UES hand excavated the upper four feet at each soil boring location in order to reduce the potential for damage to any existing buried utilities.

The boring locations were located by our drill crew based on the site plan and existing site conditions. The test boring locations are shown on the attached Boring Location Plan in Appendix A.

3.0 FINDINGS

3.1 SURFACE CONDITIONS

A Universal Engineering Sciences representative performed a visual site inspection of the property to gain a "hands-on" familiarity with the project area. The evaluated road consists of sidewalk and grassed landscape areas along the road shoulders.

3.2 SOIL SURVEY INFORMATION

We examined the U.S.D.A. Soil Conservation Service (SCS) Soil Survey of Manatee County for relevant information about the roadway project. The Manatee County Soil Survey identifies one (1) soil type along the general roadway alignment, as further described in Table 1 (USDA Soil Conservation Service, 1983).

TABLE 1
USDA Soil Conservation Service Soil Classification

Name and Soil No.	Drainage Characteristics	Hydrologic Group	Predicted Seasonal High Water Table	Notable Feature
Cassia (#11)	Somewhat Poorly drained	A/D	18 to 42"	-
EauGallie (#20)	Poorly drained	A/D	6 to 18"	-
Floridana, Immokalle & Okeelanta (#26)	Very Poorly drained	C/D	0	-

3.3 SUBSURFACE CONDITIONS

The boring locations and detailed subsurface conditions are illustrated in Appendix A: Boring Location Plan and Boring Logs. The classifications and descriptions shown on the logs are generally based upon visual characterizations of the recovered soil samples. Also, see Appendix A: Soils Classification Chart, for further explanation of the symbols and placement of data on the Boring Logs. The following table summarizes the soil conditions encountered.

TABLE 2
General Soil Profile

Typical depth (ft)		Soil Descriptions
From	To	
0	6	Very loose to loose fine sand and fine sand with silt [SP, SP-SM] (A-2) (A-3)
6	13	Very loose to dense fine sand and fine sand with silt [SP, SP-SM] (A-2) (A-3)
13	15*	Medium dense to very dense fine sand and fine sand with silt and shell [SP, SP-SM] (A-3)

* **Termination Depth of Deepest Boring**
[ ] **Bracketed Text Indicates: Unified Soil Classification**
( ) **Parenthesis Text Indicates: AASHTO Soil Classification**

Variations in the depth, thickness and consistency of the aforementioned soil strata occurred at the individual test boring locations. We encountered groundwater at depths ranging from 2.7 to 4.7 feet below existing grade at the time of our investigation. The variations in the measured water levels are attributed to the variation in the ground surface elevation at this site as well as the soil type encountered.

A notable feature is the presence of very dense sands encountered in borings B-1 and B-3 below a depth of 13 feet below grade. This soil may vary across the site in depth and consistency, and may be difficult to excavate.

4.0 SOIL DESIGN PARAMETERS

Based on the SPT test results and soils encountered with the borings along the evaluated roads, soil design parameters of angle of internal friction, earth pressure coefficient and unit weights were estimated and are presented in Table 3.

Table 3 Estimated Soil Design Parameters						
Typical Depth (Ft)		Effective Unit Weight (pcf)	Friction Angel (degrees)	Recommended Earth Pressure Coefficients		
From	To			At Rest K_O	Active K_A	Passive K_P
B-1						
0	8	43	29	0.5	0.3	2.8
8	13	48	30	0.5	0.3	3.0
13	15	63	34	0.4	0.3	3.5
B-2						
0	6	43	29	0.5	0.3	2.8
6	8	58	33	0.4	0.29	3.4
8	15	53	32	0.47	0.3	3.25
B-3						
0	6	43	29	0.5	0.3	2.8
6	13	48	30	0.5	0.3	3.0
13	15	63	34	0.4	0.3	3.5
B-4						
0	6	43	29	0.5	0.3	2.8
6	8	48	30	0.5	0.3	3.0
8	15	58	33	0.4	0.29	3.4
B-5						
0	15	43	29	0.5	0.3	2.8

5.0 RECOMMENDATIONS

The following recommendations are based upon a review of the attached soil tests data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. If the roadway alignment or grading plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

Additionally, if subsurface conditions are encountered during construction, which were not encountered in the borings and cores, report those conditions immediately to us for observation and recommendations.

In this section of the report, we present our detailed recommendations for:

- **Groundwater Control**
- **Roadway Embankment**
- **Pavement Evaluation**
- **Drainage Structure and Utility Considerations**

5.1 GROUNDWATER CONTROL

The groundwater table will fluctuate seasonally depending upon local rainfall. The rainy season in Southwest Florida is normally between June and September. Based on our review of USGS data, Manatee County Soil Survey and regional hydrogeology and our boring data, our best estimate is the seasonal high water table (SHWT) at the boring locations would generally from 2 to 3 feet below existing ground surface at the shoulder test boring locations. Water will likely be ponded above the existing ground surface in the low lying depression and slough areas along the alignment for extended periods of time during the wet season or periods of heavy rainfall.

It should be noted that the estimated seasonal high groundwater levels do not provide any assurance that groundwater levels will not exceed those estimated levels during any given year in the future. Should impediments to surface water drainage exist on site, or should rainfall intensity and duration, or total rainfall quantities exceed normally anticipated rainfall quantities, groundwater levels may exceed our seasonal high estimates. Also, on-site and/or off-site surface water alterations and improvements can cause variations in seasonal high groundwater levels.

Temporary dewatering may be required during site preparation, initial embankment and fill placement in the lower lying slough or depressional areas along the alignment, particularly if construction takes place during the rainy season. Temporary dewatering will also likely be a construction consideration during drainage, and utility excavations.

In general, we recommend that the water surface be maintained at least 24 inches below all earthwork and compaction surfaces.

5.2 ROADWAY EMBANKMENT

We offer the following recommendations for site preparation and embankment construction.

5.2.1 Site Preparation

The following procedures should be followed to properly prepare the alignment area for roadway embankment construction.

1. If required, perform remedial dewatering prior to any earthwork operations.

2. Strip the proposed construction limits of all vegetation, roots, topsoil, existing improvements, debris and other deleterious materials within the limits of the pavement, shoulder, sidewalk, and other structural areas.

3. Proof-roll the subgrade with a heavily loaded, rubber-tired vehicle under the observation of a Universal Engineering Sciences' geotechnical engineer or his representative. Proof-rolling will help locate any zones of especially loose or soft soils not encountered in the soil test borings. Then undercut, or otherwise treat these zones as recommended by the engineer.

4. Proof-compact the subgrade from the surface by a vibratory roller until you obtain a minimum density of 100 percent of the standard Proctor maximum dry density (AASTHO T-99) to a depth of 1 foot below the existing site grade.

5. Test the subgrade for compaction at a frequency of not less than one test every 500 feet for each lane, shoulder, bike path, sidewall, curb or other structural area per foot of depth of improvement.

5.2.2 Embankment Materials and Construction

We recommend the construction of the roadway and associated embankments proceed according to F.D.O.T. index 120 (FDOT Standard Specification for Road and Bridge Construction 2010). The fill material utilized should consist of clean sand with less than 5 percent soil fines. Fill materials with soil fines between 5 and 12 percent may be used when above the water table, so long as strict moisture control is applied (within 2% of optimum moisture). The fill material should be placed in uniform 6 inch loose lifts and compacted to 100 percent of the standard Proctor maximum dry density (AASHTO T-99). Field density tests should be performed on each layer of fill material at a frequency of one test for every 500 linear feet of construction for each lane or associated area.

The surficial soils at the site would generally be suitable for use in embankment construction. However, fill from off-site borrow sources will generally be required above existing grades along the majority of the intersection. The soil placed within the stabilized subgrade layer must meet an LBR of 40 or will need to be stabilized after placement to achieve the minimum LBR value.

5.0 LIMITATIONS

This report has been prepared in order to aid the architect/engineer in the design of the proposed force main structure. The scope of services provided was limited to the specific project and locations described herein. The description of the project's design parameters represents our understanding of significant aspects relevant to soil and foundation characteristics.

The recommendations submitted in this report are based upon the data obtained from the limited number of soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations or unexplored areas of the site. This report should not be used for estimating such items as cut and fill quantities.

Borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information to negate presence of anomalous materials or for estimation of material quantities unless our contracted services ***specifically*** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect such anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

All users of this report are cautioned that there was no requirement for Universal to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore no attempt was made by Universal to locate or identify such concerns. Universal cannot be responsible for any buried man-made objects or environmental hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested.

For a further description of the scope and limitations of this report please review the document attached within Appendix B "Important Information About Your Geotechnical Engineering Report" prepared by ASFE, an association of firms practicing in the geosciences.

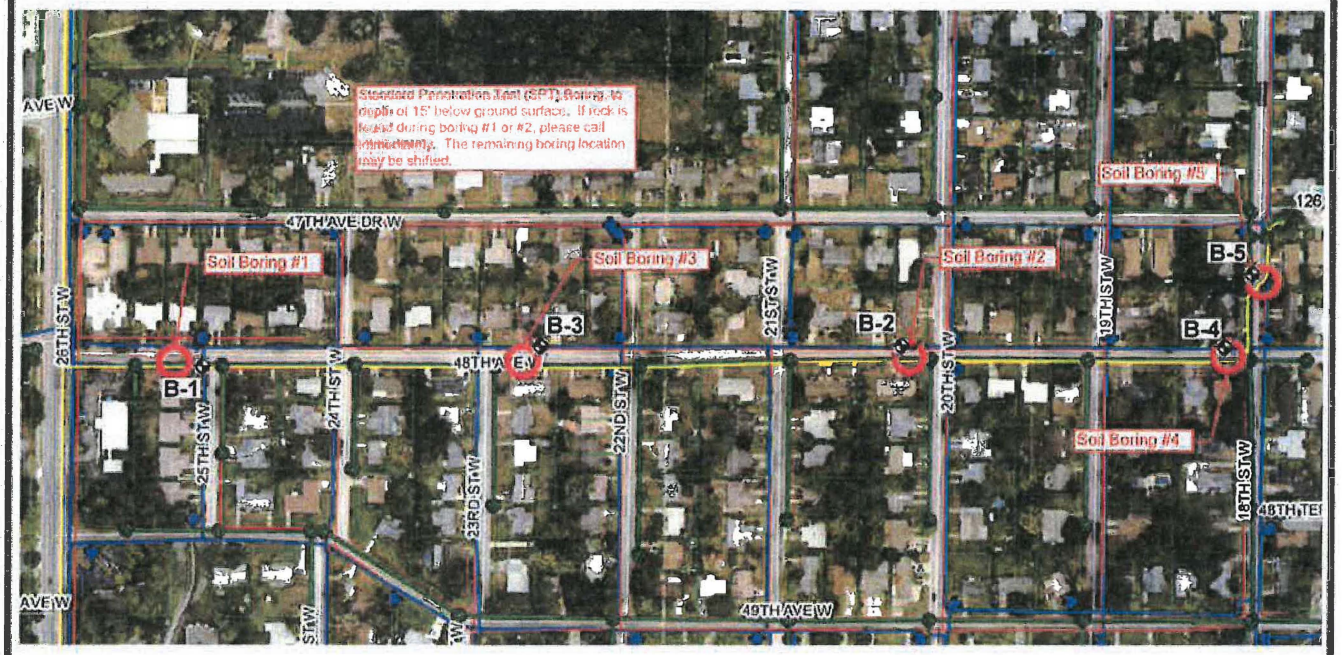
APPENDIX A

UNIVERSAL
ENGINEERING SCIENCES

PROPOSED FORCE MAIN 31A REPLACEMENT
48TH AVE. W. & 18TH STREET W.
BRADENTON, MANATEE COUNTY, FLORIDA

SITE LOCATION PLAN

DRAWN BY:	S.C	DATE:	NOVEMBER 2015	CHECKED BY: Robert G.		DATE: NOVEMBER 2015	
SCALE:	NOT TO SCALE	PROJECT NO:1130.1500174.0000		REPORT NO: 11352		APPENDIX:	



LEGEND	
APPROXIMATE LOCATION	
⊕	SPT BORING

UNIVERSAL
ENGINEERING SCIENCES

PROPOSED FORCE MAIN 31A REPLACEMENT
48TH AVE. W. & 18TH STREET W.
BRADENTON, MANATEE COUNTY, FLORIDA

BORING LOCATION PLAN

DRAWN BY:	S.C	DATE:	NOVEMBER 2015	CHECKED BY: Robert G.		DATE: NOVEMBER 2015	
SCALE:	NOT TO SCALE	PROJECT NO:1130.1500174.0000			REPORT NO: 11352	APPENDIX:	

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	1130.1500240.0000
REPORT NO.:	11402
PAGE:	1

PROJECT: Proposed Force Main 31A Replacement
48th Ave. W.
Bradenton, Manatee County, Florida

BORING DESIGNATION: **B-01** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: Manatee County

LOCATION: See Boring Location Plan

REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 2.7
DATE OF READING: 11-19-2015
EST. W.S.W.T. (ft):

DATE STARTED: 11/19/15
DATE FINISHED: 11/19/15
DRILLED BY: M.B/L.R
TYPE OF SAMPLING: ASTM D1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						Dark brown fine sand with trace silt (SP) [A-3]						
				▼		Light brown fine sand with roots (SP) [A-3]						
							3.2	30.4				
5						Medium dense grayish brown fine sand with silt and roots (SP-SM) [A-2]						
		4-6-5-3	11			Very loose to medium dense fine sand (SP) [A-3]	10.7	22.5				
		2-2-2-2	4									
10		2-4-8	12				2.4	28.5				
						Very dense dark brown fine sand with trace silt (SP) [A-3]						
15		18-22-32	54				2.7	25.0				
						Boring Terminated at 15 Feet						

BORING_LOG (11402) 1500402 PROPOSED FM 31A REPLACEMENT.GPJ UNIENGSC.GDT 12/9/15

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	1130.1500240.0000
REPORT NO.:	11402
PAGE:	2

PROJECT: Proposed Force Main 31A Replacement
48th Ave. W.
Bradenton, Manatee County, Florida

BORING DESIGNATION: **B-02** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: Manatee County

LOCATION: See Boring Location Plan

REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 3.7
DATE OF READING: 11-19-2015
EST. W.S.W.T. (ft):

DATE STARTED: 11/19/15
DATE FINISHED: 11/19/15
DRILLED BY: M.B/L.R
TYPE OF SAMPLING: ASTM D1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0				▼		Gray fine sand with silt (SP-SM) [A-3]						
						Light yellowish brown fine sand with roots (SP) [A-3]						
						Loose to dense dark brown fine sand with silt (SP-SM) [A-3]	3.2	27.1				
5		2-2-4-8	6				7.2	21.9				
		12-18-15-12	33			Medium dense yellowish brown fine sand with trace silt (SP) [A-3]						
10		11-13-11-7	24				2.8	25.0				
15		9-10-10	20			**Boring Terminated at 15 Feet**	3.1	23.1				

BORING LOG: (11402) 1500402 PROPOSED FM 31A REPLACEMENT.GPJ UNIENGSC.GDT 12/8/15

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	1130.1500240.0000
REPORT NO.:	11402
PAGE:	3

PROJECT: Proposed Force Main 31A Replacement
48th Ave. W.
Bradenton, Manatee County, Florida

BORING DESIGNATION: **B-03** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: Manatee County

LOCATION: See Boring Location Plan

REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 4.7
DATE OF READING: 11-19-2015
EST. W.S.W.T. (ft):

DATE STARTED: 11/19/15
DATE FINISHED: 11/19/15
DRILLED BY: M.B/L.R
TYPE OF SAMPLING: ASTM D1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						Light grayish brown fine sand with trace silt (SP) [A-3]						
							2.1	6.4				
						Light yellowish brown fine sand (SP) [A-3]						
				▼		Loose brown fine sand (SP) [A-3]						
5												
		2-4-5-6	9			Medium dense dark brown fine sand with large roots (SP) [A-3]	1.4	23.8				
		5-6-6-9	12			Medium dense dark brown fine sand (SP) [A-3]	1.4	24.4				
10		5-6-10-19	16				2.5	23.6				
						Very dense dark gray fine sand with silt (SP-SM) [A-3]						
15		21-23-32	55			**Boring Terminated at 15 Feet**						

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.	1130.1500240.0000
REPORT NO.	11402
PAGE:	4

PROJECT: Proposed Force Main 31A Replacement
48th Ave. W.
Bradenton, Manatee County, Florida

BORING DESIGNATION: **B-04** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: Manatee County

LOCATION: See Boring Location Plan

REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 4.25
DATE OF READING: 11-19-2015
EST. W.S.W.T. (ft):

DATE STARTED: 11/19/15
DATE FINISHED: 11/19/15
DRILLED BY: M.B/L.R
TYPE OF SAMPLING: ASTM D1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./DAY)	ORG. CONT. (%)
0						Light brown fine sand (SP) [A-3]						
						Dark brown fine sand with silt (SP-SM) [A-3]	2.6	5.2				
				▼		Very loose grayish brown fine sand with silt and roots (SP-SM) [A-2]	5.1	26.0				
5		2-2-2-2	4			Medium dense to dense white fine sand (SP) [A-3]	10.2	31.7				
		2-5-10-15	15									
10		12-17-18-20	36				3.2	22.7				
						Dense light brown fine sand with trace silt (SP) [A-3]						
15		7-13-17	30			**Boring Terminated at 15 Feet**						

BORING LOG (11402) 1500402 PROPOSED FM 31A REPLACEMENT.GPJ UNIENGSC.GDT 12/8/15

UNIVERSAL ENGINEERING SCIENCES
BORING LOG

PROJECT NO.:	1130.1500240.0000
REPORT NO.:	11402
PAGE:	5

PROJECT: Proposed Force Main 31A Replacement
48th Ave. W.
Bradenton, Manatee County, Florida

BORING DESIGNATION: **B-05** SHEET: **1 of 1**
SECTION: TOWNSHIP: RANGE:

CLIENT: Manatee County

LOCATION: See Boring Location Plan

REMARKS:

G.S. ELEVATION (ft):
WATER TABLE (ft): 4.25
DATE OF READING: 11-19-2015
EST. W.S.W.T. (ft):

DATE STARTED: 11/19/15
DATE FINISHED: 11/19/15
DRILLED BY: M.B/L.R
TYPE OF SAMPLING: ASTM D1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N (BLOWS/ FT.)	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	K (FT./ DAY)	ORG. CONT. (%)
0						Light brown fine sand (SP) [A-3]						
							1.1	10.5				
						Light brown fine sand with trace silt (SP) [A-3]						
				▼			1.3	21.3				
						Very loose dark brown fine sand (SP) [A-3]						
5												
		2-2-2-2	4				1.8	24.5				
		2-2-2-2	4			Very loose dark brown fine sand with trace silt and trace shell (SP) [A-3]						
10		2-2-2-2	4				2.5	20.8				
						Loose gray shelly fine sand (SP) [A-3]						
15		3-3-4	7			**Boring Terminated at 15 Feet**						

UNIVERSAL ENGINEERING SCIENCES
9802 Palm River Road
Tampa, Florida 33619

(813) 740-8506

SOIL CLASSIFICATION CHART

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	Relative Density	SPT Blow Count
Very loose	0 to 15 %	< 4
Loose	15 to 35 %	4 to 10
Medium dense	35 to 65 %	10 to 30
Dense	65 to 85 %	30 to 50
Very dense	85 to 100 %	> 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	Unconfined Compressive Strength kPa	SPT Blow Count
Very soft	< 25	< 2
Soft	25 to 50	2 to 4
Medium stiff	50 to 100	4 to 8
Stiff	100 to 200	8 to 15
Very stiff	200 to 400	15 to 30
Hard	> 400	> 30

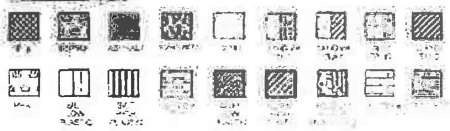
GENERAL NOTES

1. Classifications are based on the United 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.

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 conditions at other locations or times.

SOIL SYMBOLS



OTHER SYMBOLS

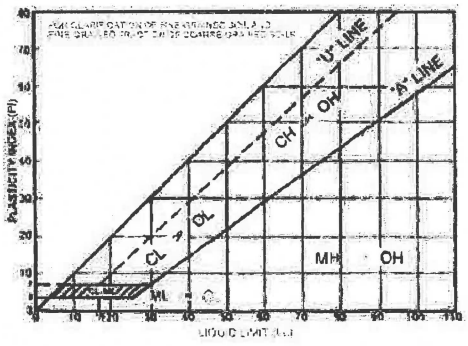
Measured Water Table Level

Estimated Seasonal High Water Table

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria
Coarse-Grained Soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7 / Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7
Fine-Grained Soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, 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	
	Silts and Clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, organic silts	
			CH	Inorganic clays of high plasticity fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly Organic Soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows:

Less than 5 percent ... GW, GP, SW, SP
More than 12 percent ... GM, GC, SM, SC
5 to 12 percent ... Borderline cases requiring dual symbols*



Plasticity Chart

Particle Size	Sieve	mm
Material		
Gravel		4.76 to 19.1
Fine	#4 to 3/4 in.	
Coarse	3/4 in. to 3 in.	19.1 to 76.2
Cobble	3 in. to 12 in.	76.2 to 304.8
Boulders	12 in. to 36 in.	304.8 to 914.4

Particle Size	Sieve sizes	mm
Material		
Silt or clay	< #200	< 0.074
Sand	#200 to #40	0.074 to 0.42
Fine	#40 to #10	0.42 to 2.00
Medium	#10 to #4	2.00 to 4.76
Coarse		

* When the percent passing a No. 200 sieve is between 5% and 12%, a dual symbol is used to denote the soil. For example, SP-SC, poorly-graded sand with clay content between 5% and 12%.

APPENDIX B

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant. ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth
8811 Colesville Road/Suite G106 Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org