

October 17, 2023

Athens Utilities Board Mr. Kevin Goins 100 New Englewood Road Athens, TN 37303

Re: Report of Geotechnical Exploration Proposed Self-Support Tower Site Location: County Road 477 Englewood, Tennessee GEOServices Project No. 41-23615

Dear Mr. Goins:

GEOServices, LLC has completed the requested exploration and herewith submits our data and conclusions. Our services were in general accordance with GEOServices Proposal No. 14-23442, dated September 12, 2023, for a geotechnical exploration for the proposed tower. This report presents our findings per the scope of work referenced above.

If you have any questions or comments do not hesitate to contact our office to discuss the details of this report.

Sincerely, GEOServices, LLC

Derek K. Kilday, P.E. V.P. – Chattanooga Area Manager



# REPORT OF GEOTECHNICAL EXPLORATION PROPOSED SELF-SUPPORT TOWER SITE LOCATION: COUNTY ROAD 477 ENGLEWOOD, TENNESSEE

Prepared For:

Athens Utilities Board 100 New Englewood Road Athens, TN 37303

Prepared by:



GEOServices, LLC 6607 Mountain View Road, Suite 139 Ooltewah, Tennessee 37363

October 17, 2023

# TABLE OF CONTENTS

PURPOSE AND SCOPE	1
PROJECT DESCRIPTION	1
SITE LOCATION	1
EXPLORATION	1
SUBSURFACE CONDITIONS	2
SUBSURFACE WATER	3
FOUNDATION PARAMETERS	3
LIMITATIONS	4

# LIST OF ATTACHMENTS

ATTACHMENT 1: BORING LOCATION PLAN ATTACHMENT 2: GENERAL NOTES ATTACHMENT 3: BORING LOGS ATTACHMENT 4: LABORATORY SUMMARY SHEET

## PURPOSE AND SCOPE

The purpose of this geotechnical exploration is to characterize the subsurface conditions at the site and provide subsurface design parameters for the proposed tower foundation. Our scope of services for this task included drilling two soil borings, at the proposed tower location, and preparing this report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents soil parameters pertaining to foundation design.

#### **PROJECT DESCRIPTION**

The site information package was sent to GEOServices via e-mail which included the site survey data and the site location. GEOServices was not provided with loading information but understands the proposed construction will consist of a self-support tower with a total height of approximately 190 feet.

The geotechnical information presented in this report is based on the available project information, the tower location, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform GEOServices in writing so that we can amend the recommendations presented in this report. GEOServices cannot be responsible for the implementation of its recommendations when it is not notified of changes in conditions.

# SITE LOCATION

The proposed tower is located along the east side of County Road 477, north of its intersection with County Road 480, in Englewood (McMinn County), Tennessee. The coordinates of the proposed tower are North American Datum of 1983 (NAD83) Latitude 35.394271° N and Longitude 84.461246° W.

#### **EXPLORATION**

An ATV mounted drill rig was utilized to advance two borings at the site. Boring B-1 was located at the approximate proposed tower center and was advanced to a depth of 39.2 feet below the ground surface where auger refusal was encountered. Boring B-2 was located approximately 20 feet to the southeast of the tower center and was advanced to a depth of 27.6 feet below the ground surface where auger refusal

was encountered. Samples obtained were shipped to a GEOServices office. GEOServices personnel logged the sampled material under the direction of a geotechnical engineer. The samples not used for laboratory testing will be retained for 30 days from the date of this report before being discarded.

# SUBSURFACE CONDITIONS

The tables below provide subsurface descriptions of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs should be reviewed for specific information at the boring locations. The boring logs include soil descriptions, stratifications, penetration resistance, and groundwater information at the approximate location of the samples observed. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected across the site. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.

Depth (ft below ground surface)	Description	USCS Classification (Visual)	Standard Penetration Test (N-value)	Relative Density or Consistency	
0-8	Silty SAND	SM	11 to 8	Medium Dense to Loose	
8 - 18	Silty SAND	SM	22 to 17	Medium Dense	
18 - 39.2	Silty SAND with trace rock fragments	SM	11 to 50/1"	Medium Dense to Very Dense	

Table 1 – Subsurf	ace Conditions	(Boring B-1)	l

 Table 2 – Subsurface Conditions (Boring B-2)

Depth (ft below ground surface)	Description	USCS Classification (Visual)	Standard Penetration Test (N-value)	Relative Density or Consistency	
0-12	Silty SAND	SM	7 to 12	Loose to Medium Dense	
12 – 27.6	Silty SAND with trace rock fragments	SM	12 to 14	Medium Dense	

# SUBSURFACE WATER

Subsurface water was not observed in the soil borings at the completion of drilling. It is possible for the subsurface water table to fluctuate within the depths explored during other times of the year depending upon climatic and rainfall conditions.

# FOUNDATION PARAMETERS

Based on the observed subsurface conditions, the proposed tower can be supported on a conventional shallow foundation or a drilled pier foundation system. Therefore, we are providing design parameters for each foundation type.

#### **Shallow Foundations**

Based on the information obtained at the borings during this exploration, and considering a factor of safety of 3 with respect to general shear failure, we assess the allowable bearing pressure to be used for design of shallow type foundations to be as follows:

Depth Range (ft)	Wet Unit Weight (pcf)	Allowable Bearing Pressure (psf)
0 – 2	115	NA
2 – 8	120	2,500
8 – 15	120	3,000

Table 2 – Allowable Bearing Pressures

# **Pier Foundations**

If a drilled pier foundation system is utilized, parameters recommended for the design analysis are as follows:

Depth Range (ft)	Wet Unit Weight (pcf)	Allowable End Bearing (psf) <sup>(1)</sup>	Cohesion (psf) <sup>(2,3)</sup>	Total Angle of Internal Friction Φ (°)	Effective Angle of Internal Friction Φ (°)	Ultimate Frictional Resistance <sup>(4)</sup> (psf/ft)	K <sup>(5)</sup> (pci)	Strain Factor E50
0 – 2	115	NA	Neglect	Neglect	Neglect	Neglect	Neglect	Neglect
2 – 8	120	2,500	0	30	30	30.6	90	N/A
8 - 18	120	3,000	0	32	32	31.0	225	N/A
18 - 39.2	120	3,500	0	32	32	31.0	225	N/A

Table 3	- Subsurface	Parameters
rusic s	Subsuljace	, and meters

(1) Factor of safety of 3.

(2) Based on N values and are conservative estimates based upon prudent engineering judgment. If the structure is considered a "critical structure" or if actual values are needed, laboratory testing should be performed to determine the soil's strength parameters.

(3) Resistance of concrete against undisturbed natural soil can be taken as 55% of the Undrained Shear Strength (Cohesion) for short term loading conditions.

(4) The value of Ultimate Frictional Resistance is calculated as  $\mu^*(effective unit weight)^*(depth)^*K_o(=1-sin(\Phi)OCR^{(sin\Phi)})$ . OCR is neglected in this case.

(5) Lateral Modulus of subgrade reaction. \*The wet unit weights listed in the table are based on prudent engineering judgment and do not reflect the buoyant unit weight of the soils below the groundwater table. The buoyant unit weight is the unit weight of soil minus the unit weight of water.

#### LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made. If changes occur in the design, location or concept of the project, the conclusions and recommendations contained may not be valid for the proposed construction.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the subsurface exploration. The variations between soil conditions across the site may exist and may not become evident until construction. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the

tower are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing.

The satisfactory long-term performance of the foundation will be dependent upon the workmanship and adherence to details contained in our recommendations and the project specifications. Furthermore, certain geotechnical aspects of the construction require that decisions be made during construction based on careful and knowledgeable observation. The geotechnical engineer should be retained to provide observations and testing of construction activities involved in the foundations, and related activities of this project.







GEOServi	Contraction of the second seco	chnical and	Materials Engineers		BC	ORIN	ng Nu	IMB PA	ER   GE 1	<b>B-1</b> OF 2
PROJ	ECT NAM	ME P	roposed Self-Support Tower	GEOServices PROJECT# 41	-23615					
DATE	9/21/2	23		PROJECT LOCATION _Engley	wood, Tei	nnesse	e			
DRILL	ING COI	NTRAG	TOR Tri-State Drilling	LOGGED BY L. Martinez		ON-SI	TE REP			
DRILL	ING ME	тнор	Hollow Stem Auger	LATITUDE / LONGITUDE	-					
GROU	JND ELE	VATIC	N PROPOSED FFE	NORTHING / EASTING						
REFUS	SAL		Depth 39.2 ft							
TOP C	OF ROCK	<u> </u>	Depth 39.2 ft	GROUND WATER LEVELS:						
BEGA	N CORI	NG		AT END OF DRILLING						
FOOT	AGE CO	RED (I	.F)	AFTER 1 HOUR						
BOTT	OM OF	HOLE	Depth 39.2 ft	AFTER 24 HOURS						
	7				щ	%			ATTEI	RBERG <u>/ITS</u>
L =		Ξg			BER	D RV	VTS LUE)	URE VT (9		Σ
(ft DEP	EVA (ft	Lo RA	MATERIAL DESCRIPTIO	2N	UM IPLE	NO(IN)		OIST		EAC
		G			SAN	REC	υz	Σõ	25	IN
0			SILTY SAND (SM) dark brown and dark marge	ni modium donce to looce						
			moist (RESIDUUM)	in, medium dense to loose,						
					1 55	1	4-6-4			
	-						(10)	6		
					<u> </u>	1				
	-				V ss		5-6-5	6		
5					2		(11)			
	-					-				
							6-4-4 (8)	8		
						-	(-7			
	-		SILTY SAND (SM) - dark brown and dark maroc	on; medium dense; moist	-					
L _	-		(RESIDUUM)		V ss	]	8-10-12			
10					4		(22)	10		
	-				<u> </u>	1				
	-									
	-									
	-									
F -							5-8-9 (17)	20		
15	-					-	. ,			
F -										
L										
[ -			SILTY SAND (SM) - with trace amounts of rock	fragments - dark brown and						
	-			141)	V ss		5-5-6	16		
20					6		(11)			
NOT	TES:									

GEOServi	DE ces, LLC-Geote	chnical and	Materials Engineers		BC	DRI	ng Nu	MB PA	ER I GE 2	<b>B-1</b> OF 2
		MF P	COMPANY	GEOServices PROJECT# 41	-23615					
DATE	9/21/	23		PROJECT LOCATION Engle	wood, Ter	nnesse	e			
DRILL	ING CO	NTRAG	TOR Tri-State Drilling	LOGGED BY L. Martinez		ON-SI	TE REP			
DRILL	ING ME	тнор	Hollow Stem Auger	LATITUDE / LONGITUDE	-					
GROU		VATIC	N PROPOSED FFE	NORTHING / EASTING						
REFUS	SAL		Depth 39.2 ft							
тор с	OF ROCH	٢	Depth 39.2 ft	GROUND WATER LEVELS:						
BEGA	N CORI	NG		AT END OF DRILLING						
FOOT	AGE CO	RED (	F)	AFTER 1 HOUR						
BOTT	OM OF	HOLE	Depth 39.2 ft	AFTER 24 HOURS				1		
	_				ш.	%		(9	ATTEF	RBERG ∕IITS
E		Э Н л			BER	D)	VTS -UE)	URE UT (9		≥
(ft)	$[\widehat{\pm}]$ $[\widehat{\pm}]$ $[\widehat{\pm}]$ MATERIAL DESCRIPTION			DN	IPLE	OVE (RQI		OIST	E E	EXE
	E	G			NAN N	REC	υZ	Σõ	l ⊒ =	INI
20			SILTY SAND (SM) with trace amounts of rock	fragmants dark brown and						
			dark maroon; medium dense; moist (RESIDUU	M) (continued)						
					V ss		6-9-9	21		
25					7		(18)	21		
					55		10-14-13			
20					8		(27)	14		
					<u> </u>					
							9-12-17 (29)	14		
35					<u> </u>		. ,			
			SILTY SAND (SM) - with rock fragments - dark k	prown and dark maroon;						
L _										
					× 55		50/3"	16		
			Refusal at 39.2 fee	t.		ļ				
<u> </u>			Bottom of borehole at 39	0.2 feet.						
	ES:									

GEDServi	<b>F</b> ices, LLC-Geote	chnical and	Materials Engineers		BC	ORIN	ng Nu	PA	ER GE 1	<b>B-2</b> OF 2
PROJ	ECT NA	ME PI	oposed Self-Support Tower	GEOServices PROJECT# 41	-23615					
DATE	9/21/	23	· · · ·	PROJECT LOCATION _Engley	wood, Ter	nnesse	e			
DRILL	ING CO	NTRAC	TOR Tri-State Drilling	LOGGED BY L. Martinez		ON-SI	TE REP			
DRILL	ING ME	тнор	Hollow Stem Auger	LATITUDE / LONGITUDE	-					
GROU	JND ELE	VATIO	N PROPOSED FFE	NORTHING / EASTING						
REFU	SAL		Depth 27.6 ft							
тор с	OF ROCK	۲	Depth 27.6 ft	GROUND WATER LEVELS:						
BEGA	N CORII	NG		AT END OF DRILLING						
FOOT	AGE CO	RED (I	F)	AFTER 1 HOUR						
BOTT	OM OF	HOLE	Depth 27.6 ft	AFTER 24 HOURS						
					ш			(	ATTE	RBERG
EPTH (ft)	/ATION (ft)	APHIC -OG	MATERIAL DESCRIPTIO	N	PLE TYPI MBER	VERY % (QD)	LOW NUNTS /ALUE)	ISTURE FENT (%	 	
	ELEV	GR			SAMI	RECO (F	(SCB	CON	LIAC	PLAST
0			SILTY SAND (SM) - dark brown and dark maroor moist (RESIDUUM)	n; loose to medium dense;						
	-						E 4 2		-	
	-						(7)	16		
					<u> </u>	-			1	
	1								-	
					V ss		3-3-4	12		
5					2		(7)	12		
						1			1	
									-	
					ss		4-5-6	14		
						(11)		-		
	-									
						-	5.6.6		1	
							5-6-6 (12)	14		
10	-				<u> </u>				-	
	-		SILTY SAND (SM) with trace amounts of rock fra	agments - dark brown and	-					
L _			dark maroon; medium dense; moist (RESIDUUN	ЛĬ						
						-			-	
					SS SS		4-6-6	13		
15							(12)		-	
L -	-									
	-									
I	-				∭ ss		7-8-6			
20					6		(14)	9		
	TES:				<i>r</i> V			1	I	1

GEOServi	Ces, LLC-Geote	chnical and	<b>Materials Engineers</b>		BC	DRI	NG NU	IMB PA	ER I GE 2	<b>3-2</b> OF 2
			COMPANY	GEOServices DBOIECT# /1	-22615					
DATE	9/21/	73		PROJECT LOCATION Englewood Tennessee						
DRILL			TOR Tri-State Drilling	LOGGED BY   Martinez	10000, 101		TE RED			
DRILL		тнор	Hollow Stem Auger							
GROU		VATIO	N PROPOSED FFE	NORTHING / EASTING						
REFUS	5AI		Denth 27.6 ft							
торо		(	Depth 27.6 ft	GROUND WATER LEVELS:						
BEGA		NG		AT END OF DRILLING						
FOOT	AGE CO	RED (I	.F)	AFTER 1 HOUR						
вотт	OM OF	HOLE	Depth 27.6 ft	AFTER 24 HOURS						
_		-							ATTER	RBERG
	Z	0			PE ~	% /	(a ÎII	я (%)	LIN	1ITS
t)	ATIC (t)	Ηg		ON	LE T	AER)		ITU ITU		È.
DEI (f	(f	GRA			MDI	(GO RO	N </td <td>10IS</td> <td>IN IN</td> <td>STIC VDE)</td>	10IS	IN IN	STIC VDE)
	Ш				SA	RE	Ξ	28		A =
20			SILTY SAND (SM) with trace amounts of rock f	ragments - dark brown and						
			dark maroon; medium dense; moist (RESIDUL	IM) (continued)						
					SS SS		6-7-7	11		
25					7		(14)	11		
						1				
			Refusal at 27.6 fe	et.	1					
			Bottom of borehole at 2	.7.6 feet.						
NOT	ES:									



# **Proposed Self-Support Tower**

Englewood, Tennessee

GEOServices Project No. 41-23615 September 28, 2023

# LABORATORY SUMMARY SHEET

Boring	Sample	Denth	Natural Moisture	Percent	Atterberg Limits			Soil
Number	Number	(feet)	Content	#200	LL PL F		PI	Туре
B-1	1	1.0-2.5	6.0%					
	2	3.5-5.0	6.0%					
	3	6.0-7.5	8.0%					
	4	8.5-10.0	10.0%					
	5	13.5-15.0	20.0%					
	6	18.5-20.0	16.0%					
	7	23.5-25.0	21.0%					
	8	28.5-30.0	14.0%	19.0%				
	9	33.5-35.0	14.0%					
	10	38.5-40.0	16.0%					
B-2	1	1.0-2.5	24.0%					
	2	3.5-5.0	12.0%	23.0%				
	3	6.0-7.5	14.0%					
	4	8.5-10.0	15.0%					
	5	13.5-15.0	14.0%					
	6	18.5-20.0	9.0%					
	7	23.5-25.0	11.0%					