COLUMBIA COUNTY BOARD OF COUNTY COMMISSIONERS
BID NO. 2016-R
ADDENDUM 2.

Sheriff's Office GEO study attached.

Date: **April 1, 2016**

Lawrence Wilson
Columbia County
4917 US Highway 90
Lake City, FL 32055
Office: (386) 752-9212

Tower Engineering Professionals, Inc.
326 Tryon Road
Raleigh, NC 27603
(919) 661-6351
Geotech@tepgroup.net

Subject: Subsurface Exploration Report

Columbia County Designation:	**Site Name:**	Columbia County Sheriff's Office
Engineering Firm Designation:	**TEP Project Number:**	67224.44847
Site Data:	**4917 US-90, Lake City, FL 32055 (Columbia County) Latitude N*30° 11' 28.8"*, Longitude W*82° 33' 24.1"* 160 Foot - Proposed Self Supporting Tower**	

Dear Mr. Wilson,

Tower Engineering Professionals, Inc. (TEP) is pleased to submit this **"Subsurface Exploration Report"** to evaluate subsurface conditions in the tower area as they pertain to providing support for the tower foundation.

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions in this report are based on the applicable standards of TEP's practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

TEP assumes the current ground surface elevation; tower location and subsequent centerlines provided are correct and are consistent with the elevation and centerlines to be used for construction of the structure. Should the ground surface elevation be altered and/or the tower location be moved or shifted TEP should be contacted to determine if additional borings are necessary.

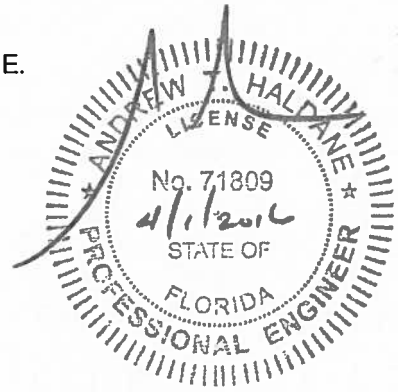
The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The soil conditions may vary from what is represented in the boring logs. While some transitions may be gradual, subsurface conditions in other areas may be quite different. Should actual site conditions vary from those presented in this report, TEP should be provided the opportunity to amend its recommendations as necessary.

We at *Tower Engineering Professionals, Inc.* appreciate the opportunity of providing our continuing professional services to you and Columbia County. If you have any questions or need further assistance on this or any other projects please give us a call.

Report Prepared/Reviewed by: Tyrel A. DeShong / John D. Longest, P.E.

Respectfully submitted by:

Andrew T. Haldane, P.E.



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1) PROJECT DESCRIPTION

Based on the preliminary drawings, it is understood a self supporting communications tower will be constructed at the referenced site. The structure loads will be provided by the tower manufacturer.

2) SITE EXPLORATION

The field exploration included the performance of one soil test boring (B-1) to the planned depth of 60 feet (bgs) at the centerline of the proposed self supporting tower. The boring was performed by an ATV mounted drill rig using mud rotary drilling techniques to advance the boring. Split-spoon samples and Standard Penetration Resistance Values (N-values) were obtained in accordance with ASTM D 1586 at a frequency of five samples in the top 10 feet and one sample every 5 feet thereafter.

The Split-spoon samples were transported to the TEP laboratory where they were classified by a Geotechnical Engineer in general accordance with the Unified Soil Classification System (USCS), using visual-manual identification procedures (ASTM D 2488).

A Boring Location Plan showing the approximate boring location, a Boring Log presenting the subsurface information obtained and a brief guide to interpreting the boring log are included in the Appendix.

3) SITE CONDITIONS

The site is located at 4917 US-90 in Lake City, Columbia County, Florida. The proposed tower and compound are to be located in an open grassy field. The ground topography is relatively level to lightly sloping.

4) SUBSURFACE CONDITIONS

The following description of subsurface conditions is brief and general. For more detailed information, the individual Boring Log contained in Appendix B - Boring Log may be consulted.

4.1) Soil

The USCS classification of the materials encountered in the boring include OL, SP, and SM. The Standard Penetration Resistance ("N" Values) recorded in the materials ranged from 7 to 19 blows per foot of penetration.

4.2) Rock

Rock was not encountered in the boring. Refusal of auger advancement was not encountered in the boring.

4.3) Subsurface Water

Subsurface water was encountered at a depth of 3.3 feet (bgs) in the boring at the time of drilling. It should be noted the subsurface water level will fluctuate during the year, due to seasonal variations and construction activity in the area.

4.4) Frost

The TIA frost depth for Columbia County, Florida is 0 inches.

5) TOWER FOUNDATION DESIGN

Based on the boring data, it is the opinion of TEP that single drilled shaft for each leg can be used to support the new tower. If the drilled shaft foundation option is utilized, design of the foundation should be adjusted to terminate in a known material. The following presents TEP's conclusions and recommendations regarding the foundation type.

5.1) Shallow Foundation

Due to the organic materials encountered in the first 8 feet of the boring, a Shallow foundation is not recommended for this site. See Section 5.2) for drilled shaft foundation design parameters.

5.2) Drilled Shaft Foundation

The following values may be used for design of drilled shaft foundations. TEP recommends the side frictional and lateral resistance values developed in the top section of the caisson for a depth equal to the half the diameter of the caisson or the frost depth, whichever is greater, be neglected in the calculations. The values are based on the current ground surface elevation.

Table 1 – Drilled Shaft Foundation Analysis Parameters

Depth		Soil	Static Bearing[1] (psf)	Side Frictional Resistance[2] (psf)	Cohesion[3] (psf)	Friction Angle[3] (degrees)	Effective Unit Weight (pcf)
Top	Bottom						
0	2	OL	0	0	-	-	100
2	4	OL	0	0	-	-	37
4	6	OL	0	0	-	-	37
6	8	OL	0	0	-	-	37
8	13.5	SP	2825	90	-	34	49
13.5	18.5	SM	4725	150	-	35	50
18.5	23.5	SM	4750	190	-	34	50
23.5	28.5	SM	7125	240	-	35	50
28.5	33.5	SM	8300	280	-	35	50
33.5	38.5	SM	9475	330	-	35	50
38.5	43.5	SM	7800	360	-	34	50
43.5	48.5	SM	5200	370	-	31	50
48.5	53.5	SM	8325	440	-	33	50
53.5	58.5	SM	7375	470	-	32	50
58.5	60	SM	9300	510	-	33	50

Notes:

1) The bearing values provided are gross allowable with a minimum factor of safety of 2. Bearing may be increased by 1/3 for transient loading (e.g. wind or earthquake loading). If the bearing depth of the foundation is less than 5 diameters below the ground surface the bearing values listed in Table 1 – Shallow Foundation Analysis Parameters should be utilized
2) The side frictional resistance values provided are allowable with a minimum factor of safety of 2. Side frictional resistance values may be increased by 1/3 for transient loading (e.g. wind or earthquake loading)
3) These values should be considered ultimate soil parameters

6) SOIL RESISTIVITY

Soil resistivity was performed at the TEP laboratory in accordance with ASTM G187-05 (Standard Test Method for Measurement of Soil Resistivity Using the Two Electrode Soil Box Method). Test results indicated a result of 100,000 ohms/cm.

7) CONSTRUCTION CONSIDERATIONS - DRILLED SHAFTS

Based on TEP's experience a conventional drilled shaft rig (Hughes Tool LDH or equivalent) can be used to excavate to the termination depth of TEP's boring. An earth auger can typically penetrate the materials encountered to the termination depth of the boring with moderate difficulty. Materials below the auger refusal depth may require a coring bit or roller-bit to remove the material. Special excavation equipment may be necessary for a shaft greater that 60-inches in diameter. If hole collapse is encountered during construction, the design and geotechnical engineers should be contacted immediately to make any necessary adjustments.

Due to the subsurface water and the sandy soil, the contractor may elect to utilize the "slurry" method for shaft construction. The following are general procedure recommendations in drilled shaft construction using the "slurry" method:

1) Slurry drilled shafts are constructed by conventional caisson drill rigs excavating beneath a drilling mud slurry. Typically, the slurry is introduced into the excavation after the groundwater table has been penetrated and/or the soils on the sides of the excavation are observed to be caving-in. When the design shaft depth is reached, fluid concrete is placed through a tremie pipe at the bottom of the excavation.

2) The slurry level should be maintained at a minimum of 5 feet or one shaft diameter, whichever is greater, above the subsurface water level.

3) Inspection during excavation should include verification of plumbness, maintenance of sufficient slurry head, monitoring the specific gravity, pH and sand content of the drilling slurry, and monitoring any changes in the depth of the excavation between initial approval and prior to concreting.

4) A removable steel casing may be installed in the shaft to prevent caving of the excavation sides due to soil relaxation. Loose soils in the bottom of the shaft should be removed.

5) The specific gravity or relative density of the drilling mud slurry should be monitored from the initial mixing to the completion of the excavation. An increase in the specific gravity or density of the drilling slurry by as much as 10 percent is indicative of soil particles settling out of the slurry onto the bottom of the excavation. This settling will result in a reduction of the allowable bearing capacity of the bottom of the drilled shaft.

6) After approval, the drilled shaft should be concreted as soon as practical using a tremie pipe.

7) For slurry drilled shafts, the concrete should have a 6 to 8 inch slump prior to discharge into the tremie. The bottom of the tremie should be set at about one tremie pipe diameter above the excavation. A closure flap at the bottom of the tremie should be used, or a sliding plug introduced into the tremie before the concrete, to reduce the potential for the concrete being contaminated by the slurry. The bottom of the tremie must be maintained in concrete during placement, which should be continuous.

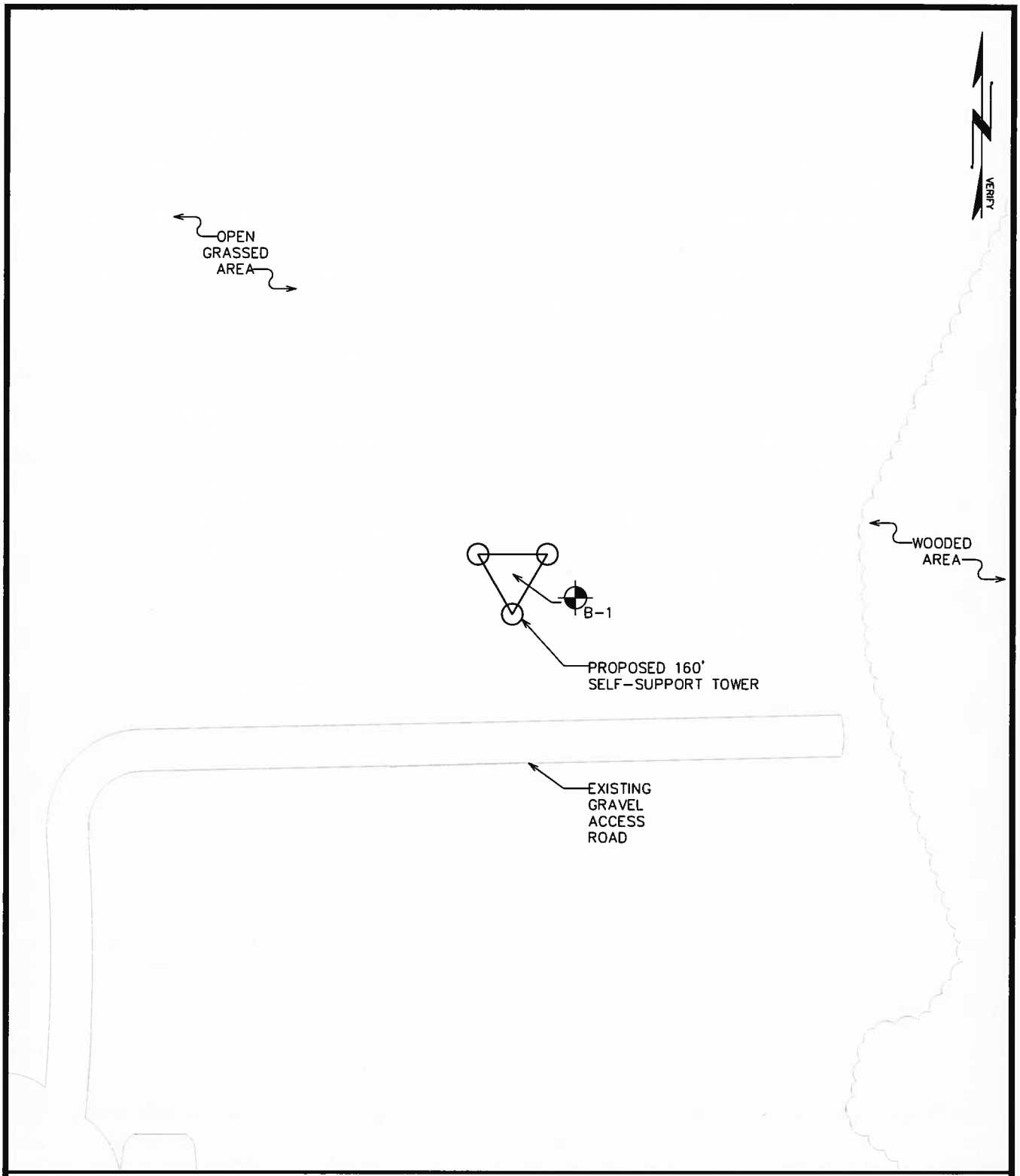
8) The protective steel casing should be extracted as concrete is placed. A head of concrete should be maintained above the bottom of the casing to prevent soil and water intrusion into the concrete below the casing.

9) Additional concrete should be placed via the tremie causing the slurry to overflow from the excavation in order to reduce the likelihood of slurry pockets remaining in the drilled shaft.

If variability in the subsurface materials is encountered, a representative of the Geotechnical Engineer should verify that the design parameters are valid during construction. Modification to the design values presented above may be required in the field.

APPENDIX A

BORING LAYOUT



BORING LAYOUT

SCALE: N.T.S.

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PREPARED FOR:
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PROJECT INFORMATION:
COLUMBIA COUNTY SHERIFF OFFICE
4917 US-90 East
LAKE CITY, FL 32055
(COLUMBIA COUNTY)

REVISION: 0
TEP JOB #: 67224.44847
SHEET NUMBER:
C-1

APPENDIX B

BORING LOG

Tower Engineering Professionals, Inc.
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LOG OF BORING B-1

PROJECT	SITE ID:	TEP NO.:
Columbia County Sheriffs Office		67224.44847

DATE STARTED	DRILLING METHOD	HOLE SIZE	CITY, STATE
3/15/2016	Mud Rotary	2-3/4in	Lake City, Florida

DATE COMPLETE	HAMMER WEIGHT/FALL	HAMMER TYPE	TOTAL DEPTH	DRILL RIG TYPE
3/15/2016	140lbs / 30in	Rope & Cathead	60.0 FT	Mud Bug

GROUND EL.	LOGGED BY	CHECKED BY	BACKFILL	DEPTH/EL. GROUNDWATER
	JEL	TAD	Grout	▽ 3.3/ ATD

BORING LOCATION: Adjacent to the centerline of the proposed tower

SAMPLE NUMBER	SAMPLE LENGTH (INCHES)	BLOW COUNTS (N) / REC% / RQD%	ELEVATION (FEET)	DEPTH (FEET)	SAMPLE GRAPHIC	USCS GRAPHIC	DESCRIPTION AND CLASSIFICATION	REMARKS	POCKET PEN TSF	UNCONFINED STRENGTH, PSF	UNIT WEIGHT PCF
S1	24	4-5-4-4 (9)					0.0-4.0: Loose, gray, fine to medium, poorly graded SAND (OL), little organics, trace roots, trace silt, wet				
S2	24	3-4-3-5 (7)									
S3	24	4-4-5-4 (9)		5			4.0-6.0: little silt				
S4	24	5-5-4-6 (9)					6.0-8.0: Loose, grayish brown, fine to medium, silty SAND (OL), little organics, wet				
S5	24	6-5-6-6 (11)		10			8.0-13.5: Medium dense, light brown, fine to medium, poorly graded SAND (SP), trace silt, trace particulate organics, wet				
S6	18	6-6-7 (13)		15			13.5-48.5: Medium dense, white, fine, silty SAND (SM), wet				
S7	18	3-5-7 (12)		20							
S8	18	6-6-9 (15)		25							
S9	18	5-9-7 (16)		30							
S10	18	6-8-11 (19)		35							
S11	18	7-7-9 (16)		40							
S12	18	6-5-6 (11)		45							
S13	18	5-7-7 (14)		50			48.5-60.0: light brown				
S14	18	6-6-8 (14)		55							
S15	18	7-7-9 (16)		60			60.0: Boring Terminated				
				65							

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Key to Soil Symbols and Terms

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portions retained on No. 200 sieve): includes (1) clean gravel and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density as determined by laboratory tests or standard penetration resistance tests.

Descriptive Terms	SPT Blow Count
Very Loose	< 4
Loose	4 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	> 50

FINE-GRAINED SOILS (major portions passing on No. 200 sieve): includes (1) inorganic and organic silts and clays (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings, SPT blow count, or unconfined compression tests.

Descriptive Terms	SPT Blow Count
Very Soft	< 2
Soft	2 to 4
Medium Stiff	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	> 30

GENERAL NOTES

1. Classifications are bases on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Surface elevations are based on topographic maps and estimated locations and should be considered approximate.

3. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not guaranteed to be representative of subsurface condition at other locations or times.

	Group Symbols	Typical Names
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, little or no fines/sands
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-silt mixtures
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly-graded sands, little or no fines/sands/gravels
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
	ML	Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
	PT	Peat and other highly organic soils

Sampler Symbols

- Split Spoon
- Standard Penetration Test (SPT)
- Pushed Shelby Tube
- Auger Cuttings
- Grab Sample
- Dynamic Cone Penetrometer
- Hand Auger
- Rock Core

Log Abbreviations

ATD - At Time of Drilling
AD - After Drilling
EOD - End of Drilling
RMR - Rock Mass Rating
WOH - Weight of Hammer
WOR - Weight of Rod
REC - Rock Core Recovery
RQD - Rock Quality Designation

Information Regarding This Subsurface Exploration Report

The information contained in this report has been specifically tailored to the needs of the client at the time the report was provided, for the specific purpose of the project named in this report. The attached report may not address the needs of contractors, civil engineers, or structural engineers. Anyone other than the named client should consult with the geotechnical engineer prior to utilizing the information contained in the report.

It is always recommended that the full report be read. While certain aspects of the report may seem unnecessary or irrelevant; just as each project and site are unique, so are the subsurface investigation reports and the information contained in them. Several factors can influence the contents of these reports, and the geotechnical engineer has taken into consideration the specific project, the project location, the client's objectives, potential future improvements, etc. If there is any question about whether the attached report pertains to your specific project or if you would like to verify that certain factors were considered in the preparation of this report, it is recommended that you contact the geotechnical engineer.

Geotechnical subsurface investigations often are prepared during the preliminary stages of a project and aspects of the project may change later on. Some changes may require a report revision or additional exploration. Some changes that often need to be brought to the attention of the geotechnical engineer include changes in location, size and/or type of structure, modifications to existing structures, grading around the project site, etc. Some naturally occurring changes can also develop that impact the information contained in this geotechnical report such as earthquakes, landslides, floods, subsurface water levels changing, etc. It is always recommended that the geotechnical be informed of known changes at the project site.

Subsurface exploration reports are generated based on the analysis and professional opinions of a geotechnical engineer based on the results of field and laboratory data. Often subsurface conditions can vary – sometimes significantly – across a site and over short distances. It often is helpful to retain the geotechnical engineer's services during the construction process. Otherwise, the geotechnical cannot assume responsibility or liability for report recommendations which may have needed to change based on changing site conditions or misinterpretation of recommendations.

Geotechnical engineers assemble testing and/or boring logs based on their interpretation of field and laboratory data. Testing and/or boring logs should always be coupled with the subsurface exploration report. The geotechnical engineer and Tower Engineering Professionals cannot be held reliable for interpretations, analyses, or recommendations based solely on the testing and/or boring log if it is independent of the prepared report.

The scope of the subsurface exploration report does not include an assessment or analysis of environmental conditions, determination of the presence or absence of wetlands or hazardous or toxic materials on or below the ground surface. Any notes regarding odors, fill, debris, or anything of that nature are offered as general information for the client, often to help identify or delineate natural soil boundaries.

For additional information, please contact the geotechnical engineer named in the attached report.

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