ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

August 3, 2017

Mr. Bill Nicholson
Chatham County
124 Bull Street
Savannah, GA 31401

Reference: Report of Geotechnical Exploration
L. Scott Stell Engineering Improvements
Savannah, Georgia

ECS Project No. 23: 2940

Dear Mr. Nicholson:

ECS Southeast, LLP (ECS) is pleased to submit our report of geotechnical exploration for the above referenced project. The attached report presents an introduction to the proposed project, results of our exploration, subsurface conditions, and our recommendations. The work was completed in general accordance with ECS Proposal No. 23:3444 as authorized by Bill Nicholson with Chatham County on May 24, 2017.

We appreciate the opportunity of working with you on this project and look forward to our continued association. Should you have questions regarding our findings or need additional consultations, please do not hesitate to contact our office at (912)-966-2527.

Respectfully,

ECS SOUTHEAST, LLP

Mo Ahamed, EIT
Staff Geotechnical Engineer

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8-3-17

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REPORT OF GEOTECHNICAL EXPLORATION

L Scott Stell Engineering Improvements
Savannah, Georgia

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APPENDIX

INTRODUCTION

General

This report presents the results of a geotechnical exploration for the engineering improvements at L Scott Stell Park in Savannah, Georgia. Work was performed in general accordance with ECS Proposal No. 23:3444 as authorized by task order under our annual contract by Bill Nicholson with Chatham County on May 24, 2017.

Project Information

This section is based on information provided and our site reconnaissance. The site is located at the L Scott Stell Park in Savannah, Chatham County, Georgia. A Site Location Diagram is included in the Appendix as Figure 1. We understand the proposed project consists of the construction of a new restroom facility, a septic field, and the installation of new asphalt paving.

The site is currently developed as a community park. The proposed area of improvement includes existing restrooms, storage and maintenance buildings, as well as driveways and parking areas. We assume shallow leveling cuts and fills will be required to establish final subgrade elevations.

At the time of this report we have not been provided with structural loading information, however, we assume maximum column loads will not exceed 100 kips and maximum strip loads will not exceed 3 kips per linear foot. If these assumptions are inaccurate or erroneous, please contact us to provide additional project information so we can determine if changes in our recommendations are needed.

Purposes of Exploration

The purpose of this exploration was to explore the soil and groundwater conditions at the site and to develop engineering recommendations to guide design and construction of the proposed project.

We accomplished the purposes of the study by:

1. Reviewing the available publications concerning local geology of the site and performing a general site reconnaissance.

2. Performing hand augers with dynamic cone penetration (DCP) and WildCat Dynamic Cone Penetrometer Test (WDCP) to explore the subsurface soil and groundwater conditions.

3. Performing a Level IV soil investigation in accordance with the Georgia Department of Human Resources “Manual for On-Site Sewage Management Systems” and six (6) Double Ring Infiltrometer Tests.

4. Performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties.

5. Evaluating the field and laboratory data to develop appropriate engineering recommendations.

FIELD EXPLORATION AND LABORATORY TESTING

Subsurface Exploration

To explore the subsurface conditions at this site, a total of three WDCP Tests (WC-1 through WC-3) and nine hand auger soil test borings (HA-1 through HA-9) were performed in the proposed development area. WildCat borings WC-1, WC-2, and WC-3 were performed in the proposed area to depths of 12.5 to 15 feet below existing grade (BGS). The WDCP testing logs have been included with this report. Hand auger borings were performed in the proposed restroom, parking, and driveways to depths of approximately 5 feet BGS. Hand Auger Borings (HA-1 through HA-7) within the proposed driveways were supplemented with Dynamic Cone Penetrometer testing (DCP) within the upper 2 feet. Test locations were determined in the field by our representative using a handheld GPS device. The test locations are shown on the attached Boring Location Plan (Figure 2) should be considered approximate.

WDCP testing was conducted to provide relative bearing values at regular intervals throughout the soil profile. In WDCP testing, a cone with a diameter of 1.47 inches is driven into the soil by a 35-pound hammer falling 15 inches. The number of blows required to drive the cone through 10 centimeter intervals is recorded. The blows obtained from WDCP can be correlated to Standard Penetration Test (SPT) N-values. A simple spread sheet computer program logs the hammer blows per 10 cm and converts this number to Standard Penetration Test (SPT) N value for the corresponding soil depth. This value can be used as a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, it also indicates the consistency of cohesive soils.

Representative soil samples from the hand augering were obtained by means of the hand operated auger sample procedure in general accordance with ASTM Specification D-1452. In this procedure, the auger boring was made by rotating and advancing the auger bucket to the desired depths while periodically removing the bucket from the hole to clear and examine the auger cuttings. The drill crew prepared a field log of the soils encountered in the hand auger borings. Representative portions of each sample were sealed and returned to our laboratory in Savannah, Georgia for further visual examination and laboratory testing by ECS.

Dynamic Cone Penetrometer (DCP) testing was conducted to provide relative bearing values at regular intervals throughout the boring profile. In DCP testing, a 15 pound hammer falls 20 inches and drives the cone point through the 1.75 inch intervals and blow counts are recorded for each interval driven (as specified in ASTM Special Testing Publication 399, 1966).

The DCP values, shown on the hand auger logs, can be used as a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, they also indicate the consistency of cohesive soils. This indication is qualitative, since many factors can significantly affect the dynamic cone penetration resistance value and limit the validity of a direct correlation between field test results and inferred soil strength parameters.

A Level IV Soil Investigation for the proposed on-site waste disposal system and six double-ring infiltrometer (DRI- 1 through DRI-6) tests were also conducted. The Level IV Soil Survey, hand auger boring logs, WDCP logs, and DRI test results are attached to this report.

Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check visual classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications of soil samples as well as gradation analysis, and natural moisture content testing on selected soil samples.

A Geotechnical Engineer classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System. The group symbols for each soil type are indicated in parentheses followed by the soil descriptions on the boring logs. The 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 transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposition.

SUBSURFACE CONDITIONS

Regional Geology

The site is located within Georgia’s Coastal Plain Geologic Province. The soils of the Southern Coastal Plain Physiographic Province of Georgia are primarily composed of Pleistocene to Holocene age deposits. The soil in the Coastal Plain is the result of sediment deposition in a former marine environment, during a time when sea levels were much higher than they are at present. The Pleistocene-Holocene deposits are generally composed of alternating sands, silts, and clays, which correspond to eustatic fluctuations in sea-level over several million years. The shallow groundwater table in the Coastal Plain region can fluctuate several feet with seasonal rainfall. Seasonal high groundwater levels are typically found at shallow depths in the flood plains with a reasonable probability of flooding in winter and spring. Seasonal high groundwater can be found at the surface in poorly draining areas. It is important to note that the groundwater table can exhibit some distortions due to differences in vertical and lateral permeability.

Based on the online Soil Survey of Chatham County, Georgia, as prepared by the US Department of Agriculture Soil Conservation Service, the site was described as Pamlico shoreline complex-marsh and lagoonal facies. A summary of the predominant soil types (within the upper 5 feet below original grade) at the site and their characteristics is included in the following table:

Soil Type	Constituents	Parent Material	Internal Drainage	Depth to Water Table (Inches)
Cape Fear Soils (Cc)	Loam, Clays	Marine	Very Poorly Drained	0 to 12
Craven Loamy Fine Sand (Cx)	Loamy Fine Sand, Sandy Clay	Marine	Moderately Well Drained	18 to 42
Ocilla Complex (Oj)	Loamy Fine Sand, Sandy Clay	Marine	Somewhat Poorly Drained	12 to 30

Soil Conditions

The subsurface conditions discussed in the following paragraphs and those shown on the boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. We note that the transition between different soil strata is usually less distinct than those shown on the boring logs.

Surface Materials

Hand augers HA-1 to HA-3 initially encountered approximately 1 inch of asphalt overlying 6 inches of graded aggregate base at the existing ground surface.

Fill Materials

Fill may be any material that has been transported and deposited by man. Undocumented fill is considered any man placed materials with no moisture-density records from the time it was originally placed.

Underlying surficial materials, fill soils were encountered in Hand augers HA-5 and HA-9 to depths of approximately 0 to 2 feet below the existing ground surface. The soils generally consisted of firm to stiff Lean Clay with Sand. DCP values typically ranged from 9 to 11 blows per increment (bpf). While no unsuitable materials were visually observed in the soil samples recovered, other unsuitable materials may exist in the undocumented fill and remain undetected in the widely spaced borings.

Natural Soils

Underlying fill soils in HA-5 and HA-9, and in hand augers HA-1 through HA-4, and HA-6 through HA-8, coastal sedimentary deposits were encountered. The soil was classified as clayey fine grained clayey sand (SC) transitioning with depth to sandy clay (CL) to the maximum depth explored.

Groundwater Conditions

Groundwater level measurements were recorded during the Level IV Soil Survey. Results indicated groundwater depths ranging from 3 feet to 4 feet. Seasonal High Water Table was estimated to be approximately 2 feet BGS. Results from the soil survey and DRI testing are attached in the Appendix of this report.

Please note that groundwater levels in coastal geology fluctuate with tidal, seasonal, and climatic variations, and may be significantly different at other times. Depending on rainfall events, we expect groundwater levels to fluctuate significantly, rise to within a few feet of the ground surface and generally correspond to levels in the adjacent drainage ditch and pond.

Groundwater levels should be checked prior to construction to assess possible effects on grading operations and other activities.

ANALYSIS AND RECOMMENDATIONS

Foundation Design

At the time of this study, no structural loading information was available. We assume the maximum column loads will not exceed 100 kips and the maximum strip loads will not exceed 3 kips per linear foot. Also at the time of this study, no grading plan was available. We assume the site will have limited cut and fill depths on the order of 2 feet or less. If more than 2 feet of fill is planned, please advise ECS so that we may reevaluate our recommendations.

Assuming any unsuitable materials or low consistency soils are “demucked” or over-excavated, it is our recommendation that the proposed structure be supported on conventional shallow foundations, provided the criteria in the following sections entitled *Subgrade Preparation* and *Recommended Earthwork Specifications* are met.

We recommend foundations be designed for a net allowable soil bearing pressure of 2,000 pounds per square foot (psf). For footings constructed in accordance with the requirements outlined in this report, maximum total settlement is expected to be less than 1 inch.

To reduce the possibility of foundation bearing failure and excessive settlement due to local shear or "punching" failures, we recommend that continuous footings have a minimum width of

18 inches and that isolated column footings have a minimum lateral dimension of 24 inches even though the allowable bearing pressure may not be fully developed in all cases.

We recommend the bearing elevation for foundations be a minimum depth of 18 inches below the finished exterior grade to provide adequate bearing capacity and resistance to future disturbance.

Ground Floor Slab Design

The floor slab can be adequately supported on undisturbed low plasticity natural soils or on newly-placed engineered fill provided the site preparation and fill recommendations outlined herein are implemented. For a properly prepared site, a modulus of subgrade reaction (ks) for the soil of 100 pounds per cubic inch for the soil can be used. This value is representative of a 1-ft square loaded area and may need to be adjusted depending the size and shape of the loaded area depending on the method of structural analysis. We recommend slabs-on-grade be underlain by a minimum of 4 inches of granular material having a maximum aggregate size of 1½ inches and no more than 2 percent fines. Prior to placing the granular material, the floor subgrade soil should be properly compacted, proofrolled, and be free of standing water, mud, and frozen soil.

A properly designed and constructed capillary break layer can often eliminate the need for a moisture vapor retarder and can assist in more uniform curing of concrete. If a vapor retarder is considered to provide additional moisture protection, special attention should be given to the surface curing of the slabs to minimize uneven drying of the slabs and associated cracking and/or slab curling. The use of a blotter or cushion layer above the vapor retarder can also be considered for project specific reasons.

Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction and ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs for additional guidance on this issue.

ECS recommends that the slab on grade be isolated from the footings so differential settlement of the structure will not induce shear stresses on the floor slab. Also, in order to minimize the crack width of shrinkage cracks that may develop near the surface of the slab, we recommend mesh reinforcement as a minimum be included in the design of the floor slab. For maximum effectiveness, temperature and shrinkage reinforcements in slabs on ground should be positioned in the upper third of the slab thickness. The Wire Reinforcement Institute recommends the mesh reinforcement be placed 2 inches below the slab surface or upper one-third of slab thickness, whichever is closer to the surface.

Adequate construction joints, contraction joints and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage. Please refer to ACI 302.1R96 Guide for Concrete Floor and Slab Construction for additional information regarding concrete slab joint design.

The above recommendations are general in nature and site specific design recommendations by the Structural Engineer of Record should take precedence.

Pavement Design

Based on information provided, a typical minimum pavement section is shown below. We understand the following:

1. California Bearing Ratio (CBR) tests were not performed for the proposed subgrade soils at these sites. Our pavement design analyses are based on local experience and assumed CBR values.

2. Our pavement design analysis is based on assumed traffic information.

3. We assume that the top 12 inches of the proposed roadway subgrade will be firm and unyielding and be compacted to at least 98 percent of maximum dry density in accordance with ASTM-D-1557, Modified Proctor Method.

4. We assume that criteria from our sections entitled “Subgrade Preparation” and “Fill Placement” will be followed.

5. We assume a minimum separation of 24 inches between the bottom of the base course material and the seasonal high groundwater table.

Minimum Flexible Pavement Section

Material Type	Parking Stalls and Driveways	Heavy Duty Truck Driveways
AC Surface Course HMA Superpave – 9.5mm	2.0 inches	1.0 inch
AC Base Course HMA Superpave – 19mm	-	2.0 inches
Graded Aggregate Base (GAB)	6.0 inches	8.0 inches

Aggregate material used as base course must comply with the gradation requirements established by the GDOT. Aggregate material should be compacted to at least 98 percent of the maximum dry density obtained in accordance with ASTM D-1557, Modified Proctor Method.

The flexible pavement specifications used in roadways and parking stalls may not be adequate for a trash compactor/dumpster pick-up area, truck dock, or heavily trafficked service related drop off and pickup lanes due to the heavy or repetitive loads and tire scuffing anticipated. We recommend that a rigid concrete pavement section be provided for those areas.

The concrete section should be at least 6 inches thick and should consist of concrete having a minimum 28-day compressive strength of 4,000 pounds per square inch (psi). A minimum of 4 inches of compacted graded aggregate base should be placed beneath rigid concrete pavements. For dumpster storage areas, the concrete slab area should be large enough to support both the dumpster and the truck used to unload the dumpster.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the risk of the subgrade materials becoming saturated over a long period of time.

CONSTRUCTION RECOMMENDATIONS

Dewatering

The depth and fluctuation of the groundwater table for this project must be considered in design of the project and in planning the construction sequence. Groundwater levels should be checked immediately prior to any earthwork operations. Groundwater levels may fluctuate during tidal cycles due to the site's proximity to tidal water.

Due to the potential for shallow groundwater conditions in areas of the site, it may be necessary to perform temporary dewatering during construction. Dewatering operations may consist of installing perimeter rim ditches and if necessary secondary rim-ditches or a well point system, to withdraw groundwater. Temporary dewatering will not only help lower the natural moisture content of the subgrade soils but will also allow heavy construction equipment to gain access to portions of the site.

The groundwater table should be controlled at least 3 feet below the compacted surface or excavation elevations. The Contractor shall be solely responsible for all means and methods necessary to control the groundwater at a depth sufficient to successfully complete the site preparation, mass grading, and new grade supported construction.

Subgrade Preparation

After implementing successful dewatering, as needed, the subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, and any other soft or unsuitable material from the building and pavement areas. We recommend earthwork clearing and stripping be extended a minimum of 10 feet beyond the building and 5 feet beyond pavement limits. Stripping limits

should be extended an additional 1 foot for each foot of fill required at the building and pavement areas exterior edge.

Depending on planned finished grades, unsuitable material existing at shallow depth should be "demucked" or over-excavated from within the building (under slabs and footings) and pavement areas. Unsuitable soil materials are defined as those in ASTM D2487 soil classification groups ML, MH, CH, CL, OL and PT and those soils contaminated with construction debris or organics.

Soil materials defined as those in ASTM D2487 soil classification groups SC or SM may be deemed unusable during subgrade evaluation due to the natural moisture content, consistency, or fines content of the material. Additionally, soils within the top 2 feet of pavement subgrade should have no more than 15 percent passing the No. 200 sieve. The unsuitable material should be replaced with approved structural fill.

After stripping, "demucking", or over-excavating to the desired grade, and prior to structural fill placement, the stripped surface should be observed by an experienced geotechnical engineer or his authorized representative. For building and pavement areas, the subgrade should be densified with a large vibratory roller to achieve uniform subgrade. In areas where groundwater is brought to the surface during this densification process, the Contractor should cease the vibratory compaction effort, allow the groundwater to recede, and possibly be prepared to implement a static densification approach.

After the completion of densification, proofrolling using a loaded dump truck having an axle weight of at least 10 tons should be used to aid in identifying localized soft or unsuitable material which should be removed. Any soft or unsuitable materials encountered during this proofrolling should be removed and replaced with an approved backfill compacted to the criteria given below and/or stabilized with geogrid/geosynthetic fabric. The most appropriate remedial measure activity, if required, should be determined in the field by an ECS engineer based upon the prevailing conditions.

We recommend a grading allowance for soft/loose or unsuitable soils be set aside as a contingency and that the Owner anticipate undercutting of unsuitable materials may be necessary during site grading. The actual extent and nature of the required remedial measures can be determined by ECS from proofrolling, hand augers, DCP testing, and/or test pits at the time of construction.

Recommended Earthwork Specifications

Fill in structural areas should be placed over a stable and unyielding subgrade. Soils used for structural fill shall have a PI (Plasticity Index) of less than 10, and a LL (Liquid Limit) of less than 30. Structural fill in the building area and below the top 2 feet in pavement areas should be inorganic, non-plastic granular soil containing less than 25 percent fines passing the No. 200 sieve. Soils to be used as structural fill within the top 2 feet below pavement areas should be inorganic, non-plastic granular soil containing less than 15 percent fines passing the No. 200 sieve. The structural fill depths are understood to extend from below the building slab granular

base material or roadway graded aggregate base material. The maximum permissible organic content in structural fill shall be 2 percent.

Grade controls should also be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by a qualified representative of ECS to determine that the required degrees of compaction are being achieved. The structural fill should be placed in level lifts not exceeding 12 inches in loose thickness and compacted to at least 95 percent of the maximum dry density obtained in accordance with ASTM D1557, Modified Proctor Method. Thinner lifts should be used within utility trenches, against below-grade walls, and within other localized excavations.

Fill placed in the top 2 feet under paved areas, curb and gutter, sidewalks, building slabs, and within 10 feet of buildings should be compacted to at least 98 percent of the maximum dry density obtained in accordance with ASTM D-1557, Modified Proctor Method. In-place density tests shall be performed at a frequency of about 1 test per 2,500 square feet of fill area for each lift or fill placed. Within localized excavations, at least one in-place density test shall be performed for each lift of fill for every 50 linear feet. The elevation and location of the tests should be clearly identified and recorded at the time of fill placement. The Contractor shall provide adequate controls so that the in-place density test locations and elevations can be accurately recorded.

The moisture content of the fill at the time of placement shall be within +/- 3 percent (wet or dry) of the optimum moisture content, as determined by the Modified Proctor Method. Moisture contents may be controlled by disking or other approved chemical or mechanical means to achieve the desired moisture content and density specification. During the warmer summer months wetting of fill soils should be expected to maintain the soils within their working range of optimum.

Suitability of On-Site Soils for Reuse as Fill

Soil types encountered in the hand augers performed for this project consisted of SC and CL. In general, the natural soils appear marginal for re-use as structural fill if they are free from deleterious materials, such as organics and debris and their moisture content at the time of placement is within the workable range for proper compaction. The on-site soils should be tested by ECS prior to use as structural fill.

Laboratory testing on the selected soils indicates that the natural moisture content of the soils ranged from approximately 7.5 to 20.2 percent. These soil moistures are slightly above optimum for proper compaction. Depending upon the moisture condition of the site soil at the time of placement, the clayey site soils may require drying for proper compaction.

The clayey sand site soils contain moderately high percentages of fine-grained soils, typically 20 to 37 percent in the samples tested. These soils are likely moisture sensitive and may be difficult to use as structural fill if the material becomes too wet. Depending on rainfall conditions at the time of construction, the fine grained soils at the site could become unworkable.

CLOSING

This report has been prepared in accordance with generally accepted geotechnical engineering practice. No warranty is expressed or implied. The evaluations and recommendations presented in this report are based on the available project information, as well as on the results of the exploration. ECS should be given the opportunity to review the final drawings and site plans for this project to determine if changes to the recommendations outlined in this report are needed.

We recommend that the construction activities be monitored by ECS to provide the necessary overview and to check the suitability of the subgrade soils for supporting the footings. If ECS is not retained for this extension of the field exploration, we cannot be responsible for the performance of the foundations or site improvements. We would be pleased to provide an estimated cost for these services at the appropriate time.

This report is provided for the exclusive use of Chatham County and their project specific design team. This report is not intended to be used or relied upon in connection with other projects or by other third parties. ECS disclaims liability for any such third party use or reliance without express written permission.

REPORT OF GEOTECHNICAL EXPLORATION

L SCOTT STELL PARK ENGINEERING IMPROVEMENTS

FOR

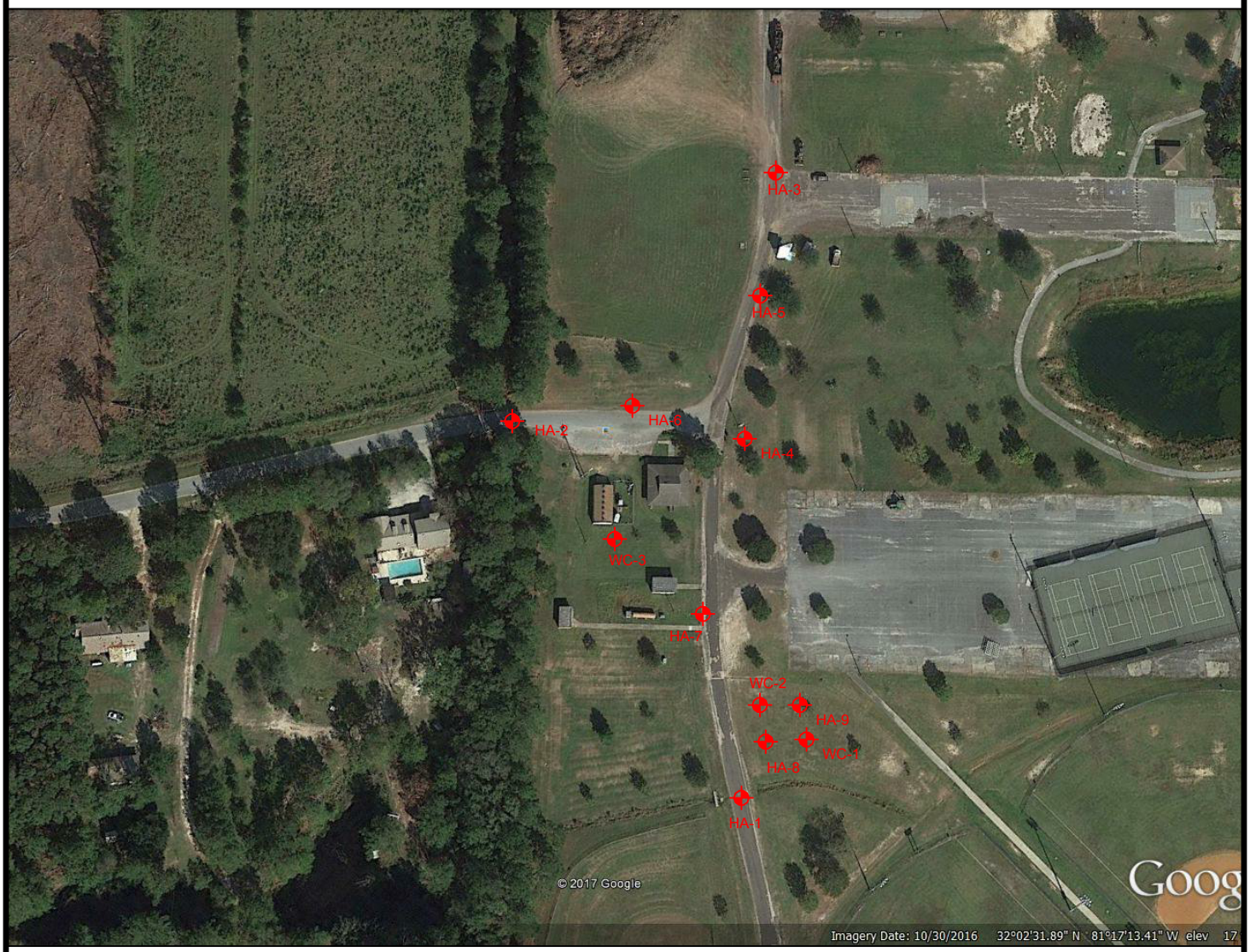
CHATHAM COUNTY

AUGUST 03, 2017

ECS PROJECT NO. 23:2940

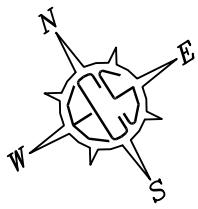
Appendix I

ECS	**SITE VICINITY MAP**	**Figure No.:** 1
	REPORT OF GEOTECHNICAL EXPLORATION	**Project No.: 23:2940**
	L Scott Stell Park, Savannah. Georgia	**Scale: NTS**
	Reference: Google Earth	**Date: 07/2017**



LEGEND

- Approximate Boring Location
- HA-X Hand Auger Designation
- WC-X WC Designation



ECS	JOB NO.	23:2940	REVISIONS	FIGURE NAME: BORING LOCATION DIAGRAM	PROJECT: L Scott Stell Park Engineering Improvements	FIGURE NO.: 2
	SCALE	NTS				
	DRAWN	MSA		REFERENCE: GOOGLE EARTH	PREPARED FOR: Chatham County	
	APPR. BY	RLG				
	DATE	7/2017				

Appendix II

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]	
	ASPHALT
	CONCRETE
	GRAVEL
	TOPSOIL
	VOID
	BRICK
	AGGREGATE BASE COURSE
	FILL[3] MAN-PLACED SOILS
GW	**WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GP	**POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines
GM	**SILTY GRAVEL** gravel-sand-silt mixtures
GC	**CLAYEY GRAVEL** gravel-sand-clay mixtures
SW	**WELL-GRADED SAND** gravelly sand, little or no fines
SP	**POORLY-GRADED SAND** gravelly sand, little or no fines
SM	**SILTY SAND** sand-silt mixtures
SC	**CLAYEY SAND** sand-clay mixtures
ML	**SILT** non-plastic to medium plasticity
MH	**ELASTIC SILT** high plasticity
CL	**LEAN CLAY** low to medium plasticity
CH	**FAT CLAY** high plasticity
OL	**ORGANIC SILT or CLAY** non-plastic to low plasticity
OH	**ORGANIC SILT or CLAY** high plasticity
PT	**PEAT** highly organic soils

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

PARTICLE SIZE IDENTIFICATION		
DESIGNATION		**PARTICLE SIZES**
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS		
UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	**SPT[5] (BPF)**	**CONSISTENCY[7] (COHESIVE)**
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Medium Stiff
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS	
SPT[5]	**DENSITY**
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
Dual Symbol *(ex: SW-SM)*	10	10
With	15 - 20	15 - 25
Adjective *(ex: "Silty")*	≥25	≥30

WATER LEVELS[6]		
	WL	Water Level (WS)(WD)
		(WS) While Sampling
		(WD) While Drilling
	SHW	Seasonal High WT
	ACR	After Casing Removal
	SWT	Stabilized Water Table
	DCI	Dry Cave-In
	WCI	Wet Cave-In

[1] *Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

[2] *To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

[3] *Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

[4] *Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

[5] *Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

[6] *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 granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

[7] *Minor deviation from ASTM D 2488-09 Note 16.*

[8] *Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

PROJECT NAME:		HAND AUGER #
L. Scott Stell Park Improvements		HA-1
CLIENT:	Job #:	SURFACE ELEVATION
Chatham County	23:2940	

LOCATION:	ARCH./ENG:
383 Bush Road, Savannah, Chatham County, GA	Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		Asphalt Depth [1.00"] ABC Stone Depth [6.00"]		14-23-27			
1		(SP) SAND, grayish to dark gray, moist, medium dense		12-23-26		S-1	
2				19-23-30		S-2	
3						S-3	
4		(CL) LEAN CLAY WITH SAND, dark gray, moist, firm				S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME: L. Scott Stell Park Improvements

HAND AUGER #: HA-2

CLIENT: Chatham County

Job #: 23:2940

SURFACE ELEVATION:

LOCATION: 383 Bush Road, Savannah, Chatham County, GA

ARCH./ENG.: Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		Asphalt Depth [1.00"] ABC Stone Depth [6.00"]		14-23-27			
1		(SC) CLAYEY SAND, light gray to dark gray, moist, medium dense		19-23-30		S-1	
2		(CL) LEAN CLAY WITH SAND, gray, moist, stiff		13-6-7		S-2	
3						S-3	
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME: L. Scott Stell Park Improvements

HAND AUGER # HA-3

CLIENT: Chatham County

Job #: 23:2940

SURFACE ELEVATION

LOCATION: 383 Bush Road, Savannah, Chatham County, GA

ARCH./ENG: Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		Asphalt Depth [1.00"] ABC Stone Depth [6.00"]		31-35-35			
1		(SC) CLAYEY SAND, grayish, moist, medium dense		30--		S-1	
2				25-28-		S-2	7.6
3						S-3	
4		(CL) LEAN CLAY WITH SAND, dark gray, moist, stiff				S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME:		HAND AUGER #
L. Scott Stell Park Improvements		HA-4
CLIENT:	Job #:	SURFACE ELEVATION
Chatham County	23:2940	

LOCATION:	ARCH./ENG:
383 Bush Road, Savannah, Chatham County, GA	Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0				4-6-10			
		(SC) CLAYEY SAND, tannish gray to dark gray, moist, loose					
1				9-11-13		S-1	
2		(CL) LEAN CLAY WITH SAND, dark gray to tannish gray, moist, firm		20-24-24		S-2	
3						S-3	
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME:		HAND AUGER #
L. Scott Stell Park Improvements		HA-5
CLIENT:	Job #:	SURFACE ELEVATION
Chatham County	23:2940	

LOCATION:	ARCH./ENG:
383 Bush Road, Savannah, Chatham County, GA	Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		(CL FILL) FILL, LEAN CLAY WITH SAND, tannish gray, moist, stiff		9-9-11			
1		(SC) CLAYEY SAND, gray, moist, medium dense		9-14-15		S-1	
2		(SC) CLAYEY SAND, tannish gray to dark gray, moist, stiff		9-9-12		S-2	
3						S-3	20.2
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME:			HAND AUGER #
L. Scott Stell Park Improvements			HA-6
CLIENT:	Job #:		SURFACE ELEVATION
Chatham County	23:2940		

LOCATION:	ARCH./ENG:
383 Bush Road, Savannah, Chatham County, GA	Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		(SC) CLAYEY SAND, tannish gray, moist, medium dense		7-15-17			
1		(CL) LEAN CLAY WITH SAND, tan to dark gray, moist, stiff		30--		S-1	
2				11-13-21		S-2	
3						S-3	
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME: L. Scott Stell Park Improvements

HAND AUGER # HA-7

CLIENT: Chatham County

Job #: 23:2940

SURFACE ELEVATION

LOCATION: 383 Bush Road, Savannah, Chatham County, GA

ARCH./ENG: Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		(SC) CLAYEY SAND, dark gray to light gray, moist, medium dense		21-24-			
1				29--		S-1	
2				30-24-		S-2	
3		(CL) LEAN CLAY WITH SAND, tan to dark gray, wet, very stiff				S-3	
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME: L. Scott Stell Park Improvements

HAND AUGER # HA-8

CLIENT: Chatham County

Job #: 23:2940

SURFACE ELEVATION

LOCATION: 383 Bush Road, Savannah, Chatham County, GA

ARCH./ENG: Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		(SC) CLAYEY SAND, contains roots, tan to dark gray, moist, medium dense					
1						S-1	
2						S-2	9.1
3		(CL) LEAN CLAY WITH SAND, dark gray, wet, stiff				S-3	
4						S-4	
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ | EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

PROJECT NAME: L. Scott Stell Park Improvements

HAND AUGER #: HA-9

CLIENT: Chatham County

Job #: 23:2940

SURFACE ELEVATION:

LOCATION: 383 Bush Road, Savannah, Chatham County, GA

ARCH./ENG: Chatham County

DEPTH (FT.)	ELEV. (FT.)	DESCRIPTION OF MATERIAL	EXCAV. EFFORT	DCP	QP (TSF)	SAMPLE NO.	MOIST. CONT. (%)
0		(CL FILL) FILL, LEAN CLAY WITH SAND, dark gray, moist, firm					
1		(SC) CLAYEY SAND, light to dark gray, moist, medium dense				S-1	
2						S-2	
3		(SC) CLAYEY SAND, reddish to dark brown, moist, stiff				S-3	
4						S-4	13.9
5		END OF HAND AUGER @ 5'				S-5	
6							
7							

REMARKS:

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

GROUND WATER: While Drilling ▽ After Drilling ▼ EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

ECS REP.:	DATE:	UNITS:	Cave-in Depth:	Groundwater While Drilling:	Groundwater:
BG	06/09/17	Feet			

WILDCAT DYNAMIC CONE LOG

ECS Carolinas, LLP
1306 Heidt Ave
Savannah, GA 31401

PROJECT NUMBER: 2940
DATE STARTED: 07-19-2017
DATE COMPLETED: 07-19-2017

HOLE #: WC-1
CREW: MKF/MSA
PROJECT: L Scott Stell Park Engineering Improvements
ADDRESS: Chatham County
LOCATION: Savannah GA

SURFACE ELEVATION: unk
WATER ON COMPLETION: n/a
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 2 ft	8	35.5	•••••••••	10	LOOSE	STIFF
-	8	35.5	•••••••••	10	LOOSE	STIFF
-	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 3 ft	15	66.6	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 1 m	12	53.3	••••••••••••••	15	MEDIUM DENSE	STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 4 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 5 ft	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 6 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 2 m	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 7 ft	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
- 8 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
- 9 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
- 3 m 10 ft	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	12	36.7	•••••••••••	10	LOOSE	STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	12	36.7	•••••••••••	10	LOOSE	STIFF
- 11 ft	13	39.8	••••••••••••	11	MEDIUM DENSE	STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	12	36.7	•••••••••••	10	LOOSE	STIFF
- 12 ft	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	11	33.7	•••••••••	9	LOOSE	STIFF
- 4 m 13 ft	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF

WILDCAT DYNAMIC CONE LOG

PROJECT: L Scott Stell Park Engineering Improvements PROJECT NUMBER: 2940

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	7	19.4	•••••	5	LOOSE	MEDIUM STIFF
	16	44.3	••••••••••••	12	MEDIUM DENSE	STIFF
14 ft	19	52.6	••••••••••••••	15	MEDIUM DENSE	STIFF
	14	38.8	••••••••••	11	MEDIUM DENSE	STIFF
	29	80.3	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
15 ft	28	77.6	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
	20	55.4	••••••••••••••	15	MEDIUM DENSE	STIFF
	22	60.9	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
16 ft						
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

WILDCAT DYNAMIC CONE LOG

ECS Carolinas, LLP
1306 Heidt Ave
Savannah, GA 31401

PROJECT NUMBER: 2940
DATE STARTED: 07-19-2017
DATE COMPLETED: 07-19-2017

HOLE #: WC-2A
CREW: MKF/MSA
PROJECT: L Scott Stell Park Engineering Improvements
ADDRESS: Chatham County
LOCATION: Savannah GA

SURFACE ELEVATION: unk
WATER ON COMPLETION: n/a
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	8	35.5	••••••••••	10	LOOSE	STIFF
- 1 ft	18	79.9	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	25	111.0	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 2 ft	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 3 ft	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 1 m	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 4 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 5 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 6 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 2 m	4	15.4	••••	4	VERY LOOSE	SOFT
- 7 ft	3	10.3	••	2	VERY LOOSE	SOFT
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
- 8 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
- 9 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 3 m 10 ft	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	12	36.7	••••••••••	10	LOOSE	STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
- 11 ft	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
- 12 ft	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	11	33.7	•••••••••	9	LOOSE	STIFF
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

ECS Carolinas, LLP
1306 Heidt Ave
Savannah, GA 31401

PROJECT NUMBER: 2940
DATE STARTED: 07-19-2017
DATE COMPLETED: 07-19-2017

HOLE #: WC-3B
CREW: MKF/MSA
PROJECT: L Scott Stell Park Engineering Improvements
ADDRESS: Chatham County
LOCATION: Savannah GA

SURFACE ELEVATION: unk
WATER ON COMPLETION: n/a
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 2 ft	8	35.5	•••••••••	10	LOOSE	STIFF
-	13	57.7	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	15	66.6	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 3 ft	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 1 m	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 4 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 5 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 6 ft	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 2 m	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 7 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	11	37.6	•••••••••••	10	LOOSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 8 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	11	37.6	•••••••••••	10	LOOSE	STIFF
- 9 ft	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	16	54.7	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 3 m 10 ft	20	68.4	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	18	55.1	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	20	61.2	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
- 11 ft	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	39.8	••••••••••••	11	MEDIUM DENSE	STIFF
-	16	49.0	••••••••••••••	13	MEDIUM DENSE	STIFF
- 12 ft	16	49.0	••••••••••••••	13	MEDIUM DENSE	STIFF
-	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
-	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
- 4 m 13 ft						

Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
HA-3												
	S-2	1.00 - 2.00	7.6	SC				22.3				
HA-5												
	S-3	2.00 - 3.00	20.2	SC				29.7				
HA-8												
	S-2	1.00 - 2.00	9.1	SC				28.2				
HA-9												
	S-4	3.00 - 4.00	13.9	SC				37.2				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 23:2940
Project Name: L. Scott Stell Park Improvements
PM: Mohammad Ahamed, EIT
PE: Bob Goehring, P.E., D.GE.
Printed On: Monday, July 31, 2017

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SENT VIA E-MAIL

July 11, 2017

Mr. Joseph T. Botte
ECS Southeast, LLP
1306 Heidt Avenue, Suite A
Savannah, GA 31408

RE: Level IV Soil Survey and Double Ring Infiltrometer Test Results
L. Scott Stell Park Engineering Improvements Project
Savannah, Chatham County, Georgia
Arrowood Project No.: 2017-071

Dear Mr. Botte:

Arrowood Environmental Group (Arrowood) is pleased to provide you with the results of the Level IV Soil Investigation for a proposed on-site waste disposal system as well as the results of the double-infiltrometer (DRI) tests that were conducted at the L. Scott Stell Park in Savannah, Chatham County, Georgia. Arrowood has completed the work at the Site in accordance with Arrowood Proposal No. 043-2017. The Level IV Soil Survey and boring logs as well as the DRI test results are attached to this letter.

Should you have any questions regarding the information contained in this report, please feel free to call Steven Smith at 912-659-3122. We appreciate this opportunity to provide these services to you and look forward to working with you again in the future.

Sincerely,

J. Larry Miles, Jr. MS, CSP
Principal

Steven L. Smith, Jr., VP
Senior Environmental Scientist

County:	Chatham	Date:	7/11/2017
Client:	ECS Southeast, LLC		
Site Location	L. Scott Stell Park		
Scale:	1"=15'		
Intensity of Investigation:	Level IV Soil Survey		

Boring	Soil Series	Slope %	Depth to Bedrock (inches)	Depth to Seasonal High Water Table (inches)	Absorption Rate at Recommended Trench Depth (min/inch)	Recommended Trench Bottom Depth (inches)	Suitability Code
B-1	Ogeechee Variant	1-2	>60	24-36[1]	70	12	C
B-2	Ogeechee Variant	1-2	>60	24-36[1]	70	12	C
B-3	Ogeechee Variant	1-2	>60	36-48[1]	70	24	C
B-4	Ogeechee Variant	1-2	>60	24-36[1]	70	12	C

[1] Chroma =2 mottles were encountered due to seasonally high water table.

Soil Suitability Codes

C	Because of flooding, shallow seasonal water tables, soil horizons with very slow percolation rates, perched water tables, or imperfect drainage, these soils are not suitable for installation of a conventional on-site system without site modifications, special designs or installation. Properties of the soil and site may require the drain field area to be greater than the minimum and/or the drain field design to require equal distribution or level field installation. Non-conventional systems and installation must be approved by the local Environmental Health Specialist.

General Notes

Soil test borings illustrated on the map were located using differential GPS data. The location of the survey was provided by ECS Southeast, LLC. Each boring location was identified to have 18-24" of fill over the native soil profile. The soil fill material was identified to have higher clay content than the upper horizons of the native soil profile below the fill material. Adsorption rates were calculated based off the completion of one (1) percolation test advanced immediately to the west-northwest of soil boring SB-2. The percolation test was completed by advancing a 4.0-inch diameter boring to 2-feet below ground surface (bgs). The boring was filled with water and the water column fall was measured on time intervals to determine the adsorption rate of the soils within the study area.

Based on the seasonally high water tables observed within borings completed during this study, an alternative system will be required to be installed within the study area for the on-site waste disposal system. A Wisconson Mound Soil Adsorption System should be designed in accordance with the Georgia DPH *Manual for On-site Sewage Management Systems* and must be approved by the local environmental health department.

This report is null and void if the study area is cut more than 24 inches or filled after the date of the fieldwork. Areas located beyond the limit of study should not be considered for drain field installation without an additional study. Care should be taken by the installer to avoid smearing trench walls or improper installation, which can lead to system failure. Trench walls should be picked if possible. Areas which flood, have flooding potential, or which serve as drainage ways should not be used. All on-site surface drainage, sub-surface drainage, and water flow should be diverted from the primary and reserve septic drain field areas.

David F. Remick, P.G.
Georgia Lic#: PG000662
Exp. Date: 12/31/2017
P.O. Box 61237
Savannah, GA 31420
Phone: (912) 659-3122

Level IV Soil Survey
ECS Southeast, LLC
L Scott Stell Engineering Improvment Project
Savannah, Chatham County, Georgia
Drawing Date: July 10, 2017
Date of Field Survey: June 1, 2017

0 7.5 15 30 45 Feet

ARROWOOD ENVIRONMENTAL GROUP, INC.

BORING NUMBER SB-1 **COORDINATE SYSTEM** State Plane Georgia East 1001

MAP DATUM NAD 1983 **NORTHING:** 743492

UNITS Feet **EASTING:** 928715

NORTH REFERENCE TRUE **GROUND ELV.:** 16'

PROJECT NAME L. Scott Stell Level IV Soil Survey **PROJECT NUMBER** 2017-071

SITE INFORMATION

DATE:	WEATHER	VEGETATION
6/1/2017	Mostly Cloudy	Grass

LANDSCAPE POSITION: Upland **SLOPE:** 1-2% **OTHER:**

DEPTH IN INCHES	COLOR	TEXTURE (GROUP)	OTHER COMMENTS
0-4	Dk. Brn	Fine sand	Roots. Fill material.
4-8	Tan	Loamy sand	Orange mottles. Very moist. Fill.
8-10	Orangish Yell.	Sandy loam	Brown and Grey mottles. Fill.
10-14	Grey	Sandy clay loam	Orange mottles. Fill.
14-24	Lt. Tan	Loamy sand	Orange mottles
24-32	Dk. Grey	Loamy sand	Few faint orange mottles
32-36	Grey	Sandy loam	Numerous tan mottles. Moist.
36-60	Grey	Sandy clay	Few orange and light grey mottles. Saturated.
60-72	Lt. Grey	Sandy clay loam	Orange, bluish grey, and dk. Grey mottles. Saturated.

Notes: **Seasonal high water table at 24" bgs. Current water table at 36" within boring after allowing to stay open for 1 hour.**

BORING NUMBER SB-2 **COORDINATE SYSTEM** State Plane Georgia East 1001

MAP DATUM NAD 1983 **NORTHING:** 743479

UNITS Feet **EASTING:** 928706

NORTH REFERENCE TRUE **GROUND ELV.:** 16'

PROJECT NAME L. Scott Stell Level IV Soil Survey **PROJECT NUMBER** 2017-071

SITE INFORMATION

DATE:	WEATHER	VEGETATION
6/1/2017	Mostly Cloudy	Grass

LANDSCAPE POSITION: Upland **SLOPE:** 1-2% **OTHER:**

DEPTH IN INCHES	COLOR	TEXTURE (GROUP)	OTHER COMMENTS
0-4	Dk. Brn	Sandy loam	Roots. Fill.
4-24	Dk. Grey	Sandy clay loam	Orange and Lt. grey mottles. Fill.
24-36	Lt. Tan	Loamy sand	Lt. grey and Orange mottles. Moist.
36-42	Lt. Grey	Sandy clay loam	Numerou orange mottles in pore lining. Saturated.

Notes: **Seasonal high water table at 24" bgs. Current water table at 36" within boring after allowing to stay open for 1 hour.**

BORING NUMBER SB-3 **COORDINATE SYSTEM** State Plane Georgia East 1001

MAP DATUM NAD 1983 **NORTHING:** 743514

UNITS Feet **EASTING:** 928683

NORTH REFERENCE TRUE **GROUND ELV.:** 16'

PROJECT NAME L. Scott Stell Level IV Soil Survey **PROJECT NUMBER** 2017-071

SITE INFORMATION

DATE:	WEATHER	VEGETATION
6/1/2017	Mostly Cloudy	Grass

LANDSCAPE POSITION: Upland **SLOPE:** 1-2% **OTHER:**

DEPTH IN INCHES	COLOR	TEXTURE (GROUP)	OTHER COMMENTS
0-3	Brown	Loamy sand	Roots
3-9	Orange	Sandy loam	Lt. tan mottles. Coarse sand. Fill
9-18	Brownish Yellow	Sandy loam	Lt. Tan and orange mottles. Fill.
18-24	Grey	Sandy clay	Numerous orange mottles. Moist. Fill
24-30	Greyish Tan	Sandy loam	Brownish yellow mottles.
30-34	Dk. Grey	Sandy loam	Roots
34-42	Tan	Loamy sand	Course sand. Moist.
42-48	Grey	Sandy clay loam	Numerous orange mottles. Moist
48-60	Lt. Grey	Sandy clay	Numerous orange and lt. grey mottles. Saturated.

Notes: **Seasonal high water table at 42" bgs. Current water table at 60" within boring after allowing to stay open for 1 hour.**

BORING NUMBER SB-4 **COORDINATE SYSTEM** State Plane Georgia East 1001

MAP DATUM NAD 1983 **NORTHING:** 943501

UNITS Feet **EASTING:** 928673

NORTH REFERENCE TRUE **GROUND ELV.:** 16'

PROJECT NAME L. Scott Stell Level IV Soil Survey **PROJECT NUMBER** 2017-071

SITE INFORMATION

DATE:	WEATHER	VEGETATION
6/1/2017	Mostly Cloudy	Grass

LANDSCAPE POSITION: Upland **SLOPE:** 1-2% **OTHER:**

DEPTH IN INCHES	COLOR	TEXTURE (GROUP)	OTHER COMMENTS
0-24	Grey	Sandy loam (pockets of SCL)	Orange mottles. Roots. Fill
24-36	Brownish tan	Sandy loam	10% grey mottles
36-42	Dk. Grey	Sandy loam	
42-48	Grey	Sandy clay	Numerous orange mottles. Moist
48-60	Grey	Sandy clay	Numerous orange mottles. Saturated.
60-72	Bluish grey	Sandy clay	Numerous orange mottles. Saturated.

Notes: **Seasonal high water table at 24" bgs. Current water table at 48" within boring after allowing to stay open for 1 hour.**

Figure 1 - Double Ring Infiltrometer Test Results
ECS Southeast, LLC
L Scott Stell Engineering Improvement Project
Savannah, Chatham County, Georgia
Drawing Date: July 10, 2017

0 37.5 75 150 225 Feet

ARROWOOD ENVIRONMENTAL GROUP, INC.

Appendix III

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.

ASFE
The Best People on Earth

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