Geotechnical Exploration
Publix Super Markets – Dacula Distribution Center
Wastewater Pretreatment Upgrades
Dacula, Georgia
S&ME Project No. 1280-15-044

Prepared for:
Applied Technologies, Inc.
16815 West Wisconsin Avenue
Brookfield, Wisconsin 53005

Prepared by:
S&ME, Inc.
4350 River Green Pkwy, Ste 200
Duluth, GA 30096

November 16, 2015

Table of Contents

Appendix

November 16, 2015

Applied Technologies, Inc.
16815 West Wisconsin Avenue
Brookfield, Wisconsin 53005

Attention: Mr. Ed Longhini

Reference: **Geotechnical Exploration**
Publix Super Markets - Dacula Distribution Center
Wastewater Pretreatment Upgrades
Dacula, Georgia
S&ME Project No. 1280-15-044

Gentlemen:

1.0 Introduction

S&ME, Inc. has completed a subsurface exploration for the referenced project. This exploration was performed in general accordance with our Proposal No. 12-1500489, dated September 30, 2015 as authorized by Mr. Ed Longhini on October 13, 2015. The purpose of the exploration was to obtain subsurface data so that we could evaluate foundation support conditions, general rock and groundwater levels at the site, and excavation conditions. This report presents our understanding of the project, the subsurface conditions encountered in the borings, and our conclusions and recommendations for foundations, excavation conditions, lateral earth pressures, groundwater considerations, and a seismic site classification.

2.0 Project Information

A pretreatment wastewater facility is located in the southwest corner of the Publix Distribution Center in Dacula, Georgia. Upgrades to the pretreatment facility are planned which include construction of two new structures. An approximately 30-foot diameter wastewater storage tank will be constructed to the south of the existing facility. The base of the tank will be near existing grades and will be supported on a reinforced concrete mat and a perimeter ring-wall footing. The tank is expected to be comprised of steel and will be about 30 feet high. Loads directly beneath the footprint of the tank are expected to be about 1,800 to 2,000 psf.

A new aeration basin is planned north of the existing structure; however, it is not expected to be constructed until sometime in the future. The dimensions of the basin have not been provided, but most of the structure is expected to be below ground; thus, the applied weight of the structure and its contents are expected to be similar to the weight of existing soil that will be removed in order to build the structure.

3.0 Exploration and Testing Procedures

3.1 Field Exploration and Testing

Field sampling and testing by S&ME, Inc. are in general accordance with ASTM procedures and geotechnical engineering practice. The Appendix contains brief descriptions of the procedures as well as the data obtained. Our project engineer made a site visit to observe pertinent site and topographic features as well as surface indications of the site geology. The two borings were field-located at the approximate requested locations by estimating right angles and taping distances from the existing structure. The boring locations shown on the Boring Location Plan in the Appendix are approximate. No ground surface elevations were shown on the plan provided to us; therefore, ground surface elevations are not shown on the boring logs in the Appendix.

The exploratory borings were made by mechanically twisting hollow-stem augers into the soil. Soil samples were obtained at 2 ½ to 5-foot depth intervals with a standard 1.4-inch I.D., 2-inch O.D. split-barrel sampler. The sampler was first seated six inches and then driven an additional foot with blows of a manual 140-pound hammer falling 30 inches (operated by rope and cathead). The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "standard penetration resistance" with units of blows per foot (bpf). Very dense residual materials described as partially weathered rock were encountered in both borings. In these materials, 50 hammer blows drove the sampler less than 6 inches, and the boring logs show the penetration for 50 blows as 50/3", 50/5", etc.

In addition to split-barrel samples, we obtained three relatively undisturbed thin-walled tube samples for possible laboratory testing. We obtained the samples from a boring offset a few feet from Boring B-2 where soils were similar to those at B-1, but generally of a slightly lower consistency. The tubes were sealed and transported to our laboratory.

Soil samples obtained during the exploration were transported to our laboratory and reviewed by the project and senior engineers. The purposes of this review were to check the field descriptions, visually estimate the percentages of the soils' constituents (sand, clay, etc.), identify pertinent structural features such as foliation planes, slickensides, etc., and observe evidence of soil origin. The stratification lines shown on the boring logs represent the approximate boundaries between soil types, but the transitions may be more gradual.

3.2 Laboratory Testing

The three thin-walled tube samples were cut and the retained soil was observed by our engineers. One of the samples was selected for consolidation testing. The consolidation test data were used to characterize the compressibility of the on-site soils and as a basis for settlement analysis. We also performed Atterberg limits, a sieve analysis, and moisture content testing on select split-spoon samples and on the sample selected for consolidation testing.

Laboratory testing by S&ME, Inc. is in general accordance with ASTM and U.S. Army Corps of Engineers procedures. The Appendix contains brief descriptions of the laboratory procedures and laboratory test reports.

4.0 Site and Subsurface Conditions

4.1 Site Conditions

The pretreatment facility is located in the southwest corner of the Publix Distribution Center at 445 Hurricane Trail NE, Dacula, Georgia. The area surrounding the existing pretreatment facility is relatively flat. Asphalt drive/parking areas are located north, south, and east of the building. The area of the planned new construction is covered by short grass. We suspect that various utility lines that service the existing facility may be present within or in the vicinity of the new construction; however, we are not informed of any specific on-site utilities by Publix personnel.

4.2 Area Geology

The project site is in Georgia's Piedmont physiographic province. The soil overburden of this area is residuum formed by in-place weathering of the parent rocks. Geologic mapping indicates that the site is underlain by the Wolf Creek formation which consists of thinly laminated, fine-grained amphibolites, interlayered with silvery gray biotite schist.

A typical upland Piedmont soil profile consists of thin topsoil underlain by a few feet of clayey soils that transition with increasing depth into less clayey, coarser grained silts and sands with varying mica content. Separating the completely weathered soil overburden from the unaltered parent rock is a transition zone of residuum with penetration resistances of more than 100 bpf (50/6”), which is locally described as *partially weathered rock*. Partially weathered rock retains much of the appearance and fabric of the parent rock formations and may consist of thinly interlayered, very hard or dense soil and rock.

The weathering processes that formed the overburden soils and partially weathered rock were extremely variable, depending on such factors as rock mineralogy, past groundwater conditions, and the tectonic history (joints, faults, and igneous intrusions) of the specific area. Differential weathering of the rock mass has resulted in erratically varying subsurface conditions, evidenced by abrupt changes in soil type and consistency in relatively short horizontal and vertical distances. Depths to rock can be irregular and isolated boulders, discontinuous rock layers, or rock pinnacles can be present within the overburden and transition zones.

The naturally developed Piedmont soil profile can be altered by natural processes as well as man's grading activities, such as excavation and fill placement. Fill soils have been placed on this site during past grading activities. Fill can be composed of variable materials, including soil, rock, trash and/or debris. The engineering properties of fill depend primarily on the degree of compaction, composition and moisture content.

4.3 Subsurface Conditions

Boring B-1 was located approximately 35 feet south of the existing facility and Boring B-2 was located approximately 20 feet north of the existing facility. Each boring initially encountered about 1 inch of topsoil which was underlain by fill soil to depths of 14 and 8 ½ feet. The fill was comprised of red-brown sandy elastic silt (MH) and silty fat clay (CH) that had standard penetration resistance values ranging from 8 to 19 bpf. Beneath the fill were Piedmont residual soils comprised of orange-brown, tan, and gray sandy elastic silt (MH), silty fat clay (CH), or silty fine sand (SM) with varying amounts of mica. Standard penetration resistance values in the residual soil ranged from 11 to 25 bpf.

Borings B-1 and B-2 encountered partially weathered rock at depths of 18 feet and 20 feet below the ground surface, respectively. The partially weathered rock was sampled as gray, brown, and black silty fine sand (SM). Boring B-1 encountered auger refusal at a depth of 28 feet below the ground surface and Boring B-2 encountered auger refusal at a depth of 25 feet below the ground surface.

Groundwater was encountered in both of the borings. Approximately 24 hours after the time of drilling, groundwater was measured at a depth of 14 feet in Boring B-1 and at 13 ½ feet in Boring B-2. Several soil samples obtained from near or below the groundwater level were assessed to be wet. We note that groundwater levels commonly fluctuate several feet with both seasonal and yearly rainfall variations.

The preceding is a generalized description of subsurface conditions at the two boring locations. The boring logs in the Appendix contain more detailed descriptions of materials encountered at each boring location.

4.4 Laboratory Data Summary

The following table summarizes the laboratory index tests performed on selected split-spoon and thin-wall tube samples. The Appendix includes the particle size distribution test reports (sieve analyses) as well as a consolidation test report.

Boring No.	Sample Depth (ft)	Liquid Limit (%)	Plasticity Index (%)	Fines (%)	Moisture Content (%)
B-1	0 – 1 ½	--	--	--	30.4
B-1	6 – 7 ½	--	--	--	38.1
B-1	11 – 12 ½	--	--	--	36.9
B-1	16 – 17 ½	--	--	--	33.6
B-1	18 ½ – 20	--	--	--	17.7
B-1	23 ½ – 25	--	--	--	8.9
B-2	0 – 1 ½	--	--	--	30.2
B-2	3 – 5	59	29	78	30.0
B-2	6 – 7 ½	--	--	--	32.1
B-2	8 ½ – 10	74	36	65	39.4
B-2	11 – 12 ½	--	--	--	36.5
B-2	13 ½ – 15	--	--	--	39.1
B-2	16 – 17 ½	--	--	--	33.4
B-2	18 ½ – 20	--	--	--	29.9
B-2	23 ½ – 25	--	--	--	12.0

"--" = Test not performed on this sample.

5.0 Limitations of Conclusions and Recommendations

This report is for the exclusive use of Applied Technologies, Inc. for specific application to the subject project. Our conclusions and recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the State of Georgia. No other warranty is expressed or implied. This company is not responsible for the conclusions, opinions, or recommendations of others based on these data.

Our conclusions and recommendations are based on the design information furnished to us, the data obtained from the previously described subsurface exploration, and our past experience. They do not reflect variations in the subsurface conditions which are likely to exist between our borings and in unexplored areas of the site. These variations result from the inherent variability of the subsurface conditions in this geologic region as well as past site use and grading, including previous fill placement. If such variations become apparent during construction, it will be necessary for us to re-evaluate our conclusions and recommendations based upon on-site observation of the conditions.

If the overall design, elevation, or location of the proposed structures is changed, the recommendations contained in this report must not be considered valid unless the changes are reviewed by our firm and our recommendations modified or confirmed in writing. When the design is finalized, we should be given the opportunity to review the foundation plan and applicable portions of the project specifications. This service will allow us to determine whether these documents are consistent with the intent of our recommendations.

Subsequent report sections include comments about geotechnical aspects of the proposed construction. The recommendations contained herein are not intended to dictate construction methods or sequences. They are based on findings from this subsurface exploration and are furnished solely to help designers understand subsurface conditions related to foundation and earthwork plans and specifications. Depending on the final design of the project, the recommendations also may be useful to personnel who observe construction activity.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of the geotechnical design. We recommend that the owner retain these services and that we be allowed to continue our involvement in the project through these phases of construction. Our firm is not responsible for interpretation of the data contained in this report by others, nor do we accept any responsibility for job site safety which is the sole responsibility of the contractor.

6.0 Conclusions and Recommendations

6.1 Above-Ground Wastewater Storage Tank

The following recommendations apply to the 30-foot diameter above-ground wastewater storage tank. Please refer to Section 6.2 of this report for general recommendations regarding the new aeration basin.

6.1.1 General

The exploratory findings indicate that the planned wastewater storage tank can be supported by a shallow mat and ring wall foundation system, assuming the settlement magnitude noted in Report Section 6.1.4 is acceptable to the designer. If that amount of settlement cannot be tolerated, the settlement magnitude can be reduced by some depth of soil removal and crushed stone backfill placement, or the structure can be supported by a deep foundation system. Supplemental analysis would be needed for us to provide recommendations for these alternative approaches.

Atterberg limits testing indicates the structure will be underlain by clays and silts which classify as CH and MH by the Unified Soil Classification System. Such materials are sometimes considered problematic due to shrink/swell potential. The two samples tested had Plasticity Indices of 29 and 36 percent. These values are moderately high, but we (S&ME and QORE prior to its purchase by S&ME) have been involved in many projects at the Publix Distribution Center in Dacula dating back to the original site grading and building construction, and are aware of no problems at the facility related to shrink/swell of fill or residual soils. We assess that these soil types can be left in place beneath the planned structure (provided they are firm and stable as addressed in Report Section 6.1.2) without employing special procedures. While we believe that no special procedures are needed due to potential shrink-swell issues with on-site materials, the areas outside the structure should be graded to prevent ponding of water near the tank's foundation.

6.1.2 Earthwork Recommendations

No significant mass grading is anticipated to prepare the site for tank construction. Initially, all grass, topsoil, and organics should be stripped from the construction area. Any existing utilities in the area of the proposed tank should be abandoned and removed along with any associated trench backfill. Trenches resulting from utility removal should be backfilled with structural fill. After stripping, utility removal and trench backfill, areas which are at grade or which will receive fill should be evaluated by a member of our engineering staff. The evaluation should include observing proofrolling with a loaded tandem-axle dump truck. Proofrolling consists of applying repeated passes to the subgrade with this equipment. Any materials judged to deflect excessively under the wheel loads and which cannot be densified by continued rolling should be further removed to expose firm, stable soil.

Any fill used to level the site or for backfill should be comprised of structural fill. Structural fill for this project is defined as inorganic natural soil placed in relatively thin (4- to 6-inch) layers and compacted to at least 95 percent of the soil's maximum dry density as determined by the standard Proctor compaction test (ASTM D698). Maximum particle sizes should be limited to about 4 inches. The soil should exhibit a plasticity index of less than 35. The soils encountered in the borings of this exploration should be satisfactory for re-use as structural fill from a composition standpoint. The moisture content of excavated soil could vary considerably with weather conditions during construction. Drying or wetting of the soils may be necessary to achieve the recommended compaction criterion. Moisture contents of the soil from the upper 10 feet of both Boring B-1 and B-2 ranged from 30.0 to 39.4 percent. Based on our experience with similar soil on previous Publix Distribution Center projects, we expect the corresponding standard Proctor optimum moisture contents will range from the mid-20s to low 30s (percent).

In-place density testing must be performed as a check that the previously recommended compaction criterion has been achieved. Density tests should be performed on any fill or backfill placed. We recommend density testing at no greater than 1-foot vertical increments by a technician working under the direction of our project engineer.

6.1.3 *Excavation Conditions/Groundwater*

In the area of the planned above-ground tank, groundwater was encountered at a depth of 14 feet below the ground surface and high-consistency material (partially weathered rock) was encountered at a depth of 18 feet below the ground surface. We expected only minor cut or fill in the tank area and therefore do not anticipate excavation difficulty or groundwater impact during construction of the tank foundation/mat.

6.1.4 *Foundation Recommendations*

The approximately 30-foot diameter tank is planned to be supported on a reinforced concrete mat that will have a contact pressure of 1,800 to 2,000 psf and a perimeter ring wall footing. We were not provided a width and bearing pressure for the ring wall foundation, but expect it to be 3 feet or less wide and to have a bearing pressure of 2,000 psf or less. We used consolidation test data obtained from this exploration to evaluate settlement of the tank mat. Moderately compressible soils are present to a depth of 18 feet below the ground surface at Boring B-1 (a 20-foot somewhat compressible profile was present at Boring B-2). For a mat proportioned for a contact pressure of 2,000 psf, we anticipate settlement of about 1 ½ inches at the center of the mat transitioning to about ½ inch of settlement at the perimeter based on calculations using consolidation test data from this exploration and past subsurface explorations at Publix Distribution Center. We recommend use of a modulus of subgrade reaction (k) of 15 pci in design of the mat. We expect settlement of the perimeter ring wall foundation to be similar to the settlement of the mat perimeter.

We recommend that the perimeter ring wall foundation bear at least 18 inches below the lowest adjacent grade for protection against frost penetration and to limit moisture content change in soils directly below the base of the foundation. The foundation excavation and mat area should be evaluated by a representative of our firm just before foundation/mat construction to check that the field conditions are consistent with our assumptions and recommendations. Undercutting and crushed stone or structural fill replacement will be required if soft or otherwise unsatisfactory soils are detected during the evaluation.

The strength properties of soil exposed in foundation subgrades will change if exposed to wetting, drying, or freezing. Whenever possible, concrete should be placed during the day the foundation or mat excavation is completed. If subgrades will be left exposed to the elements for more than one day, they should be covered with polyethylene sheeting. Optionally the areas can be overexcavated followed by placement of a lean (1,000 psi) concrete veneer about 3 inches thick (mud mat) or by placement of one foot of compacted crushed stone (No. 57 or graded aggregate base). Excavation of disturbed soil may be required if protective measures are not implemented and foundation/subgrade soils are exposed to rain, freezing temperatures, or prolonged periods of hot, dry weather.

We do not know how close the new tank foundation will be to the perimeter of the existing structure or what the bottom elevation of the existing structure is in the vicinity of the planned tank. Loads applied by the tank mat/ring wall foundation may cause some settlement in the adjacent structure or induce lateral forces into below-ground walls of the structure if the new and existing structures are very close to each other. We can comment on this in more detail after design is further along, if requested.

6.1.5 *Earth Pressure Recommendations*

There may be appurtenances associated with the wastewater storage tank (pump pits, etc.) that will have perimeter walls which will act as retaining walls. Such walls are expected to be laterally restrained and not free to deflect or rotate, we recommend that they be designed using the "at-rest" earth pressure condition. Any below ground walls which are free to deflect or rotate may be designed for the "active" earth pressure condition.

Soils behind the retaining walls/below ground walls are assumed to exert a triangular stress distribution which can be modeled in terms of an "equivalent fluid" for both the active and at-rest cases. If a uniform area surcharge is applied behind the wall, a portion of the surcharge is transferred to the wall in the form of a uniform or rectangular lateral stress distribution. The magnitude of the lateral stress transferred to the wall is a function of the soil's strength and the permissible degree of deflection or rotation. It is computed by multiplying the soil's "earth pressure coefficient" by the magnitude of the surcharge. The following table contains values of earth pressure coefficients for both the active and at-rest earth pressure conditions.

Earth Pressure Condition	Earth Pressure Coefficient	Equivalent Fluid Pressure
At-Rest, Horizontal Backfill	0.33	60
Active, Horizontal Backfill	0.36	40

Passive earth pressure of soil adjacent to the foundation as well as soil friction at the footing base maybe used to resist sliding. The ultimate friction coefficient between the concrete foundation and soil can be assumed to be 0.4. For computations, the ultimate passive soil resistance may be assumed to act as a fluid with an equivalent unit weight of 300 pcf.

We recommend that a safety factor of 2 or more be used when computing restraining forces because no strength tests have been performed on the material and the simplified earth pressure theory (Rankine) was used to estimate the soil's passive resistance.

The recommended earth pressure coefficients assume that there are level ground surfaces on both sides of the walls and that constantly functioning drainage systems are installed between walls and backfill to prevent the build-up of hydrostatic pressures and lateral stresses in excess of those calculated for drained conditions.

6.1.6 Seismic Site Classification

A Seismic Site Classification "D" in accordance with the International Building Code 2012 (IBC 2012) is appropriate for the planned tank based upon the borings of this exploration and our understanding that the tank foundation will be constructed near existing grades. This classification was determined by the Average N-value method of IBC 2012.

6.2 New Aeration Basin

Limited information is available at this time regarding the future design and construction of a new aeration basin north of the existing structure. We understand that most of the structure is expected to be below ground.

Moderate consistency soil was encountered in Boring B-2 to a depth of 20 feet below the ground surface. These materials can be routinely excavated with moderate-sized tracked excavators. If excavations will extend below 20 feet, concentrated effort with large tracked excavators will be required to remove the partially weathered rock. Blasting should be anticipated if excavations are planned deeper than 25 feet.

Groundwater was encountered at a depth of 13 ½ feet below the ground surface. Depending on the depth of excavation, temporary or permanent dewatering may be required.

Existing soils, partially weathered rock, or rock are expected to be satisfactory for support of the structure. Since the weight of soil being removed to install the new aeration basin will likely offset the weight of the new structure, we anticipate settlement should be minor.

Earthwork and earth pressure recommendations for the wastewater storage tank should generally apply to the aeration basin project. Excavation to install the aeration basin may require shoring or bracing of the existing pre-treatment structure depending on their closeness and the aeration basin's bottom elevation compared to the bottom elevation of the existing structure.

Once more detailed project information is known about the aeration basin, we can provide more detailed recommendations and an appropriate seismic site classification using the boring data already obtained.

7.0 Acknowledgment

S&ME, Inc. appreciates being selected to participate in this phase of the project. We are available to provide consulting services and quality control testing during the construction phase. Please contact us if you have any questions about this report, or if we may be of further service.

Respectfully Submitted,

S&ME, Inc.

Sarah E. Ball, P.E.
Project Geotechnical Engineer
Ga. Reg. 32185

Kenneth A. Ball, P.E.
Principal Geotechnical/Materials Engineer
Ga. Reg. 12623

SEB/KAB/ab

Appendix

Boring Location Plan

Boring Logs

Laboratory Test Reports

Procedures

Important Information about Your Geotechnical Engineering Report

NOTES:

- DRAWING FOR ILLUSTRATIVE PURPOSES ONLY
- BASE IMAGE OBTAINED FROM GOOGLE EARTH

LEGEND:

- APPROXIMATE BORING LOCATION

S&ME

BORING LOCATION PLAN

PUBLIX DISTRIBUTION CENTER
WASTEWATER PRETREATMENT SYSTEM UPGRADE
DACULA, GEORGIA

JOB NUMBER:	1280-15-044	APPROXIMATE SCALE:	1"=30'
DRAWN BY:	JLN	CHECKED BY:	SB
DATE:	11/09/2015	FIGURE:	1

BORING NUMBER B-1

S&ME Inc

CLIENT Applied Technologies, Inc.	**PROJECT NAME** Publix Distribution Center - Wastewater Pretreatment System Upgrade
PROJECT NUMBER 1280-15-044	**PROJECT LOCATION** 445 Hurricane Trail NE, Dacula, GA
DATE STARTED 10/20/15 **COMPLETED** 10/20/15	
DRILLING CONTRACTOR Sunrise Drilling Company	**GROUND ELEVATION** **HOLE SIZE** 6 inches
DRILLING METHOD Rope & Cathead CME 45	**GROUND WATER LEVELS:**
LOGGED BY Sarah Ball **CHECKED BY** Ken Ball	▽ **AT TIME OF DRILLING** 20.00 ft
NOTES	▼ **24hrs AFTER DRILLING** 14.00 ft

DEPTH (ft)	ELEV. (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	▲ SPT N VALUE ▲ (20 40 60 80)
0			TOPSOIL (1 INCH)						
			SANDY ELASTIC SILT, red-brown, stiff to very stiff, FILL	MH	SS 1		6 - 6 - 7 **(13)**		
5					SS 2		7 - 8 - 9 **(17)**		
					SS 3		7 - 8 - 8 **(16)**		
			SANDY ELASTIC SILT, red-brown, firm to stiff, trace topsoil, FILL	MH	SS 4		3 - 4 - 4 **(8)**		
10					SS 5		4 - 5 - 6 **(11)**		
		▼	SILTY FAT CLAY, tan-brown, stiff to very stiff, RESIDUUM	CH	SS 6		11 - 12 - 12 **(24)**		
15					SS 7		6 - 6 - 6 **(12)**		
			SILTY SAND, gray-brown, fine grained, very dense, PARTIALLY WEATHERED ROCK	SM	SS 8		50/3" **(100+)**		>>▲
20		▽							
					SS 9		50/6" **(100+)**		>>▲
25									

Refusal at 28.0 feet.
Bottom of borehole at 28.0 feet.

CLIENT Applied Technologies, Inc.
PROJECT NAME Publix Distribution Center - Wastewater Pretreatment System Upgrade
PROJECT NUMBER 1280-15-044
PROJECT LOCATION 445 Hurricane Trail NE, Dacula, GA
DATE STARTED 10/20/15 **COMPLETED** 10/20/15
DRILLING CONTRACTOR Sunrise Drilling Company
GROUND ELEVATION
HOLE SIZE 6 inches
DRILLING METHOD Rope & Cathead CME 45
GROUND WATER LEVELS:
LOGGED BY Sarah Ball **CHECKED BY** Ken Ball
▽ **AT TIME OF DRILLING** 16.00 ft
▼ **AFTER DRILLING** 13.50 ft
NOTES

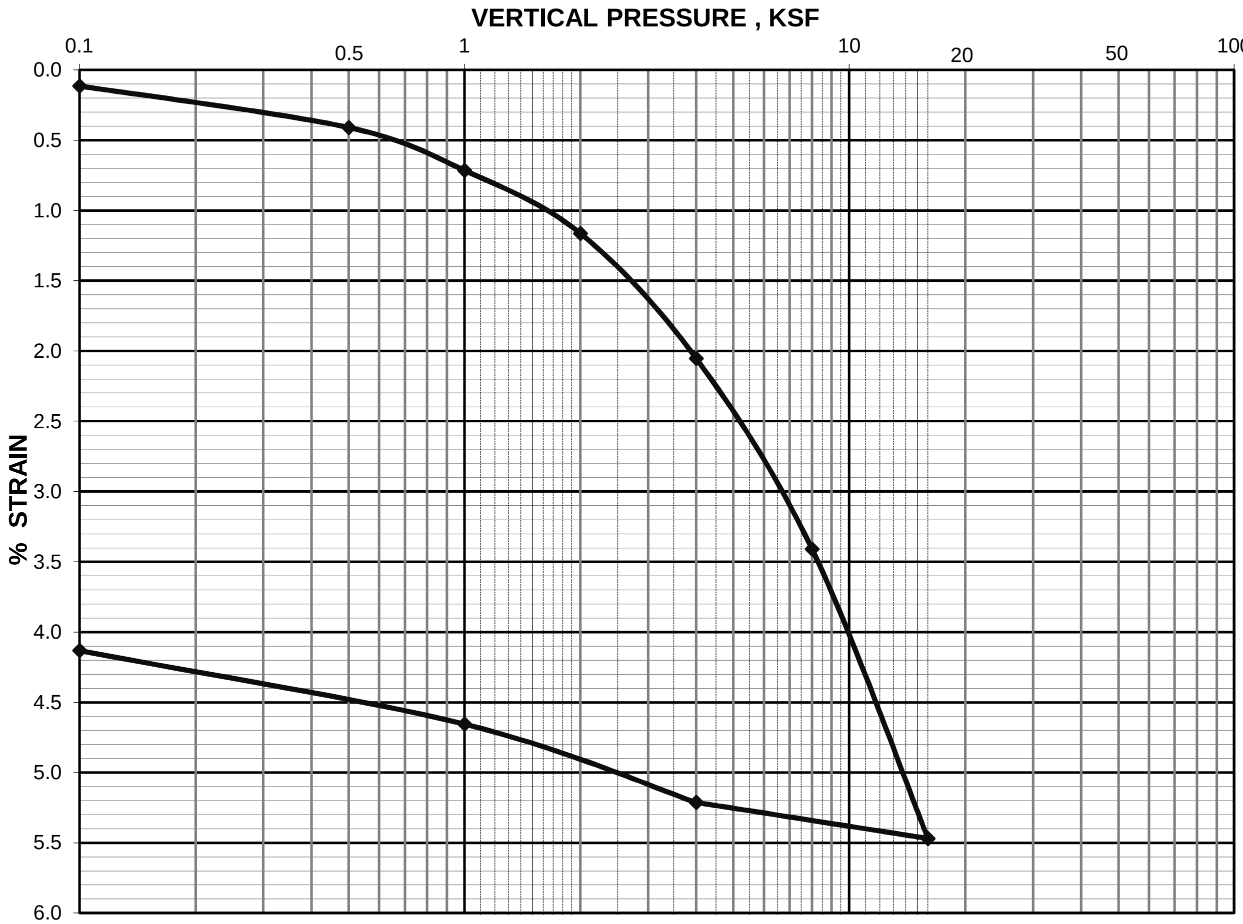
DEPTH (ft)	ELEV. (ft)	MATERIAL DESCRIPTION	USCS	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)
0		TOPSOIL (1 INCH)		SS 1		5 - 6 - 7 **(13)**	
		SANDY FAT CLAY, red-brown, stiff to very stiff, with some rock fragments, and mica, FILL	CH	UD 1 SS 2		4 - 4 - 6 **(10)**	
5				SS 3		11 - 10 - 9 **(19)**	
		SANDY ELASTIC SILT, orange-brown, stiff, micaceous, FILL	MH	UD 2 SS 4		4 - 5 - 7 **(12)**	
10				SS 5		5 - 5 - 6 **(11)**	
		▼ SILTY SAND, brown and gray, fine grained, wet, medium dense, micaceous, RESIDUUM	SM	SS 6		8 - 11 - 14 **(25)**	
15		▽		SS 7		8 - 8 - 11 **(19)**	
				UD 3 SS 8		8 - 7 - 11 **(18)**	
20		SILTY SAND, brown and black, fine grained, very dense, micaceous, PARTIALLY WEATHERED ROCK	SM	SS 9		50/5" **(100+)**	
25							

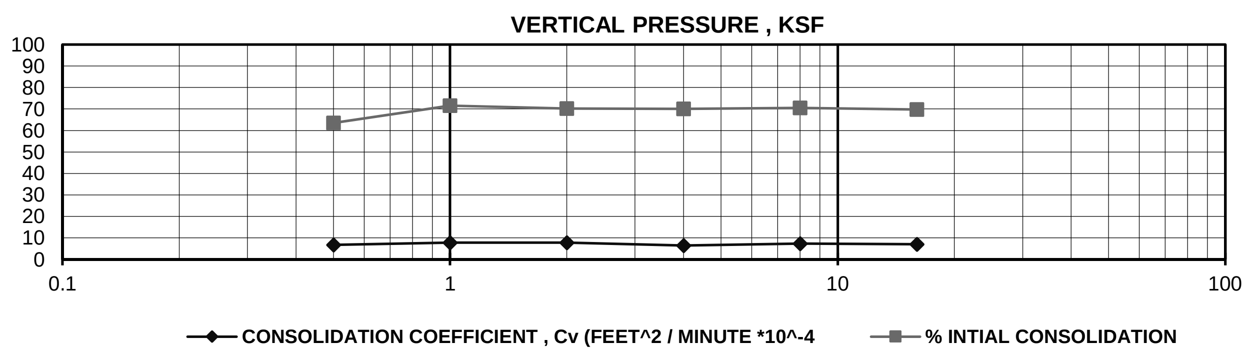
Refusal at 25.0 feet.
Bottom of borehole at 25.0 feet.

CONSOLIDATION TEST REPORT
(ASTM D 2435)

REV1,12/14/06

Project Name :	Publix Distribution Center-Wastewater Pretreatment Sys			Review Date :	10/30/15
S&ME project No. :	1280-15-044	Sample Date :	*10/20/15*	Reviewed By :	K. Ball
Sample ID :	B-2	Depth. :	3'-5'	Performed By :	JH,AM
Client :	*Applied Technologies*			Test Date :	*10/30/15*
Wet Density, γ_{wet}, PCF :	118.0	Dry Density , γ_{DRY} , PCF :	91.4	Sample Type :	UD
Void Ratio , e_o :	0.858	Water Content , %. :	29.1	Sample No. :	N/A
Saturation , S_O , % :	92.2	Test Method : B	Sq. root of t	Specific Gravity, GS :	2.721
Liquid Limit, % :	*59*	PI, % :	*29*	Fines, % :	*78*
Soil Description :	Red-brown fat clay with sand and mica (CH).				
REMOLDED PROPERTIES :	-		-		-



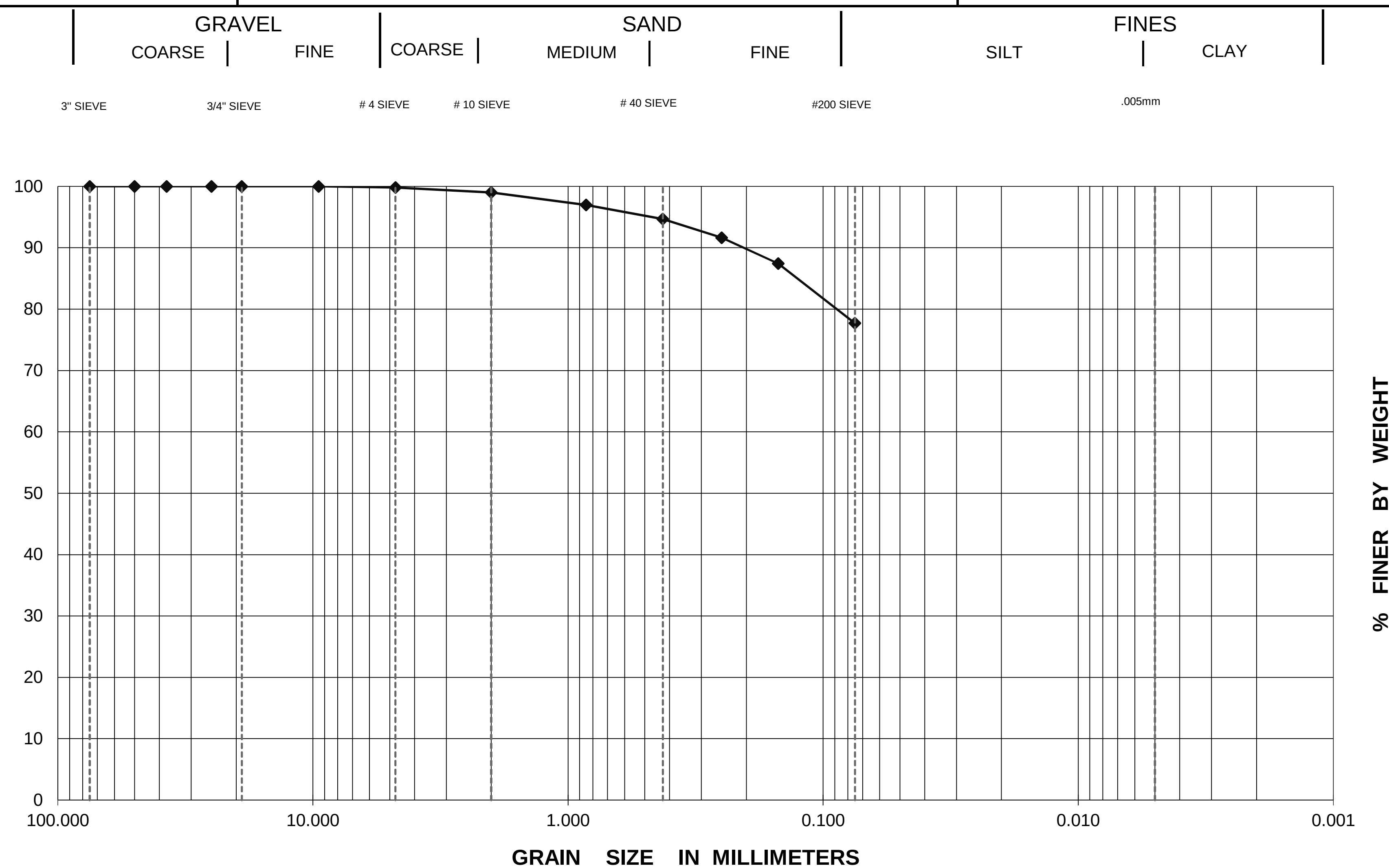


PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV6,12/02/09

Project Name :	*Publix Distribution Center-Wastewater Pretreatment System Upgrade*			*0*		Review Date :	10/30/15
S&ME project No. :	*1280-15-044*		Sample Date :	10/20/15		Reviewed By :	K. Ball
Sample ID :	*B-2*		Depth. :	*3'-5'*		Performed By :	*JH,AM*
Client :	Applied Technologies					Test Date :	10/30/15
Soil Description :	*Red-brown fat clay with sand and mica (CH).*					Fines, % :	*78*
Liquid Limit, % :	*59*	PI, % :	29	Clay,.005 MM, % :	N/A	Water Content, % :	*30.0*
D10 , MM :	N/A	D30 , MM : N/A	D60 , MM :	N/A		Coefficient of Curvature , C_C :	*N/A*
Classification :		Unified : *CH*				Coefficient of Uniformity , C_U :	*N/A*

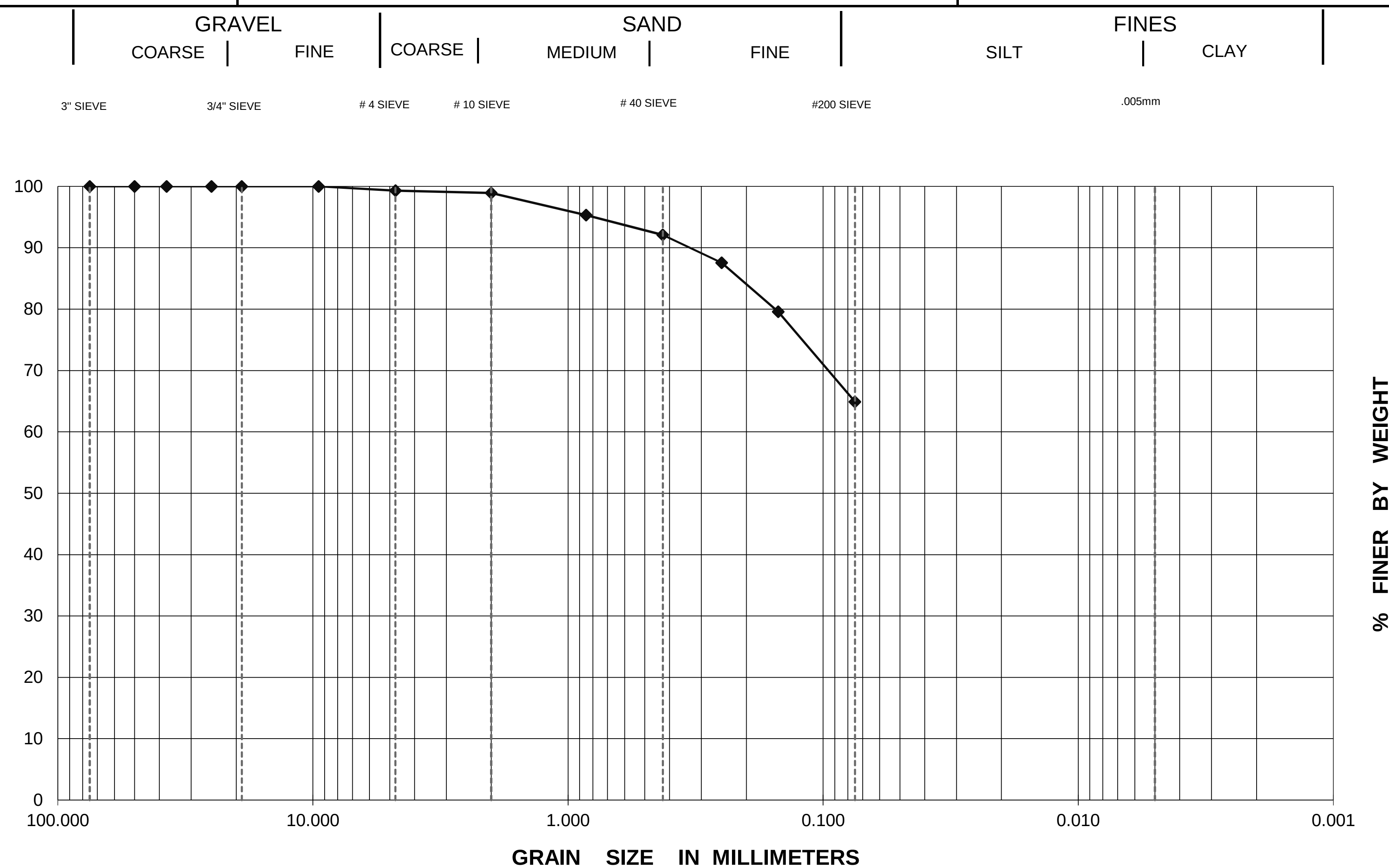


PARTICLE- SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER ASTM D422

REV6,12/02/09

Project Name :	*Publix Distribution Center-Wastewater Pretreatment System Upgrade*							Review Date :	10/30/15
S&ME project No. :	*1280-15-044*				Sample Date :	10/20/15		Reviewed By :	K. Ball
Sample ID :	*B-2*				Depth. :	*8.5'-10'*		Performed By :	*JH,AM*
Client :	Applied Technologies							Test Date :	10/30/15
Soil Description :	*Orange-brown sandy elastic silt with mica (MH).*							Fines, % :	*65*
Liquid Limit, % :	*74*	PI, % :		36	Clay,.005 MM, % :	N/A		Water Content, % :	*39.4*
D10 , MM :	N/A	D30 , MM :	N/A		D60 , MM :	N/A	Coefficient of Curvature , C_C :		*N/A*
Classification :		Unified :	*MH*				Coefficient of Uniformity , C_U :		*N/A*



INTRODUCTION

S&ME, Inc. performs most all tests in general accordance with the American Society for Testing and Materials (ASTM) or the United States Army Corps of Engineers procedures. These procedures are generally recognized as the basis for uniformity and consistency of test results in the geotechnical engineering profession. All work is initiated and supervised by qualified engineers. Our tests are performed by skilled technicians trained in either ASTM or Corps procedures. Our equipment is well maintained, and our laboratory equipment is calibrated at least yearly.

Subsequent portions of this Appendix present brief descriptions of our testing procedures. Where applicable, we have referenced these procedures to either ASTM or the Corps of Engineers. Reference should be made to the following publications for specific descriptions of apparatus, procedures, reporting, etc.

Annual Book of ASTM Standards, Section 4, Volume 4.08: Soil and Rock: Building Stones. American Society for Testing and Materials, Latest Edition

EM 1110-2-1803. Subsurface Investigations, Soils, Chapter 3. U.S. Army Corps of Engineers, 1972.

EM 1110-1-1801, Geological Investigations. U.S. Army Corps of Engineers, 1978.

EM 1110-2-1907, Soil Sampling. U.S. Army Corps of Engineers, 1972.

EM 1110-1-1802, Geophysical Exploration. U.S. Army Corps of Engineers, 1979.

EM 1110-2-1906, Laboratory Soils Testing. U.S. Army Corps of Engineers, 1970.

SOIL TEST BORING PROCEDURES, ASTM D-1586

The borings were advanced by a hollow stem auger which was mechanically driven by a 125-horsepower drill rig. At regular intervals, soil samples were obtained through the hollow central portion of the augers with a standard 1.4 inch I.D., 2.0 inch O.D. split tube sampler.

The sampler was initially seated six inches to penetrate any loose cuttings; then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated as the *standard penetration resistance*. Penetration resistance, when properly evaluated, is an index to the soil's strength and density.

The samples were classified in the field by the driller as they were obtained. Representative portions of each soil sample were then sealed in containers and transported to our laboratory. The samples were examined by a graduate geotechnical engineer or engineering geologist to visually check the field classifications. All boring data, including sampling intervals, penetration resistances, soil classifications, and groundwater level are presented on the attached Test Boring Records.

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)

- Fill
- Asphalt
- Concrete
- Topsoil
- Gravel
- Sand
- Silt
- Clay
- Sandstone
- Silty Sand
- Interbedded Sandstone/Shale
- Shale
- Clayey Silt
- Sandy Clay
- Silty Clay
- Partially Weathered Rock
- Mine Spoil

WATER LEVELS

(Shown in Water Level Column)

- ▽ = Water Level At Termination of Boring
- ▼ = Water Level Taken After 24 Hours
- ◄ = Loss of Drilling Water
- HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)

- ■ Shelby Tube
- ⊠ Split Spoon
- I Rock Core
- □ No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.

S&ME

ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

AUGER REFUSAL MATERIALS

Auger refusal is a term that describes subsurface materials sufficiently competent to prevent further penetration by our $5^{5}/_{8}$-inch O. D. hollow-stem augers. Our criteria for auger refusal is the inability of our 125-horsepower drill rig to advance the augers while operating in second gear. Typically, refusal materials exhibit penetration resistances in excess of 100 blows per foot. Refusal materials can be hard cemented soil, soft weathered rock, coarse gravel or boulders, rubble or other hard debris, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

UNDISTURBED SAMPLING, ASTM D-1587

Split-tube samples obtained in conjunction with penetration testing are suitable for visual examination and classification tests but are not sufficiently intact for quantitative testing. Relatively undisturbed samples suitable for quantitative laboratory testing were obtained by slowly and uniformly pushing sections of 3-inch, O.D., 16 gauge, steel tubing into the soil at the desire sampling levels. The length of the soil sample was measured and recorded immediately after removing a sampling tube and the encased soil from the ground. The ends of the tube were then sealed with wax, plastic caps, and tape transported to our laboratory in protective containers. The locations of the undisturbed samples are shown on the Test Boring Records.

GRAIN SIZE TEST
ASTM D-422, EM 1110-2-1906, APPENDIX V

The grain size distribution of soil particles in a specimen is an indicator of physical properties among which are permeability, compaction characteristics, consolidation, shrinkage and swell parameters, and liquefaction characteristics. The soil specimen is prepared and tested to determine the percentages of particles of various sizes. The cumulative percentages by weight for each size are depicted on a graph showing the distribution of gradations. The distribution of particles larger than 75 microns (retained on No. 200 sieve) is determined by sieving, while the smaller particle sizes are measured by a sedimentation process, using a hydrometer to secure the necessary data.

The soil specimen is prepared by either drying or using a wet method. The wet method is used when the soil specimen is a clay or silt with properties that change if the sample is prepared dry.

After preparation, the coarse material (material retained on the No. 200 sieve) is dried and then passed through a series of nested sieves. The portion retained on each sieve is weighed, and the percent by weight retained on each sieve is computed and plotted on Grain Size Distribution Sheets.

The fine grained soil distribution (silt and clay size particles) is determined with a hydrometer. The prepared soil specimen is placed in suspension using distilled water and a dispersing agent. The density of the solution is measured with the hydrometer at selected time intervals, and the particle sizes and weights are computed using Stoke's law. These values give a curve or distribution for various particle sizes of microscopic silt and clay size particles. If the distribution of silt and clay size particles has been determined for a selected soil sample, the data are presented on the Grain Size Distribution Sheet as an extension of the grain size distribution curve for the coarse soil fraction.

MOISTURE CONTENT DETERMINATION
ASTM D-2216, EM 1110-2-1906, APPENDIX I

The moisture content of soils is an indicator of various physical properties, including strength and compressibility. Selected samples obtained during exploratory drilling were taken from their sealed containers. Each sample was weighed and then placed in an oven heated to $110^{o}C \pm 5^{\circ}$. The sample remained in the oven until the free moisture had evaporated. The dried sample was removed from the oven, allowed to cool, and re-weighed. The moisture content was computed by dividing the weight of evaporated water by the weight of the dry sample. The results, expressed as a percent, are shown on the attached Soil Data Summary Sheet.

ATTERBERG LIMITS DETERMINATION
ASTM D-4318, EM 1110-2-1906, APPENDIX III

Representative samples were subjected to Atterberg limits testing to determine the soil's plasticity characteristics. The plasticity index (PI) is the range of moisture content through which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes wet enough to flow as a viscous fluid. To determine the liquid limit, a soil specimen is first washed through a No. 40 sieve. The materials finer than the No. 40 sieve are retained and dried until the soil is in a viscous fluid state. A portion of this soil is then placed in a brass cup of standardized dimensions. A groove is cut through the middle of the soil specimen with a grooving tool of standard dimensions. The cup is attached to a cam that lifts the cup 10 mm, and then allows the cup to fall onto a hard rubber base. The cam is rotated at about 2 cps until the two halves of the soil specimen come in contact at the bottom of the groove for a distance of $^1/_2$ inch. The number of blows required to achieve this $^1/_2$ inch contact is recorded, and part of the specimen is subjected to a moisture content determination. The remainder of the specimen is allowed to air dry for a short time, and the grooving process and cam action repeated. This testing sequence is repeated until more than 25 blows is required to achieve the required groove contact. After the number of blows vs. moisture content for the various test points are plotted on arithmetic graph paper, the moisture content corresponding to 25 blows is designated the liquid limit.

The plastic limit (PL) is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into threads $^1/_8$" in diameter. The plastic limit is determined by taking a pat of soil remaining from the liquid limit test, and repeatedly rolling, kneading, and air drying it until the soil breaks into threads about $^1/_8$ inches in diameter and $^3/_8$ inches long. The moisture content of these soil threads is then determined, and is designated the plastic limit. The results of the liquid and plastic limits tests are tabulated on the attached Soil Data Summary Sheet.

CONSOLIDATION TEST
ASTM D-2435, EM 1110-2-1906, APPENDIX VIII

The consolidation test provides data for calculating amount and time rate of settlement of a soil subjected to structural loads. Undisturbed sample tubes were cut and a representative section of each undisturbed sample was selected for consolidation testing in our fixed-ring consolidometers. The enclosed soil was extruded from each sampler section and trimmed into a soil disc 2.5 inches in diameter and 1 inch thick. The soil discs were confined in stainless steel rings, and sandwiched between porous stones in a consolidometer. Each was initially subjected to incrementally increasing vertical load to its overburden pressure. After a sample was unloaded to 0.1 ksf, it was again subjected to incrementally increasing vertical loads. The resulting deformations were measured with a dial gauge accurate to 0.0001 inch. If a soil sample had been obtained from beneath the water table, the sample and ring were inundated with water prior to loading. If a soil sample had been obtained above the water table, the sample was maintained at its natural moisture content throughout the test. The test results are presented as pressure versus percent consolidation curves on Consolidation Test Sheets.

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Scope of Geotechnical Services

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project. Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer’s understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.