REPORT
OF
LIMITED SUBSURFACE EXPLORATION

DOUBLE OAKS ROAD – WOODWARD AVENUE EXTENSION
CHARLOTTE, NORTH CAROLINA

ECS PROJECT NO. 08-9358
REVISED ON APRIL 1, 2014

REPORT OF LIMITED SUBSURFACE EXPLORATION

Double Oaks Road - Woodward Avenue Extension
Charlotte, North Carolina

Prepared For:

LandDesign
223 North Graham Street
Charlotte, North Carolina 28202

Prepared By:

ECS CAROLINAS, LLP
1812 Center Park Drive, Suite D
Charlotte, North Carolina 28217

ECS Project No:

08-9358

Report Date:

Revised on April 1, 2014

ECS CAROLINAS, LLP

"Setting the Standard for Service"

Geotechnical • Construction Materials • Environmental • Facilities

NC Registered Engineering Firm F-1078

October 18, 2013
Revised on April 1, 2014

Mr. Kevin Vogel, P.E.
LandDesign
223 North Graham Street
Charlotte, North Carolina 28202

Reference: Revised Report of Limited Subsurface Exploration
Double Oaks Road - Woodward Avenue Extension
Charlotte, North Carolina
ECS Project No. 08-9358

Dear Mr. Vogel:

ECS Carolinas, LLP (ECS) has completed the limited subsurface exploration for the above referenced project. This project was authorized and performed in general accordance with ECS Proposal No. 08-15502P dated October 4, 2013. The purpose of this exploration was to determine the general subsurface conditions at the site and to observe the presence of potential landfill debris within the tested locations.

ECS Carolinas, LLP appreciates the opportunity to assist you during this phase of the project. If you have questions concerning this report, please contact our office.

Respectfully,

ECS CAROLINAS, LLP

NORTH CAROLINA PROFESSIONAL SEAL 036328 ENGINEER ERIK H. FREEBURG

4/1/14

Erik H. Freeburg, P.E.
Geotechnical Services Manager
NC Registration No. 036328

Lee J. McGuinness, P.E.
Principal Engineer

1. INTRODUCTION

1.1. Project Information

The project site is located at the intersection of Double Oaks Road and Woodward Avenue in Charlotte, North Carolina as shown in the Site Vicinity Map (Figure 1) included in the Appendix. Based on our discussions and the provided project information, a portion of road may be within the limits of a previous landfill. Previous soil data was collected by URS and interpolated limits of found debris were presented on a site plan by LandDesign. The interpolated limits indicated that landfill debris may be present beneath the Woodward Avenue Extension. At this time, the curb and gutter along the Woodward Avenue Extension as well as stone base have been placed. Based on our discussion, approximately 4 to 5 feet of fill was placed within the roadway.

1.2. Scope of Services

Our scope of services included a limited subsurface exploration with widely spaced soil test borings (B-1 through B-3) to depths ranging from 6.5 to 15 feet below existing grades. The borings were performed at the approximate locations shown on the Test Location Diagram (Figure 2) in the Appendix. The soil test borings were performed with a track-mounted SIMCO 2400 ATV drill rig using continuous-flight, hollow-stem augers.

2. FIELD SERVICES

2.1. Test Locations

The soil boring locations were selected and located in the field by ECS using existing landmarks as reference. In addition, a representative with the Charlotte Housing Partnership, Mr. Johnny Shout, was present to aid in the selection of the boring locations. The borings were performed on the outside of the curb area in an effort to avoid disturbing the aggregate stone base in the roadway. The approximate test locations are shown on the Boring Location Diagram (Figure 2) presented in the Appendix of this report and should be considered accurate only to the degree implied by the method used to obtain them.

2.2. Soil Test Borings

Three (3) widely spaced soil test borings were drilled to evaluate the stratification and engineering properties of the subsurface soils at the project site. Standard Penetration Tests (SPT's) were performed at designated intervals in general accordance with ASTM D 1586. The Standard Penetration Test is used to provide an index for estimating soil strength and density. In conjunction with the penetration testing, split-barrel soil samples were recovered for soil classification at each test interval. Boring Logs are included in the Appendix.

The drill crew also maintained a field log of the soils encountered at each of the boring locations. After recovery, each sample was removed from the auger and visually classified. Representative portions of each sample were then sealed and brought to our laboratory in Charlotte, North Carolina for further visual examination. Groundwater measurements were attempted at the termination of drilling and prior to demobilization from the project site.

3. LABORATORY SERVICES

Soil samples were collected from the borings and examined in our laboratory to check field classifications and to determine pertinent engineering properties. Data obtained from the borings and our visual/manual examinations are included on the respective boring logs in the Appendix.

3.1. Soil Classification

A geotechnical engineer classified each soil sample on the basis of color, texture, and plasticity characteristics in general accordance with the Unified Soil Classification System (USCS). The soil engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transition between strata may be gradual in both the vertical and horizontal directions. The results of the visual classifications are presented on the Boring Logs included in the Appendix.

4. SITE AND SUBSURFACE FINDINGS

4.1. Area Geology

The site is located in the Piedmont Physiographic Province of North Carolina. The native soils in the Piedmont Province consist mainly of residuum with underlying saprolites weathered from the parent bedrock, which can be found in both weathered and unweathered states. Although the surficial materials normally retain the structure of the original parent bedrock, they typically have a much lower density and exhibit strengths and other engineering properties typical of soil. In a mature weathering profile of the Piedmont Province, the soils are generally found to be finer grained at the surface where more extensive weathering has occurred. The particle size of the soils generally becomes more granular with increasing depth and gradually changes first to weathered and finally to unweathered parent bedrock. The mineral composition of the parent rock and the environment in which weathering occurs largely control the resulting soil's engineering characteristics. The residual soils are the product of the weathering of the parent bedrock.

In addition, it is apparent that the natural geology within the site has been modified in the past by grading that included the placement of fill materials. The quality of man-made fills can vary significantly, and it is often difficult to assess the engineering properties of existing fills. Furthermore, there is no specific correlation between N-values from standard penetration tests performed in soil test borings and the degree of compaction of existing fill soils; however, a qualitative assessment of existing fills can sometimes be made based on the N-values obtained and observations of the materials sampled in the test borings.

4.2. Subsurface Conditions

The subsurface conditions at the site, as indicated by the borings, generally consisted of fill, residual soil, partially weathered rock, and refusal materials to the depths explored. The generalized subsurface conditions are described below. For soil stratification at a particular test location, the respective Boring Log found in the Appendix should be reviewed.

Fill soils were encountered at the ground surface at each of the boring location. The fill extended to depths ranging from approximately 3 to 5½ feet below the existing ground surface. The fill soils encountered generally consisted of Silty SAND (SM) and Sandy SILT (ML) exhibiting SPT N-values ranging from 7 to 18 blows per foot (bpf).

Residual soil was encountered below the fill at each of the boring locations. Residual soils are formed by the in-place chemical and mechanical weathering of the parent bedrock. The residual soils encountered in the borings generally consisted of Silty SAND (SM) and Sandy SILT (ML) exhibiting SPT N-values ranging from 11 to 40 bpf. Borings B-1 and B-3 were terminated in residual soil.

Partially weathered rock (PWR) was encountered below the residual soils at boring B-2 and at a depth of approximately 5½ feet below the existing ground surface. PWR is defined as residual material exhibiting SPT N-values greater than 100 bpf. The PWR encountered in the borings generally consisted of Silty SAND (SM) exhibiting SPT N-values of 50 blows per 0 inches of penetration.

Auger refusal was encountered at boring B-2 at a depth of approximately 6½ feet below the existing ground surface. Auger refusal indicates the presence of material that permitted no further advancement of the hollow stem auger or split spoon sampler. No sample was recovered in the split-spoon sampler. Rock core samples were beyond the scope of this exploration.

4.3. Groundwater Observations

Groundwater measurements were attempted at the termination of drilling and prior to demobilizing from the project site. No groundwater was encountered at the boring locations at the time of our exploration within the depths explored. Fluctuations in the groundwater elevation should be expected depending on precipitation, run-off, utility leaks, and other factors not evident at the time of our evaluation. Normally, highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall.

5. CONCLUSIONS

The widely spaced borings performed at this site represent the subsurface conditions at the location of the borings. Due to inconsistencies associated with fill and the prevailing geology, there can be changes in the subsurface conditions over relatively short distances that have not been disclosed by the results of the test location performed. Consequently, there may be undisclosed subsurface conditions that require special treatment or additional preparation once these conditions are revealed during construction.

Fill soils were encountered at the ground surface at each of the boring locations. The fill extended to depths ranging from approximately 3 to 5½ feet below the existing ground surface. The existing fill observed within the tested locations appeared free of concentrated organics and debris. Based on previous available soil borings (ECS Project No. 08-4442-B, dated July 13, 2007), the landfill debris was dark in color with concentrated amounts of debris within the boring

locations. Evidence of this landfill debris was not present within the borings performed during this limited subsurface exploration.

ECS was not provided with documentation of the previous earthwork activities within the Woodward Avenue Extension, thus the fill should be considered undocumented. Undocumented fill poses risks associated with undetected deleterious inclusions within the fill and/or deleterious materials at the virgin ground fill interface that are covered by the fill. If the owner possesses compaction data from previous earthwork activities, ECS should be given the opportunity to review this data and make revisions to this report if needed. However, based on our discussion with Mr. Johnny Shout, with Charlotte Housing Partnership, we understand the landfill debris was not encountered within the limits of the roadway during construction.

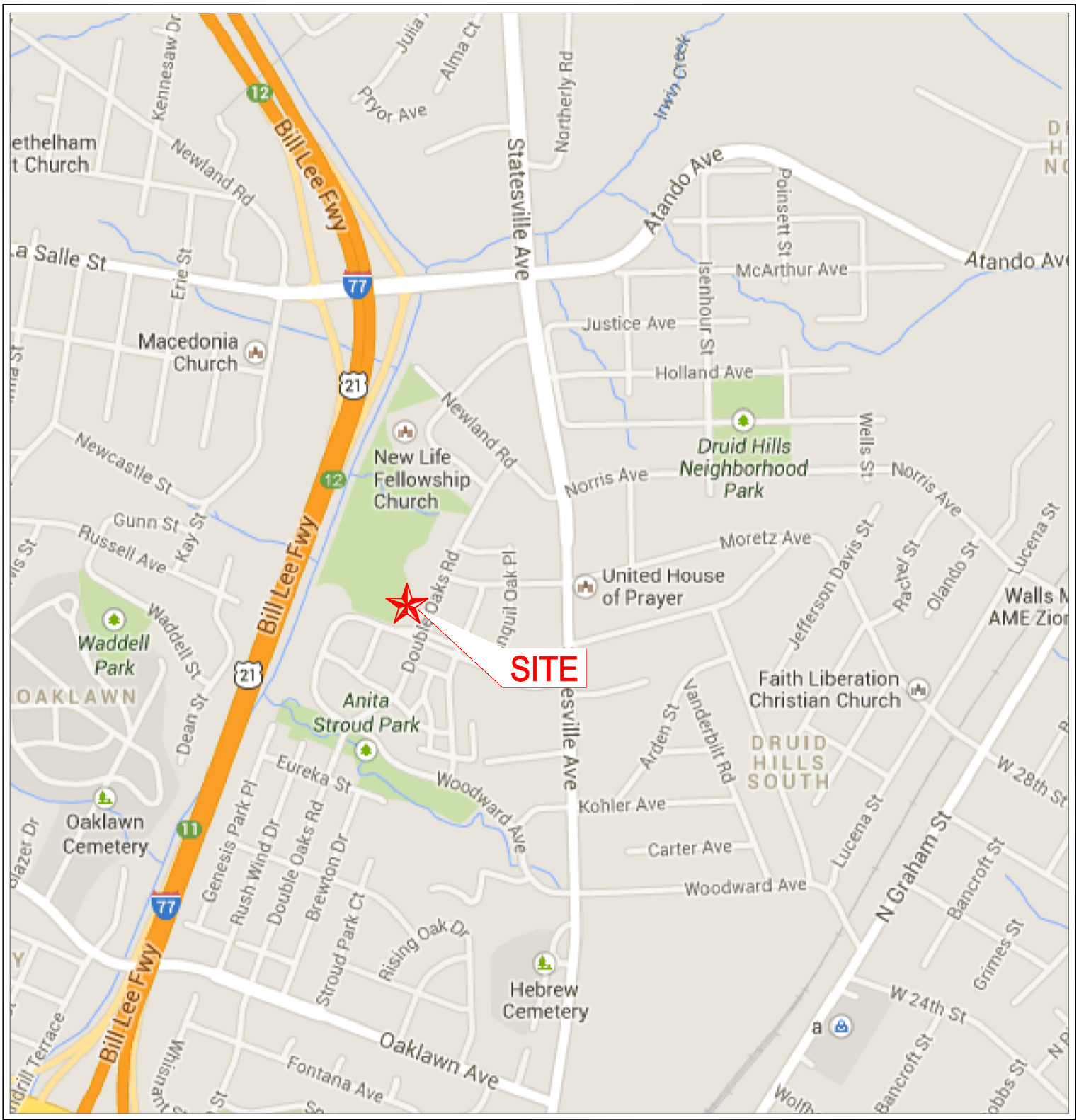
The Woodward Avenue Extension is currently at grade with aggregate base course (ABC) stone and curbing in place prior to asphalt pavement. Although limited information has been provided to ECS regarding preparation of the subgrade soils, the N-values within the soil test borings indicate the existing fill material was placed with some compactive effort. Therefore, pending a successful proofroll of the ABC stone prior to asphalt pavement, the soils at the tested locations appear generally suitable for support of the roadway.

6. GENERAL COMMENTS

The widely spaced borings performed at this site represent the subsurface conditions at the location of the borings only. Due to the prevailing geology and fill material, changes in the subsurface conditions can occur over relatively short distances that have not been disclosed by the results of the borings performed. ECS has attempted to be as specific as feasible with the limited information available.

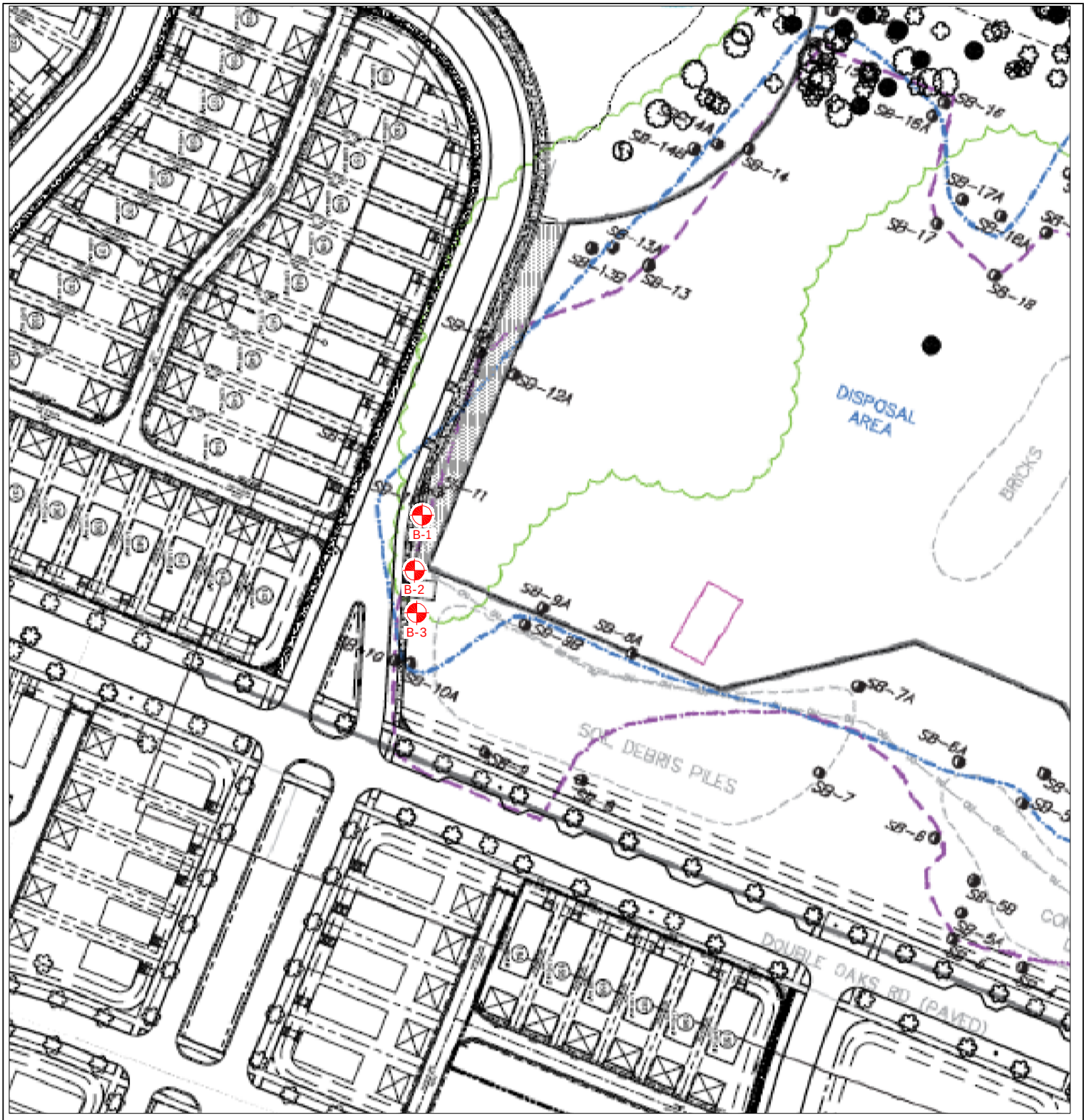
Our limited subsurface exploration has been based on our understanding of the site and project information and the data obtained. The general subsurface conditions utilized in our limited subsurface exploration have been based on interpolation of subsurface data between and away from the test holes. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our evaluation. The assessment of site environmental conditions for the presence of pollutants in the soil, rock, and groundwater of the site was beyond the scope of this exploration.

The recommendations outlined herein should not be construed to address moisture or water intrusion effects after construction is completed. Proper design of landscaping, surface and subsurface water control measures are required to properly address these issues. In addition, proper operation and maintenance of building systems is required to minimize the effects of moisture or water intrusion. The design, construction, operation, and maintenance of waterproofing and dampproofing systems are beyond the scope of services for this project.



LEGEND:

Source: Google Maps	ECS SETTING THE STANDARD FOR SERVICE	**FIGURE 1** **SITE VICINITY MAP** **Double Oaks Woodward Ave.** **Debris DTR** **Charlotte, NC**	PROJ. MGR. EHF DRAFTSMAN TLH REVISIONS	SCALE N.T.S. PROJECT NO. 08-9358 FIGURE 1 DATE 10-08-13



LEGEND:

= Approximate Location of Boring

N
W E
S

Background Image Provided by: Client Provided	ECS SETTING THE STANDARD FOR SERVICE	**FIGURE 2** **BORING LOCATION DIAGRAM** **Double Oaks Woodward Ave.** **Debris DTR** **Charlotte, NC**	PROJ. MGR. EHF	SCALE N.T.S.
			DRAFTSMAN TLH	PROJECT NO. 08-9358
			REVISIONS	FIGURE 2
				DATE 10-08-13

CLIENT	JOB #	BORING #	SHEET
Land Design	9358	B-1	1 OF 1

PROJECT NAME: Double Oaks Woodward Ave. Debris â DTR

ARCHITECT-ENGINEER:

SITE LOCATION: Woodward avenue and double oaks road., Charlotte, Mecklenburg County

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

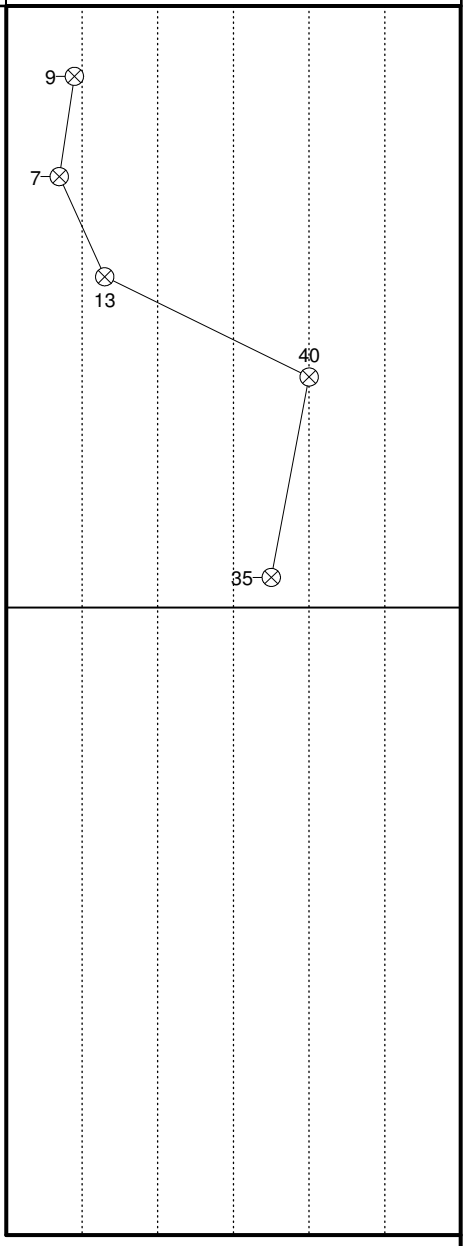
DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"
0					FILL - Loose, Brown, Silty Fine to Medium SAND, Moist (FILL - SM)	
	S-1	SS	18	10		4 4 5
	S-2	SS	18	16		3 3 4
5					RESIDUAL - Stiff, Brown, Sandy SILT, Moist (ML)	
	S-3	SS	18	14		5 5 8
					Hard, Olive, Sandy SILT, Moist (ML)	
	S-4	SS	18	18		8 14 26
10						
	S-5	SS	18	18		7 14 21
15					END OF BORING @ 15.0'	
20						
25						
30						

WATER LEVELS | ELEVATION (FT)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL GNE WS ☐ WD ☐	BORING STARTED 10/07/13	
WL(BCR) WL(ACR) GNE	BORING COMPLETED 10/07/13	CAVE IN DEPTH @ 11.1'
WL	RIG SIMCO 2400 FOREMAN Cody	DRILLING METHOD 2.25 HSA

CLIENT	JOB #	BORING #	SHEET
Land Design	9358	B-2	1 OF 1

PROJECT NAME: Double Oaks Woodward Ave. Debris â DTR

ARCHITECT-ENGINEER:

SITE LOCATION: Woodward avenue and double oaks road., Charlotte, Mecklenburg County

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

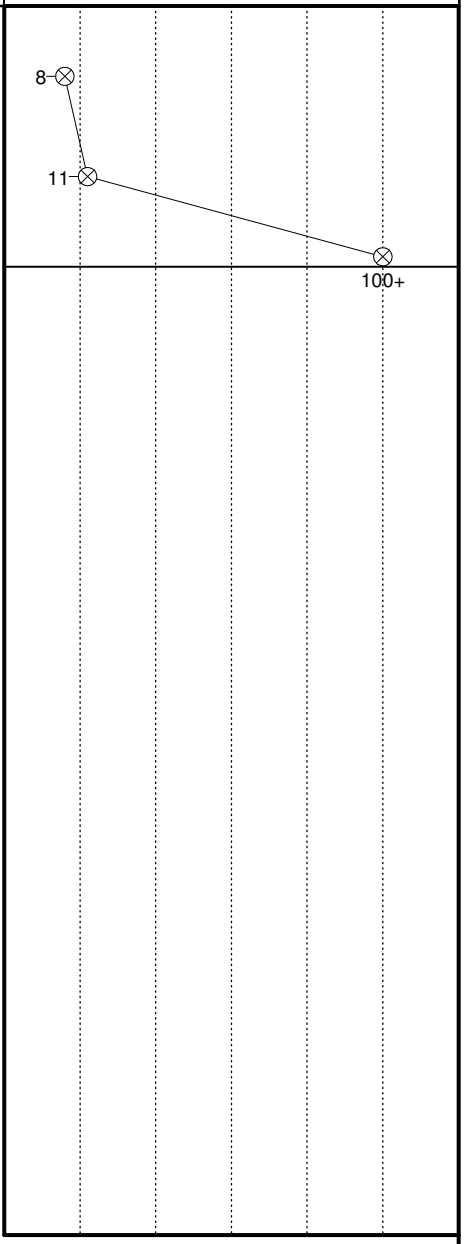
STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"
0					FILL - Medium Stiff, Reddish Brown, Sandy SILT, Moist (FILL - ML)	
	S-1	SS	18	16		3 5 3
					RESIDUAL - Medium Dense, Olive, Silty Fine to Medium SAND, Moist (SM)	
	S-2	SS	18	14		5 5 6
5					PARTIALLY WEATHERED ROCK - Olive, Silty Fine to Medium SAND, (PWR)	
	S-3	SS	6	6	AUGER REFUSAL @ 6.5'	4 50/0
10						
15						
20						
25						
30						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL GNE WS ☐ WD ☐	BORING STARTED 10/07/13	
WL(BCR) WL(ACR) GNE	BORING COMPLETED 10/07/13	CAVE IN DEPTH @ 5.3'
WL	RIG SIMCO 2400 FOREMAN Cody	DRILLING METHOD 2.25 HSA

CLIENT	JOB #	BORING #	SHEET
Land Design	9358	B-3	1 OF 1

PROJECT NAME: Double Oaks Woodward Ave. Debris â DTR

ARCHITECT-ENGINEER:

SITE LOCATION: Woodward avenue and double oaks road., Charlotte, Mecklenburg County

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

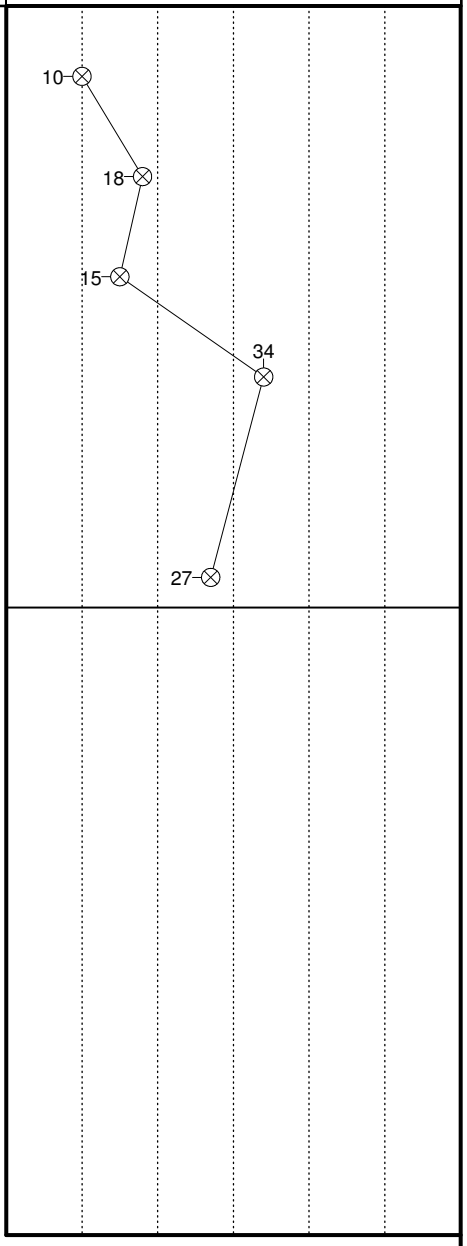
DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION 100%

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"
0					FILL - Stiff to Very Stiff, Brown, Sandy SILT, Moist (FILL - ML)	
	S-1	SS	18	18		5 6 4
	S-2	SS	18	18		7 8 10
5					RESIDUAL - Stiff, Olive, Sandy SILT, Moist (ML)	
	S-3	SS	18	14		4 6 9
	S-4	SS	18	18	Hard to Very Stiff, Olive, Sandy SILT, Moist (ML)	10 17 17
10						
	S-5	SS	18	12		7 11 16
15					END OF BORING @ 15.0'	
20						
25						
30						

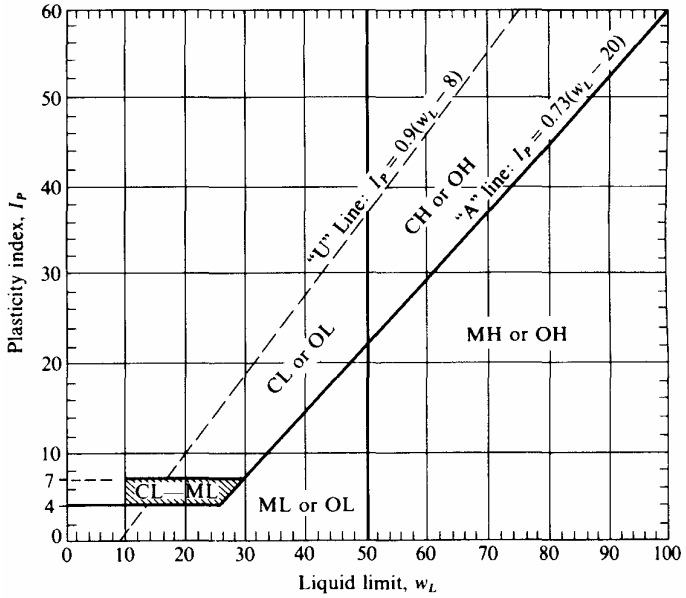
WATER LEVELS | ELEVATION (FT)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL GNE WS ☐ WD ☐	BORING STARTED 10/07/13	
WL(BCR) WL(ACR) GNE	BORING COMPLETED 10/07/13	CAVE IN DEPTH @ 11.4'
WL	RIG SIMCO 2400 FOREMAN Cody	DRILLING METHOD 2.25 HSA

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-Grained Soils (More than half of the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieves size)	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve Depending on the percentage of the fines (fraction smaller than No. 200 sieve size), Coarse grained soils are classified as follows: Less than 5% GW, GP, SW, SP; More than 12% GM, GC, SM, SC; 5 to 12% Borderline cases requiring dual symbols[b]	$C_u = D_{60}/D_{10}$ greater than 4; $C_c = (D_{30})^2/(D_{10} \times D_{60})$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines	GM[a] d	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
			GM[a] u				
			GC	Clayey Gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	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		$C_u = D_{60}/D_{10}$ greater than 6; $C_c = (D_{30})^2/(D_{10} \times D_{60})$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines	SM[a] d	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SM[a] u				
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-Grained Soils (More than half of material is smaller than No. 200 sieve)	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, elastic 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			



Reference: Winterkorn & Fang, 1975 (ASTM D-2487)

[a]Division of GM and SM groups into subdivision of d and u are for road and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater that 28.

[b]Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

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UNIFIED SOIL CLASSIFICATION SYSTEM

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash sample
REC	Rock Sample Recovery %	RQD	Rock Quality Designation %

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00–8.00		
Over 51	Very Hard	Over 8.00		

III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	▼	Est. Seasonal High GWT

The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

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 alight 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 your ASFE-member geotechnical engineer for more information.

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