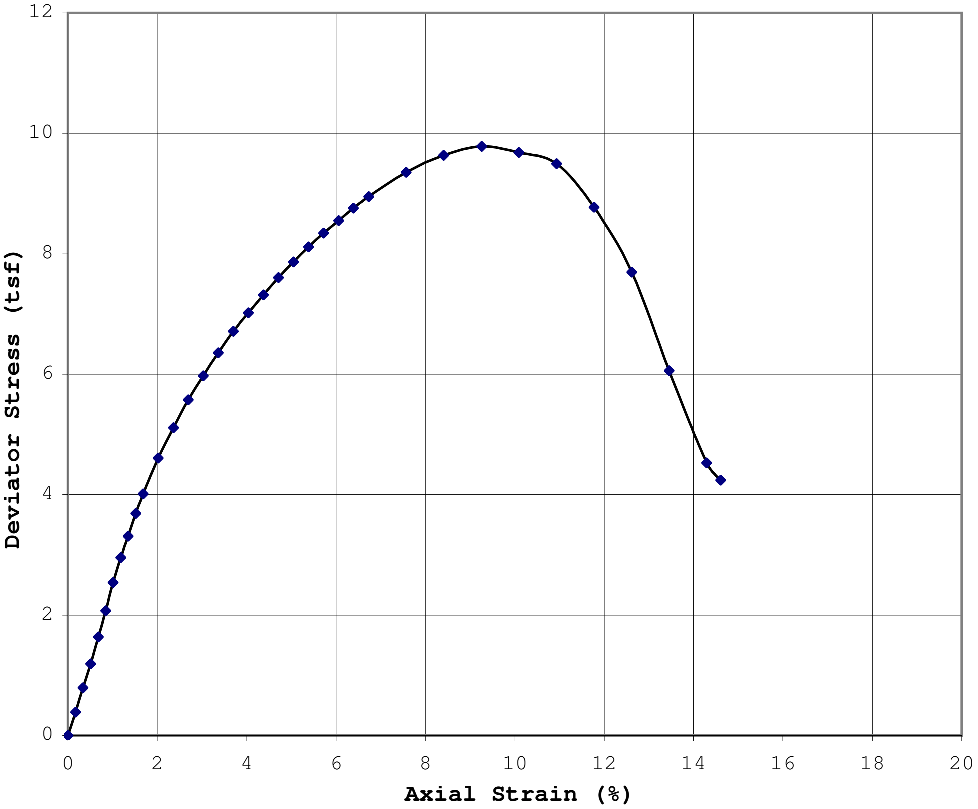
Project: Grover Hill

Job: 13378

Client: Westwood Surveying & Engineering

Date: 9/27/21

Remarks:



Boring: T-27 Depth: 10-12

Sample #:

Soil Type: Sandy Lean Clay (CL)

Strain Rate (in/min): 0.060

Sample Type: 3T

Dia. (in) 2.90 Ht. (in) 5.95

Height to Diameter Ratio: 2.1

Unconfined Comp. Strength: 9.78 tsf

Strain at Failure (%): 9.3

W.C. (%): 12.2

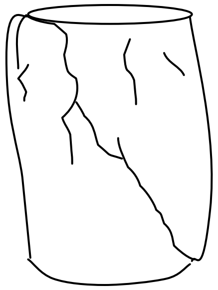
Yd (pcf): 125.3

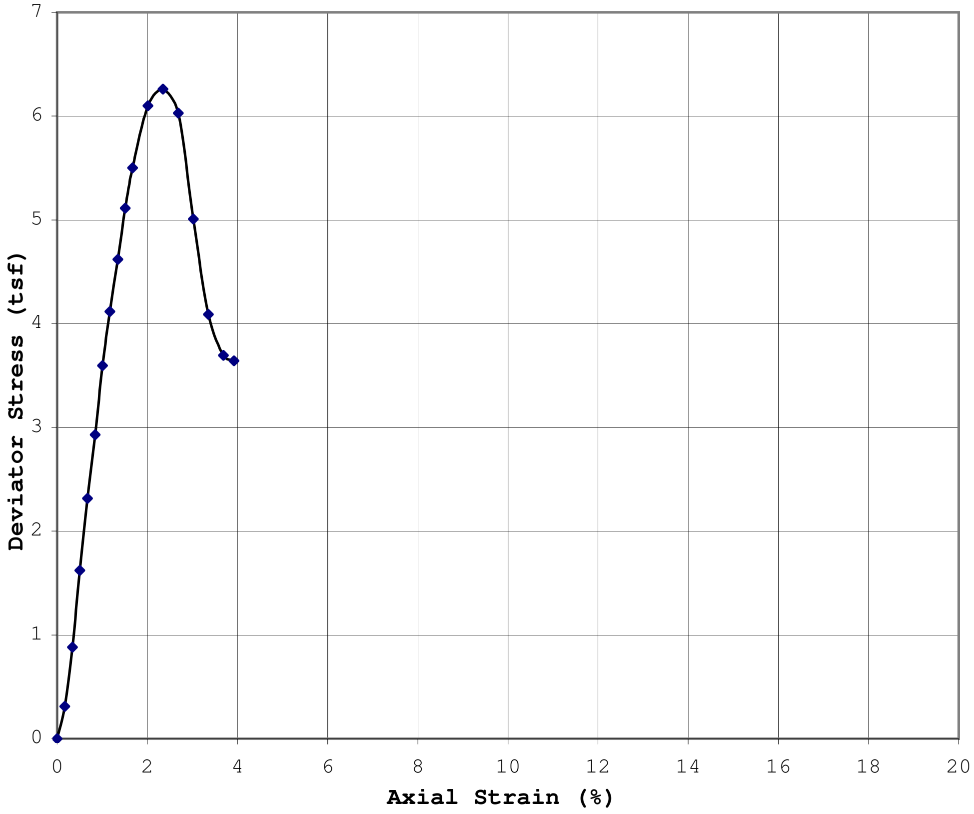
LL: 28

PL: 15

PI: 13

Sketch of Specimen After Failure





Boring: T-29 Depth: 10-12

Sample #:

Soil Type: Sandy Lean Clay (CL)

Strain Rate (in/min): 0.060

Sample Type: 3T

Dia. (in): 2.90 Ht. (in): 5.97

Height to Diameter Ratio: 2.1

Unconfined Comp. Strength: 6.26 tsf

Strain at Failure (%): 2.3

W.C. (%): 14.9

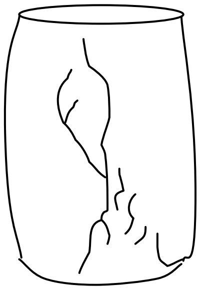
Yd (pcf): 117.5

LL: 31

PL: 16

PI: 15

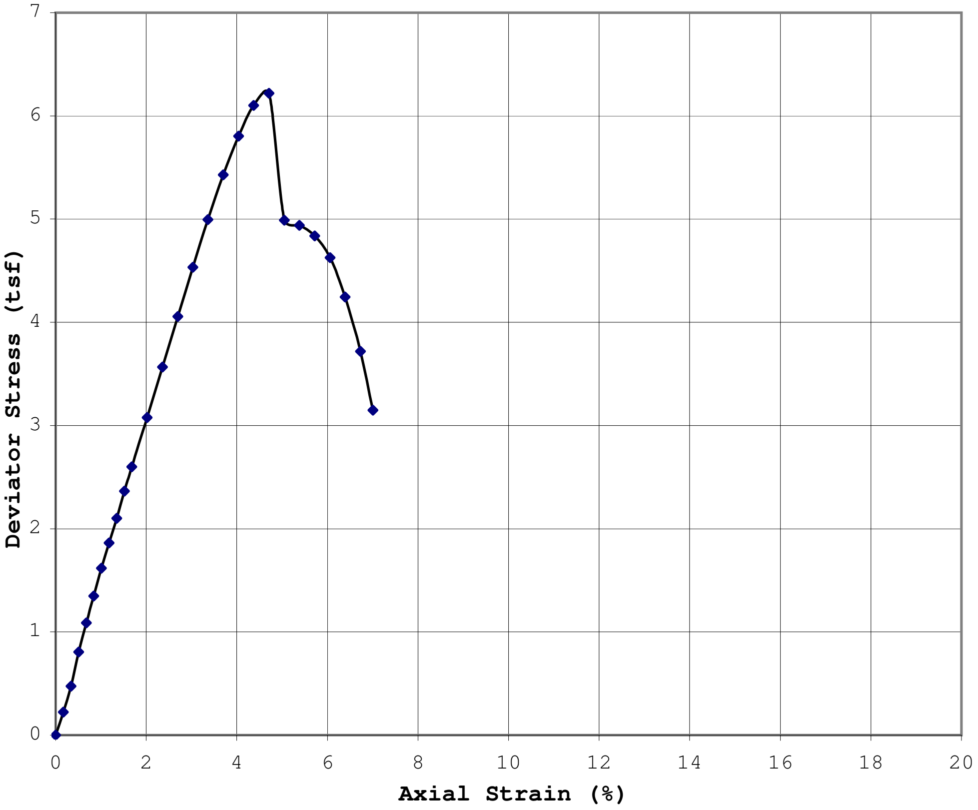
Sketch of Specimen After Failure



Unconfined Stress/Strain Curves

ASTM: D2166

Project: Grover Hill
Job: 13378
Client: Westwood Surveying & Engineering
Date: 9/27/21
Remarks:



Boring: T-37
Depth: 10-12
Sample #:

Soil Type: Sandy Lean Clay w/a little gravel (CL)

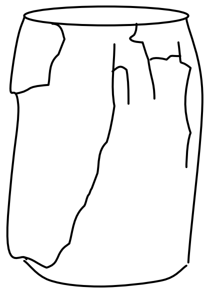
Strain Rate (in/min): 0.060
Sample Type: 3T
Dia. (in) 2.88
Ht. (in) 5.95
Height to Diameter Ratio: 2.1

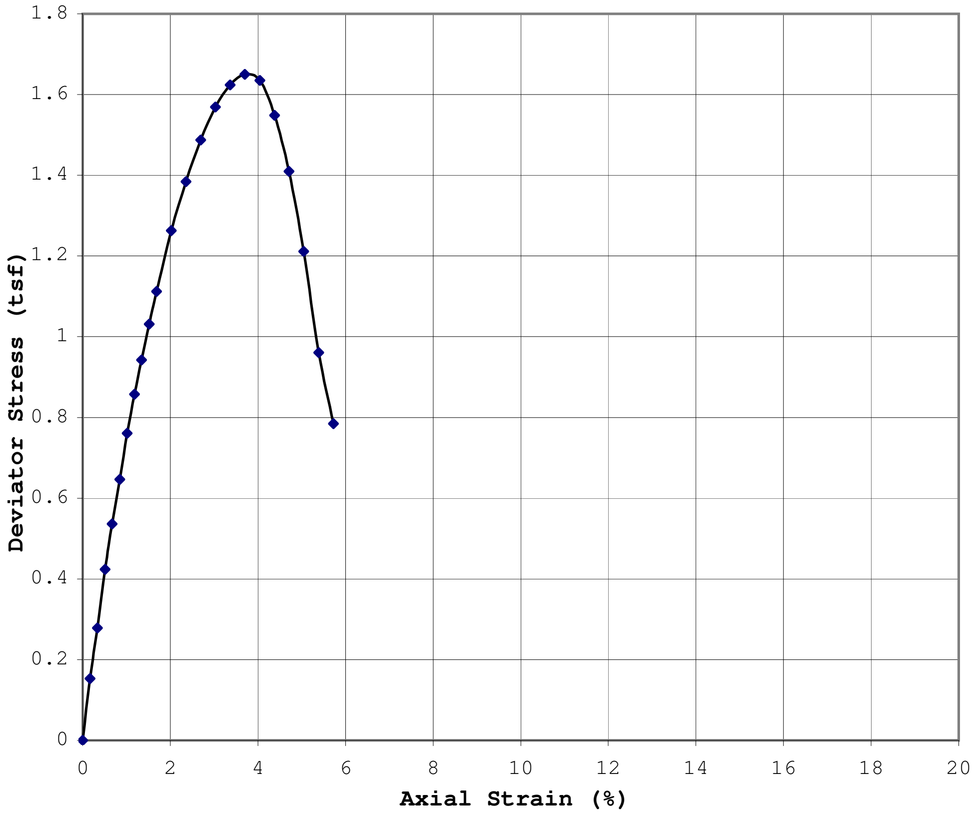
Unconfined Comp. Strength: 6.22 tsf
Strain at Failure (%): 4.7

W.C. (%): 12.7
Yd (pcf): 120.0

LL: 31
PL: 16
PI: 15

Sketch of Specimen After Failure





Boring: OM-1
Depth: 5-7
Sample #:

Soil Type: Lean Clay w/sand (CL)

Strain Rate (in/min): 0.060
Sample Type: 3T

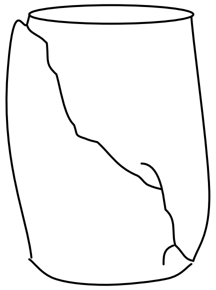
Dia. (in): 2.88
Ht. (in): 5.94
Height to Diameter Ratio: 2.1

Unconfined Comp. Strength: 1.65 tsf
Strain at Failure (%): 3.7

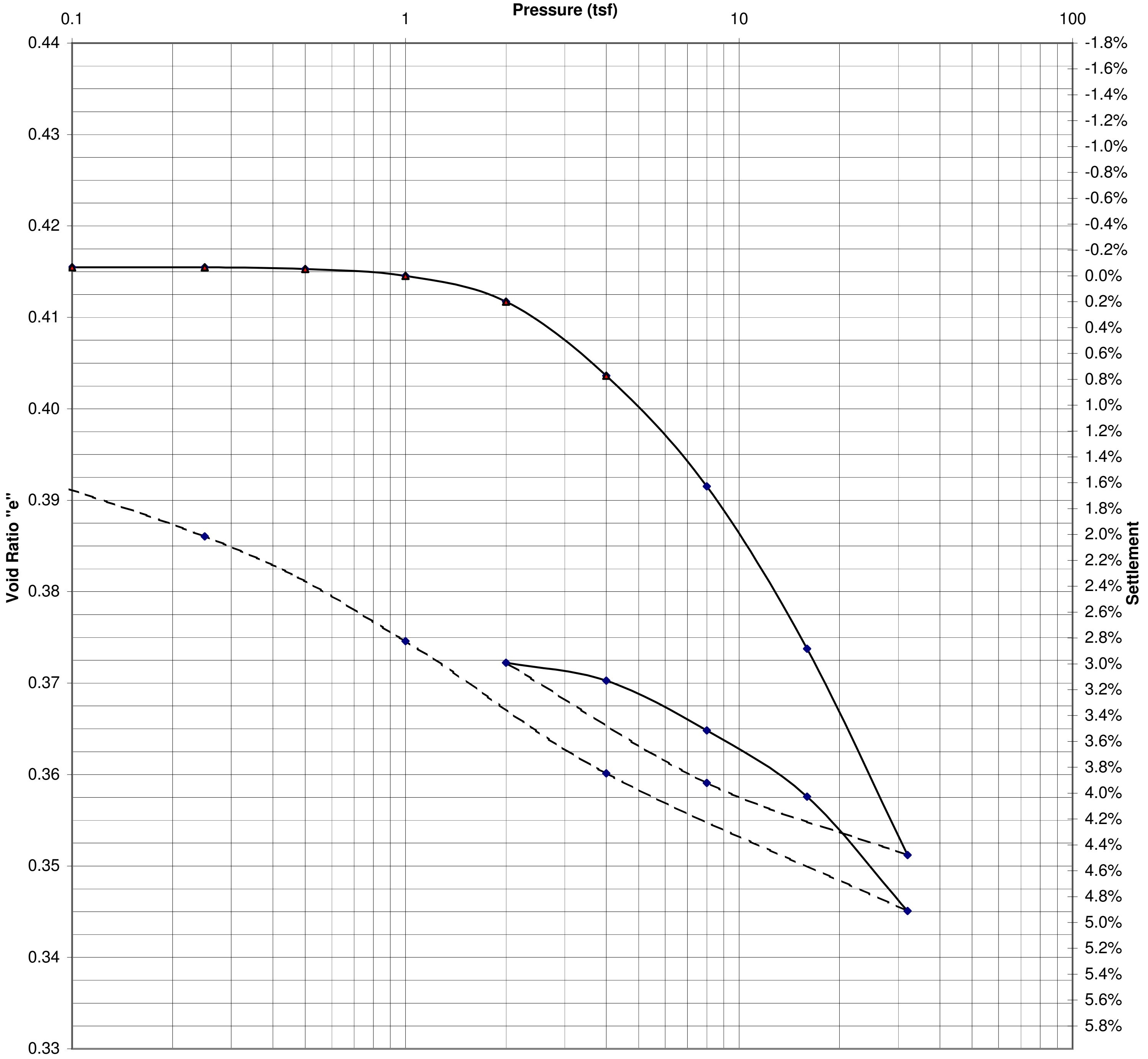
W.C. (%): 22.4
Yd (pcf): 104.0

LL: 50
PL: 20
PI: 30

Sketch of Specimen After Failure



Void Ratio and % Settlement vs. Log of Pressure



Project: Grover Hill / Westwood Surveying & Engineering

Date: 10/1/21

Sample #:

Boring #: T-16

Depth ft: 10-12

Job #: 13378

Soil Type: Lean Clay w/sand and a little gravel (CL)

Initial W/C (%): 14.6

Dry Density (pcf): 120.5

LL:

PL:

PI:

Gs: 2.73 (Assumed)

Organic Content (%):

Initial Height (in.): 0.753

Diameter (in.): 2.503

e_o= 0.414

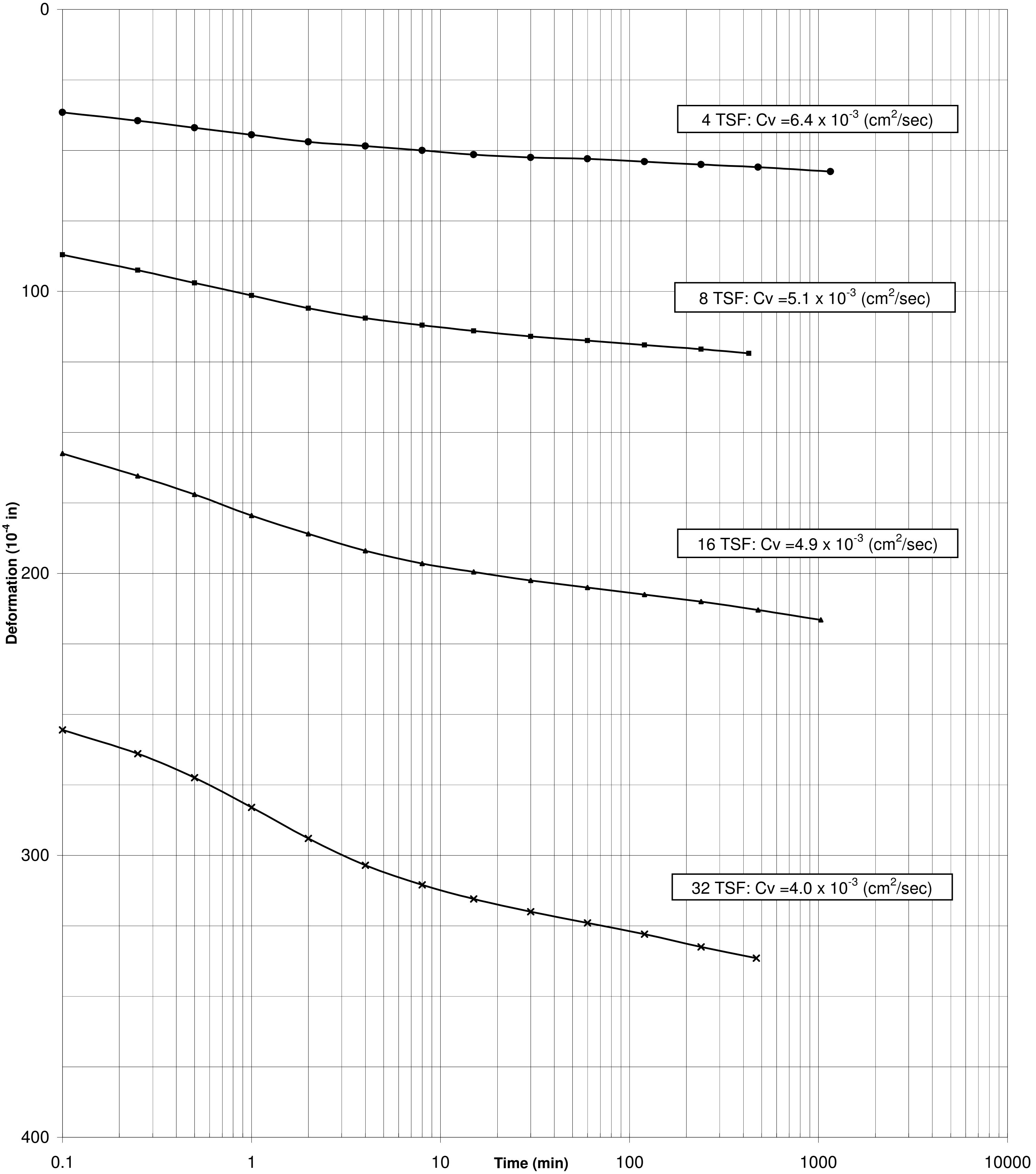
Preconsolidation Pressure (Pc): 6.2 tsf

Compression Index (Cc): 0.07

Recompression Index (Cr): 0.02

Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



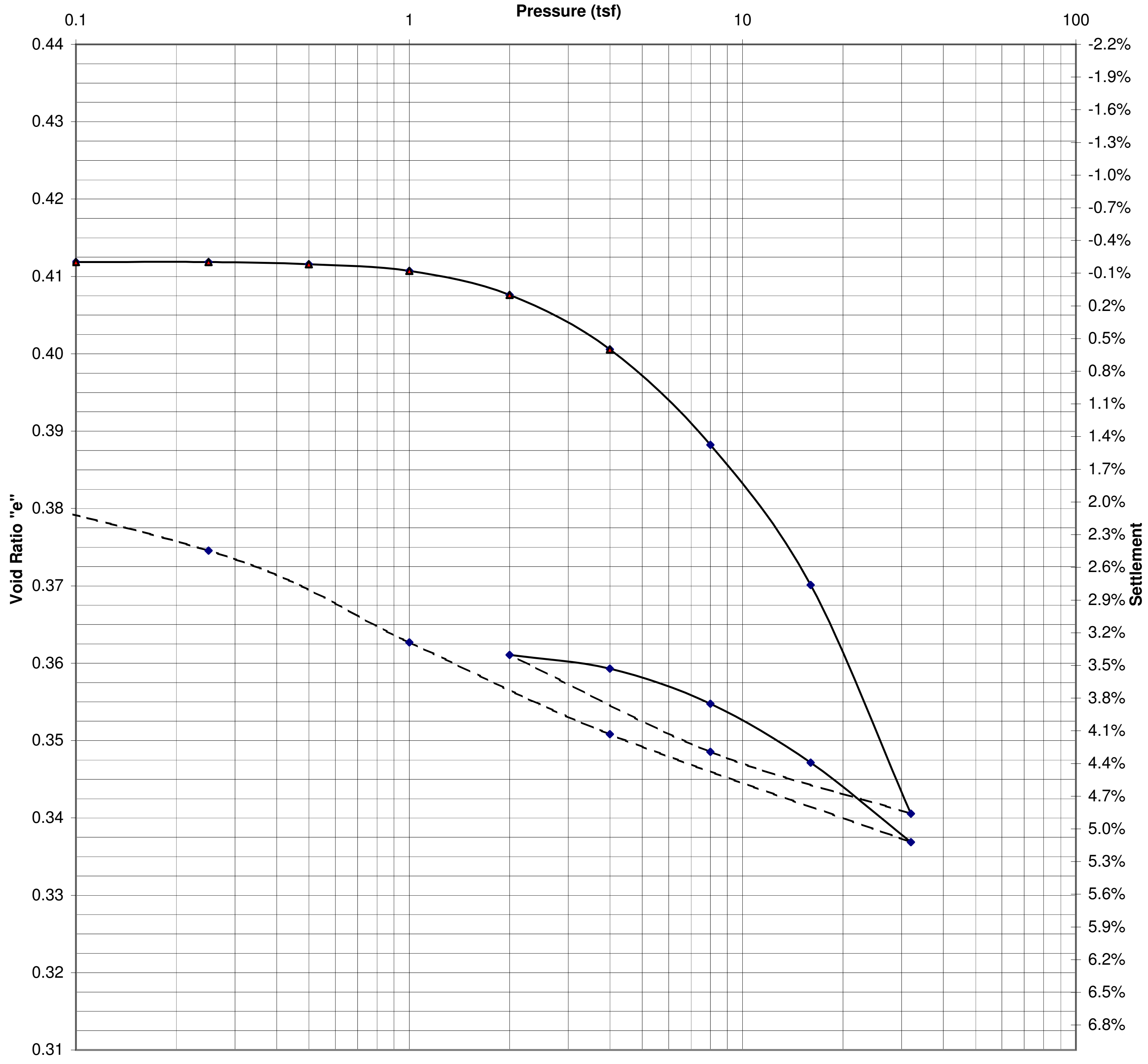
Project: Grover Hill / Westwood Surveying & Engineering			Date: 10/1/21
Sample #:	Boring #: T-16	Depth ft: 10-12	Job #: 13378

9530 James Avenue South

SOIL
ENGINEERING
TESTING, INC.

Bloomington, Minnesota 55431

Void Ratio and % Settlement vs. Log of Pressure



Project: Grover Hill / Westwood Surveying & Engineering

Date: 10/1/21

Sample #:

Boring #: T-29

Depth ft: 10-12

Job #: 13378

Soil Type: Lean Clay w/sand and a little gravel (CL)

Initial W/C (%): 13.9

Dry Density (pcf): 119.7

LL:

PL:

PI:

Gs: 2.70 (Assumed)

Organic Content (%):

Initial Height (in.): 0.748

Diameter (in.): 2.498

e_o= 0.409

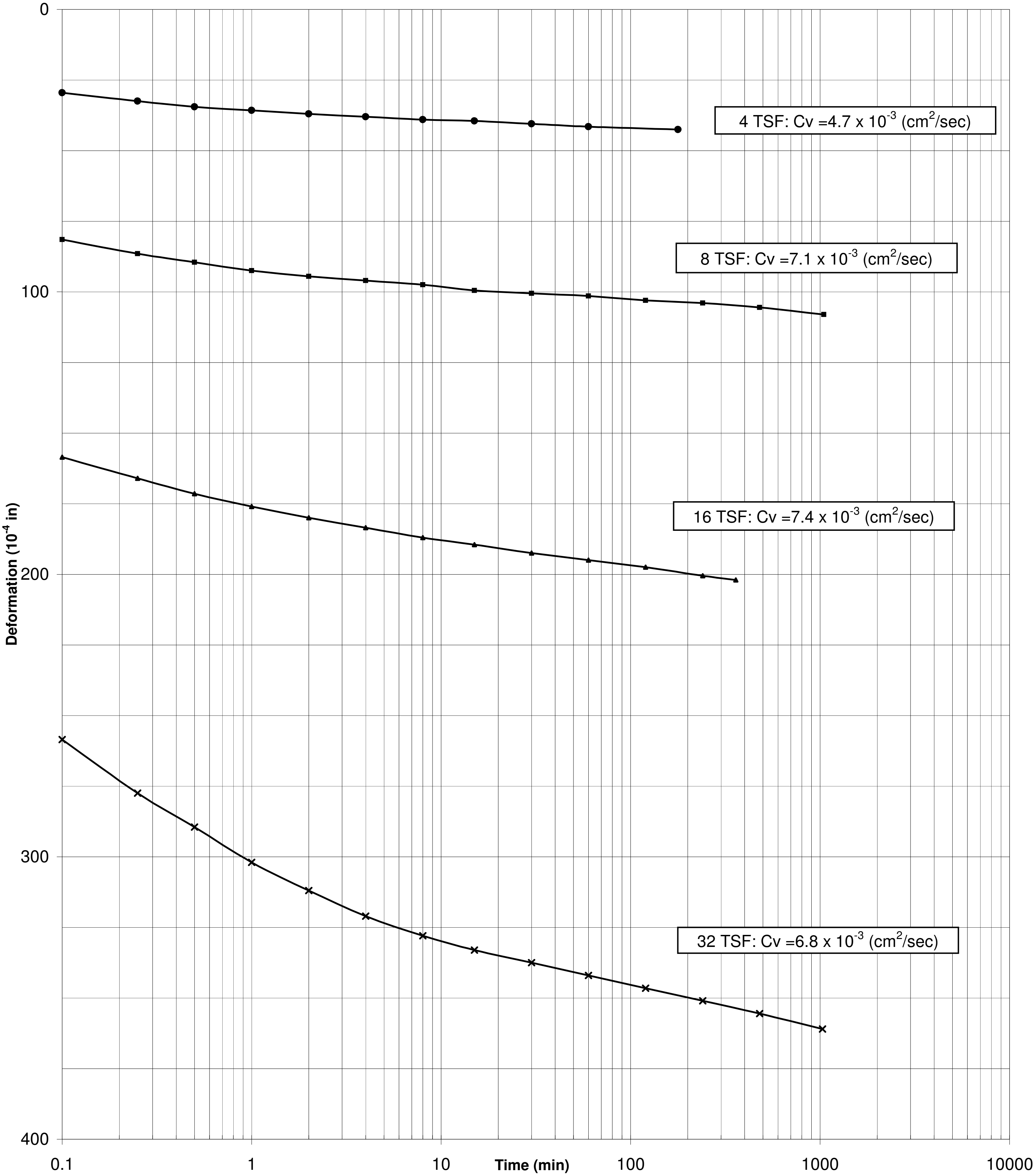
Preconsolidation Pressure (Pc): 8.6 tsf

Compression Index (Cc): 0.10

Recompression Index (Cr): 0.02

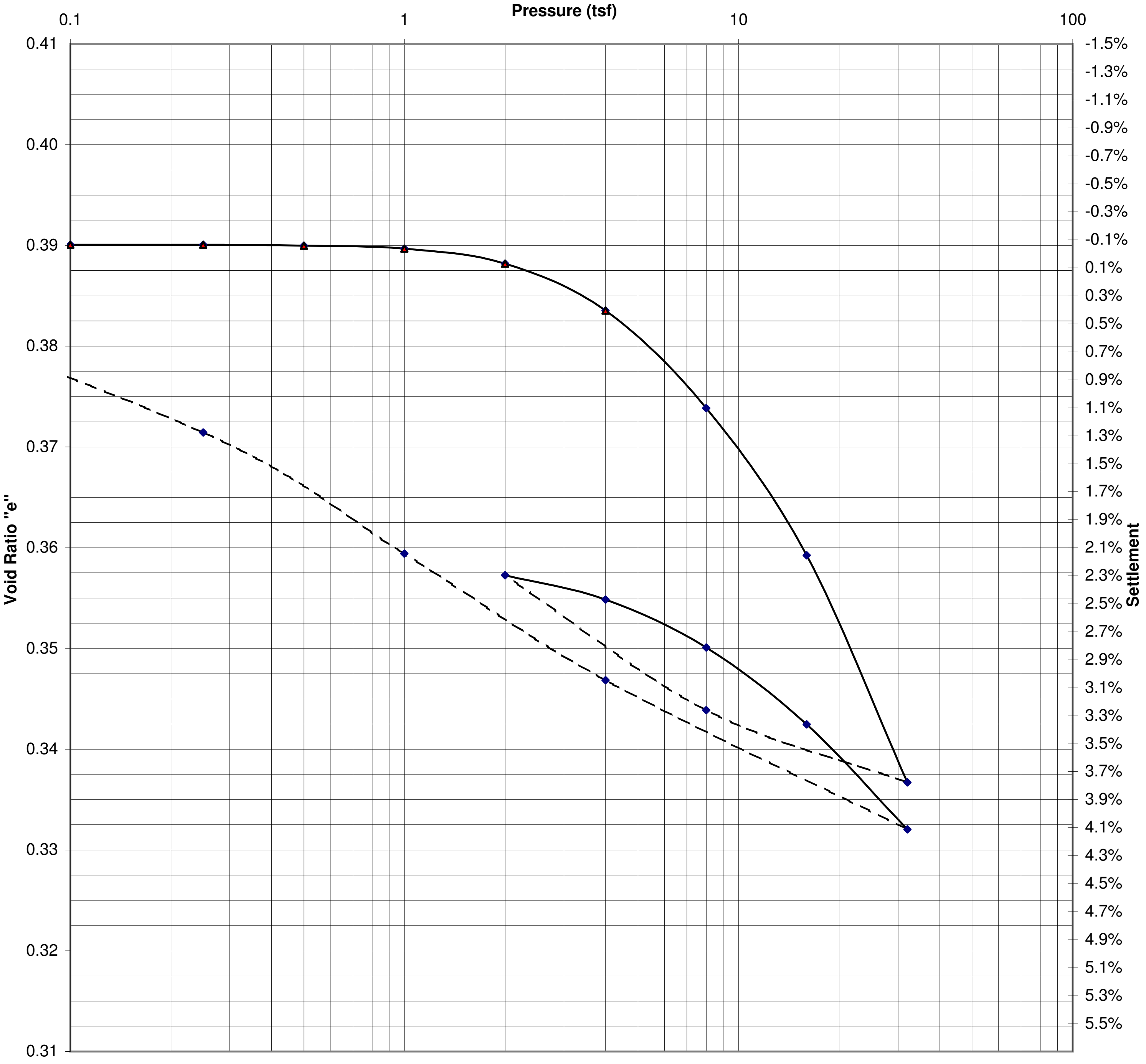
Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



Project: Grover Hill / Westwood Surveying & Engineering			Date: 10/1/21
Sample #:	Boring #: T-29	Depth ft: 10-12	Job #: 13378

Void Ratio and % Settlement vs. Log of Pressure



Project: Grover Hill / Westwood Surveying & Engineering

Date: 9/30/21

Sample #:

Boring #: T-37

Depth ft: 10-12

Job #: 13378

Soil Type: Sandy Lean Clay w/a little gravel (CL)

Initial W/C (%): 13.2

Dry Density (pcf): 122.7

LL: 31 PL: 16 PI: 15

Gs: 2.73 (Assumed)

Organic Content (%):

Initial Height (in.): 0.746

Diameter (in.): 2.501

e_o= 0.389

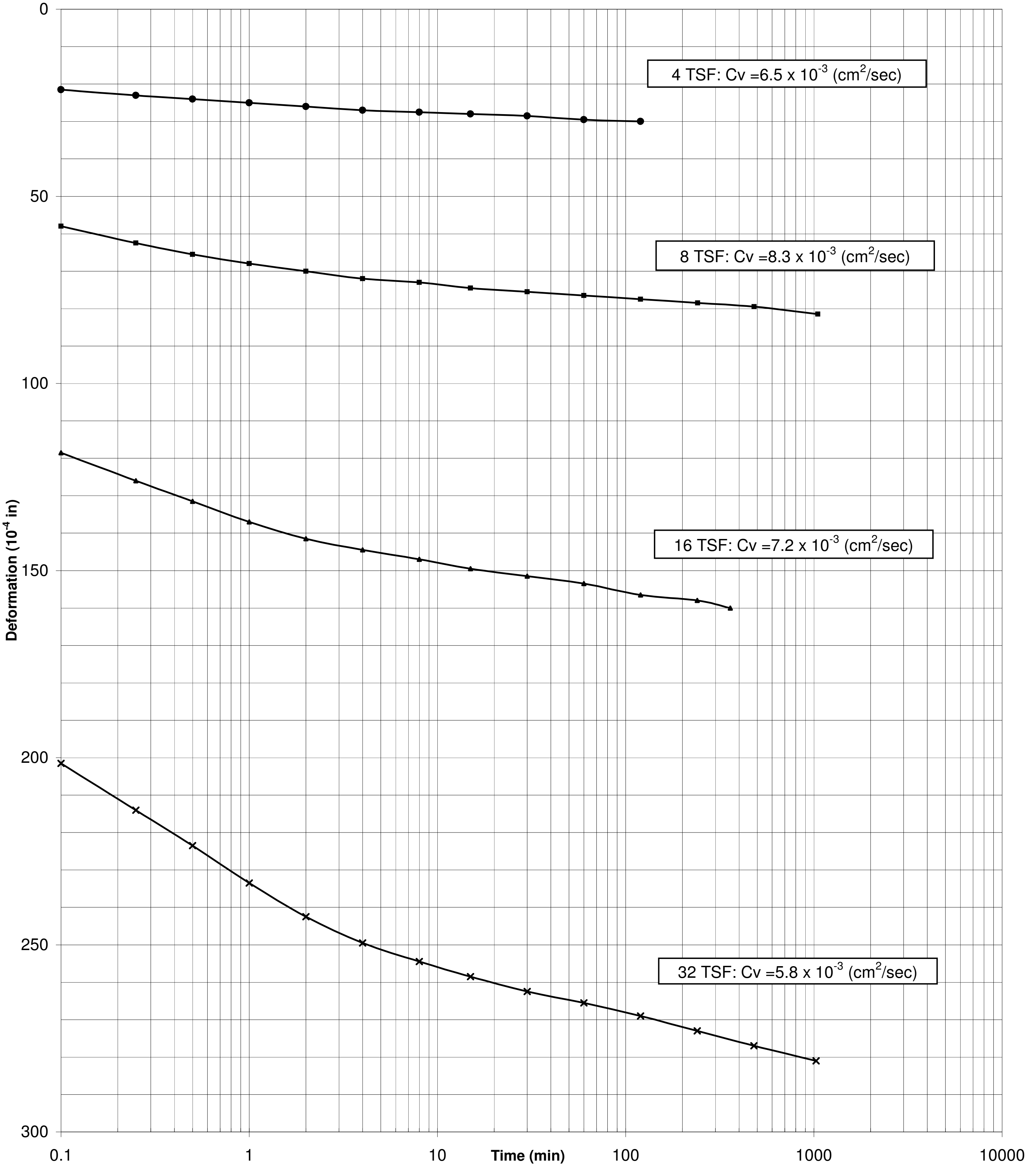
Preconsolidation Pressure (Pc): 8.6 tsf

Compression Index (Cc): 0.08

Recompression Index (Cr): 0.02

Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



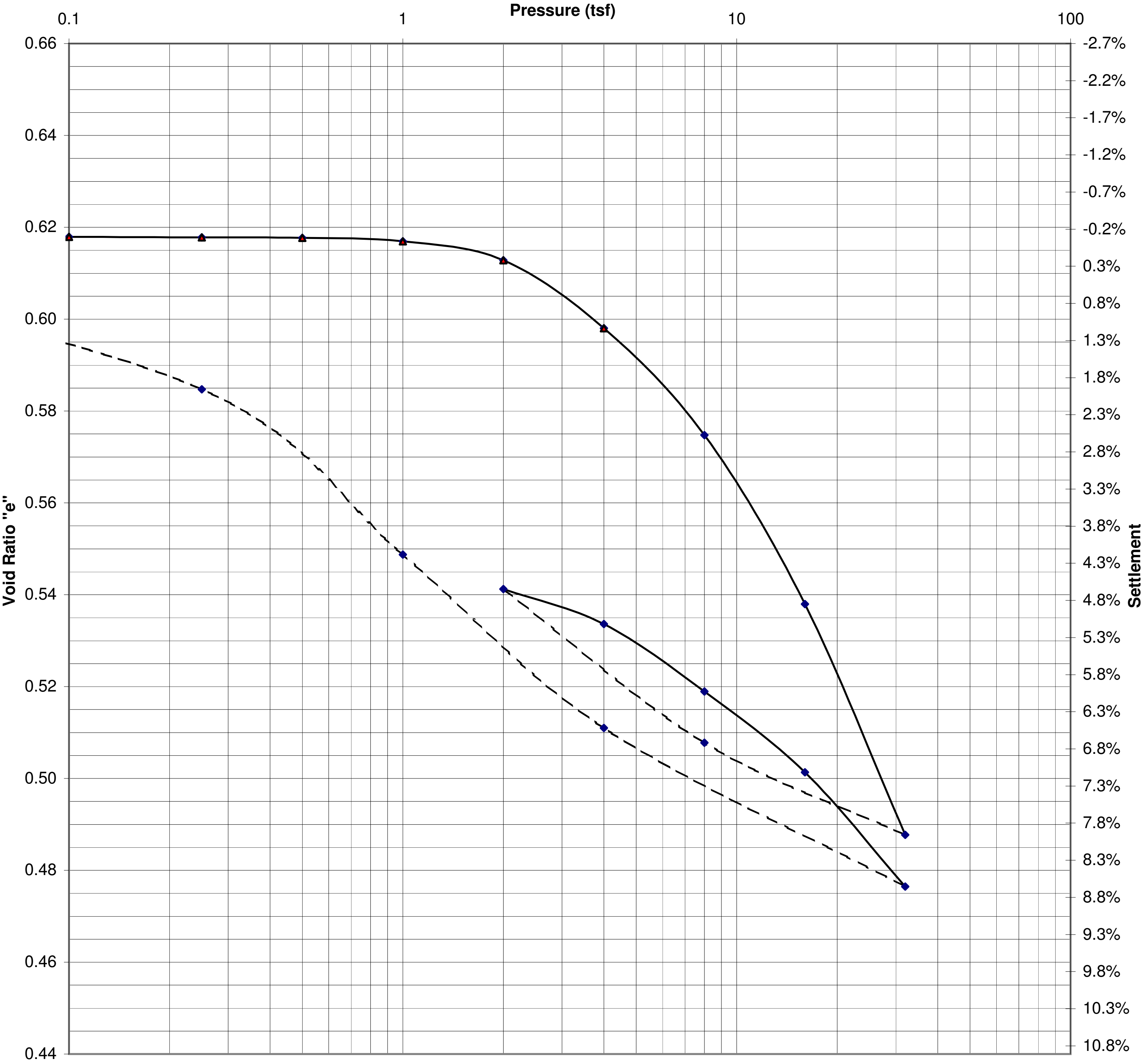
Project: Grover Hill / Westwood Surveying & Engineering			Date: 9/30/21
Sample #:	Boring #: T-37	Depth ft: 10-12	Job #: 13378

9530 James Avenue South

SOIL
ENGINEERING
TESTING, INC.

Bloomington, Minnesota 55431

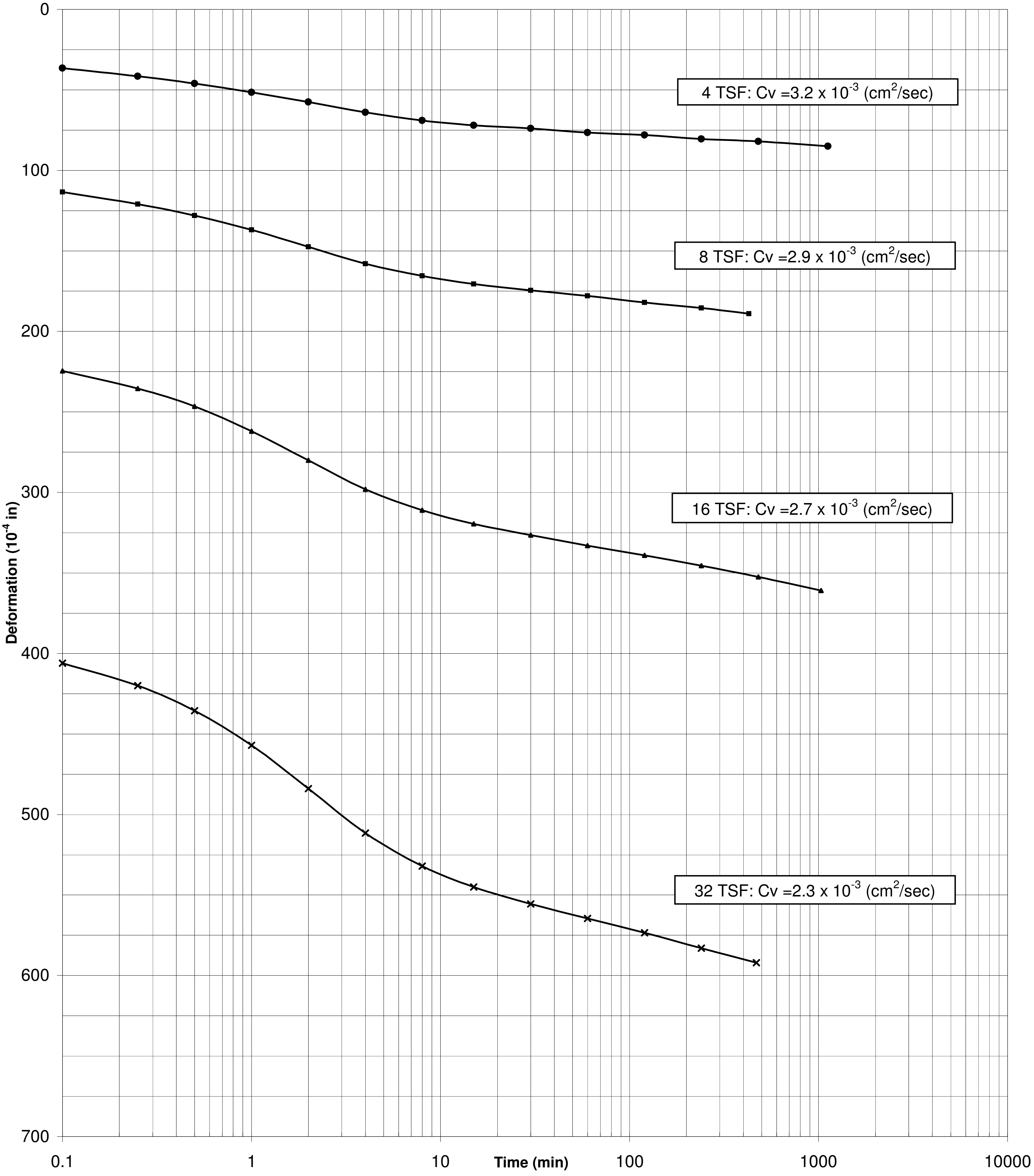
Void Ratio and % Settlement vs. Log of Pressure



Project: Grover Hill / Westwood Surveying & Engineering			Date: 9/30/21
Sample #:	Boring #: T-40	Depth ft: 10-12	Job #: 13378
Soil Type: Lean Clay w/sand and a trace of gravel (CL)			
Initial W/C (%): 22.3	Dry Density (pcf): 106.2	LL: PL: PI:	Gs: 2.75 (Assumed)
Organic Content (%):	Initial Height (in.): 0.743	Diameter (in.): 2.502	e_o= 0.616
Preconsolidation Pressure (Pc): 7.1 tsf		Compression Index (Cc): 0.17	Recompression Index (Cr): 0.05

Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



Project: Grover Hill / Westwood Surveying & Engineering

Date: 9/30/21

Sample #:

Boring #: T-40

Depth ft: 10-12

Job #: 13378

SOIL ENGINEERING TESTING, INC.

9530 James Avenue South

Bloomington, Minnesota 55431

Synergy Environmental Lab, INC

1990 Prospect Ct., Appleton, WI 54914 *P 920-830-2455 * F 920-733-0631

PAUL EGGEN
WESTWOOD PROFESSIONAL SERVICES
ONE SYSTEMS DRIVE
APPLETON WI 54914-1654

Report Date *06-Oct-21*

Project Name GROVER HILL WIND **Invoice #** E39982
Project # R0015695.00

Lab Code 5039982A
Sample ID T-14 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	72.4	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	145	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	13.2 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982B
Sample ID T-25 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	96.7	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	397	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	18.0 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Project Name GROVER HILL WIND **Invoice #** E39982
Project # R0015695.00

Lab Code 5039982C
Sample ID T-27 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	97.0	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	88.2	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	10.0 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982D
Sample ID T-31 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	96.9	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	1590	mg/kg	64.5	215	5	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	10.6 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982E
Sample ID T-33 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	97.0	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	46.2	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	< 9.2	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982F
Sample ID T-37 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	96.8	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	47.3	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	17.6 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982G
Sample ID T-41 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	97.1	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	79.3	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	< 9.2	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

Lab Code 5039982H
Sample ID SUB-03 BULK
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	97.0	%			1	5021		9/28/2021	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	84.1	mg/kg	12.9	43	1	9056		10/5/2021	ESC	1
Chlorides, Unfiltered	13.7 "J"	mg/kg	9.2	30.7	1	9056		10/5/2021	ESC	1

"J" Flag: Analyte detected between LOD and LOQ LOD Limit of Detection LOQ Limit of Quantitation

Code	Comment
1	Laboratory QC within limits.

ESC denotes sub contract lab - Certification #998093910

All solid sample results reported on a dry weight basis unless otherwise indicated. All LOD's and LOQ's are adjusted for dilutions but not dry weight. Subcontracted results are denoted by SUB in the analyst field.

Authorized Signature

Westwood

1 Systems Drive
Appleton, WI 54914

main (920) 735-6900

REPORT OF: TESTS OF CORED ROCK SPECIMENS

Project: Grover Hill Wind Energy - Grover Hill, OH **Westwood Prj. No.** R0015695.00
Report To: Starwood Energy Group **DATE:** 10/4/2021

Unconfined Compressive Strength of Rock Cores (ASTM: D7012, Method C)

Core Number	T-17	T-25	T-30	T-34
Depth	27.6-28.4'	28.5-29.3'	17-17.7'	18.5-18.9'
Rock Type:	Dolomite	Dolomite	Dolomite	Dolomite
Diameter (in.)	1.860	1.860	1.855	1.855
Area (sq. in.)	2.72	2.72	2.703	2.703
Length (in)	4.91	4.94	4.970	3.970
Length/Diameter (L/D)	2.64	2.66	2.680	2.14
Date Tested	10/1/21	10/1/21	10/1/21	10/1/21
Load at Failure (lbs)	22,760	7,420	41,660	19,410
Compressive Strength (psi)	8,380	2,730	15,410	7,180

Unit Weight of Cored Soil or Rock (ASTM: 2216, D7263)

Bulk Specific Gravity	2.651	2.685	2.778	2.743
Density (lbs/cf)	165	167.1	173	171

Remarks: Vertical fractures were observed in core T-25 prior to testing.

Appendix D

Electrical Resistivity Test Data

Westwood

Electrical Resistivity Test Results
Wenner 4-Electrode Method
Grover Hill Wind Project - Paulding County, Ohio

ER-T-16/T-26 **Latitude** **Longitude**
Location: 41.033776 -84.483429
Description: 64°F, sunny/partly cloudy, flat ground conditions

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.76	55.4	16.9
10	3.0	1.04	65.3	19.9
20	6.1	0.76	95.5	29.1
30	9.1	0.68	128	39.1
50	15.2	0.62	195	59.4
100	30.5	0.52	327	99.6

Latitude **Longitude**
Location: 41.033784 -84.482660
Date: 9/22/2021

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.46	45.9	14.0
10	3.0	0.87	54.8	16.7
20	6.1	0.63	79.1	24.1
30	9.1	0.56	106	32.2
50	15.2	0.54	170	51.7
100	30.5	-	-	-

ER-T-17 **Latitude** **Longitude**
Location: 41.029793 -84.507815
Description: 70°F, sunny, flat ground conditions
Date: 9/22/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
2	0.6	4.00	50.2	15.3
4	1.2	1.74	43.6	13.3
6	1.8	1.18	44.6	13.6
8	2.4	1.00	50.2	15.3
10	3.0	0.86	54.1	16.5
20	6.1	0.60	75.5	23.0
30	9.1	0.56	106	32.2
50	15.2	0.54	170	51.7
100	30.5	0.55	345	105

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
2	0.6	4.26	53.5	16.3
4	1.2	1.99	49.9	15.2
6	1.8	1.40	52.8	16.1
8	2.4	1.14	57.4	17.5
10	3.0	0.98	61.7	18.8
20	6.1	0.68	85.3	26.0
30	9.1	0.60	113	34.5
50	15.2	0.56	176	53.6
100	30.5	0.52	327	100

ER-T-27 **Latitude** **Longitude**
Location: 41.014493 -84.514864
Description: 70°F, sunny, flat ground conditions

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.70	53.5	16.3
10	3.0	1.10	69.2	21.1
20	6.1	0.76	95.5	29.1
30	9.1	0.68	128	39.1
50	15.2	0.67	211	64.2
100	30.5	0.65	408	125

Latitude **Longitude**
Location: 41.015177 -84.513720
Date: 9/23/2021

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	2.31	72.5	22.1
10	3.0	1.33	83.7	25.5
20	6.1	0.89	112	34.1
30	9.1	0.81	153	46.5
50	15.2	0.78	245	74.7
100	30.5	0.73	459	140

ER-T-31 **Latitude** **Longitude**
Location: 41.009925 -84.489693
Description: 70°F, cloudy, flat ground conditions
Date: 9/10/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.15	36.1	11.0
10	3.0	0.70	44.0	13.4
20	6.1	0.52	65.3	19.9
30	9.1	0.47	88.6	27.0
50	15.2	0.48	151	46.0
100	30.5	0.54	339	103

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.42	44.6	13.6
10	3.0	0.74	46.6	14.2
20	6.1	0.51	64.0	19.5
30	9.1	0.43	81.0	24.7
50	15.2	0.38	119	36.4
100	30.5	0.42	264	80.4

ER-T-33 **Latitude** **Longitude**
Location: 41.015195 -84.468639
Description: 70°F, sunny/partly cloudy, flat ground conditions
Date: 9/11/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.33	41.7	12.7
10	3.0	0.87	54.8	16.7
20	6.1	0.71	89.2	27.2
30	9.1	0.64	121	36.8
50	15.2	0.64	201	61.3
100	30.5	0.64	402	123

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.61	50.5	15.4
10	3.0	0.98	61.7	18.8
20	6.1	0.69	86.6	26.4
30	9.1	0.64	121	36.8
50	15.2	0.64	201	61.3
100	30.5	0.64	402	123

Westwood

Electrical Resistivity Test Results
Wenner 4-Electrode Method
Grover Hill Wind Project - Paulding County, Ohio

ER-T-37 **Latitude** **Longitude**
Location: 40.993929 -84.507842
Description: 70°F, sunny/partly cloudy, flat ground conditions
Date: 9/23/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	2.19	68.9	21.0
10	3.0	1.25	78.4	23.9
20	6.1	1.00	126	38.3
30	9.1	0.96	181	55.2
50	15.2	0.95	299	91.0
100	30.5	0.94	591	180

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	2.08	65.3	19.9
10	3.0	1.15	72.2	22.0
20	6.1	0.99	124	37.9
30	9.1	0.94	177	54.0
50	15.2	0.91	286	87.1
100	30.5	0.87	547	167

ER-T-40 **Latitude** **Longitude**
Location: 41.040932 -84.509848
Description: 70°F, sunny/partly cloudy, flat ground conditions
Date: 9/22/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
2	0.6	5.41	67.9	20.7
4	1.2	2.17	54.5	16.6
6	1.8	1.49	56.1	17.1
8	2.4	1.14	57.4	17.5
10	3.0	0.96	60.4	18.4
20	6.1	0.63	79.1	24.1
30	9.1	0.53	100	30.5
50	15.2	0.48	151	46.0
100	30.5	0.46	289	88.1

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
2	0.6	7.66	96.1	29.3
4	1.2	2.27	57.1	17.4
6	1.8	1.78	67.3	20.5
8	2.4	1.32	66.3	20.2
10	3.0	1.11	69.9	21.3
20	6.1	0.72	90.6	27.6
30	9.1	0.63	119	36.2
50	15.2	0.58	182	55.5
100	30.5	0.53	333	102

ER-T-43 **Latitude** **Longitude**
Location: 40.999286 -84.481418
Description: 75°F, partly cloudy, flat ground conditions
Date: 9/10/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.50	47.2	14.4
10	3.0	0.80	50.2	15.3
20	6.1	0.65	81.7	24.9
30	9.1	0.62	117	35.6
50	15.2	0.60	189	57.5
100	30.5	0.60	377	115

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	2.16	67.9	20.7
10	3.0	0.96	60.4	18.4
20	6.1	0.72	90.6	27.6
30	9.1	0.63	119	36.2
50	15.2	0.61	192	58.4
100	30.5	0.65	408	125

ER-SUB **Latitude** **Longitude**
Location: 41.018582 -84.488420
Description: 75°F, cloudy, flat ground conditions
Date: 9/11/2021

North-South Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.81	56.8	17.3
10	3.0	1.05	65.9	20.1
20	6.1	0.93	117	35.6
30	9.1	0.82	155	47.1
50	15.2	0.73	229	69.9
100	30.5	0.90	566	172
200	61.0	0.59	741	226

East-West Transect

ELECTRODE SPACING		MEASURED RESISTANCE	APPARENT RESISTIVITY	
(feet)	(meters)	(ohms)	(ohm-feet)	(ohm-meters)
5	1.5	1.59	49.9	15.2
10	3.0	0.94	59.1	18.0
20	6.1	0.68	85.3	26.0
30	9.1	0.66	124	37.9
50	15.2	0.66	207	63.2
100	30.5	0.69	433	132
200	61.0	0.63	792	241

Appendix E

Geophysical Investigation Report

FINAL REPORT
GEOPHYSICAL INVESTIGATION
GROVER HILL WIND PROJECT
GROVER HILL, OHIO

Prepared for Westwood
Middleton, Wisconsin

Prepared by GeoView, Inc.
St. Petersburg, FL

October 28, 2021

Mr. Chris Enos
Westwood
1800 Deming Way, Suite 102
Middleton, WI 53562

Subject: **Transmittal of Final Report for Geophysical Investigation**
Grover Hill Wind Project
Grover Hill, Paulding County, Ohio
GeoView Project Number 34120

Dear Mr. Enos,

GeoView, Inc. (GeoView) is pleased to submit the final report that summarizes and presents the results of the geophysical investigation conducted at the above referenced site. This study was done to evaluate the shear wave velocities and compressional wave velocities at the project site. GeoView appreciates the opportunity to have assisted you on this project. If you have any questions or comments about the report, please contact us.

GEOVIEW, INC.

Christopher Taylor

Chris Taylor, P.G.
Vice President
Florida Professional Geologist Number 2256

A Geophysical Services Company

4610 Central Avenue
St. Petersburg, FL 33711

Tel.: (727) 209-2334
Fax: (727) 328-2477

1.0 Introduction

A geophysical investigation was conducted at the Grover Hill Wind Project in Paulding County, Ohio. The location of the geophysical survey area is provided on Figure 1. The purpose of the study was to evaluate the shear wave and compressional wave velocities at five specific locations of the project site. The locations were T-14, T, 25, T-29, T-31 and T-38. The investigation was conducted in October 2021.

2.0 Description of Geophysical Investigation

The geophysical survey was conducted using Multi-channel Analysis of Surface Waves (MASW). The seismic data was collected along five seismic lines. The locations of the lines are shown on Figure 1 and are provided in Table 1. The length of each MASW seismic line was 115 feet. MASW data acquisition was accomplished using a Geometrics Geode, 24-channel digital seismograph. A sledge hammer striking a polyethylene plate (shot point) was used to generate surface waves. The propagation velocities were recorded using the array of low frequency geophones (4.5 Hertz). A record length of 3 seconds was used. The geophones were spaced at 5-foot intervals. Eight shot points per line were collected for the 1-D soundings. The shot point locations were nominally located at -90, -60, -30, -5, 120, 145, 175 and 205 feet along each line. In some instances, the offsets had to be modified to accommodate site conditions. Multiple records from the same shot point were stacked together to increase signal and decrease noise within the data. The data was processed by Dr. Choon Park of Park Seismics. The data was used to calculate a 1-dimension vertical profile of the approximate the shear wave velocities under the center of the MASW transect.

The compressional wave velocities were calculated with seismic refraction. The survey was accomplished using a Geometrics Geode, 24-channel digital seismograph. A sledge hammer striking a polyethylene plate (shot point) was used to generate surface waves. The propagation velocities were recorded using the array of 40 Hertz geophones. A record length of .8 seconds was used. The geophones were spaced at 10-foot intervals. Eight shot points per line were collected for the 1-D soundings. The shot point locations were nominally located at -80, -5, 35, 75, 115 (midpoint), 145, 175, 235 and 305 along each line. In some instances, the offsets had to be modified to accommodate site conditions. Multiple records from the same shot point were stacked together to increase signal and decrease noise within the data. The data was processed with seismic refraction tomography. The travel times of the P-wave energy (Appendix 1) were manually picked for each shot using Pickwin v. 5.2.1.3 (Geometrics). The travel-time picks were imported into Plotrefa v. 3.1.0.5

(Geometrics) and Surfer for modeling. An iterative, least-squares inversion routine was used to provide a tomographic model of P-wave velocity. The inversion routine traces rays between each source-geophone pair through a velocity model, adjusting the model to minimize the difference between the observed and calculated travel times. The resulting 2D cross-sections of P-wave velocity extend to a depth of approximately 45 feet below the surface. A description of the seismic method and the methods employed for geotechnical characterization studies is provided in Appendix A2.1.

Upon completion of the geophysical survey the velocities were compared to rippability charts published by Caterpillar Tractor Company. Appendix 1 shows the estimated rippability of various rock types for different seismic velocities using D10 and D11 Caterpillar tractors.

Location	Latitude	Longitude
T-14	41.036791	-84.500297
T-25	41.026420	-84.48344
T-29	41.009893	-84.508497
T-31	41.009874	-84.489703
T-38	40.999323	-84.486552

Table 1 – Coordinates of Centers of MASW Transects

T-14 was oriented east to west and was centered by the boring. T-25 was oriented east to west and was centered 10 feet south of the boring. T-29 was oriented east to west and was centered by the boring. T-31 was oriented north to south and was centered 48 feet east and 17 feet south of the boring. T-38 was oriented north to south and was centered 4 feet east and 5 feet south of the boring

3.0 Survey Results

Results from the MASW survey and the refraction data are presented in Appendix 1. The dispersion curves show the data was of good quality and it was possible to calculate a well-resolved 1-D shear wave velocity profile to a depth 100 feet below land surface. The p-wave data extended to a depth of approximately 45feet bls.

T-14

MASW

From a depth of approximately 0 to 17 feet, the 1-D Vs profile shows a shear wave velocity ranging from approximately 340 to 670 feet/second. This zone is associated with the stiff clay layer encountered in the boring. The data shows an increase in shear wave velocity to a velocity of approximately 2,000 to 3,000 feet/second at a depth of approximately 17 feet. This zone is suspected to be associated with the limestone encountered in the boring. The calculated average shear wave velocity of the upper 100 feet was 1876 feet/second. Based on the shear waved velocities, the site would be categorized as Class C according to the seismic site classification codes adopted by the National Earthquake Hazard Reduction Program and the International Building Code. Class C is reported as ‘Very Dense Soil and Soft Rock with Shear Wave velocities of 1,200 to 2,500 feet per second.

Refraction

The transects show surficial low to moderate p-wave velocity layer (2,000-4,000 feet/second) represented in blue) extending to a depth of approximately 17 to 20 feet. This layer is underlain a high velocity layer (10,000 to 15,000 feet/second, represented in yellow to red.

T-25

MASW

From a depth of approximately 0 to 17 feet, the 1-D Vs profile shows a shear wave velocity ranging from approximately 390 to 560 feet/second. This zone is associated with the stiff clay layer encountered in the boring. The data shows an increase in shear wave velocity to a velocity of approximately 2,600 to 2,700 feet/second at a depth of approximately 17 feet. This zone is suspected to be associated with the limestone encountered in the boring. The calculated average shear wave velocity of the upper 100 feet was 1861 feet/second. Based on the shear waved velocities, the site would be categorized as Class C according to the seismic site classification codes adopted by the National Earthquake Hazard Reduction Program and the International Building Code. Class C is reported as ‘Very Dense Soil and Soft Rock with Shear Wave velocities of 1,200 to 2,500 feet per second.

Refraction

The transects show surficial low to moderate p-wave velocity layer (2,000-4,000 feet/second) represented in blue) extending to a depth of approximately 15 to

20 feet. This layer is underlain a high velocity layer (10,000 to 15,000 feet/second, represented in yellow to red.

T-29

MASW

From a depth of approximately 0 to 17 feet, the 1-D Vs profile shows a shear wave velocity ranging from approximately 380 to 1000 feet/second. This zone is associated with the stiff clay layer encountered in the boring. The data shows an increase in shear wave velocity to a velocity of approximately 2,300 to 2,480 feet/second at a depth of approximately 17 feet. This zone is suspected to be associated with the limestone encountered in the boring. The calculated average shear wave velocity of the upper 100 feet was 1677 feet/second. Based on the shear waved velocities, the site would be categorized as Class C according to the seismic site classification codes adopted by the National Earthquake Hazard Reduction Program and the International Building Code. Class C is reported as ‘Very Dense Soil and Soft Rock with Shear Wave velocities of 1,200 to 2,500 feet per second.

Refraction

The transects show surficial low to moderate p-wave velocity layer (2,000-4,000 feet/second) represented in blue) extending to a depth of approximately 15 to 20 feet. This layer is underlain a high velocity layer (10,000 to 15,000 feet/second, represented in yellow to red.

T-31

MASW

From a depth of approximately 0 to 17 feet, the 1-D Vs profile shows a shear wave velocity ranging from approximately 320 to 680 feet/second. This zone is associated with the stiff clay layer encountered in the boring. The data shows an increase in shear wave velocity to a velocity of approximately 2,850 to 3,050 feet/second at a depth of approximately 17 feet. This zone is suspected to be associated with the limestone encountered in the boring. The calculated average shear wave velocity of the upper 100 feet was 2004 feet/second. Based on the shear waved velocities, the site would be categorized as Class C according to the seismic site classification codes adopted by the National Earthquake Hazard Reduction Program and the International Building Code. Class C is reported as ‘Very Dense Soil and Soft Rock with Shear Wave velocities of 1,200 to 2,500 feet per second.

Refraction

The transects show surficial low to moderate p-wave velocity layer (2,000-4,000 feet/second) represented in blue) extending to a depth of approximately 15 to 20 feet. This layer is underlain a high velocity layer (8,000 to 12,000 feet/second, represented in green to yellow.

T-38

MASW

From a depth of approximately 0 to 12 feet, the 1-D Vs profile shows a shear wave velocity ranging from approximately 320 to 340 feet/second. This zone is associated with the stiff clay layer encountered in the boring. The data shows an increase in shear wave velocity to a velocity of approximately 1,900 to 2,000 feet/second at a depth of approximately 12 feet. This zone is suspected to be associated with the limestone encountered in the boring. The calculated average shear wave velocity of the upper 100 feet was 1568 feet/second. Based on the shear waved velocities, the site would be categorized as Class C according to the seismic site classification codes adopted by the National Earthquake Hazard Reduction Program and the International Building Code. Class C is reported as ‘Very Dense Soil and Soft Rock with Shear Wave velocities of 1,200 to 2,500 feet per second.

Refraction

The transects show surficial low to moderate p-wave velocity layer (2,000-4,000 feet/second) represented in blue) extending to a depth of approximately 12 to 20 feet. This layer is underlain a high velocity layer (10,000 to 14,000 feet/second, represented in yellow to orange.

Rock Rippability

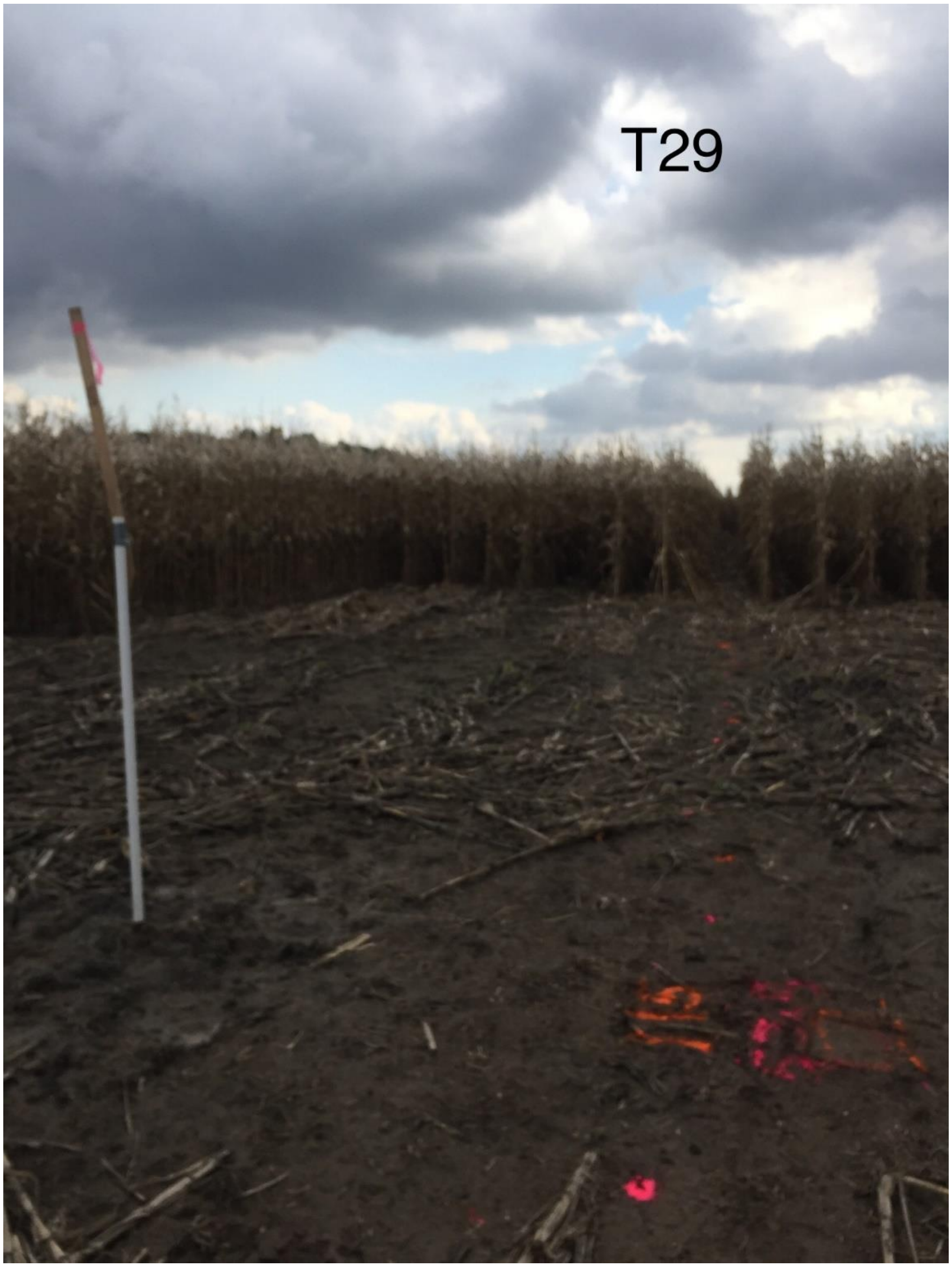
The majority of the limestone ranged in velocity from 9,000 to 15,000 feet/second. Based on Rippability Charts by Caterpillar, the majority of limestone within this velocity range would be considered non-rippable using D10 and D11 equipment. Areas with p-wave velocities above 11,000 feet/second are represented in yellows to reds and would be classified as non-rippable. Areas with p-wave velocities above between 8,000 to 11,000 feet/second are represented in green would be classified as marginally rippable using Caterpillar D10 equipment. It is noted tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials. Low seismic velocities in sedimentary rocks can indicate probable rippability. However, if the fractures and joints do not allow tooth penetration then the material may not be ripped effectively.

3.0 Limitations

The analysis and collection of geophysical data is both a technical and interpretative skill. The technical aspects of the work are learned from both training and experience. Having the opportunity to compare data collected in numerous settings to the results from geotechnical studies performed at the same locations develops interpretative skills for geological characterization studies. GeoView can make no warranties or representations of geological conditions that may be present beyond the depth of investigation or resolving capability of the equipment or in areas that were not accessible to the geophysical investigation.

Site Photograph 1

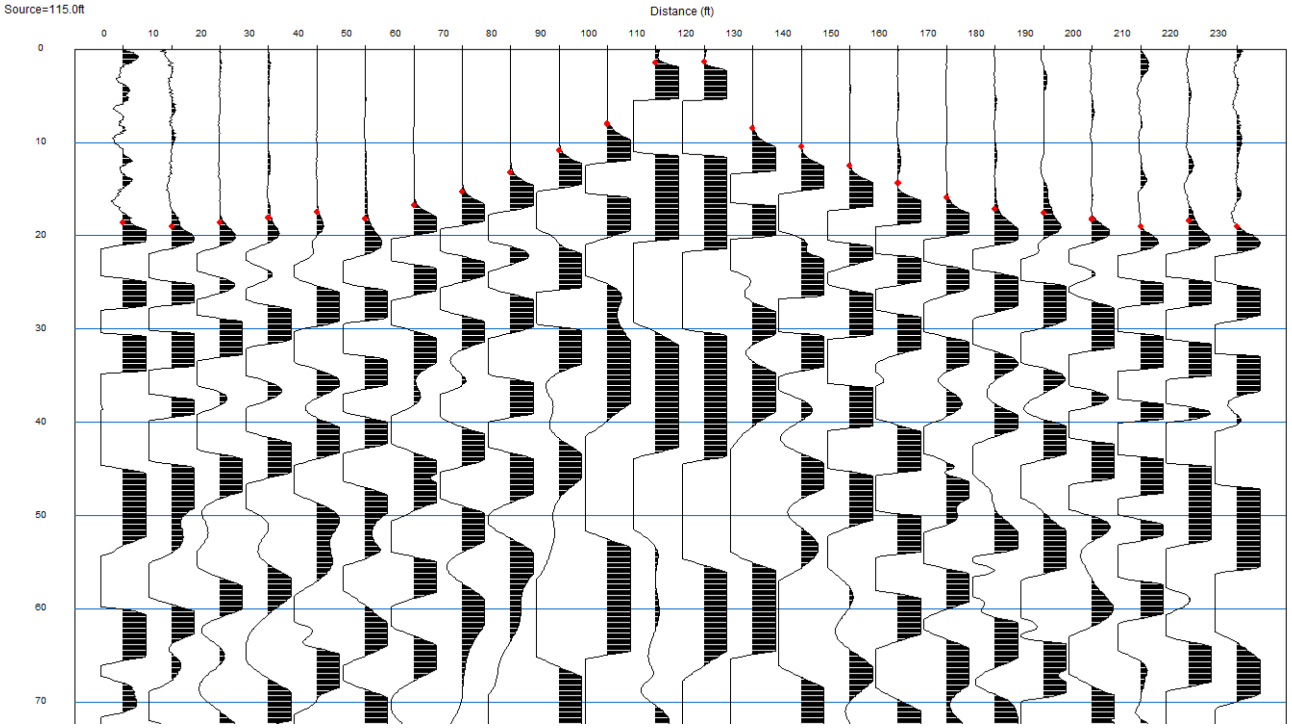
Site Photograph 2



Site Photograph 3

Site Photograph 4

Site Photograph 5



Example Refraction Data

Area T14, Shot at 115 feet

APPENDIX 1

FIGURE, RIPPABILITY CHART
AND MASW AND REFRACTION DATA

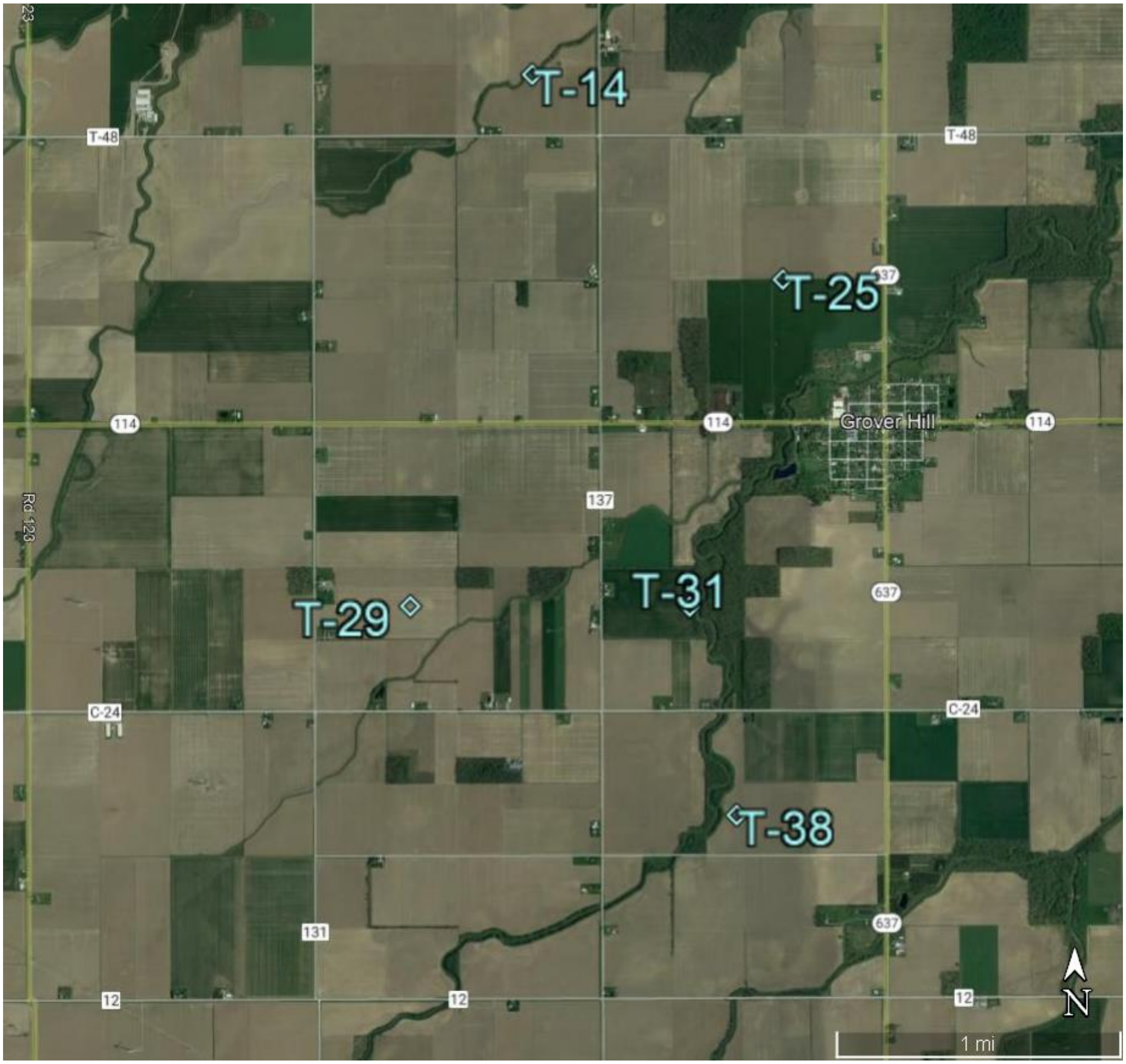
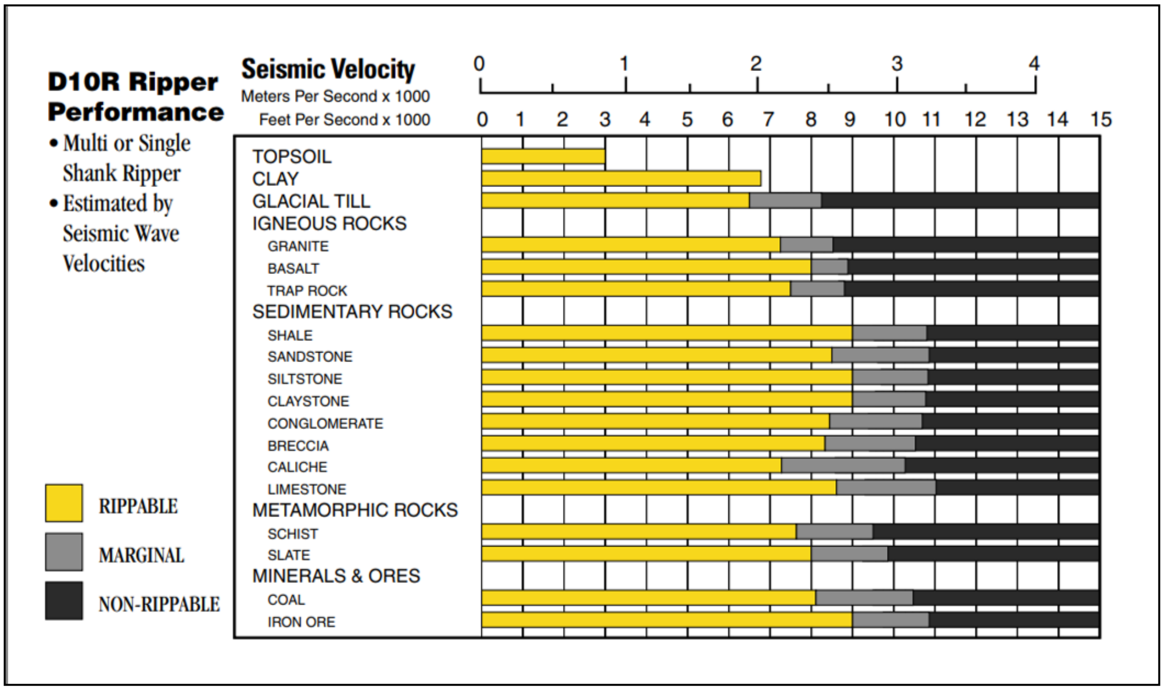
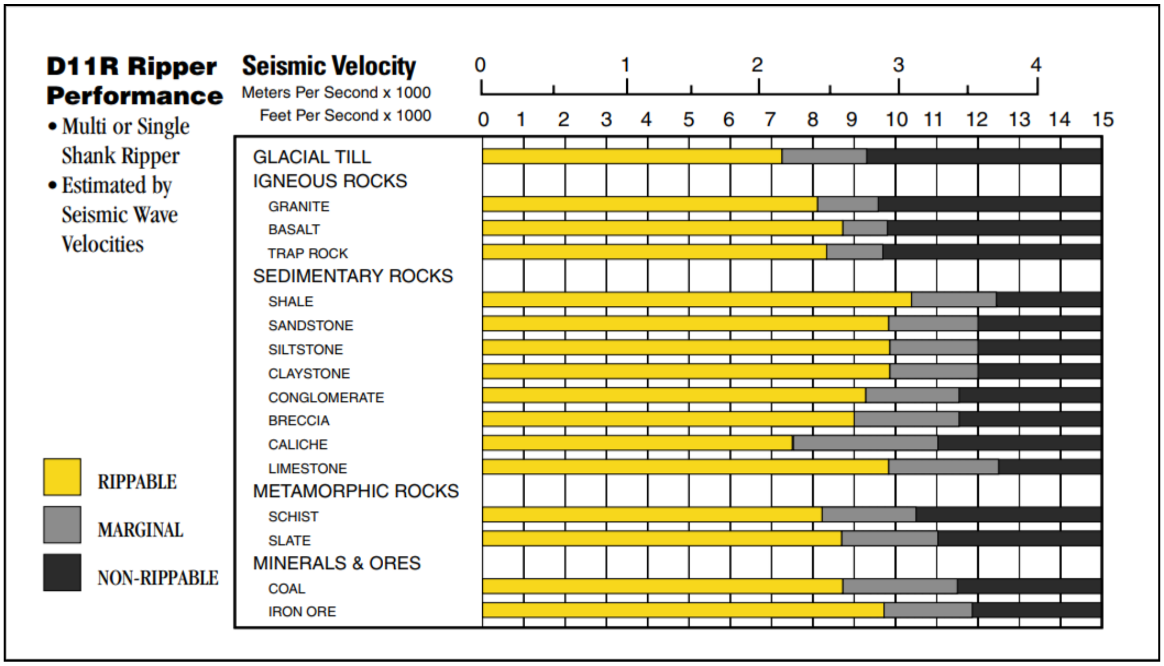


FIGURE 1 – TEST LOCATIONS

CATERPILLAR RIPPABILITY CHARTS

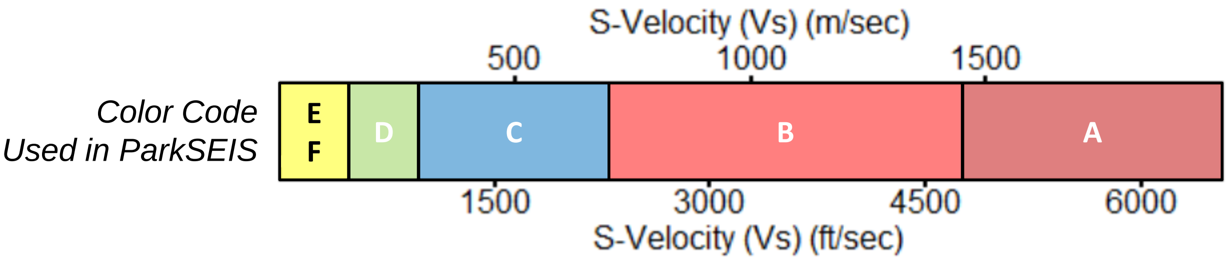


D10R RIPPABILITY CHART



D11R RIPPABILITY CHART

Seismic Site Classification (Vs$^{30\text{-m}}$ or Vs$^{100\text{-ft}}$)



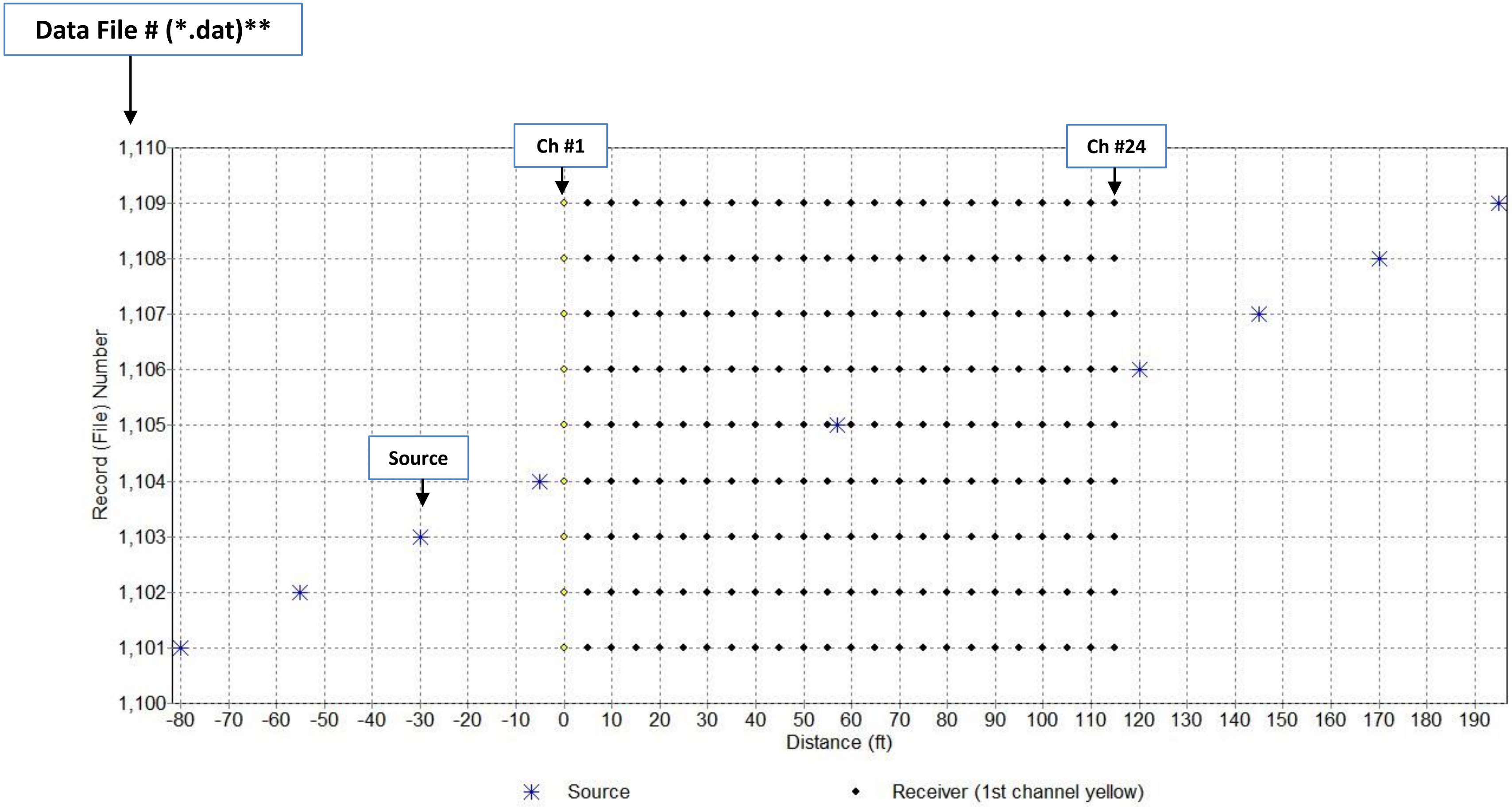
NEHRP* Seismic site classification based on shear-velocity (Vs) ranges.

Site Class	S-Velocity (Vs) (ft/sec)	S-Velocity (Vs) (m/sec)
A **(Hard Rock)**	> 5,000	**> 1500**
B **(Rock)**	2,500 – 5000	**760 – 1500**
C **(Very Dense Soil and Soft Rock)**	1,200 – 2,500	**360 – 760**
D **(Stiff Soil)**	600 – 1,200	**180 – 360**
E **(Soft Clay Soil)**	< 600	**< 180**
F **(Soils Requiring Add'l Response)**	< 600, and meeting some additional conditions.	**< 180, and meeting some additional conditions.**

*** National Earthquake Hazard Reduction Program (www.nehrp.gov)**

T-14

Source/Receiver (SR) Setup* (T14 – "Grove Hill MASW")



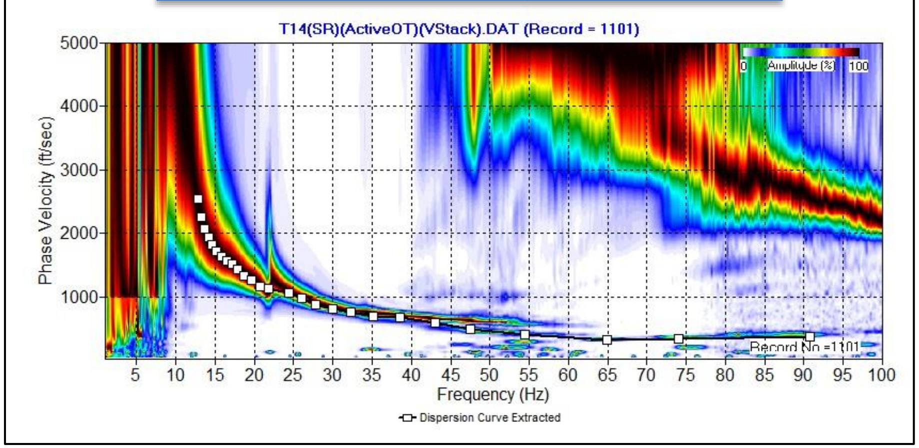
**Setup encoded in the original field files.*

***Renamed to fit the software limit (e.g., from "10101.dat" to "1101.dat", etc.)*

Result: 1-D Shear-Velocity (Vs) Profile (T14)

Dispersion

Frequency (Hz)	1-100
Phase Velocity (ft/sec)	10-5000
Data Quality (Complexity*)	**Excellent (Low)**



**Complexity of the overall dispersion patterns indicative of the complexity of the subsurface velocity (Vs) distributions.*

1-D
Vs Profile

Max. Depth (ft)	77.6
Number of Layers	10
Seismic Site Class (Vs-100ft)	**'C' (1876 ft/s)**

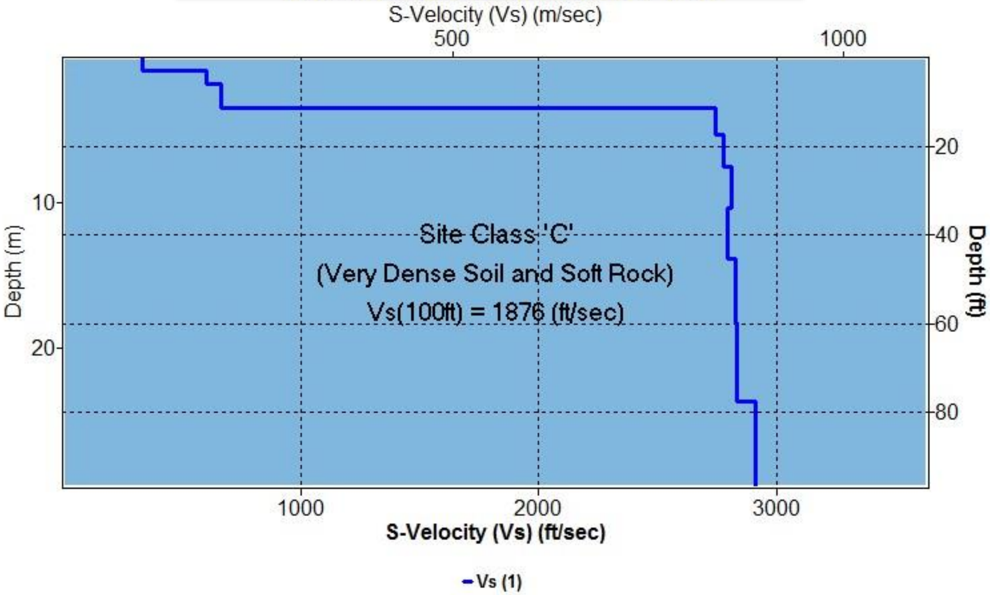
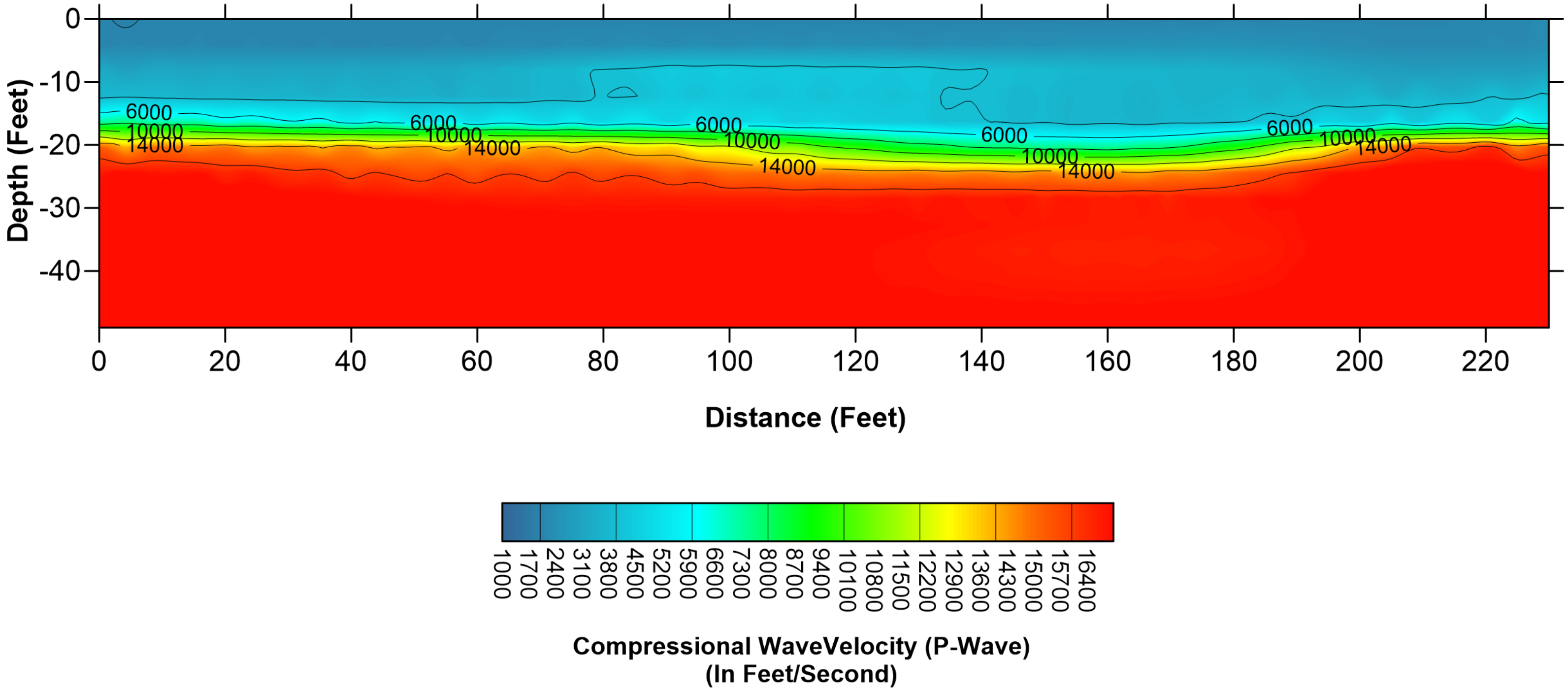


Table of Vs Values

No.	Depth (ft)	Final Vs (ft/sec)
1	3.007	**338.52**
2	5.959	**604.41**
3	11.466	**667.16**
4	17.34	**2744.02**
5	24.682	**2776.53**
6	33.861	**2810.66**
7	45.333	**2790.84**
8	59.674	**2823.87**
9	77.6	**2830.47**
10	**HS***	**2909.74**

*HS: half space

T-14



Scale: 1"= 30'

0 15 30

GeoView
A geophysical services company

**P-WAVE VELOCITY
CROSS SECTION
AREA T-14**

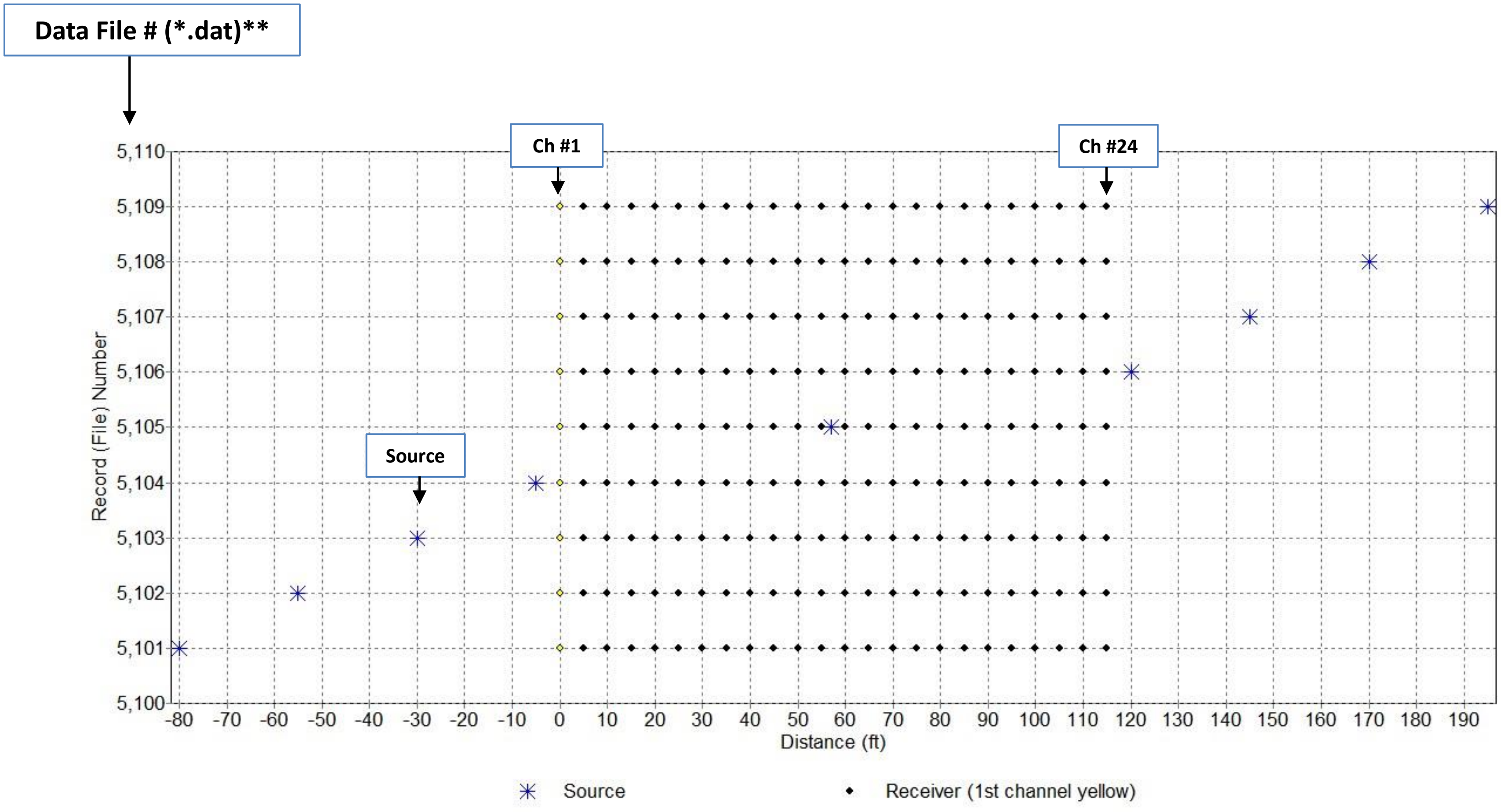
**GROVER HILL WIND PROJECT
GROVER HILL, OHIO**

**WESTWOOD
MIDDLETON, WISCONSIN**

PROJECT:
34120
DATE:
10/28/21

T-25

Source/Receiver (SR) Setup*
(T25 – "Grove Hill MASW")



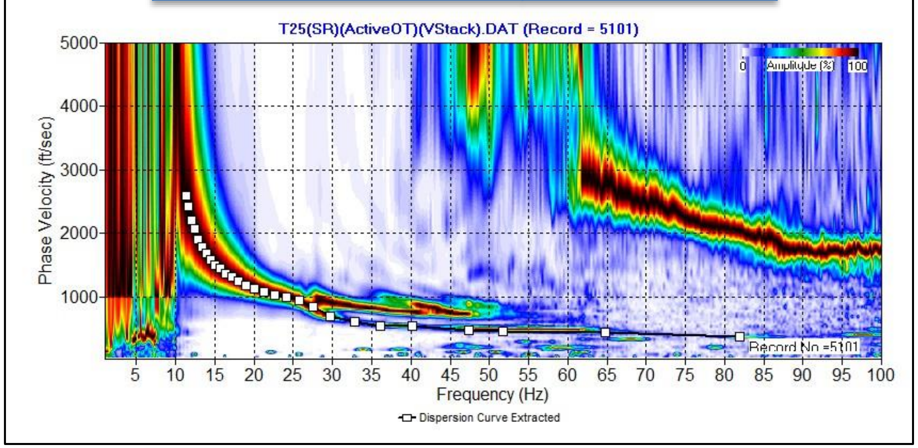
**Setup encoded in the original field files.*

***Renamed to fit the software limit (e.g., from "50101.dat" to "5101.dat", etc.)*

Result: 1-D Shear-Velocity (Vs) Profile (T25)

Dispersion

Frequency (Hz)	1-100
Phase Velocity (ft/sec)	10-5000
Data Quality (Complexity*)	**Excellent (Low)**



**Complexity of the overall dispersion patterns indicative of the complexity of the subsurface velocity (Vs) distributions.*

1-D
Vs Profile

Max. Depth (ft)	77.6
Number of Layers	10
Seismic Site Class (Vs-100ft)	**'C' (1861 ft/s)**

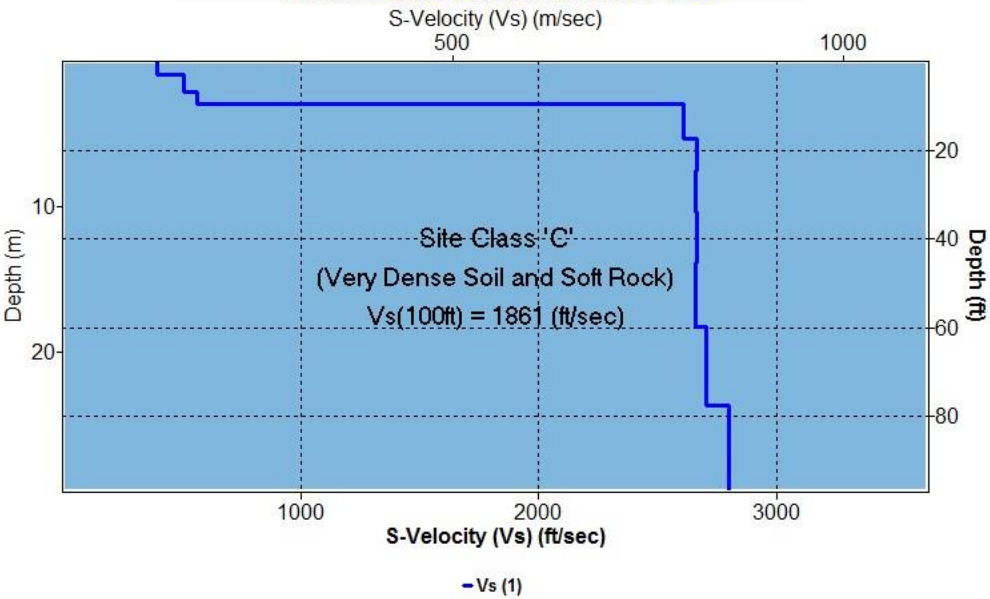
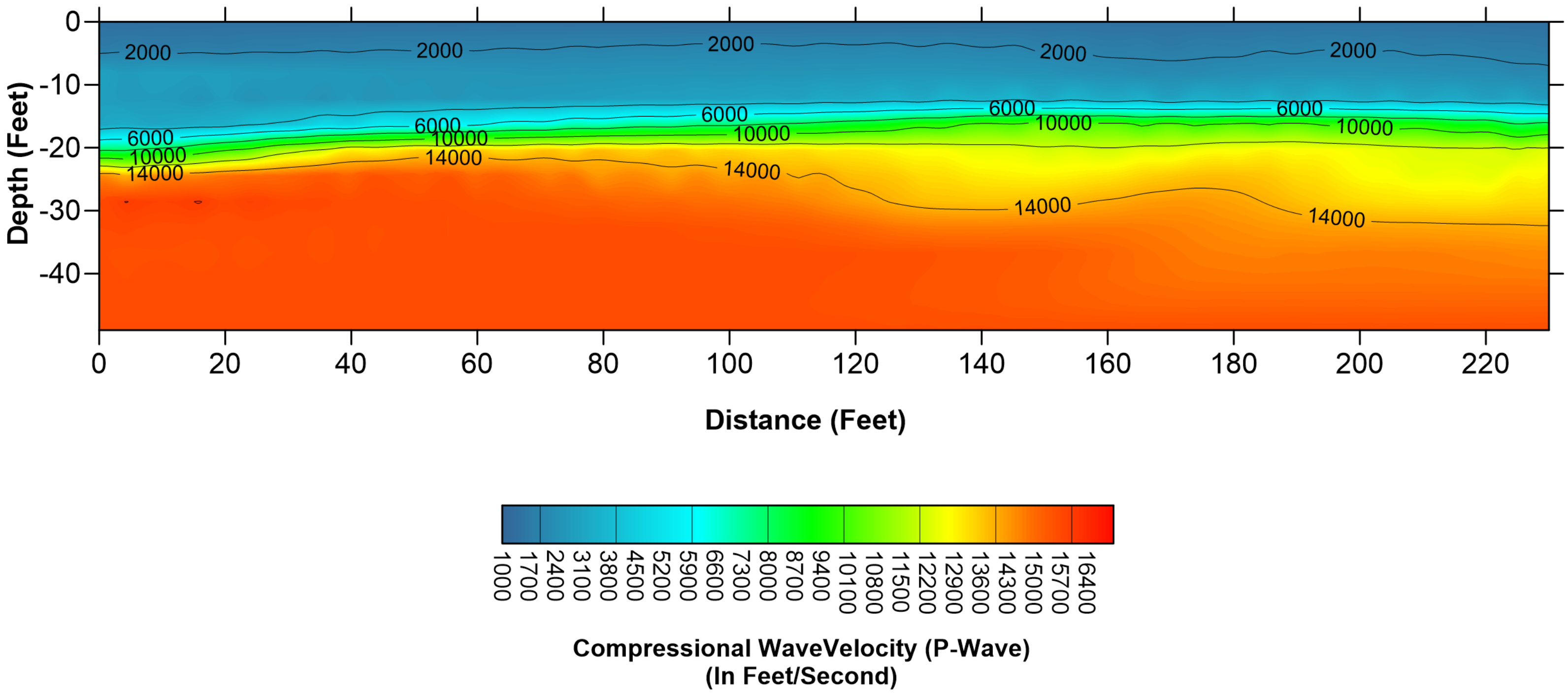


Table of Vs Values

No.	Depth (ft)	Final Vs (ft/sec)
1	3.007	**395.02**
2	6.767	**509.81**
3	9.752	**563.83**
4	17.34	**2609.81**
5	24.682	**2663.83**
6	33.861	**2660.46**
7	45.333	**2663.83**
8	59.674	**2660.46**
9	77.6	**2700.97**
10	**HS***	**2795.5**

*HS: half space

T-25



Scale: 1"= 30'

0 15 30

Geo View
A geophysical services company

P-WAVE VELOCITY
CROSS SECTION
AREA T-25

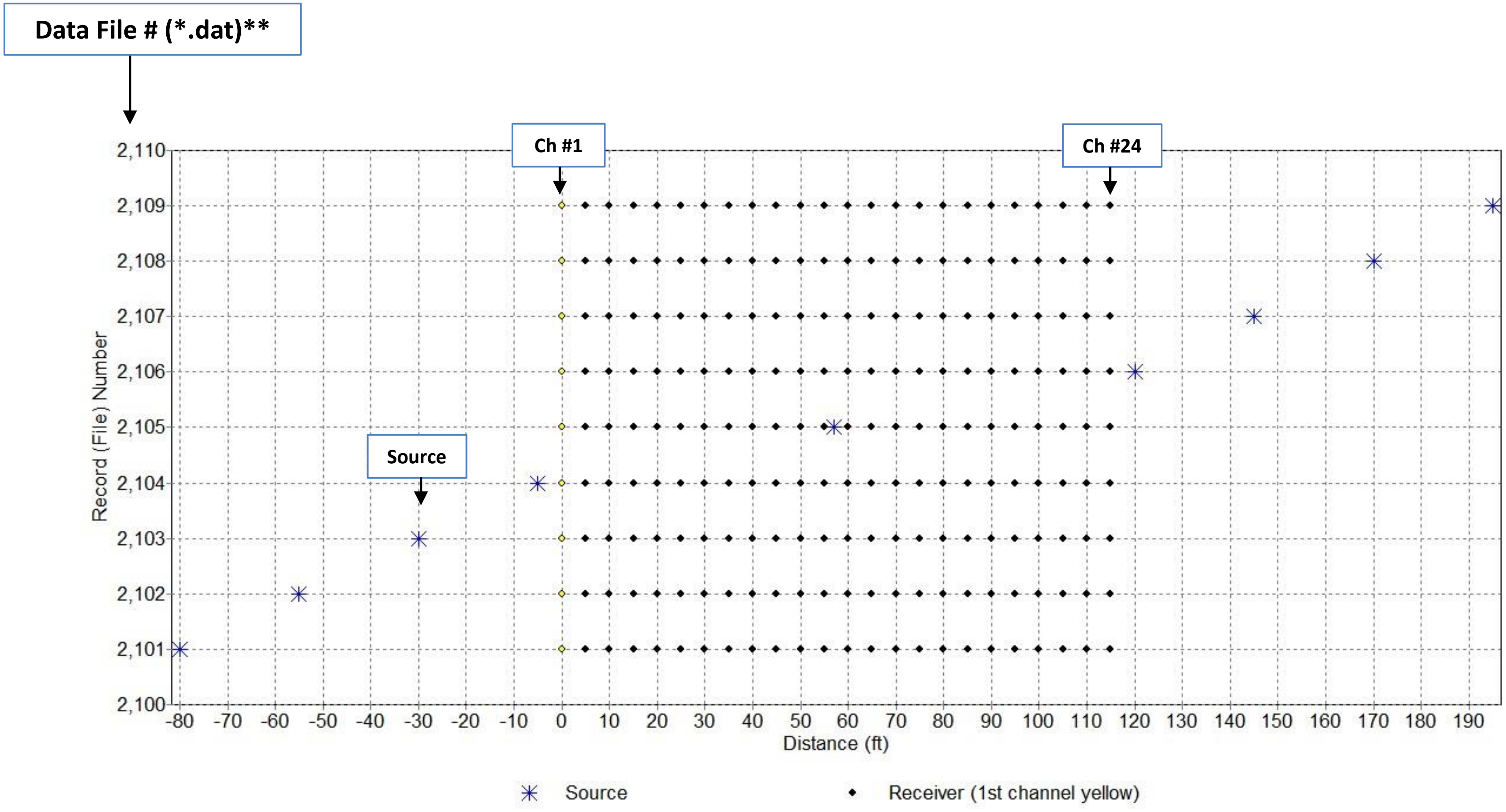
GROVER HILL WIND PROJECT
GROVER HILL, OHIO

WESTWOOD
MIDDLETON, WISCONSIN

PROJECT:
34120
DATE:
10/28/21

T-29

Source/Receiver (SR) Setup* (T29 – "Grove Hill MASW")



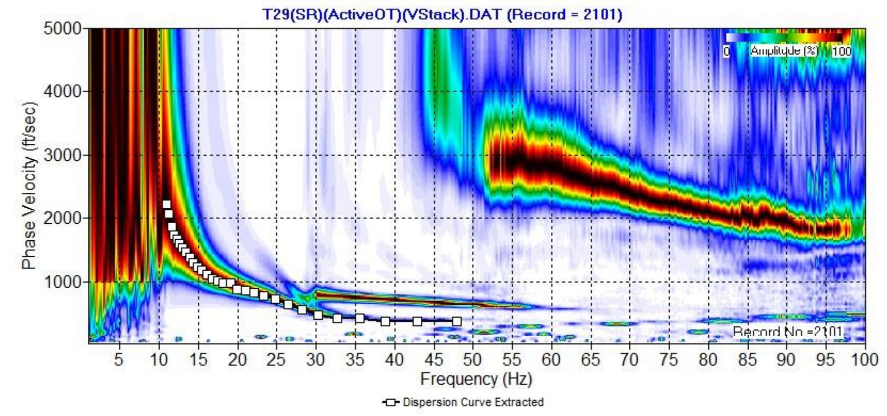
**Setup encoded in the original field files.*

***Renamed to fit the software limit (e.g., from "20101.dat" to "2101.dat", etc.)*

Result: 1-D Shear-Velocity (Vs) Profile (T29)

Dispersion

Frequency (Hz)	1-100
Phase Velocity (ft/sec)	10-5000
Data Quality (Complexity*)	**Excellent (Low)**



**Complexity of the overall dispersion patterns indicative of the complexity of the subsurface velocity (Vs) distributions.*

1-D Vs Profile

Max. Depth (ft)	77.6
Number of Layers	10
Seismic Site Class (Vs-100ft)	**'C' (1677 ft/s)**

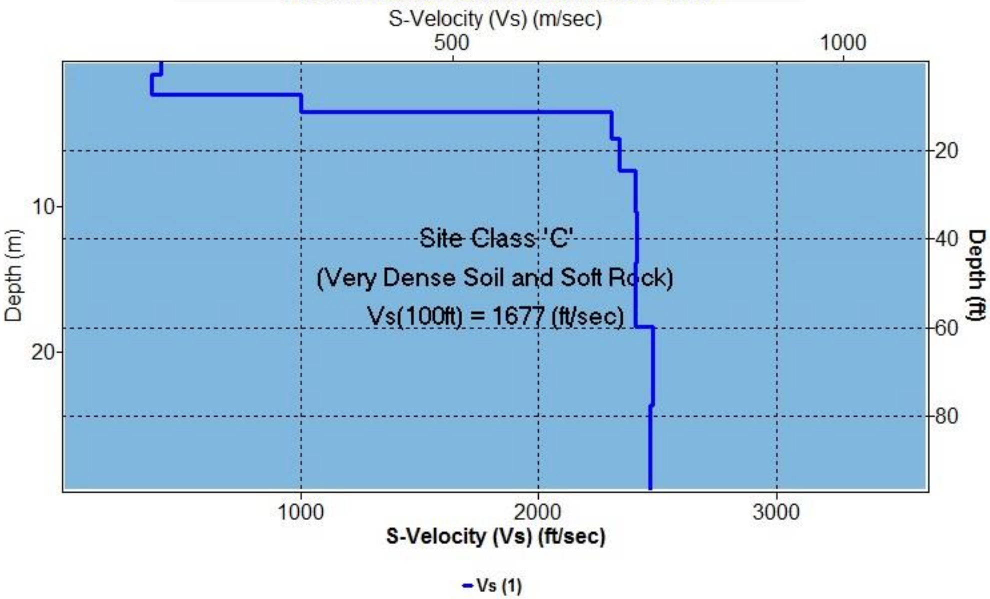
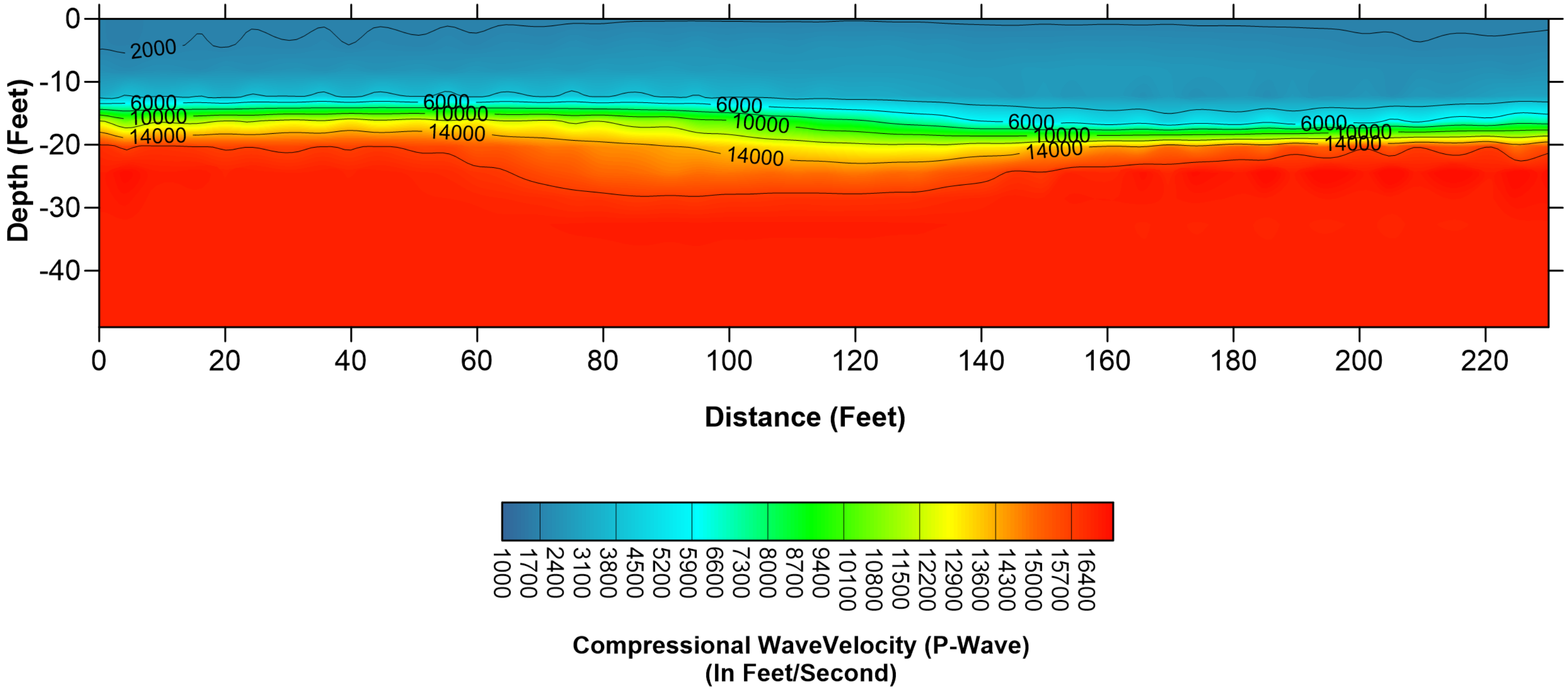


Table of Vs Values

No.	Depth (ft)	Final Vs (ft/sec)
1	3.007	**414.6**
2	7.439	**375.18**
3	11.466	**1001.99**
4	17.34	**2307.49**
5	24.682	**2338.24**
6	33.861	**2404.23**
7	45.333	**2413.65**
8	59.674	**2404.38**
9	77.6	**2481.38**
10	**HS***	**2466**

*HS: half space

T-29



Scale: 1"= 30'

0 15 30

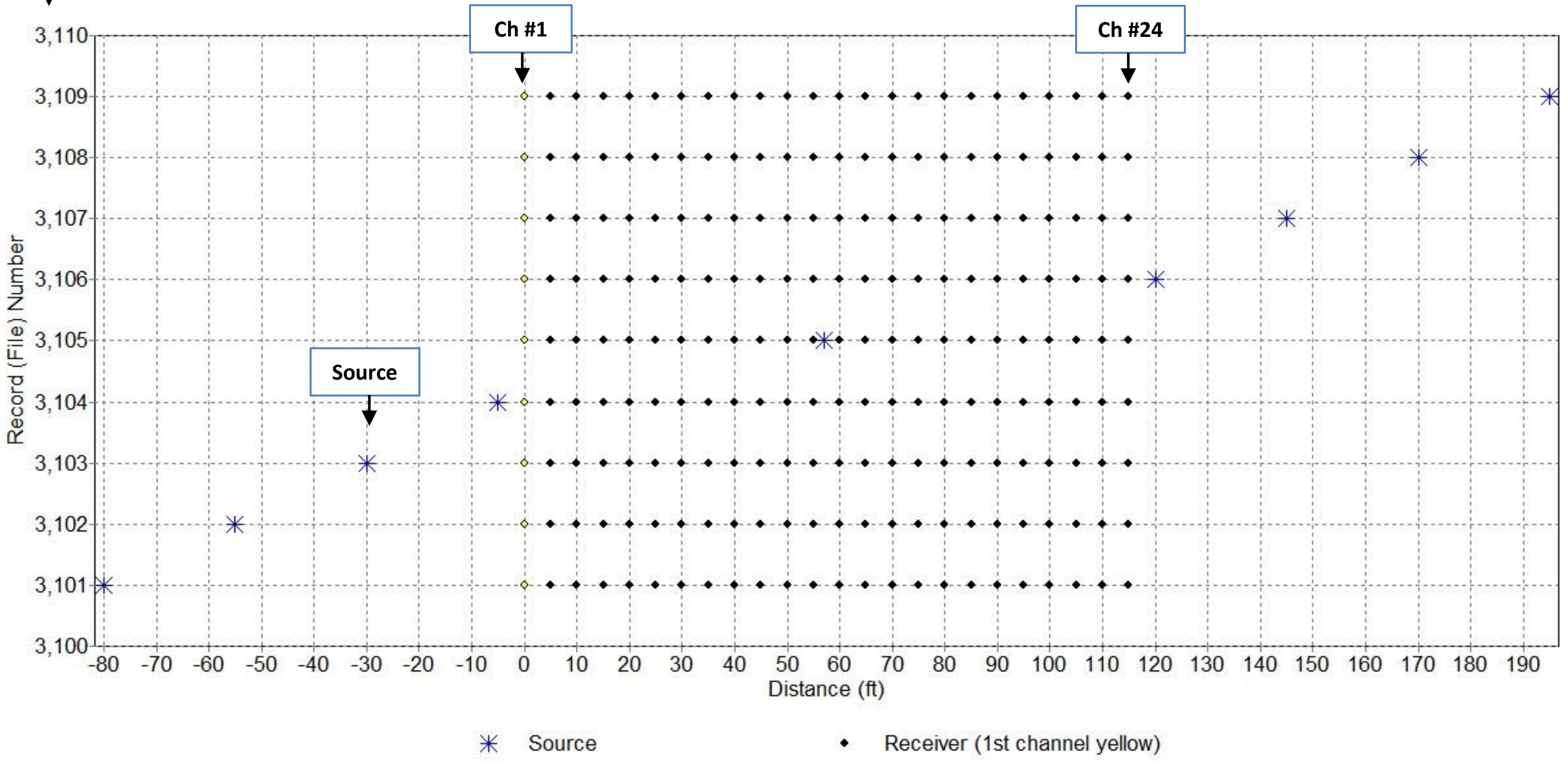
GeoView
A geophysical services company

		GROVER HILL WIND PROJECT GROVER HILL, OHIO
P-WAVE VELOCITY CROSS SECTION AREA T-29	WESTWOOD MIDDLETON, WISCONSIN	PROJECT: 34120 DATE: 10/28/21

T-31

Source/Receiver (SR) Setup* (T31 – "Grove Hill MASW")

Data File # (*.dat)**



Ch #1

Ch #24

Source

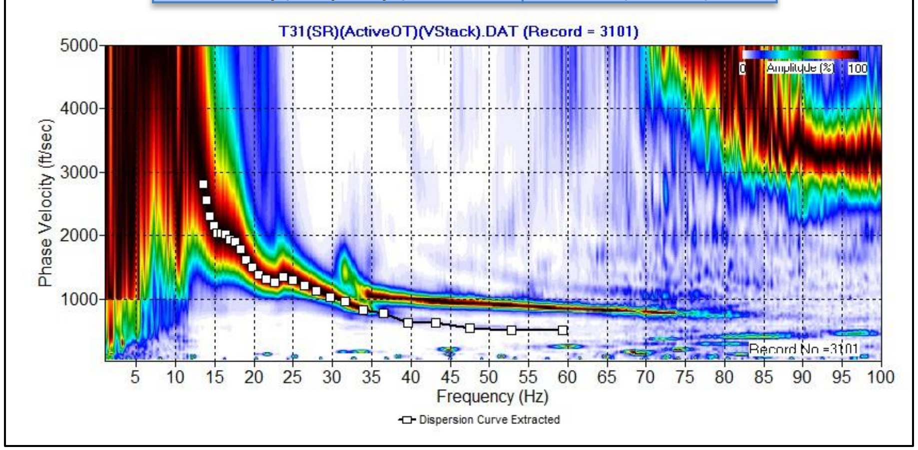
**Setup encoded in the original field files.*

***Renamed to fit the software limit (e.g., from "30101.dat" to "3101.dat", etc.)*

Result: 1-D Shear-Velocity (Vs) Profile (T31)

Dispersion

Frequency (Hz)	1-100
Phase Velocity (ft/sec)	10-5000
Data Quality (Complexity*)	**Excellent (Medium)**



Complexity of the overall dispersion patterns indicative of the complexity of the subsurface velocity (Vs) distributions.

1-D Vs Profile

Max. Depth (ft)	77.6
Number of Layers	10
Seismic Site Class (Vs-100ft)	**'C' (2004 ft/s)**

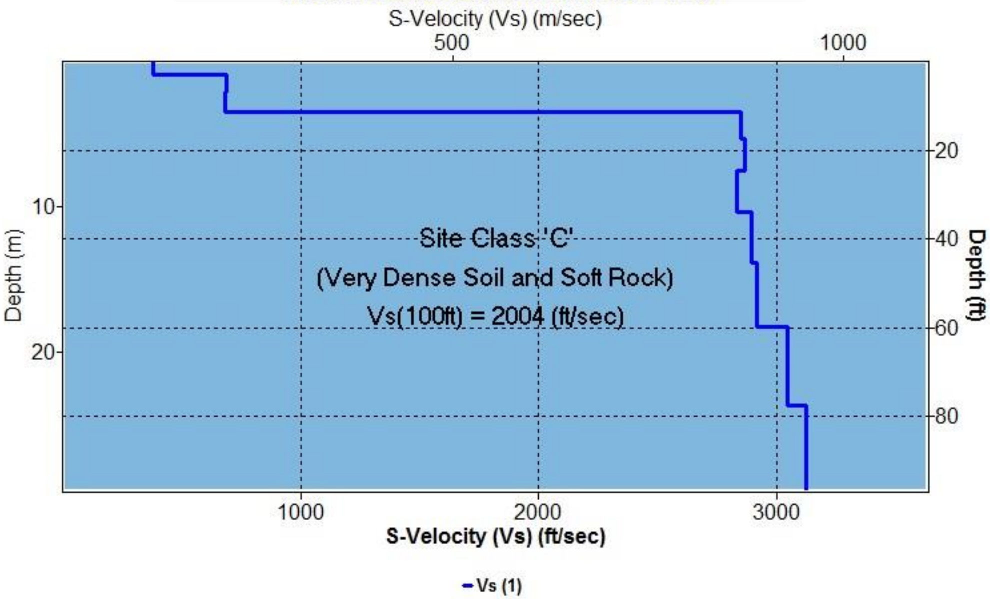
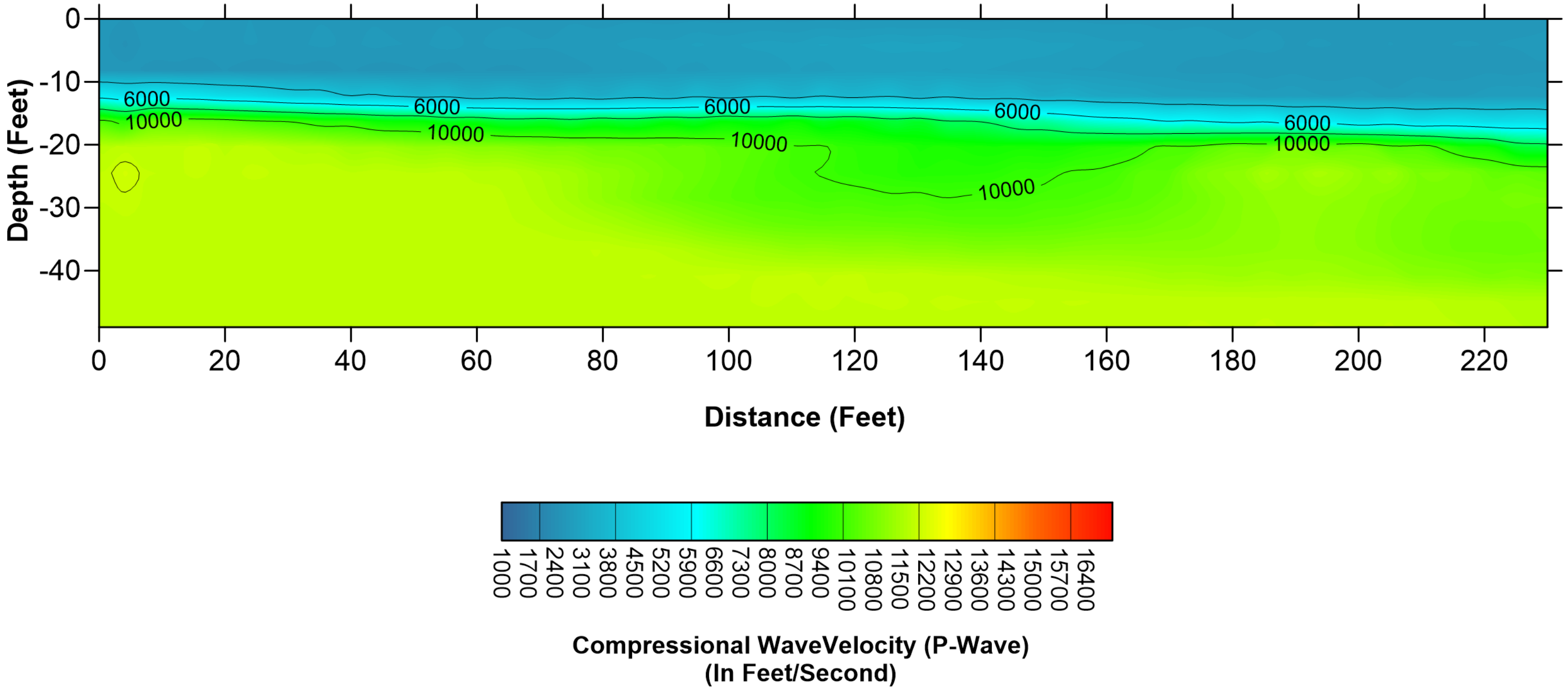


Table of Vs Values

No.	Depth (ft)	Final Vs (ft/sec)
1	3.007	**382.42**
2	6.767	**690.1**
3	11.358	**681.59**
4	17.34	**2845.83**
5	24.682	**2865.44**
6	33.861	**2833.72**
7	45.333	**2890.99**
8	59.674	**2916.15**
9	77.6	**3044.12**
10	**HS***	**3124.22**

*HS: half space

T-31



Scale: 1"= 30'

0 15 30

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P-WAVE VELOCITY
CROSS SECTION
AREA T-31

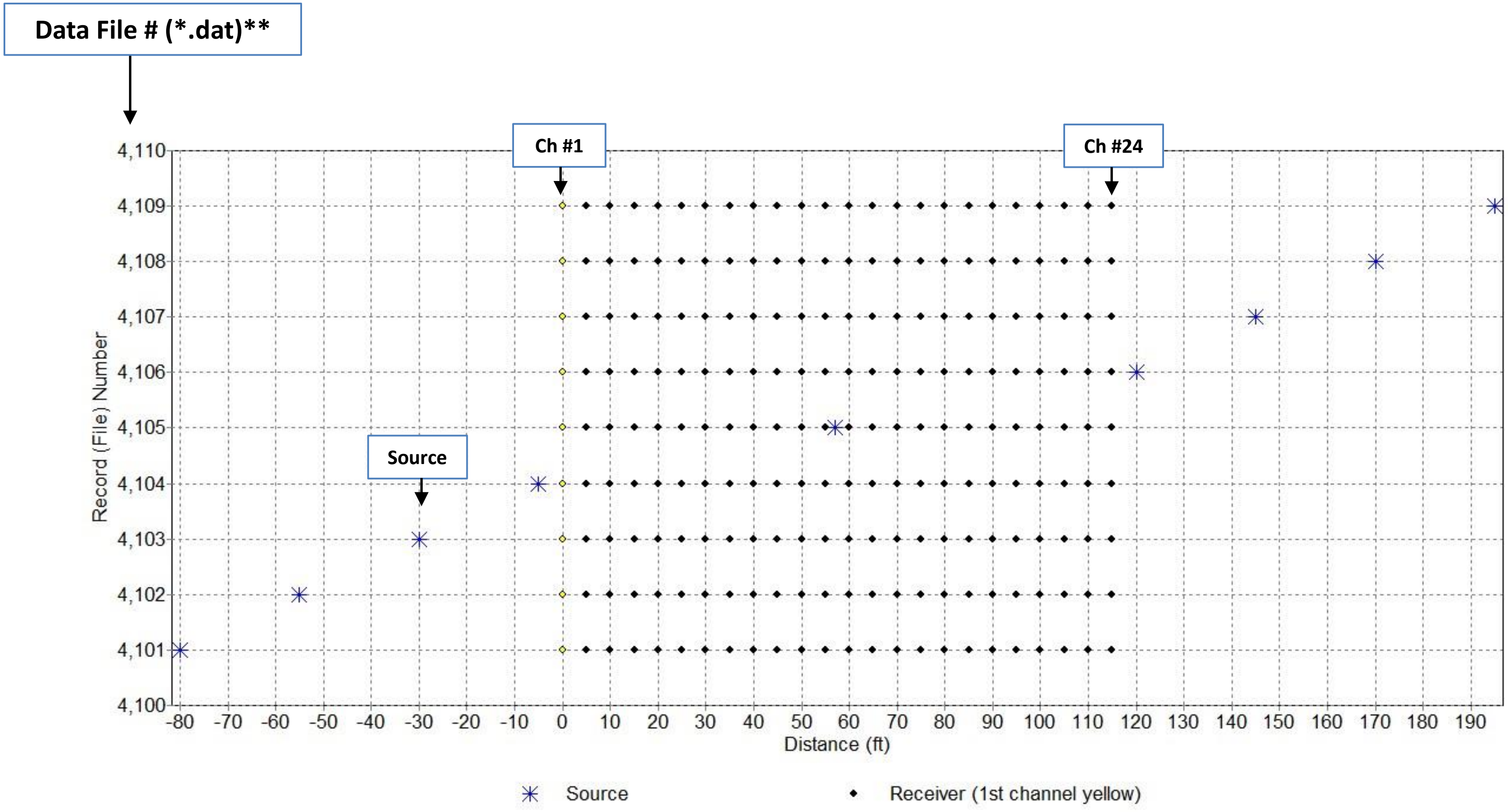
GROVER HILL WIND PROJECT
GROVER HILL, OHIO

WESTWOOD
MIDDLETON, WISCONSIN

PROJECT:
34120
DATE:
10/28/21

T-38

Source/Receiver (SR) Setup* (T38 – "Grove Hill MASW")



Data File # (*.dat)**

Ch #1

Ch #24

Source

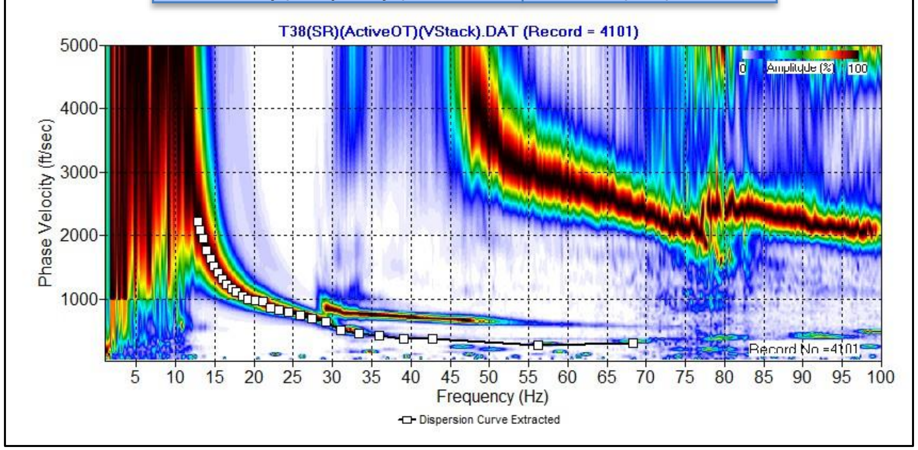
**Setup encoded in the original field files.*

***Renamed to fit the software limit (e.g., from "40101.dat" to "4101.dat", etc.)*

Result: 1-D Shear-Velocity (Vs) Profile (T38)

Dispersion

Frequency (Hz)	1-100
Phase Velocity (ft/sec)	10-5000
Data Quality (Complexity*)	**Excellent (Low)**



**Complexity of the overall dispersion patterns indicative of the complexity of the subsurface velocity (Vs) distributions.*

1-D Vs Profile

Max. Depth (ft)	77.6
Number of Layers	10
Seismic Site Class (Vs-100ft)	**'C' (1568 ft/s)**

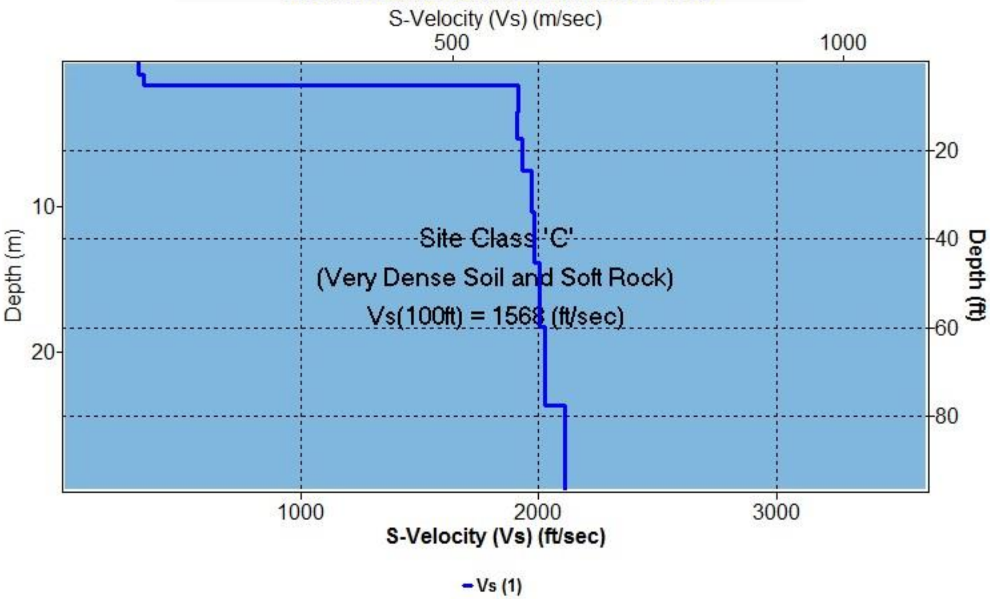
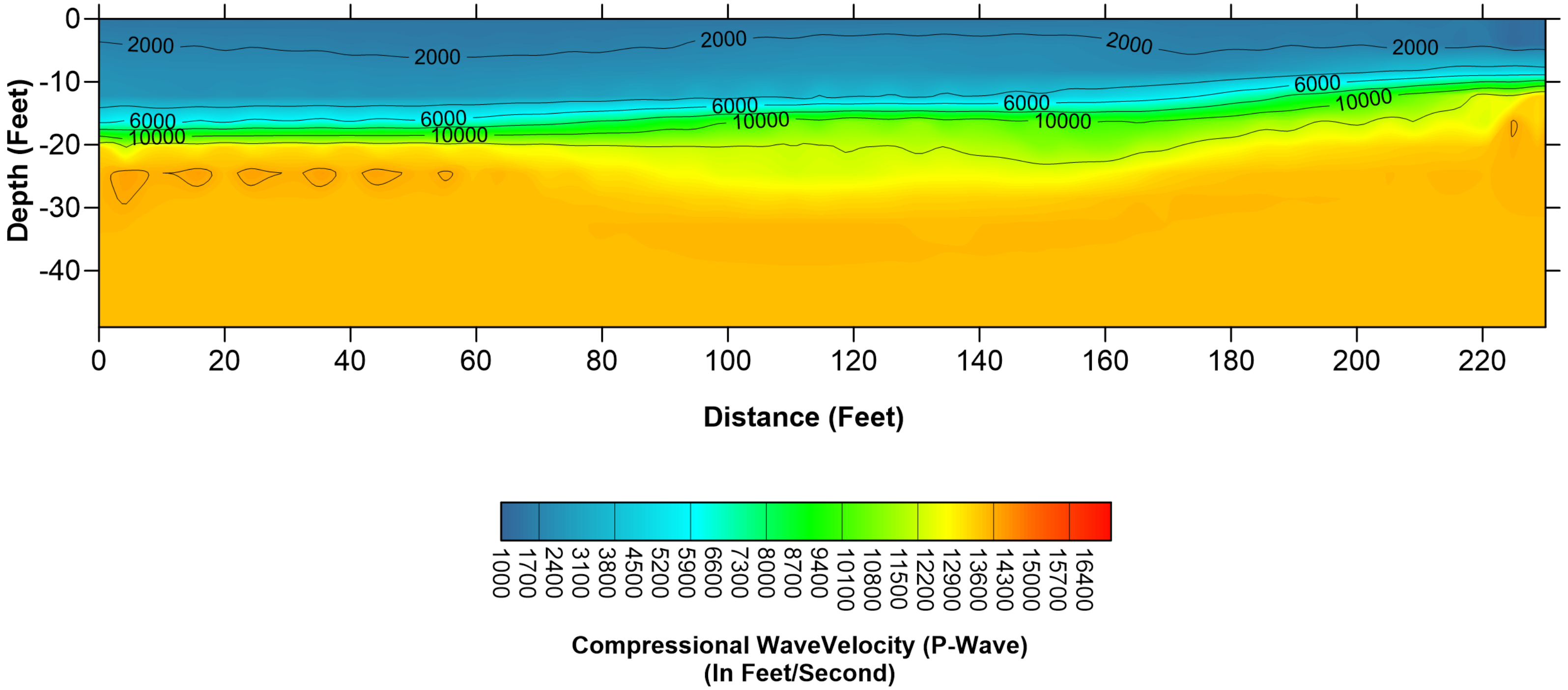


Table of Vs Values

No.	Depth (ft)	Final Vs (ft/sec)
1	3.007	**316.75**
2	5.433	**338.97**
3	11.466	**1913.91**
4	17.34	**1910.89**
5	24.682	**1932.05**
6	33.861	**1968.33**
7	45.333	**1980.43**
8	59.674	**2001.59**
9	77.6	**2025.78**
10	**HS***	**2107.42**

*HS: half space

T-38



Scale: 1"= 30'

0 15 30

GeoView
A geophysical services company

P-WAVE VELOCITY
CROSS SECTION
AREA T-38

GROVER HILL WIND PROJECT
GROVER HILL, OHIO

WESTWOOD
MIDDLETON, WISCONSIN

PROJECT:
34120
DATE:
10/28/21