

Exhibit C
Geotechnical Addendum

RRC

September 29, 2021



September 29, 2021

Mr. Clay Parrish
Apex Clean Energy, Inc.
310 Fourth Street NE, Suite 300
Charlottesville, VA 22902

**Re: Geotechnical Addendum Letter
Emerson Creek Wind Project – Karst Assessment T-25, T-26, T-42 and T-75
Erie and Huron Counties, Ohio
RRC Project No. MD1901007**

1.0 INTRODUCTION

RRC Power & Energy, LLC (RRC) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Emerson Creek Wind Project. Our findings and recommendations were presented in the Geotechnical Report Emerson Creek Wind Project – Erie and Huron Counties, Ohio by RRC Power & Energy, LLC dated April 29, 2020, RRC Project No. MD1901007. This letter includes the results of supplemental geophysical surveys and geotechnical subsurface explorations to provide supplemental karst risk analysis, geotechnical design and construction recommendations Turbine Nos. T-25, T-26, T-42, and T-75.

This addendum letter includes the field exploration summary, logs of boring, laboratory test results, foundation design and construction recommendations for the proposed investigated sites. In addition, this letter presents an updated Table A1 *Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations* within Appendix A for the project.

2.0 FIELD EXPLORATION

Original scope of work conducted by RRC included drilling conventional boreholes at 80 proposed WTG locations during the period of April 1, 2019 through December 20, 2019. Based on available geological maps and literature, and review of the logs of borings as part of this study, RRC conducted void and karst risk assessment as shown in Table A1 within Appendix A in the revised Geotechnical Report dated April 29, 2020.

Based on the logs of boring performed during 2019 through 2020, potential for karst or void at Turbine Nos. T-25, T-26, and T-75 was evaluated as moderate to high. RRC recommended

void assessment using pilot holes prior to construction and grout injection if voids are encountered. Alternatively, 2-D Electrical Imaging (EI) survey was recommended to evaluate karst risk and verify if further void assessment using pilot holes is required. The potential for karst risk at T-42 was evaluated as low, therefore, no additional void assessment was deemed necessary.

As part of the supplementary investigation, RRC performed 2-D Electrical Imaging surveys at Turbine Nos. T-25, T-26, T-42 and T-75 during the period of August 10 through 13, 2021. Detail methodology and interpretation of EI results are discussed in the subsequent section of this letter report. Based on the results of EI profile, a total of 3 confirmation borings were drilled within footprint of each moderate to high-risk WTG sites (T-25, T-26 and T-75) to correlate soil/bedrock profile. No additional confirmation borings were drilled at T-42 (low risk) site as supplemental EI profile confirmed original finding. Confirmation borings were drilled during the period of August 18 through August 24, 2021. The borings were drilled to a depth of approximately 35 feet below existing site grade at the WTG sites.

A summary of geographic latitude and longitude coordinates and depth of each boring is presented in Table A2 within Appendix A. Figures 1 and 2 show geophysical and confirmation geotechnical boring locations on a topographic map. Logs of both original and confirmation borings are also presented within Appendix A.

Engineering properties of the subsurface materials were assessed through laboratory testing on selected soil and bedrock samples. A summary of laboratory test results is also presented within Appendix A.

3.0 GEOPHYSICAL INVESTIGATION

3.1 Electrical Resistivity Imaging Survey

2-D Electrical Resistivity Imaging equipment used during this investigation consisted of an Advanced Geosciences, Inc. (AGI) Supersting R8/IP Resistivitymeter, twenty-eight (28) 18-inch stainless-steel electrode stakes, multi-core electrode cable system with stainless-steel takeouts, and a switchbox R8 for 56 electrodes. The 400-volt transmitter in the Supersting is capable of output current levels of 2-amperes at 200 watts, which is powered by 12-volt automobile batteries. The Supersting can record up to eight channels simultaneously and switching between up to 112 electrode pairs to act as current or potential dipoles.

At each WTG site two orthogonal EI profiles were performed crossing approximately at the center of the WTG foundation. The total length of each profile was about 270 feet with electrode placed at 10 feet interval.

A contact resistance test was performed to monitor the electrical resistance values between each pair of consecutive electrodes. Dipoles with anomalously high contact resistances were checked (ensuring adequate coupling of the electrode to the soil and verifying clean metal-metal

contact between the multi-core cable and electrode), and the contact resistance test repeated. If anomalously high contact resistance readings persisted, the electrode location was adjusted and/or a salt-water solution was applied to the soil or ground around the electrodes in question. During the measurement cycle, the instrument displayed the sequence number, current applied, voltage differential recorded at each dipole, and the standard deviation between repeat measurements. RRC geophysicist monitored these values for anomalously low current values, negative recorded voltages, and high standard deviation values that may indicate poor quality of the field data. If a problem was identified during data collection, the operator paused the measurement cycle and inspected the electrode array for problems such as loose electrodes, disconnected electrodes, or nearby cultural features that may impact the recorded apparent resistivity values. If no apparent sources of error were noted, the operator made a note in the data recording log for evaluation during data processing.

The raw data quality and the resulting inverted resistivity model of each N-S and E-W profile from each wind turbine site are examined using the EarthImager 2D software. The surface filter was used on all the N-S and E-W electrical resistivity dipole-dipole arrays to evaluate all these resistivity profiles' raw data. The quality of each resistivity profile is good to excellent because it shows statistically minimal noise. A high-quality data set is typically achieved with a responsible data collection procedure that ensures a low contact resistance environment, a proper current injection, and appropriately measured voltages during the survey. If the data quality is good or high, raw data inversion into a resistivity model is straightforward and repeatable.

The adopted stopping criterion for the resistivity inversion for all resistivity profiles was based on the root-mean-square (RMS) percent error during the data inversion step. The L2-Norm condition was not utilized as a stopping criterion because the raw data was statistically noise-free. The value of the resulting RMS percent error determines the quality of the inversion, and hence, determines the "quality factor." An 'okay', 'good', and 'excellent' quality factor is achieved when the resulting RMS % error are < 20 %, < 10 %, and < 5 %, respectively, as shown in Table 3.1.

Table 3.1 Quality factor classification chart for an electrical resistivity imaging survey based on the RMS % and L2-Norm stopping criteria.

Quality factor	RMS	L2-Norm
Fair	<20%	<10
Good	<10%	<5
Excellent	<5%	~1

The ground contact resistance, measured in Ohms (Ω) units, was favorable during the geophysical survey campaign, with most resistances under $\leq 1,000 \Omega$. The low resistance value facilitates the injection of electrical current into the ground. Typically, clean raw data sets converge in less than four (4) iterations and yield an RMS value between 3 % and 5 %. The results of the data inversion are highly satisfactory.

For this project, all the examined electrical resistivity profiles converge at or under five iterations, yield RMS values less than 5% and yield an excellent quality factor. It is expected to have numerical variability in the RMS % value during inter-site comparisons due to the unique geological site conditions that lead to the measured apparent resistivity values. Table 2 summarizes the QA/QC results of the 4 sites based on the resulting iteration number, RMS % error, and quality factor. In summary, the reported values in Table 3.2 indicate that the raw data and the inversion results are of Good to Excellent quality. Hence, interpretation of subgrade conditions at WTG sites based on these EI results are reliable.

Table 3.2 QA/QC Results of the EI Models

Turbine ID	INVERTED RESISTIVITY MODEL		
	Iteration	RMS %	QUALITY FACTOR
T-25	2	4.88	EXCELLENT
T-26	2	3.09	EXCELLENT
T-42	4	2.72	EXCELLENT
T-75	2	4.75	EXCELLENT

Results of 2-D EI surveys are presented within Appendix A. RRC retained Grumman Exploration, Inc, and Ohio based geophysical company to QA/QC the EI survey results and independent geologic interpretation of RRC field exploration results for these four sites. Grumman Exploration Inc. review letter is also included within Appendix A.

The color scheme applied to all 8 inverted resistivity models uses the logarithmic scale to retain and enhance the near-surface materials' electrical resistivity contrast. The Resistivity range suggests that the bedrock formation (Limestone/Shale bedrock) is relatively heterogeneous because of various degrees of weathering, fracturing and/or moisture content. Generally, the bedrock can occur in four potential conditions:

- Slightly-to-Moderately weathered/fractured limestone that produces intermediate resistivity values.
- Heavily weathered limestone bedrock producing intermediate to low-resistivity values.
- Limestone bedrock with potential air-filled voids, responsible for producing very high-resistivity anomalies of concentric and elongated shapes. See example in Appendix A (void filled with air, confirmed void by grouting).
- Limestone bedrock with potential soil-filled voids, responsible for yielding very low-resistivity values.

Combining 2-D EI and geological information allows a qualitative risk assessment of the sites into low-risk, moderate-risk, and high-risk, which are described as follows:

- **Low-Risk Site:** Locations where geological, geotechnical, or geophysical information indicate competent bedrock with potential for voids or karst risk not likely and therefore, the stability of the wind turbine foundation has a minimum risk.
- **Medium-Risk Site:** Locations where geological, geotechnical, or geophysical information indicate some anomalous features. Potential risk to foundation due to major void is not likely, however, dissolution features or minor karst, if present with foundation influence may affect the foundation stability. Additional geotechnical borings and/or void assessment using pilot holes may be required for confirmation.
- **High-Risk Site:** Locations where geological, geotechnical, or geophysical information indicate evidence of potential voids/dissolution feature and/or weak subgrade condition that may affect foundation stability. Electrical imaging survey typical show at least one sizeable high-resistivity anomaly or inversions interpreted voids within foundation footprint. Figure 3 within Appendix A shows an example of anomalous zone/features identified within EI profile and logs of boring for the site. For sites such as this additional void assessment using pilot holes and mitigation using grout injection is performed during construction to lower the risk to foundation stability. For the example site, void assessment, and grouting injection up to 30 feet below existing grade was performed and WTG foundation successfully constructed.

3.2 Results and Summary

Overall, the 2D-EI survey results for T-25, T-26, T-42, and T-75 suggest a subsurface described by two geoelectric units: a surface unit with moderately to low resistivity soils ($< 100 \Omega\text{-m}$) underlain by a moderately-resistive bed rock formation ($> 100+ \Omega\text{-m}$) unit interpreted as Shale or limestone bedrock. The second layer interpreted as Limestone or shale yields a wide range of resistivities due to weathered/fractured rocks with high porosity and potential vuggy features. The results of the 2-D Electrical Resistivity Imaging (EI) survey yield a resistivity range from about $10 \Omega\text{-m}$ to $700 \Omega\text{-m}$, with average depth of investigation of 50 feet. A layered resistivity medium interpreted on top as an accumulation of glacial till from the Quaternary Period (low resistivity) deposited unconformably on Shale or/and Limestone bedrock formation (relatively higher resistivity). The EI results shows that the area consists of two geological profiles:

- Unconsolidated glacial sand, silt and/or clay strata (low resistivity) with varying amounts of sand, clay and silty and with resistivity value of $10\Omega\text{m}$ - $100\Omega\text{m}$ to depths ranging from surface to 15 ft, and
- Limestone/Shale bedrock with average resistivity range of $60\Omega\text{m}$ - $700\Omega\text{m}$ at depths from below 7ft to 60ft. This second layer has variant range of resistivity based on the moisture and the materials filled the potential fractures.

The interpreted geological profile is consistent with the known geologic profile described in published literature and logs of boring drilled within the footprints of the selected locations of T-25, T-26, T-42 and T-75. Generally, layered resistivity medium interpreted on top as an

accumulation of glacial till from the Quaternary Period (Low resistivity 10 Ω m-100 Ω m) deposited unconformably on undeformed Shale or/and Limestone bedrock formation (relatively higher resistivity 60 Ω m-700 Ω m). The Shale or limestone bedrock (i.e., the second layer) yielded a relatively broad resistivity spectrum from 60 Ω -m to 700 Ω -m within the 50 feet depth.

Based on 2-D EI result and supplemental confirmation borings, risk due to potential for karst or voids within foundation footprint is low. The risk to foundation support is considered low and therefore, no bedrock grouting is required at these locations.

Summary of geotechnical investigation, geophysical survey and overall risk for each site is presented as below:

T-25

Due to presence of very loose sand over weathered limestone encountered within the borings drilled at the center as part initial study (Geotechnical Report dated April 29, 2020), RRC identified T-25 as “high risk” for potential karst features and recommended to perform additional investigation to further assess the site. The 2-D EI inversion model results for Turbine No. T-25 did not find any indication of potential karst features within the footprint of the proposed foundation. The intermediate resistivity response (~100-200 Ω -m) between approximately 10-ft to 30-foot indicates a zone of greater bedrock weathering or fractured bedrock with clay or water infilling within the shallowest limestone strata. Confirmation borings confirm competent bedrock at or below foundation bearing elevation. Loose sand soils are limited to shallow depths above foundation bearing elevation. Based on these additional studies, overall risk is low and therefore, grout injection is not required for this site.

T-26

In the initial study (Geotechnical Report dated April 29, 2020), due to presence of highly weathered shale and limestone within logs of boring drilled near the center and general proximity to high-risk site T-24, RRC identified T-26 as “moderate risk” for potential karst risk. RRC recommended 2-D Electrical Imaging (EI) survey to further assess the presence of karst development at this site.

Based on 2-D EI and confirmation borings there is no indication of voids within the footprints of WTG location T-26. The EI inversion models indicate variation in the elevation and/or condition of the overburden-bedrock contact near T-26. This likely due to pre-glacial undulations in the bedrock surface, localized zones of deeper weathering. RRC confirmation logs of borings within the foundation footprint did not encounter any voids or dissolution features. Based on supplemental results, overall risk is low and therefore, grout injection is not required for this site.

T-42

The 2-D EI model results for Turbine No. T-42 are consistent with a simple three-layer geologic profile which are corroborated by the associated boring log. The interpreted geologic layering

consists of clay (shallow, low resistivity), sand (unsaturated to wet, high resistivity), and shale bedrock (>~35-ft to 40-ft, intermediate resistivity). Based on RRC logs of boring at this site, competent subgrade is encountered at foundation bearing elevation. EI results confirm our assessment as low risk site. Therefore, it is our opinion that additional void assessment or grouting is not required at this site.

T-75

During on the initial subsurface exploration (Geotechnical Report dated April 29, 2020), soft clay soils underlain by weathered Shale/Limestone bedrock were encountered, which could be possible characteristics of karst activity. However, no voids or active sinkholes were encountered within the boreholes. RRC categorized Turbine No. 75 as a “high risk” to further evaluate any potential for significant voids or weathering in the underlying bedrock. RRC recommended void assessment using pilot holes or 2-D Electrical Imaging survey to further assess the subgrade conditions.

Based on 2-D EI and follow-up confirmation borings there is no indication of karst features in the footprint of WTG location T-75. The logs of boring for T-75 corroborates the 2-D EI inversion model showing a simple layered geologic profile of clay and shale (low resistivity) over the limestone bedrock (relatively high resistivity). An intermediate resistivity zone occurs within the overburden near station 105-ft S (~30-ft South of the proposed tower location) that may indicate an area of elevated sand content or lower water content in the limestone bedrock. Based on the supplemental confirmation borings drilled within foundation footprint, competent bedrock was encountered with no risk for any voids or anomaly that can risk foundation. Minor vuggy (porous bedrock) or vertical fractures are not an issue for foundation stability or karst risk. Therefore, it is our opinion that overall risk is low and additional void assessment or grouting is not required at this site.

4.0 GEOTECHNICAL RECOMMENDATIONS

4.1 Turbine Gravity Foundation System

These four specific WTG sites may support gravity foundations with a net allowable bearing capacity of about 4,500 psf or more. This includes a safety factor of three for general shear failure.

Table A1, Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations dictates locations that require subgrade remediation. The depths dictated in Table A1 within Appendix A are based on existing ground elevations at the time of the geotechnical investigation. It also assumes that the depth of the foundation is 12 feet below existing site grade. Where final elevations result in foundation bearing at a different depth, then adjustments may be made to the over-excavation target.

All other pertinent recommendations are provided in RRC’s revised Geotechnical Report dated April 29, 2020.

4.2 Bearing Capacity and Settlement of Gravity Foundation System

RRC performed bearing capacity and settlement calculations in general accordance with methodologies outlined in the 2nd Edition of *Guidelines for Design of Wind Turbines*, as well as generally accepted practices based on our experience with similar soil/bedrock conditions.

The sites at WTG Boring Nos. T-25, T-26, T-42, and T-75 may use a net allowable bearing pressure in the range of 4,500 to 6,000 psf. The allowable values are based on a safety factor of three. These net allowable bearing pressure values may be increased by 25% when considering short duration loading conditions such as extreme wind and seismic forces.

Based upon anticipated structural loading, the total settlement is estimated to be on the order of 1.0 inch to 2.0 inch under normal operating loading condition. The estimated differential settlement or tilt across the foundation diameter under both dead load and normal operating loading conditions is less than the maximum allowable tilt of 0.3%.

Table 4.2.1 presents a summary of design parameters for on-site soil/bedrock and structural fill materials required for the foundation design.

Table 4.2.1 Recommended Soil and Bedrock Design Parameters

Soil/ Material Type	Friction Coefficient ⁽¹⁾	Modulus of Subgrade Reaction, k_s ⁽²⁾ (pci)
Loose Sand	0.40	50
Medium Dense Sand	0.45	100
Dense to Very Dense Sand Soils	0.45	150
Soft to medium Stiff Clay	0.35	40
Stiff to Hard Clay and Silt Soils	0.35	75
Limestone/Shale Bedrock	0.50	150

Note: ⁽¹⁾ If necessary, lateral passive earth pressures can be considered to develop additional resistance. The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

⁽²⁾ For 1-ft. X 1-ft. Plate.

The use of on-site clay, sand or gravel, and well-graded processed limestone/shale bedrock as backfill against foundations is considered acceptable provided the materials are properly processed and placed. Overburden backfill over foundations should be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698 to reduce the potential of erosion and/or scour events. Recommendations for use of on-site materials, borrow material or structural fill are discussed further in subsequent sections within this report.

5.0 CONCLUSIONS

Should you have any questions concerning this design memorandum, please do not hesitate to contact us. Your business is always appreciated.

Sincerely,

RRC Power & Energy, LLC

Checked by

Rohit Rai Pant, Ph.D., P.E.
Geotechnical Group Manager

Prepared by

Reviewed by

Seounghyun "Brian" Rho, Ph.D., E.I.T.
Geotechnical Engineer

Alfred Williams, P.E.
Geotechnical Engineer

FIRM REGISTRATION NO. OH COA.04263

Table A1 - Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations

Boring ID (FIR_LAY_057)	Latitude	Longitude	Groundwater During Drilling (ft.)	Groundwater Immediately After Drilling (ft.)	Piezometer GWL after installation (ft.)	Piezometer GWL on December 2019 (ft.)	Piezometer GWL on January 2020 (ft.)	Piezometer GWL on February 2020 (ft.)	Recommended Design Groundwater Depth (ft.)	Net Allowable Bearing Capacity (qnet all) Under Normal Operating Load Conditions Based on Foundation Bearing Elevation of 12 feet (bgs, psf)	Recommendations for Soil Improvement ^[1]	Depth of Potential Voids Encountered within Borehole (ft, bgs)	Karst Risk Assessment	Void Assessment and Mitigation before Construction	Remarks
T25	41.256898	-82.811454	4.5	NA	NE	--	--	1.4	0.0	4,500	--	NO	Low	Supplemental EI study and confirmation borings performed. Low risk confirmed.	Very loose Sand over weathered Limestone.
T26	41.255529	-82.804800	15	NA	NE	--	3.4	3.5	1.0	6,000	--	NO	Low	Supplemental EI study and confirmation borings performed. Low risk confirmed.	Highly weathered Shale/Limestone.
T42	41.200363	-82.777263	NE	NA	NE	2.7	2.3	--	0.0	6,000	--	NO	Low	Supplemental EI study performed. Low risk confirmed	
T75	41.260506	-82.803113	7	NA	NE	--	--	1.3	0.0	6,000	--	NO	Low	Supplemental EI study and confirmation borings performed. Low risk confirmed	Soft soils over weathered Shale/Limestone.

NOTE: NE = Not Encountered; NA = Not Available.

Table A2 - Summary of Subsurface Exploration and Geographic Coordinates

Turbine/Boring ID	RRC Boring Latitude	RRC Boring Longitude	Drilling/ Test Date	Auger (ft)	Rock Core (ft.)	Total Depth (ft)	RQD	Groundwater During Drilling (ft)	Groundwater Immediately After Drilling (ft)	Remarks
T25	41.256898	-82.811454	04/27/19	16.0	15.0	31.0	Fair	4.5	NA	
T25-B1	41.256828	-82.811403	08/19/21	10.0	25.0	35.0	Fair	NE	NA	About 30 feet SE offset from T-25
T25-B2	41.257006	-82.811414	8/19-8/20/21	10.5	25.0	35.5	Fair	NE	NA	About 40 feet NNE offset from T-25
T25-B3	41.256940	-82.811487	8/18-8/19/21	10.5	25.0	35.5	Fair	8.5	NA	About 20 feet NNW offset from T-25
T26	41.255529	-82.804800	04/29/19	30.0	0.0	30.0	NA	15.0	NA	
T26-B1	41.255439	-82.804806	08/23/21	10.5	25.0	35.5	Fair	NE	NA	About 35 feet South offset from T-26
T26-B2	41.255541	-82.804950	08/24/21	10.0	25.0	35.0	Poor	NE	NA	About 40 feet WNW offset from T-26
T26-B3	41.255516	-82.804649	08/23/21	10.0	25.0	35.0	Poor	NE	NA	About 40 feet East offset from T-26
T42	41.200363	-82.777263	12/19-12/20/19	12.0	0.0	39.0	NA	NE	NA	
T75	41.260506	-82.803113	04/28/19	13.0	15.0	28.0	Poor	7.0	NA	
T75-B1	41.260459	-82.803146	8/22-8/23/21	10.5	25.0	35.5	Fair	NE	NA	About 20 feet SSW offset from T-75
T75-B2	41.260530	-82.803039	8/20-8/22/21	10.0	25.0	35.0	Fair	NE	NA	About 20 feet NE offset from T-75
T75-B3	41.260546	-82.803230	08/22/21	10.0	25.0	35.0	Fair	NE	NA	About 35 feet NW offset from T-75

Notes:NE = Not Encountered; NA = Not Available.

**Emerson Creek Wind Project
Huron and Erie Counties, Ohio**

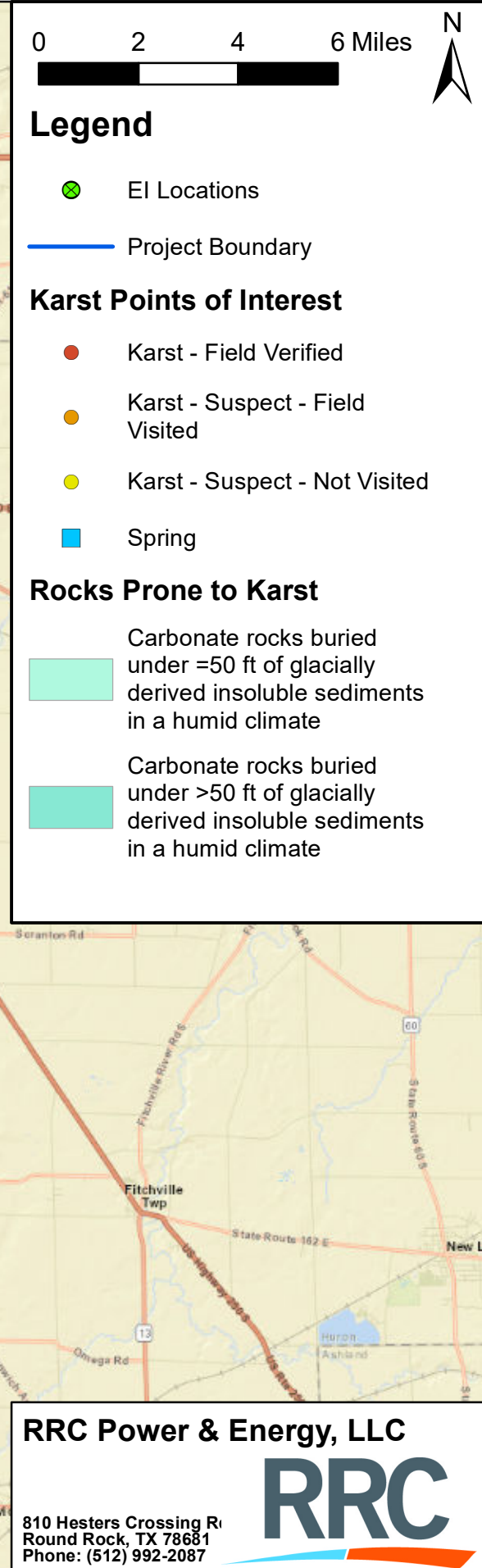


Figure 2
WTG and Confirmation
Boring Locations on a
Topographic Map

Emerson Creek Wind Project
Huron and Erie Counties, Ohio

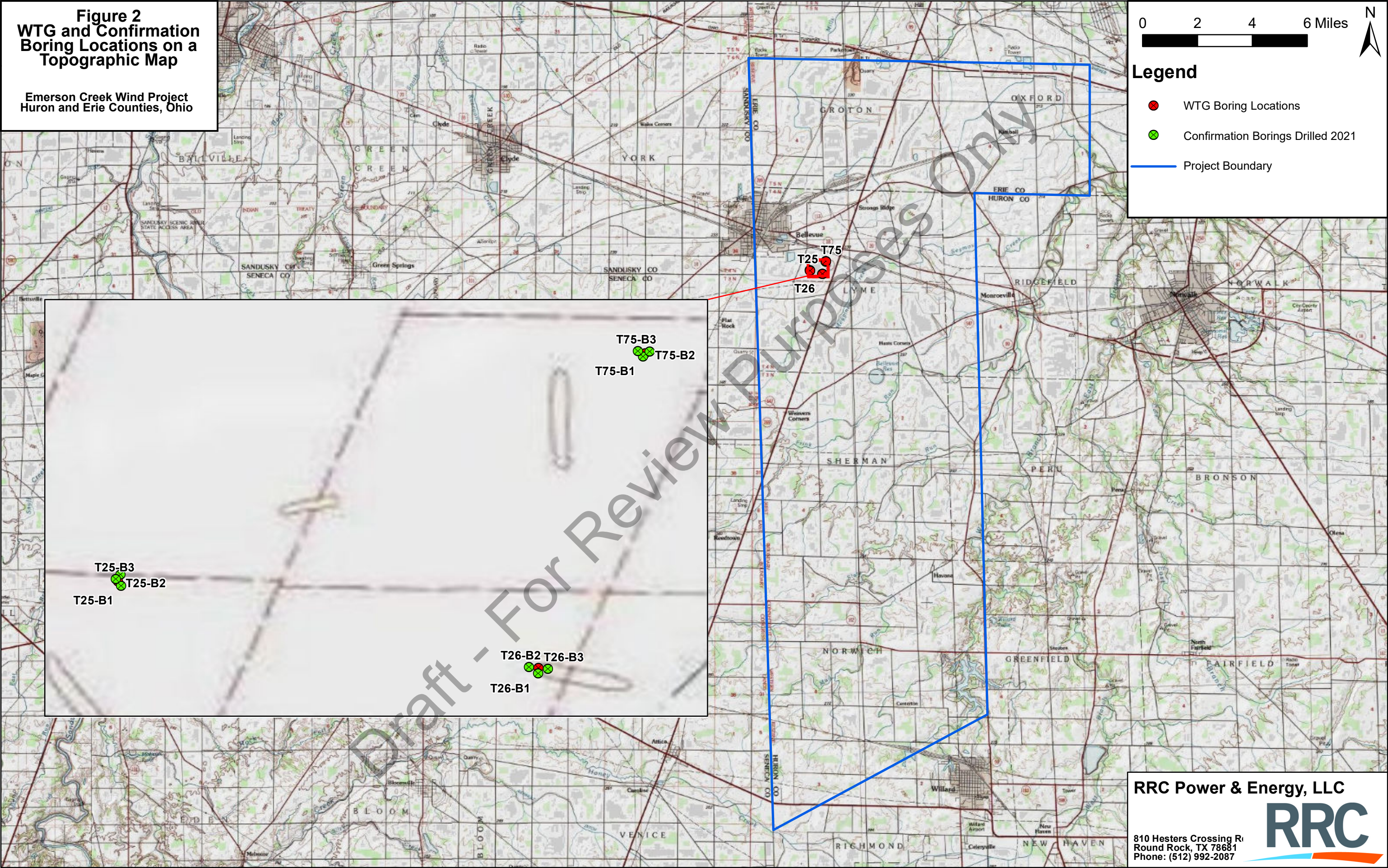
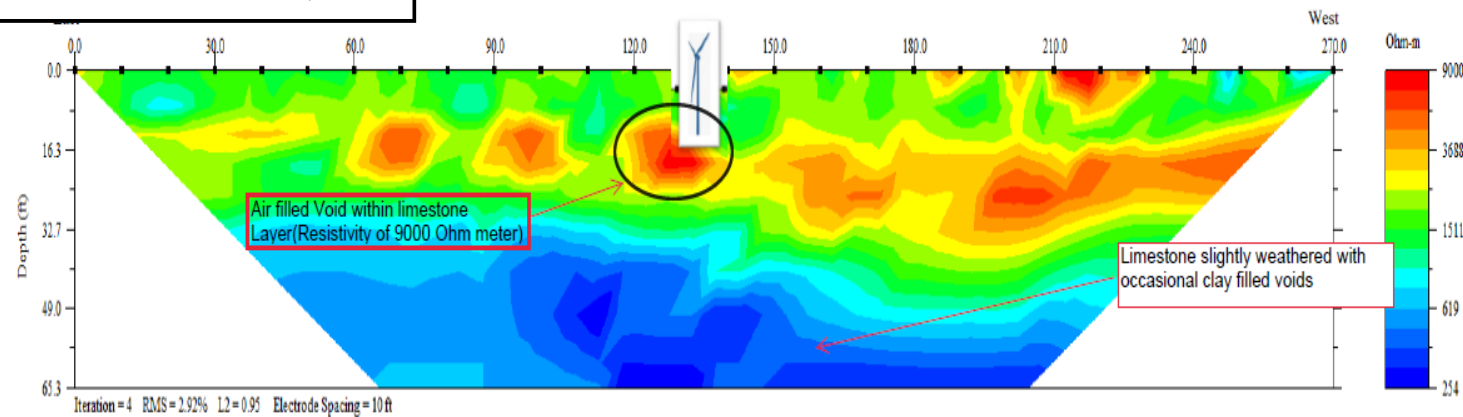


Figure 3
Example Electrical
Imaging (EI) Testing at
High Risk WTG Sites

Emerson Creek Wind Project
Huron and Erie Counties, Ohio

Electrical Resistivity imaging (2-D ERI) Survey-Void anomaly

Inverted Resistivity Section T-058 E-W



Note:
1. Data collected on September 25, 2020
2. AGI EarthImager 2D version 2.4.4 computer software developed by Advanced Geosciences, Inc was used to process the field data.
3. AGI SuperSting R8 Earth Resistivity Imaging was used for 2-D Electrical Resistivity Imaging data acquisition.

RRC
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experience matters

RRC RRC Power & Energy, LLC 810 Hesters Crossing Rd, Suite 120 Round Rock, TX 78681 Telephone: (512) 992-2087		CLIENT: PROJECT: Example BH for 2-D ERI Void confirmation LOCATION: NUMBER: DATE(S) DRILLED:	
FIELD DATA		LABORATORY DATA	
SOIL SYMBOL	DEPTH (FT)	SAMPLES N - BLOWS/FT T - TENSILE/FT R - R % RQD - %	MOISTURE CONTENT (%) ATTERBERG LIMITS LL - LIQUID LIMIT PL - PLASTIC LIMIT PI - PLASTICITY INDEX DRY DENSITY POUNDS/CU FT COMPRESSION STRENGTH (TENS/FT) STRAIN AT FAILURE (%) CONFINING PRESSURE (POUNDS/SQ IN) MINUS NO. 200 SIEVE (%)
		DRILLING METHOD(S): Solid Stem Auger: 0 to 2 ft.; NX Wet Rock Coring: 2 to 40 ft.	
		GROUNDWATER INFORMATION: Groundwater not encountered prior to the introduction of drilling fluid	
		SURFACE ELEVATION (FT):	
		DESCRIPTION OF STRATUM	
	5	N = 50/3" R = 89 RQD = 56	5 in. Topsoil
	10	R = 90 RQD = 93	SAND LEAN CLAY (CL), brown, hard, dry to moist, with Limestone fragments
	15	R = 97 RQD = 90	LIMESTONE, pale brown, fine grained, fresh to slightly weathered, moderately strong to strong rock
	20	R = 88 RQD = 58	Occasional vugs from 16.5 to 19 ft.
	25	R = 77 RQD = 53	Occasional vugs from 21 to 22 ft. Water loss at 22 ft.
	30	R = 100 RQD = 85	
	35	R = 90 RQD = 67	
	40	R = 90 RQD = 77	
		Total Depth = 40 ft.	
		REMARKS: GPS COORDINATES: Lat. Long. -	
		N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION	

BORING LOG KEY

FIELD DATA				LABORATORY DATA							DRILLING METHOD(S): Continuous Flight Auger/Hollow-stem Auger/Wet Rotary/NX Core	
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	
				LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI						
GROUNDWATER INFORMATION: Subsurface water was not encountered either during or upon completion of the drilling operations.												
SURFACE ELEVATION: ft.												
DESCRIPTION OF STRATUM												
<p>-- TESTING SYMBOLS DEFINITIONS --</p> <p>N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION</p>												

TYPICAL SOIL AND ROCK SYMBOLS (USCS CLASSIFICATION)

	Lean Clay (CL)		Poorly-Graded Sand (SP)		Claystone
	Fat Clay (CH)		Well-Graded Sand (SW)		BASALT
	Silt (ML)		Poorly-Graded Gravel (GP)		Limestone
	Elastic Silt (MH)		Well-Graded Gravel (GW)		Sandstone
	Silty Sand (SM)		Clayey Gravel (GC)		Siltstone
	Clayey Sand (SC)		Silty Gravel (GM)		Fill Material
	Silty, Clayey Sand (SC-SM)		Silty Clay (CL-ML)		Shale

DEGREE OF WEATHERING

- 1) Unweathered: No evidence of any chemical or mechanical alteration.
- 2) Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of the rock volume altered.
- 3) Moderately weathered: Discoloring evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering "halos" evident, 10% to 50% of the rock volume altered.
- 4) Highly weathered: Entire mass discolored, alteration pervading nearly all of the rock with some pockets of slightly weathered rock noticeable, some minerals leached away.
- 5) Decomposed: rock reduced to a soil with relic rock texture, generally molded and crumbled by hand.

SOIL STRUCTURE

- Calcareous.....Containing calcium carbonate
- Slickensided.....The presence of planes of weakness having a slick and glossy appearance
- Interbedded.....Alternating layers of varying material

LOG OF BORING T-25

SHEET 1 of 1



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810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 4/27/2019

FIELD DATA

LABORATORY DATA

DRILLING METHOD(S):

Hollow Stem Auger: 0 to 16 ft.; NX Wet Rock Coring: 16 to 31 ft.

GROUNDWATER INFORMATION:

Groundwater encountered at 4.5 ft. during drilling prior to the introduction of drilling fluid

SURFACE ELEVATION (FT):

DESCRIPTION OF STRATUM

1 in. Topsoil
SANDY LEAN CLAY (CL), brown, medium stiff, moist to wet

CLAYEY SAND (SC), brown, very loose to very dense, moist to wet, fine to coarse grained

LIMESTONE, gray, fine grained, slightly to moderately weathered, weak to moderately strong rock, slightly vuggy

Total Depth = 31 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:

GPS COORDINATES: Lat. 41.256898, Long. -82.811454

SHEET 1 of 1

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT:	Apex Clean Energy, Inc
PROJECT:	Emerson Creek Wind Project
LOCATION:	Erie and Huron Counties, OH
NUMBER:	MD1901007

DATE(S) DRILLED: 8/19/2021

FIELD DATA										LABORATORY DATA										DRILLING METHOD(S):			
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger: 0 to 10 ft.; NX Wet Rock Coring: 10 to 35 ft.										
					LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI						GROUNDWATER INFORMATION:										
													No groundwater encountered prior to the introduction of drilling fluid										
													SURFACE ELEVATION (FT):										
													DESCRIPTION OF STRATUM										
	5	N = 5 N = 9 N = 20 N = 50/4"	20										1 in. Topsoil LEAN CLAY (CL), with Sand, dark gray, medium stiff to very stiff, dry to moist										
	10	R = 100 RQD = 7												SHALE, dark gray, very hard, dry to moist LIMESTONE, dark gray, fine grained, slightly weathered, very weak rock									
	15	R = 100 RQD = 57												Grading light gray, fine to medium grained, fresh to slightly weathered, weak to moderately strong rock									
	20	R = 100 RQD = 63												2 in. vuggy seam at 21 ft.									
	25	R = 100 RQD = 43												6 in. Mudstone layer at 24.5 ft.									
	30	R = 100 RQD = 53												SHALE, dark gray, fine grained, moderately to highly weathered, extremely weak to very weak rock									
35													Total Depth = 35 ft.										

REMARKS:
GPS COORDINATES: Lat. 41.256828, Long. -82.811403

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
ROD - ROCK QUALITY DESIGNATION

LOG OF BORING T-25-B2

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/19/2021 - 8/20/2021

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP2\02 DESIGN\GEOTECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S):	
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger: 0 to 10.5 ft.; NX Wet Rock Coring: 10.5 to 35.5 ft.
					LL	PL	PI						GROUNDWATER INFORMATION: No groundwater encountered prior to the introduction of drilling fluid
													SURFACE ELEVATION (FT):
													DESCRIPTION OF STRATUM
	5	N = 8 N = 7		17									1 in. Topsoil LEAN CLAY (CL), trace Sand, dark brown, medium stiff, dry to moist
	10	N = 7 N = 50/3"											CLAYEY SAND (SC), dark brown, loose, moist, fine grained
	15	R = 100 RQD = 0											LIMESTONE, dark brown, very hard, dry to moist
	20	R = 100 RQD = 42						174	1073.74		0.0		LIMESTONE, dark brown, fine grained, moderately to highly weathered, extremely weak rock
	25	R = 100 RQD = 82											Grading gray, fine to medium grained, fresh to slightly weathered, weak to strong rock
	30	R = 100 RQD = 45											1.5 ft. Mudstone layer at 25.5 ft.
	35	R = 100 RQD = 57											SHALE, dark gray, fine grained, moderately weathered, extremely weak to very weak rock
													Total Depth = 35.5 ft.
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION												REMARKS: GPS COORDINATES: Lat. 41.257006, Long. -82.811414 *Denotes Total Unit Weight	

LOG OF BORING T-25-B3

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/18/2021 - 8/19/2021

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP202 DESIGN\GEO\TECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S):	
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger: 0 to 10.5 ft.; NX Wet Rock Coring: 10.5 to 35.5 ft.
					LL	PL	PI						
													GROUNDWATER INFORMATION:
													Groundwater encountered at 8.5 ft. during drilling prior to the introduction of drilling fluid
													SURFACE ELEVATION (FT):
													DESCRIPTION OF STRATUM
		N = 10											1 in. Topsoil
		N = 5											LEAN CLAY (CL), with Sand, dark gray, stiff, moist
	5	N = 7		18									SANDY LEAN CLAY (CL), dark gray, medium stiff, moist
		N = 50/3"											CLAYEY SAND (SC), brown, loose to very dense, moist, fine grained
	10												SHALE, dark gray, fine grained, slightly to moderately weathered, very weak rock
		R = 100 RQD = 0											LIMESTONE, gray, fine grained, slightly weathered, weak to moderately strong rock
	15												Grading fine to medium grained
		R = 100 RQD = 69											6 in. Mudstone layer at 24 ft.
	20												6 in. Mudstone layer at 26 ft.
		R = 100 RQD = 92											Vertical fractures at 27.5 ft.
	25												
		R = 100 RQD = 58											
	30												
		R = 100 RQD = 42											SHALE, dark gray, fine grained, highly weathered, extremely weak rock
	35												Total Depth = 35.5 ft.
													REMARKS:
													GPS COORDINATES: Lat. 41.256940, Long. -82.811487

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

LOG OF BORING T-26

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 4/29/2019

FIELD DATA

LABORATORY DATA

DRILLING METHOD(S):

Hollow Stem Auger

GROUNDWATER INFORMATION:

Groundwater encountered at 15 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

DESCRIPTION OF STRATUM

3 in. Topsoil
LEAN CLAY (CL), with Sand, brown to gray, medium stiff to stiff, moist

SHALE, dark brown to gray, very hard, dry to moist

Auger Refusal at 31 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:

GPS COORDINATES: Lat. 41.255529, Long. -82.804800

LOG OF BORING T-26-B1

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/23/2021

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP2\02 DESIGN\GEOTECHNICAL\G DRIVE\INT\PROJECTS\2019\EMERSON CREEK - MD1901007\EMERSON CREEK - MD1901007.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S):	
DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION:	
				LL	PL	PI						SURFACE ELEVATION (FT):	
												DESCRIPTION OF STRATUM	
5	N = 13 N = 7 N = 61/11" N = 50/2"		20									3 in. Topsoil LEAN CLAY (CL), trace Sand, brown, medium stiff to hard, dry to moist	
10												LIMESTONE, dark gray, very hard, dry to moist	
15	R = 93 RQD = 0											LIMESTONE, dark gray, fine grained, slightly to moderately weathered, extremely weak to very weak rock	
20	R = 100 RQD = 0												
25	R = 100 RQD = 28												
30	R = 100 RQD = 48												
35	R = 100 RQD = 90											Grading light gray, fine to medium grained, fresh to slightly weathered, weak to moderately strong rock	
												Total Depth = 35.5 ft.	
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION												REMARKS: GPS COORDINATES: Lat. 41.255439, Long. -82.804806	

LOG OF BORING T-26-B2

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/24/2021

FIELD DATA

LABORATORY DATA

DRILLING METHOD(S):

Hollow Stem Auger: 0 to 10 ft; NX Wet Rock Coring: 10 to 35 ft.

GROUNDWATER INFORMATION:

No groundwater encountered prior to the introduction of drilling fluid

SURFACE ELEVATION (FT):

DESCRIPTION OF STRATUM

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP202 DESIGN\GEO\TECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007\EMERSON CREEK - MD1901007.GPJ

SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
				LL	PL	PI					
	5	N = 13 N = 15 N = 50/3"									
	10	N = 50/3"	3								
	15	R = 100 RQD = 0									
	20	R = 100 RQD = 0									
	25	R = 100 RQD = 28									
	30	R = 100 RQD = 45									
	35	R = 95 RQD = 77									
Total Depth = 35 ft.											

REMARKS:

GPS COORDINATES: Lat. 41.255541, Long. -82.804950

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

LOG OF BORING T-26-B3

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/23/2021

FIELD DATA

LABORATORY DATA

DRILLING METHOD(S):

Hollow Stem Auger: 0 to 10 ft; NX Wet Rock Coring: 10 to 35 ft.

GROUNDWATER INFORMATION:

No groundwater encountered prior to the introduction of drilling fluid

SURFACE ELEVATION (FT):

DESCRIPTION OF STRATUM

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SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
				LL	PL	PI					
	5	N = 9 N = 6 N = 50/1"	19								
	10	N = 50/5"									
	15	R = 90 RQD = 0									
	20	R = 100 RQD = 0									
	25	R = 100 RQD = 30									
	30	R = 100 RQD = 40									
	35	R = 100 RQD = 95									
Total Depth = 35 ft.											

REMARKS:

GPS COORDINATES: Lat. 41.255516, Long. -82.804649

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

LOG OF BORING T-42

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 12/19/2019 - 12/20/2019

FIELD DATA

LABORATORY DATA

DRILLING METHOD(S):

Hollow Stem Auger: 0 to 12 ft.; Mud Rotary: 12 to 39 ft.

GROUNDWATER INFORMATION:

No groundwater encountered prior to the introduction of drilling fluid

SURFACE ELEVATION (FT):

DESCRIPTION OF STRATUM

10 in. Topsoil
FAT CLAY (CH), trace Sand, brown, soft to hard, dry to moist

Grading black to gray

POORLY GRADED SAND (SP), black, very dense, moist to wet, fine to medium grained

SHALE, olive gray, very hard, wet
Total Depth = 39 ft.

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP202 DESIGN\GEO\TECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007\EMERSON CREEK - MD1901007.GPJ

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
					LL	PL	PI					
	5	N = 4		29								
		N = 8										
		N = 83/11"										
	10	N = 50/5"										
		N = 50/3"		20								
	15	N = 50/6"		26								
	20	N = 25/0"										
	25	N = 25/0"										
	30	N = 25/0"										
	35	N = 25/0"										
		N = 25/0"										
		N = 25/0"										

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:

GPS COORDINATES: Lat. 41.200363, Long. -82.777263

LOG OF BORING T-75

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT:	Apex Clean Energy, Inc
PROJECT:	Emerson Creek Wind Project
LOCATION:	Erie and Huron Counties, OH
NUMBER:	MD1901007

DATE(S) DRILLED: 4/28/2019 - 4/29/2019

FIELD DATA				LABORATORY DATA								DRILLING METHOD(S):	
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger: 0 to 13 ft.; NX Wet Rock Coring: 13 to 28 ft.
					LL	PL	PI						GROUNDWATER INFORMATION: Groundwater encountered at 7 ft. during drilling prior to the introduction of drilling fluid
DESCRIPTION OF STRATUM													
	5	X	N = 4										2 in. Topsoil
		X	N = 8	19									SANDY LEAN CLAY (CL), brown, soft, moist
			N = 50/5"										LEAN CLAY (CL), with Sand, brown, medium stiff, moist
	10	X	N = 50/3"	16									SHALE, gray to black, very hard, moist to wet
		X	N = 50/4"										
	15		R = 75 RQD = 37					183	1612.80		0.0		LIMESTONE, light gray, fine grained, slightly to moderately weathered, weak to moderately strong rock
	20		R = 100 RQD = 44										
	25		R = 100 RQD = 76										
													Total Depth = 28 ft.
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION													REMARKS: GPS COORDINATES: Lat. 41.260506, Long. -82.803113 *Denotes Total Unit Weight

LOG OF BORING T-75-B1

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/22/2021 - 8/23/2021

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP2\02 DESIGN\GEO\TECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S):	
DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION:	
				LL	PL	PI						SURFACE ELEVATION (FT):	
												DESCRIPTION OF STRATUM	
5	N = 4 N = 8		22									2 in. Topsoil LEAN CLAY (CL), trace Sand, dark gray, soft to medium stiff, dry to moist, trace roots Roots grade out; grading with Sand	
10	N = 75/10" N = 50/3"											SHALE, dark gray, very hard, dry to moist	
15	R = 93 RQD = 18											LIMESTONE, dark gray, fine grained, fresh to slightly weathered, very weak rock Grading gray, fine to medium grained, fresh, weak to moderately strong rock	
20	R = 100 RQD = 23											6 in. vuggy layer at 18.5 ft.	
25	R = 100 RQD = 45											1 ft. Mudstone layer at 22 ft.	
30	R = 100 RQD = 62											SHALE, dark gray, fine grained, slightly to moderately weathered, extremely weak to weak rock	
35	R = 100 RQD = 15											Total Depth = 35.5 ft.	
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION												REMARKS: GPS COORDINATES: Lat. 41.260459, Long. -82.803146	

LOG OF BORING T-75-B2

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

DATE(S) DRILLED: 8/20/2021 - 8/22/2021

RENEWABLE LOG - LOG A GNNL01.GDT - 9/13/21 15:59 - R:\OPERATIONS\OP2\02 DESIGN\GEO\TECHNICAL\G DRIVE\GINT\PROJECTS\2019\EMERSON CREEK - MD1901007.GPJ

FIELD DATA														LABORATORY DATA														DRILLING METHOD(S):
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION:															
					LL	PL	PI						No groundwater encountered prior to the introduction of drilling fluid															
													SURFACE ELEVATION (FT):															
														DESCRIPTION OF STRATUM														
	5	N = 6 N = 4	19											2 in. Topsoil LEAN CLAY (CL), with Sand, dark gray, soft to medium stiff, dry to moist														
	10	N = 50/4" N = 50/4"												SHALE, dark gray, very hard, dry to moist														
	15	R = 100 RQD = 8												LIMESTONE, dark gray, fine grained, slightly weathered, extremely weak to very weak rock														
	20	R = 100 RQD = 60												Grading light gray, fine to medium grained, slightly weathered, weak to moderately strong rock														
	25	R = 100 RQD = 43												2 in. Shale seam at 18.5 ft.														
	30	R = 100 RQD = 37												6 in. Mudstone layer at 22 ft., dark gray, fine grained, moderately weathered, extremely weak rock Grading dark gray, fine grained, slightly weathered, very weak to weak rock														
	35	R = 100 RQD = 22												6 in. vertical fracture at 28 ft.														
														SHALE, dark gray, fine to medium grained, slightly to moderately weathered, extremely weak rock														
														Total Depth = 35 ft.														
	N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION														REMARKS: GPS COORDINATES: Lat. 41.260530, Long. -82.803039													

SHEET 1 of 1



RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT:	Apex Clean Energy, Inc
PROJECT:	Emerson Creek Wind Project
LOCATION:	Erie and Huron Counties, OH
NUMBER:	MD1901007

DATE(S) DRILLED: 8/22/2021

FIELD DATA				LABORATORY DATA								DRILLING METHOD(S):	
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger: 0 to 10 ft.; NX Wet Rock Coring: 10 to 35 ft.
					LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX						GROUNDWATER INFORMATION: No groundwater encountered prior to the introduction of drilling fluid
DESCRIPTION OF STRATUM													
	5	N = 5 N = 6 N = 50/3" N = 50/5"	10										2 in. Topsoil LEAN CLAY (CL), trace Sand, dark brown, medium stiff to hard, dry to moist, trace roots Roots grade out
	10												SHALE, dark gray, fine grained, slightly weathered, very weak rock
	15	R = 100 RQD = 35											LIMESTONE, light gray, fine grained, slightly weathered, very weak to weak rock
	20	R = 100 RQD = 40											Vertical fracture at 19 ft.
	25	R = 100 RQD = 52											6 in. Mudstone layer at 21 ft., highly weathered, extremely weak rock
	30	R = 100 RQD = 67											SHALE, dark gray, fine grained, highly weathered, extremely weak rock
35		R = 100 RQD = 0											Total Depth = 35 ft.
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION													REMARKS: GPS COORDINATES: Lat. 41.260546, Long. -82.803230



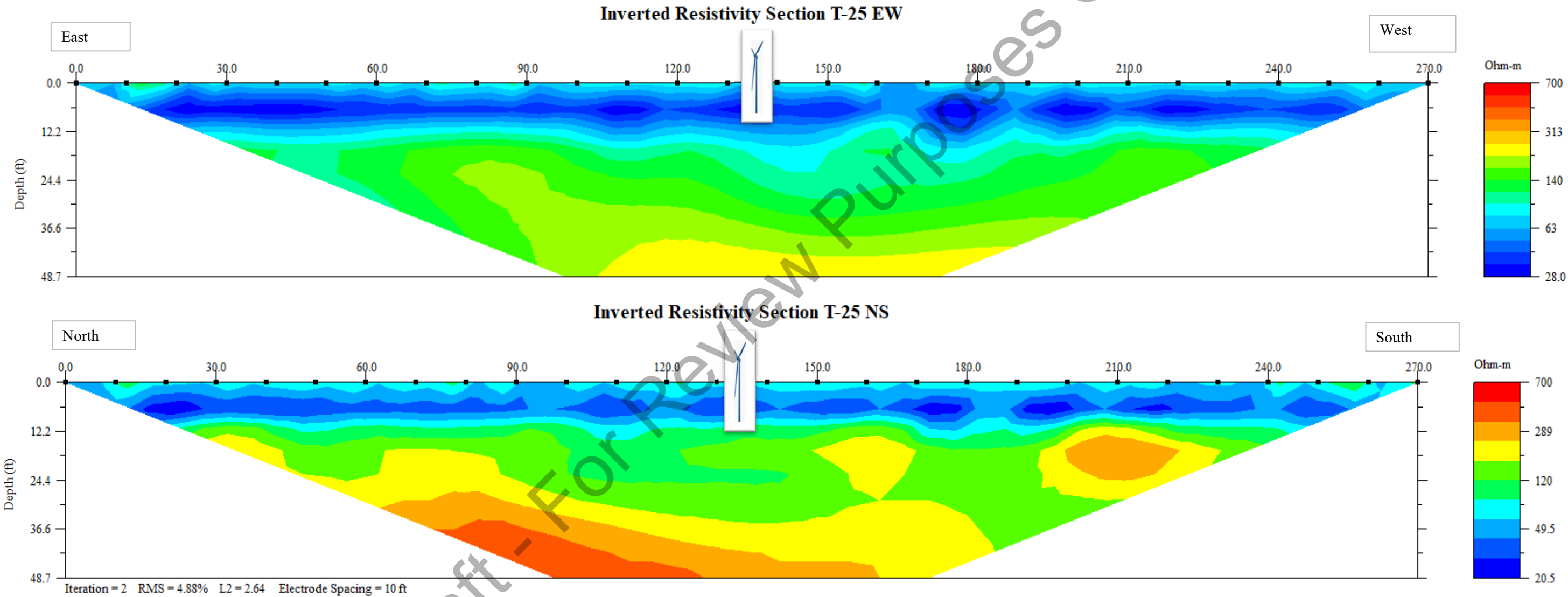
RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

SUMMARY OF LABORATORY RESULTS

CLIENT: Apex Clean Energy, Inc
PROJECT: Emerson Creek Wind Project
LOCATION: Erie and Huron Counties, OH
NUMBER: MD1901007

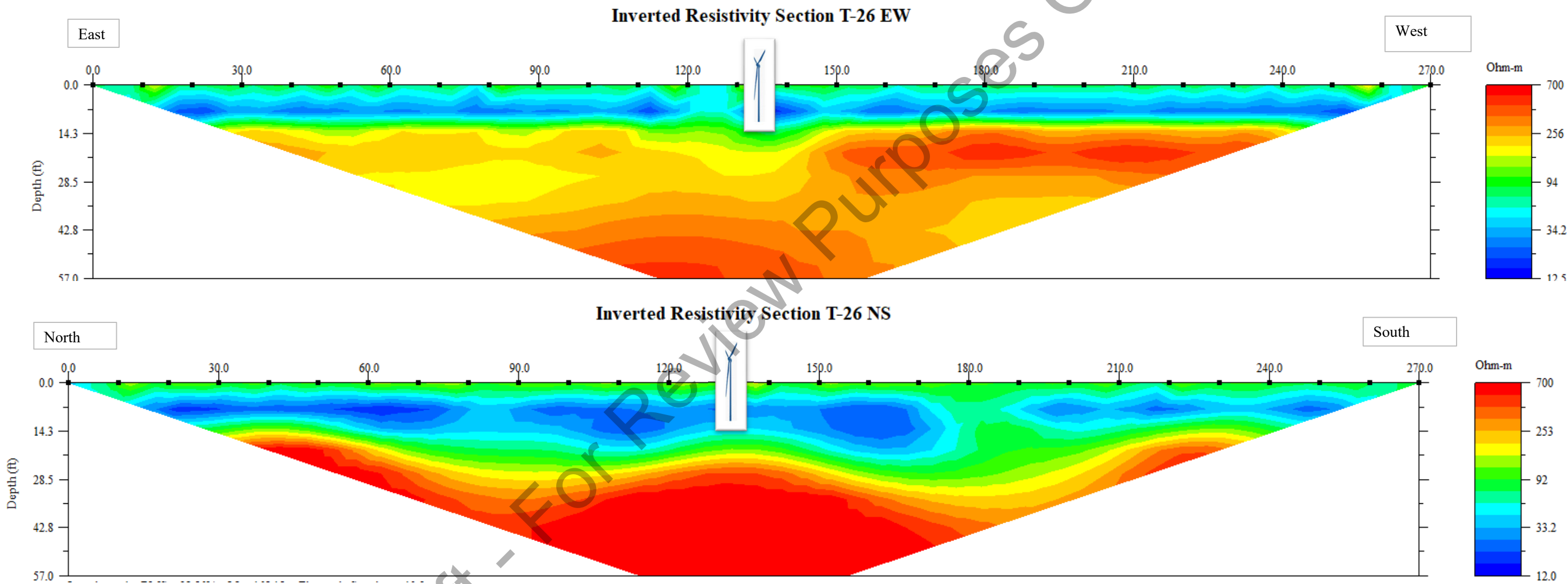
Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
T-25	1.0		18												
T-25	9.0		17												
T-25-B1	1.0		20												
T-25-B2	4.0		17												
T-25-B2	18.0			174					1073.74		0.0				
T-25-B3	7.0		18												
T-26	1.0		27											7.4	1,480
T-26	4.0		31									ND	0.0022		
T-26	14.0		5												
T-26-B1	4.0		20												
T-26-B2	9.0		3												
T-26-B3	7.0		19												
T-42	4.0		29												
T-42	12.0		20												
T-42	14.0		26												
T-75	4.0		19												
T-75	9.0		16												
T-75	13.0			183					1612.80		0.0				
T-75-B1	4.0		22												
T-75-B2	1.0		19												
T-75-B3	7.0		10												

Electrical Resistivity imaging (2-D ERI) Survey Results for WTG T-25



- Note:
- 1. Data collected on August 05, 2021
 - 2. AGI EarthImager 2D version 2.4.4 computer software developed by Advanced Geosciences, Inc was used to process the field data.
 - 3. AGI SuperSting R8 Earth Resistivity Imaging was used for 2-D Electrical Resistivity Imaging data acquisition.

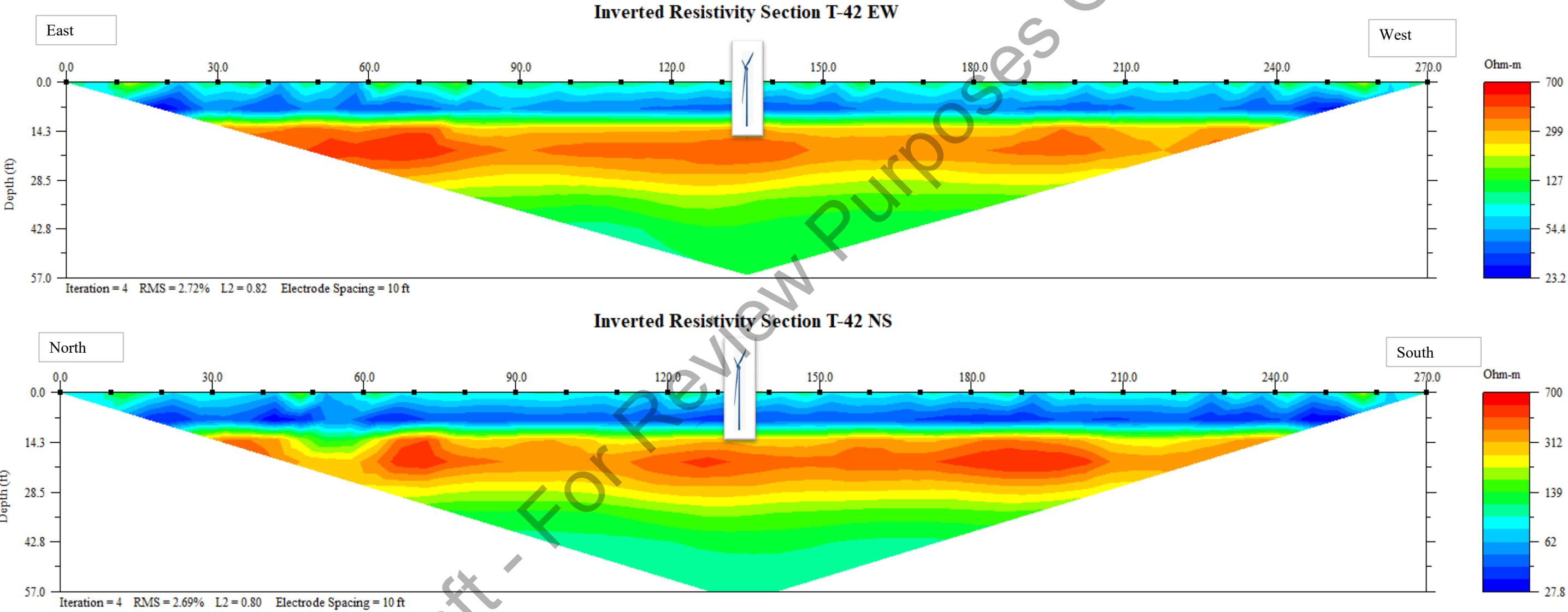
Electrical Resistivity imaging (2-D ERI) Survey Results for WTG T-26



Note:

1. Data collected on August 05, 2021
2. AGI EarthImager 2D version 2.4.4 computer software developed by Advanced Geosciences, Inc was used to process the field data.
3. AGI SuperSting R8 Earth Resistivity Imaging was used for 2-D Electrical Resistivity Imaging data acquisition.

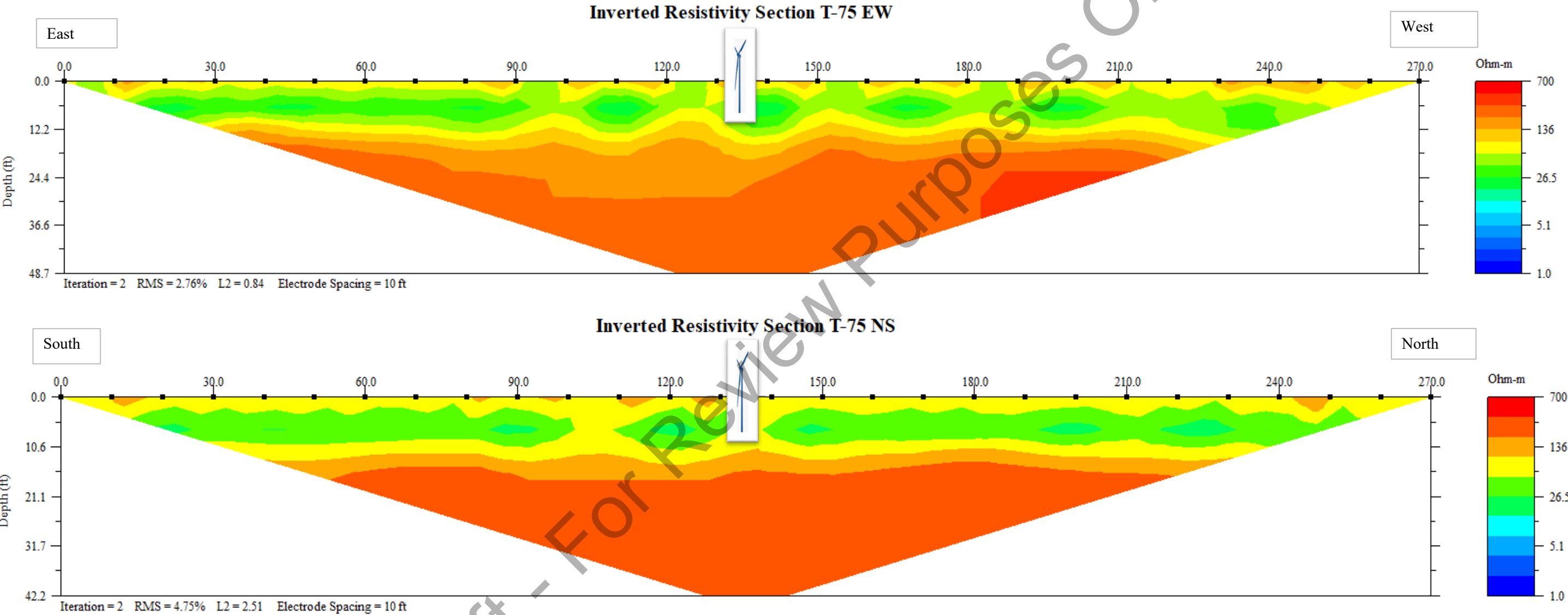
Electrical Resistivity imaging (2-D ERI) Survey Results for WTG T-42



Note:

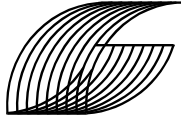
1. Data collected on August 05, 2021
2. AGI EarthImager 2D version 2.4.4 computer software developed by Advanced Geosciences, Inc was used to process the field data.
3. AGI SuperSting R8 Earth Resistivity Imaging was used for 2-D Electrical Resistivity Imaging data acquisition.

Electrical Resistivity imaging (2-D ERI) Survey Results for WTG T-75



Note:

1. Data collected on August 05, 2021
2. AGI EarthImager 2D version 2.4.4 computer software developed by Advanced Geosciences, Inc was used to process the field data.
3. AGI SuperSting R8 Earth Resistivity Imaging was used for 2-D Electrical Resistivity Imaging data acquisition.



Grumman Exploration, Inc.

2791 Leeds Road

Columbus, Ohio 43221

(614) 488-7860 tel; www.GrummanExploration.com

Non-destructive Subsurface Exploration

Near-surface Geophysics

September 23, 2021

Fesseha Zena

RRC Companies

810 Hester Crossing RD, Suite 120,

Round Rock, Texas 78681

RE: Review of a 2-D Electrical Resistivity Survey Report for The Proposed Emerson Creek Project near Bellevue, Seneca County, Ohio: GEI Project No. 01-50055

Dear Fesseha:

Grumman Exploration, Inc. has completed our review of the two-dimensional Electrical Resistivity Imaging survey results (2-D ERI) for four proposed wind turbine generating (WTG) sites near the above referenced municipality in Northern Ohio. The four locations include:

- T-25
- T-26
- T-42
- T-75

Three of the sites are located southeast of Bellevue Ohio while T-42 is located several miles south-southeast of Bellevue. The 2-D ERI tests were reportedly performed in active agricultural fields with no known sources of electrical interference, obstructions, significant topographic variation or serious survey complications. The information provided by RRC Companies included boring logs from two drilling events, the raw field data for one location, and two resistivity inversion model sections for each WTG site. It is assumed that the field data acquisition and inversion modelling were performed by RRC Companies in general accordance with accepted industry guidelines for 2-D ERI surveys.

Based on the 2-D ERI results provided for this review, the interpreted geologic profile is consistent with the known geologic profile described in published reports and local boring logs. Additionally, results are comparable to the findings of 2-D ERI surveys performed by Grumman Exploration, Inc. a few miles from the four WTG locations. The generalized geologic profile in this region of Ohio consists of a 10-ft to 20-ft thick veneer of unconsolidated glacial sand, silt and/or clay strata (low resistivity) overlying Devonian

Period bedrock consisting of either limestone (high resistivity) or a thin shale stratum (intermediate to high resistivity). Based on the boring logs provided, there is localized variability in the overburden thickness and the position of stratigraphic boundaries of the bedrock. Karstification of the uppermost Columbus limestone is well documented in Seneca, Erie and Huron Counties near Bellevue, Ohio as evidenced by exposed sinkholes, sinking streams, caverns and the deterioration and dissolution of shallow limestone strata. Karst within the Columbus limestone reportedly occurs primarily along joint planes which feed into deeper karstic Dolostone stratum and more reactive Silurian age evaporites. The effect of karst on measured electrical resistivity can vary depending on the nature, configuration and infilling of karst feature(s) at a particular location. Within the shallowest limestone bedrock, large open caverns may appear as localized high resistivity zones, while water or clay filled karst features will tend to lower the resistivity response. Based on the boring logs, the severity of weathering and shallowest karst effects appears to be more significant in the uppermost sections of the limestone bedrock.

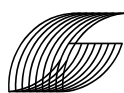
Based on 2-D ERI and follow-up confirmation borings there is no indication of voids in the footprints of WTG locations T-25, T-26 and T-75. Based on a review of the 2-D ERI results and RRC boring logs acquired within the foundation footprint, no voids are anticipated at location T-42. The following paragraphs summarize our interpretation of the geologic interpretations for the four 2-D ERI locations.

T-25

The ERI inversion model results for T-25 so no clear indication of large potential karst feature at the proposed tower location, although the elevated resistivity response on the N-S transect near station 210-ft S (~70-ft south of tower) could indicate a karst related condition. The intermediate resistivity response (~100-200 Ω -m) between approximately 10-ft to 30-ft could indicate a zone of greater bedrock weathering or karstification such as might occur in dispersed, small voids and dissolution features along with clay or water infilling within the shallowest limestone strata.

T-26

The ER inversion models indicate variation in the elevation and/or condition of the overburden-bedrock contact near T-26. Possible explanations include pre-glacial undulations in the bedrock surface, localized zones of deeper weathering, and/or minor karstification of the shallowest region of the limestone. The apparent difference in the resistivity levels between the E-W and N-W transects could point to a hidden linear feature (e.g. bedrock fracture/joints, drainage pipe, former fence line, etc.) in the vicinity of the test site. It is not clear why the E-W transect appears to show a deeper, gradational resistivity response below the tower location while the N-S shows a reasonably well-defined response for the overburden-bedrock boundary.



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T-42

The 2-D ERI model results for T-42 are consistent with a simple three-layer geologic profile which are corroborated by the associated boring log. The interpreted geologic layering consists of clay (shallow, low resistivity), sand (unsaturated to wet, high resistivity), and shale bedrock (>~35-ft to 40-ft, intermediate resistivity). The general geologic profile at this location differs from the three other test locations in that a significant sand layer separates the clay overburden from a shale stratum. The intermediate sand layer could represent a former beach sand dune, glacial outwash deposit or a former river channel.

T-75

The boring log for T-75 corroborates the 2-D ERI inversion model showing a simple layered geologic profile of wet clay and shale (low resistivity) over the limestone bedrock (high resistivity). A weak intermediate resistivity zone occurs within the overburden near station 105-ft N (~30-ft south of the proposed tower location) and could indicate an area of elevated sand content or lower water content. Such a zone could occur over an incipient karstic zone with enhanced drainage into the underlying bedrock.

Grumman Exploration, Inc. has appreciated this opportunity to be of service to RRC Companies. If you have any questions or comments regarding this review, please feel free to contact us.

Sincerely,

Grumman Exploration, Inc.



David L. Grumman, Jr.
President/Geophysicist



Grumman Exploration, Inc.

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**This foregoing document was electronically filed with the Public Utilities
Commission of Ohio Docketing Information System on**

10/28/2021 11:17:46 AM

in

Case No(s). 21-1055-EL-BGA

Summary: Application - 5 of 13 (Exhibit C – Geotechnical Addendum) electronically
filed by Christine M.T. Pirik on behalf of Firelands Wind, LLC