Preliminary Geotechnical Engineering Report

Park 53

Barrow County, Georgia

July 10, 2015

Terracon Project No. 49155065

Prepared For:

Winder Barrow Industrial Authority

Winder, Georgia

Prepared By:

Terracon Consultants, Inc.

Atlanta, Georgia

July 10, 2015

Terracon

Winder Barrow Industrial Authority
233 East Broad Street
Winder, Georgia 30680

Attn: Mr. Guy Herring

Re: Preliminary Geotechnical Engineering Report
Park 53
Barrow Country, Georgia
Terracon Project No. 49155065

Dear Mr. Herring:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with our proposal number P49150032A dated July 9, 2015.

This report presents the results of the subsurface exploration and provides preliminary geotechnical recommendations for the proposed Park 53 development in Winder, Barrow County, Georgia.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Julie A. Cummings, E.I.T.
Staff Geotechnical Engineer

John D. Lawrence, P.E.
Principal, Geotechnical Manager

GEORGIA REGISTERED No 17098 PROFESSIONAL ENGINEER JOHN DAVIES LAWRENCE 7/10/15

Mathew Donald
Office Manager

Copies to: Addressee (1 via e-mail)

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EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the proposed Park 53 development to be constructed on both sides of Highway 316 in Winder, Barrow County, Georgia. Terracon's geotechnical engineering scope of work for this project included the advancement of 30 soil test borings to a depth of 20 feet below existing site grades.

Based on the information obtained from our subsurface exploration, the following geotechnical considerations were identified:

- Based on site reconnaissance and historical aerial photos, the site has been wooded for an extended period of time.
- In general the site is characterized by residual soils consisting of sandy silts and silty sands.
- Partially Weathered Rock (PWR) was encountered in 4 of the 30 borings. The top of the PWR was encountered at depths between 6 and 18 ½ feet. Difficult excavation due to removal of PWR during site grading, foundation construction, and utility installation may be encountered at the site.
- On-site native soils typically appear suitable for use as general engineered fill; however, further testing should be performed during construction to assess specific conditions at that time. Drying should be anticipated for some of the existing near surface soils prior to use as engineering fill depending on the time of year and recent rain events.
- Mechanically Stabalized Earth (MSE) Walls typically require soils with less than 35 percent fines. Based on the laboratory testing several grain size tests did not comply with this design parameter.
- The proposed buildings may be supported on shallow spread footings bearing on residual soils, PWR and engineered fill extending to these native materials. Foundations supported on PWR will experience negligible settlement while those on soil or new fill will have some settlement; therefore, additional exploration will be needed to address potential differential settlements once additional design information is available.
- We anticipate the sandy soils encountered will provide a reasonable pavement subgrade.

Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
PARK 53
BARROW COUNTY, GEORGIA

Terracon Project No. 49155065
July 10, 2015

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed Park 53 to be located in Winder, Barrow County, Georgia. Our geotechnical engineering scope of work for this project included the advancement of 30 soil test borings to a depth of 20 feet below existing site grades. Boring Logs along with a Site Location Plan and Boring Location Plan are included in Appendix A of this report.

The purpose of these services is to provide preliminary information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- infrastructure construction
- earthwork considerations
- lateral earth pressures
- foundation design and construction
- seismic considerations

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	Refer to the Site Location Plan and Boring Location Plan (Exhibits A-1 and A-2 in Appendix A)
Structures	The land is anticipated to be developed as warehouse/storage and office buildings with access drives.
Building construction,	Unknown at this stage
Finished floor elevation	Unknown
Maximum loads, assumed for purpose of this report	Columns: 150 kips Walls: 3 klf Slabs: 150 psf max
Grading	Cuts and fills are anticipated to be up to 25 to 30 feet.
Cut and Fill Slopes	Assumed to be no steeper than 2H-1V and less than 20 feet (Horizontal to Vertical)

2.2 Site Location and Description

Item	Description
Location	The site is located at the intersection of Georgia Highway 316 and Hog Mountain Road in Winder, Barrow County, Georgia. The site is on both the north and south side of 316.
Current ground cover	The site is mostly wooded.
Existing topography	Steep hillsides, divided by small creeks.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The project site is located in the Piedmont Physiographic Province of Georgia which is characterized by medium to high grade metamorphic rocks and scattered igneous intrusions. The term metamorphic describes rocks that have been subjected to high temperatures and/or pressures, usually deep within the earth's crust. These high temperatures and pressures cause the textural and mineralogical characteristics of the original rock to be altered and can also cause certain rock types to fully melt, becoming what is known as magma. Magma is less dense than the surrounding solidified rock and tends to move upward through fractures and joints, displacing the surrounding rock. This rock type is known as an igneous intrusion.

Metamorphic rocks are predominant in this region but, due to erosion and uplift, both of these rocks will eventually become exposed at the land surface.

The subsurface bedrock in this region has undergone differing rates of weathering, which often produces a considerable variation in depth to competent rock over short horizontal distances. It is also not unusual for lenses and boulders of hard rock and zones of partially weathered rock to be present within the soil mantle above the general bedrock level. The typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands, which often consist of saprolites (native soils which maintain the original fabric of the parent rock). Generally the soil becomes harder with depth to the top of parent crystalline rock or “massive bedrock” which occurs at depth.

The boundary between soil and rock is typically not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with a standard penetration resistance exceeding 100 blows per foot (bpf).

3.2 Typical Subsurface Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Stratum 1	1 to 3 inches	Topsoil	-----
Stratum 2	18 ½ to 20 feet	Residuum Silty SAND Sandy SILT	Loose to Medium Dense Soft to Very Stiff
Stratum 3	First Encountered 6 to 18 ½ feet	Partially Weathered Rock	---

Moisture- Density Relationships (standard Proctors) and grain size tests were performed on selected auger cutting bulk samples, with the following results:

Sample Location, Depth	Maximum Dry Density	Optimum Water Content	Percent Fines
B-6, 5’-10’	104.3 PCF	19.6 %	52.8%
B-9, 5’-10’	117.6 PCF	12.0 %	34.6 %
B-27, 5’-10’	105.8 PCF	18.0 %	47.9%

Atterberg limits (plasticity) testing on selected sample indicated the soils to be classified Sandy SILT (ML) and Silty SAND (SM) according to the United Classification System (USCS), with the following measured liquid limits, plastic limits and plasticity indices:

Sample Location, Depth	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
B-6, 5'-10'	NP	NP	NP
B-9, 5'-10'	NP	NP	NP
B-27, 5'-10'	NP	NP	NP

Four additional laboratory grain size tests were conducted on selected soil samples and the test results are presented in Appendix B and on the individual boring logs. The percent fines for these tests ranged from about 28 to 63 percent Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report.

3.3 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was not observed in the borings while drilling, or for the short duration that the borings were allowed to remain open. However, this does not necessarily mean the borings terminated above groundwater. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 PRELIMINARY RECOMMENDATIONS

4.1 Geotechnical Considerations

The purpose of this study was not to provide specific foundation design recommendations for structures constructed in the industrial park but to assess general conditions. We expect typical industrial/warehouse structures to be able to use conventional shallow foundations such as spread footings, strip footings, and/or a turndown slab bearing on the existing residual soils or structural fill placed according to the standards outlined in the text of this report.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of data presented herein, engineering analyses, and our current understanding of the proposed project.

4.2 Earthwork

The actual construction means and methods are the responsibility of the contractor (s). The following construction related items pertain to general site preparation for the foundation and roadway support and are not intended to address all possible construction related concerns.

4.2.1 Site Preparation

We anticipate construction will be initiated by stripping vegetation, and loose, soft or otherwise unsuitable material. Stripped materials consisting of vegetation and organic materials should be wasted off site, or used to vegetate landscaped areas or exposed slopes after completion of grading operations.

After stripping, proofrolling should be performed with heavy rubber tire construction equipment such as a loaded scraper or fully loaded tandem-axle dump truck. A geotechnical engineer or his representative should observe proofrolling to aid in locating unstable subgrade materials. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade and to reduce the amount of undercutting / remedial work required. Unstable materials located should be stabilized as directed by the engineer based on conditions observed during construction. Undercut and replacement and densification in place are typical remediation methods.

4.2.2 Excavation

Although difficult to excavate materials were not encountered in many locations during our exploration, they may be encountered during deeper cuts and in other areas of the site. Very dense soil and PWR typically require loosening by ripping with large dozers pulling single tooth rippers in mass excavation or possibly blasting in confined (trench) excavation. Ripped PWR fragments can be re-used and mixed into engineered fill provided that it is pulverized to less than four inches in diameter and mixed with soil to create a well graded fill material. Typically large compaction equipment such as a Caterpillar 815 is required to properly compact and break down PWR, if possible.

It should be noted that boulders and/or discontinuous rock lenses may be encountered during grading. Boulders will likely need to be reduced in size prior to placement or hauled off site. This could result in a reduction of the excavated material available for use as engineered fill material. Some additional effort may be necessary to extract boulder sized materials, particularly in deep narrow excavations such as utility trenches.

Excavation techniques will vary based on the degree of weathering of the materials, fracturing and jointing in the rock, and the overall stratigraphy of the feature. Actual field conditions usually display a gradual weathering progression with poorly defined and uneven boundaries between layers of different materials. Rock levels in the Piedmont physiographic province can vary considerably in short horizontal distances and may be at higher or lower elevation between our boring locations.

Excavation of auger refusal material (apparent rock) typically requires blasting. We recommend a rock excavation definition be included in the grading contract for clarity. Rock excavation can be defined in many ways. A method specification based on the grading equipment commonly used in the project area is typical. The following is a guideline rock excavation specification for your review.

In Mass Excavation:	Any material occupying an original volume of more than 1 cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rating of not less than 56,000 pounds usable pull (Caterpillar D-8K or larger) or the excavator listed below.
In Trench Excavation:	Any material occupying an original volume of more than 1/2 cubic yard which cannot be excavated with a track excavator having a bucket curling rate of not less than 25,700 pounds, using a rock bucket and rock teeth (Caterpillar 225 or larger).

4.2.3 Materials Types

Based upon information during our exploration, the majority of the on-site soils and PWR material encountered within the limits of this exploration appear suitable for the use as structural fill. Engineered fill should consist of approved materials, free of organic material, debris and particles larger than about 4 inches. The maximum particle size criteria may be relaxed by the geotechnical engineer of record depending on construction techniques, material gradation, allowable lift thickness and observations during fill placement. Soils for use as engineered fill material should conform to the following specifications:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Fine Grain Soils	CL and ML (LL<45; PI<25)	All locations and elevations
Granular Soils	SP, SM, SC, SW	All locations and elevations

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.

4.2.4 Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

Material Type and Location[1, 2]	Per the Standard Proctor Test (ASTM D 698)		
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction[3]	
		Minimum	Maximum
Acceptable soil or approved imported fill soils:			
Beneath foundations and slabs:	95	-2%	+3%
Beneath pavements:	95	-2%	+3%
12 inches directly below pavements:	98	-2%	+3%
	Per the Modified Proctor Test (ASTM D 1557)		
Aggregate base (beneath slabs)	95	-3%	+3%
Aggregate base (beneath pavements)	98	-3%	+3%

1. Engineered fill materials should be placed in horizontal, loose lifts not exceeding 9 inches in thickness and should be thoroughly compacted. Where light compaction equipment is used, as is customary within a few feet of retaining walls and in utility trenches, the lift thickness may need to be reduced to achieve the desired degree of compaction. Soils removed which will be used as engineered fill should be protected to aid in preventing an increase in moisture content due to rain.
2. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
3. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without pumping when proofrolled.

4.2.5 Grading and Drainage

Adequate positive drainage should be provided during construction and maintained throughout the life of the development to prevent an increase in moisture content of the foundation, pavement and backfill materials. Surface water drainage should be controlled to prevent undermining of fill slopes and structures during and after construction. Vehicular traffic should be avoided or minimized on exposed surface. Based on the nature of the site and the soil types encountered, soil erosion measures will be a critical aspect of the construction design.

Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended.

It is recommended that all exposed earth slopes be seeded to provide protection against erosion as soon as possible after completion. Seeded slopes should be protected until the vegetation is established.

4.2.6 Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction and observed by Terracon.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building and pavement areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils.

Groundwater was not encountered in the borings during our exploration as presented herein. If groundwater is encountered during construction, some form of temporary or permanent dewatering may be required. Conventional dewatering methods, such as pumping from sumps, should likely be adequate for temporary removal of any shallow/ perched groundwater.

All excavations should be sloped or braced as required by OSHA regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current Occupational Health and Safety Administration (OSHA) Excavation and Trench Safety Standards.

Construction site safety is the sole responsibility of the contractor who controls the means, methods and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied or inferred.

4.3 Slopes

Our investigation did not include a detailed analysis of slope stability for any temporary or permanent condition. However, in the Piedmont Physiographic Province region up to 15 to 20-foot tall slopes are regularly built at inclinations of 2(H):1(V) and perform satisfactory if properly constructed. Shallow sloughing at the surface can occur when slopes are not properly constructed and/or exposed to inclement weather prior to placement of vegetative cover. Therefore, we recommend that fill slopes be over filled and cut back to develop an adequately compacted slope face rather than tracking in the slope face for compaction. In addition, for erosion protection, a protective vegetative cover should be established on permanent slopes as soon as possible

4.4 Preliminary Foundation Recommendation

In our opinion, typical light to medium duty industrial structures may be supported by shallow foundation systems such as spread footings, strip footings and/or a turndown slab bearing on the existing residual soils or PWR, or upon structural fill directly underlain by residual material.

Depending on the location and fill thickness below the foundations, net allowable soil bearing pressures in the range of 2,500 psf up to 5,000 psf may be available, with the higher end of this range restricted to direct bearing on PWR. Anticipated settlement will be highly dependent on the planned construction and grading.

4.5 Preliminary Floor Slab Design Recommendations

4.5.1 Floor Slab Design Recommendations

DESCRIPTION	VALUE
Floor slab support	Minimum 12 inches of approved on-site or imported soils placed and compacted in accordance with Earthwork section of this report.
Aggregate base course/capillary break	4-inch compacted layer of free draining, granular subbase material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. Narrower, turned-down slab-on-grade foundations may be utilized at the approval of the structural engineer. The slabs should be appropriately reinforced to support the proposed loads.
2. We recommend subgrades be maintained at the proper moisture condition until floor slabs and pavements are constructed. If the subgrade should become desiccated prior to construction of floor slabs and pavements, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
3. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 4 inches thick.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder or barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

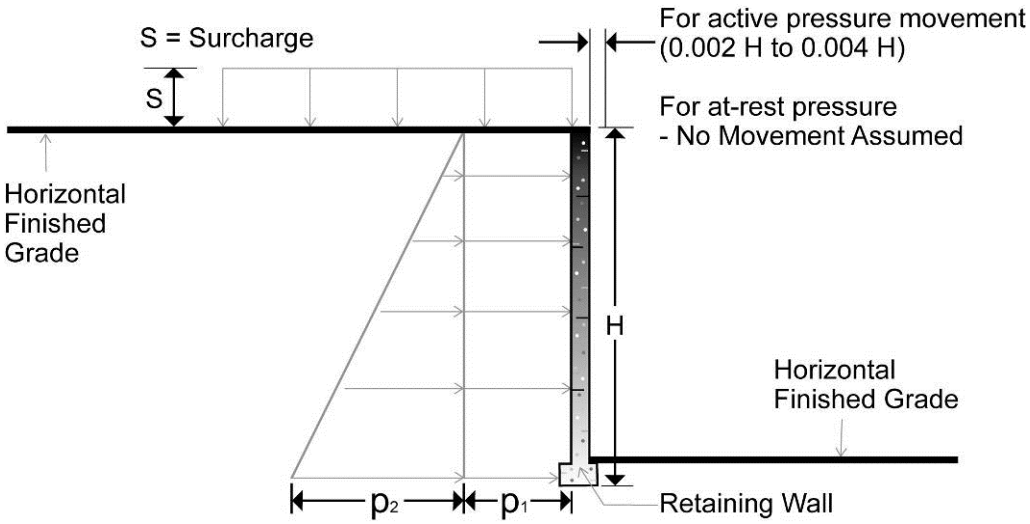
4.6 Preliminary Lateral Earth Pressures

4.6.1 Lateral Earth Pressure Design Recommendations

The lateral earth pressure recommendations herein are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls. Recommendations covering these types of wall systems are beyond the scope of services

for this assignment. However, we would be pleased to develop recommendations for the design of such wall systems upon request.

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free standing cantilever retaining walls and assumes wall movement. The "at rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

Earth Pressure Conditions	Coefficient For Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Granular - 0.29	35	(0.29)S	(35)H
	Sandy silt/Silty Sand - 0.36	45	(0.36)S	(45)H
At-Rest (Ko)	Granular - 0.46	55	(0.46)S	(55)H
	Sandy silt/Silty Sand - 0.53	65	(0.53)S	(65)H
Passive (Kp)	Granular - 3.4	400	---	---
	Sandy silt/Silty Sand – 2.8	330	---	---

Applicable conditions to the above include:

- PROVIDED FOR ESTIMATING PURPOSES ONLY
- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.35 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To aid in reducing the potential for hydrostatic pressure behind walls, we recommend a perimeter drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If adequate drainage is not possible, then combined hydrostatic and lateral earth pressures should be calculated for granular backfill using an equivalent fluid weighing 80 and 90 pcf for active and at-rest conditions, respectively. For silty backfill, an equivalent fluid weighing 85 and 95 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

Damproofing of the walls below the ground surface is also recommended to aid in preventing seepage of water into the structure during situations of heavy rains and or temporary high water table conditions above the bedrock surface that may not drain immediately.

4.7 Seismic Considerations

The 2012 International Building *Code (IBC) requires a site* profile determination extending to a depth of 100 feet for seismic site classification.

Depending on soil conditions and final grading, a site class "D" can be used for planning purposes. However, for structures where foundations bearing consistently within 20 to 30 feet of the top of PWR could potentially result in a Site Class "C".

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

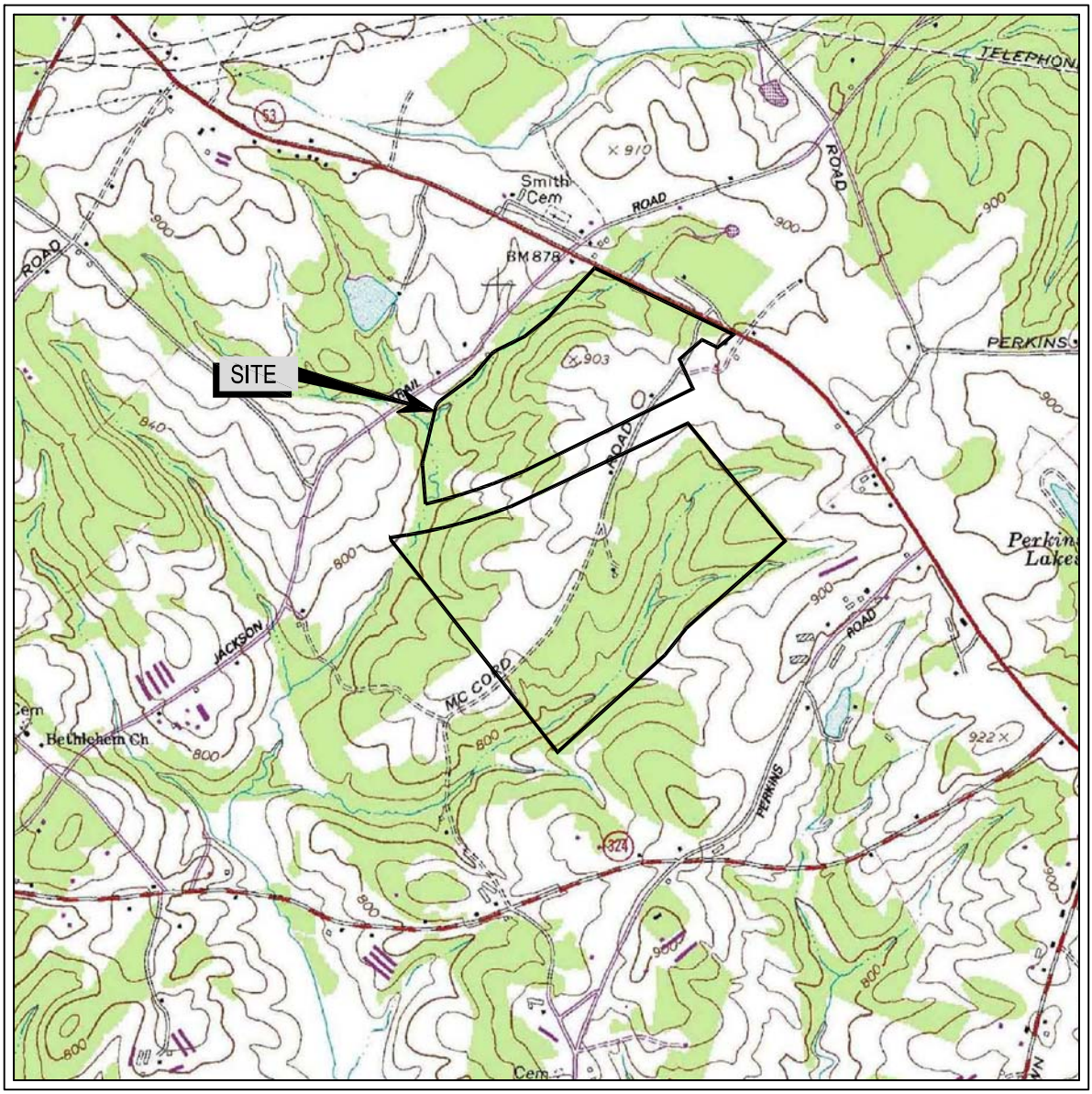
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

UNITED STATES – DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY



SCALE 1:24 000

1 .5 0 KILOMETERS 1 2

1000 0 METERS 1000 2000

1 .5 0 1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000

FEET

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

QUADRANGLE
WINDER SOUTH, GA
1964 PR1985
7.5 MINUTE SERIES (TOPOGRAPHIC)

Project Mngr:	JC
Drawn By:	DWD
Checked By:	JC/MRF
Approved By:	JL

Project No.	49155065
Scale:	AS SHOWN
File No.	GEO49155065-1
Date:	JULY 2015

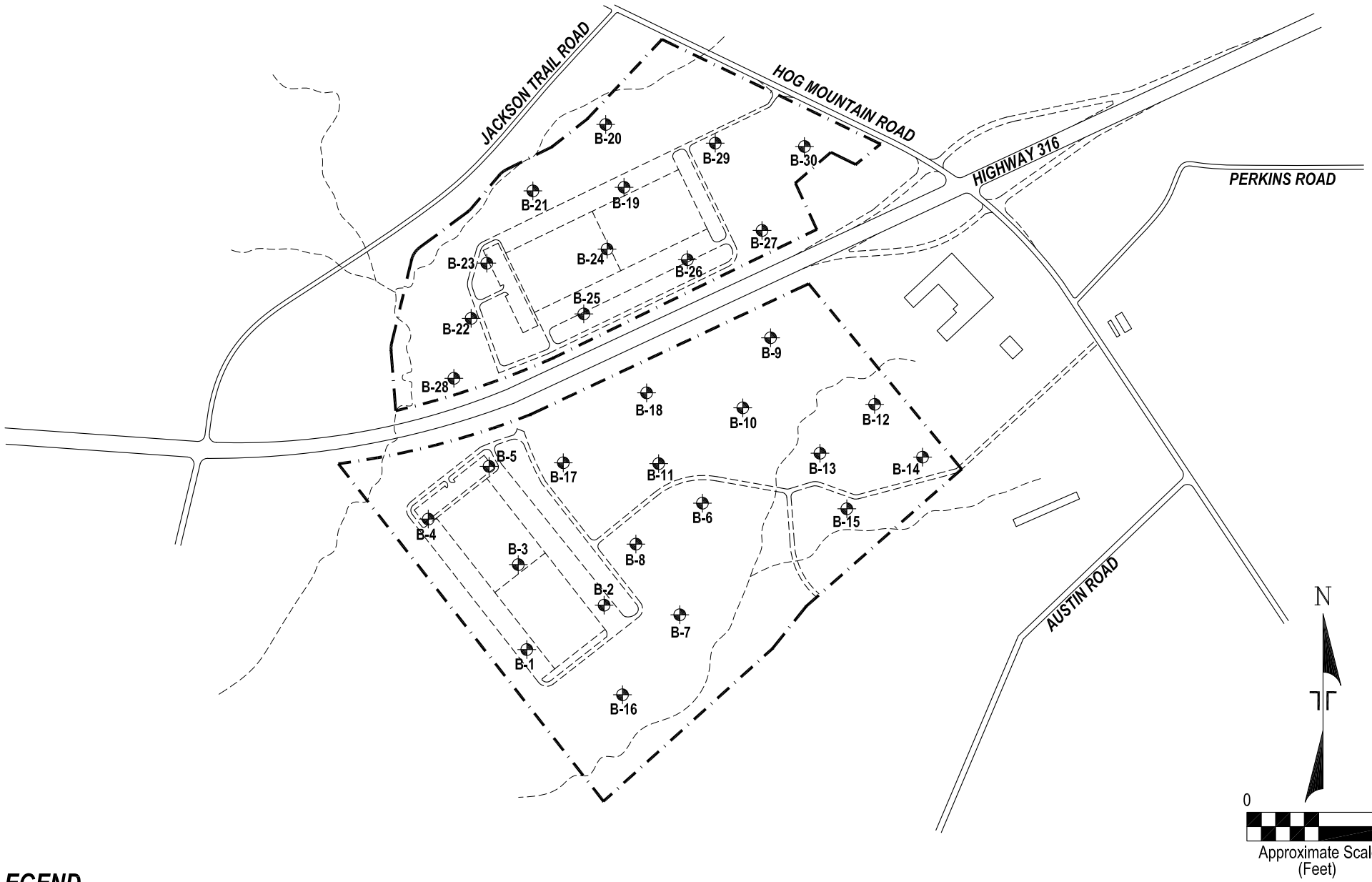
Terracon
Consulting Engineers and Scientists
2855 Premiere Parkway, Suite C Duluth, GA 30097
(770) 623-0755 (770) 623-9628

SITE LOCATION PLAN

GEOTECHNICAL ENGINEERING REPORT
PARK 53 DEVELOPMENT
HIGHWAY 316 AND HOG MOUNTAIN ROAD
WINDER, BARROW COUNTY, GA

EXHIBIT

A-1



LEGEND

SITE

APPROXIMATE BORING LOCATION

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Mngr: JC	Project No. 49155065
Drawn By: DWD	Scale: AS SHOWN
Checked By: JC/MRF	File No. GEO49155065-2
Approved By: JL	Date: JULY 2015

Terracon
Consulting Engineers and Scientists
2855 Premiere Parkway, Suite C Duluth, GA 30097
(770) 623-0755 (770) 623-9628

BORING LOCATION PLAN

GEOTECHNICAL ENGINEERING REPORT
PARK 53 DEVELOPMENT
HIGHWAY 316 AND HOG MOUNTAIN ROAD
WINDER, BARROW COUNTY, GA

EXHIBIT A-2

Field Exploration Description

The boring locations were staked by Terracon personnel. Distances from these locations to the reference features indicated on the attached diagram are approximate and were measured with a hand-held GPS unit. Right angles for the boring location measurements were estimated. Ground surface elevations indicated on the boring logs are approximate rounded to the nearest foot and were obtained by interpolation from plan contours. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with an ATV-mounted rotary drill rig using hollow stem augers to advance the boreholes. Representative soil samples were obtained by the split-barrel sampling procedure. In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). These values are indicted on the borings logs at the depths of occurrence. This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs. The samples were sealed and taken to the laboratory for testing and classification.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

The samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the boring logs are in general accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are given on the boring logs. A brief description of this classification system is attached to this report.

BORING LOG NO. B-1

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), trace mica, red-brown, medium stiff to stiff			X	3-3-4 N=7	
				X	4-4-6 N=10	
		5				
	6.0					
	SILTY SAND (SM), trace mica, red-brown, medium dense			X	4-6-10 N=16	
				X	4-4-6 N=10	
		10				
				X	3-5-5 N=10	
		15				
	- multi-colored					
				X	5-6-5 N=11	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-2

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, medium stiff to stiff				4-5-7 N=12	
					4-6-7 N=13	
		5			4-3-5 N=8	
	- purple, white, pink				3-4-5 N=9	
		10				
	13.5 **SILTY SAND (SM)**, trace mica, fine grained, brown, white, medium dense				3-5-6 N=11	
		15				
	20.0				5-6-9 N=15	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-3

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-6-8 N=14	
				X	4-5-5 N=10	
		5				
				X	4-6-7 N=13	
				X	3-6-5 N=11	
		10				
	- purple-brown, white			X	5-6-7 N=13	
		15				
				X	3-4-5 N=9	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-4

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, medium stiff to stiff				2-3-4 N=7	
					3-3-4 N=7	
		5			10-8-6 N=14	
					5-6-4 N=10	
		10				
	13.5 **SILTY SAND (SM)**, with mica, fine grained, tan, gray, black, medium dense				4-6-13 N=19	
		15				
	18.5 **PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND (SM)**, with mica, fine to coarse grained, gray, black				31-42-50/2" 50/2"	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-5

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, medium stiff to stiff				3-7-8 N=15	
					4-6-6 N=12	
		5				
	- trace mica, purple-brown				3-4-4 N=8	
					3-5-5 N=10	
		10				
					3-3-6 N=9	
		15				
	20.0				4-5-8 N=13	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-6

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SILTY SAND (SM), trace mica, fine grained, red-brown, black, medium dense			X	5-10-8 N=18	
	3.5 **SANDY SILT (ML)**, trace mica, red-brown, medium stiff to stiff			X	4-5-6 N=11	
		5		X	3-4-7 N=11	
				X	3-3-4 N=7	32
		10				
				X	6-5-7 N=12	
		15				
				X	3-5-6 N=11	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-7

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SILTY SAND (SM), fine grained, red-brown, medium dense			X	2-4-8 N=12	
				X	7-13-9 N=22	
		5				
				X	6-7-9 N=16	
	8.5					
	SANDY SILT (ML), red-brown, stiff			X	5-4-5 N=9	
		10				
				X	5-7-7 N=14	
		15				
	20.0			X	4-7-8 N=15	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-8

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-4-5 N=9	
				X	3-4-7 N=11	
		5				
				X	4-6-5 N=11	
				X	3-4-6 N=10	
		10				
	- multi-colored					
				X	4-4-5 N=9	
		15				
				X	4-4-5 N=9	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-9

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SILTY SAND (SM), with mica, fine grained, tan, loose to medium dense			X	3-5-4 N=9	11
				X	4-4-6 N=10	16
		5				
				X	1-1-2 N=3	33
	8.5 **SANDY SILT (ML)**, red-brown, soft to medium stiff			X	2-3-4 N=7	41
		10				
				X	1-1-2 N=3	39
		15				
	20.0			X	2-2-5 N=7	46
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-10

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

DEPTH	LOCATION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
0.3	**TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	2-6-7 N=13	
				X	5-5-5 N=10	
		5				
				X	4-8-7 N=15	
				X	4-6-5 N=11	
		10				
	- multi-colored			X	5-6-8 N=14	
		15				
20.0				X	3-4-5 N=9	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-11

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	4-6-7 N=13	
				X	4-4-5 N=9	
		5				
				X	4-5-6 N=11	
	- multi-colored			X	4-4-4 N=8	
		10				
	- purple-brown			X	5-7-7 N=14	
		15				
				X	4-6-9 N=15	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-12

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), trace mica, red-brown, stiff			X	6-6-8 N=14	
				X	2-5-5 N=10	
		5				
				X	4-4-7 N=11	
	8.5 **SILTY SAND (SM)**, trace mica, fine grained, brown, gray, medium dense			X	3-9-5 N=14	
		10				
	- multi-colored			X	3-5-7 N=12	
		15				
	20.0			X	3-4-5 N=9	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-13

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SILTY SAND (SM), trace mica, fine grained, red-brown, white, loose to medium dense				4-4-4 N=8	
					4-6-9 N=15	
		5			4-3-5 N=8	
	- gray, brown				3-4-5 N=9	
		10				
					3-4-5 N=9	
		15				
					5-6-7 N=13	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-14

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-4-7 N=11	
				X	5-6-7 N=13	
		5				
	6.0					
	SILTY SAND (SM), trace mica, fine grained, brown, medium dense			X	4-5-5 N=10	
				X	4-6-5 N=11	
		10				
	- with quartz fragments, purple-brown			X	9-5-6 N=11	
		15				
				X	5-6-10 N=16	
	20.0					
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-15

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 inches					
	RESIDUUM - SILTY SAND (SM), with mica, fine grained, brown, medium dense			X	3-8-7 N=15	
				X	4-5-7 N=12	
		5				
	6.0					
	SANDY SILT (ML), red-brown, medium stiff			X	4-3-5 N=8	
	8.5					
	SILTY SAND (SM), with mica and quartz fragments, fine grained, purple-brown, medium dense			X	3-9-10 N=19	
		10				
				X	7-5-11 N=16	
		15				
				X	5-9-11 N=20	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-16

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	4-7-7 N=14	
				X	2-3-3 N=6	
		5				
	- purple-brown			X	4-4-5 N=9	
				X	3-4-4 N=8	
		10				
				X	5-7-6 N=13	
		15				
				X	3-4-5 N=9	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/1/2015 | Boring Completed: 7/1/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-17

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-4-6 N=10	
				X	4-4-5 N=9	
		5				
				X	4-4-6 N=10	
				X	8-7-7 N=14	
		10				
	- multi-colored			X	4-5-7 N=12	
		15				
	18.5 **SILTY SAND (SM)**, with mica, fine grained, purple-brown, medium dense			X	4-5-6 N=11	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-18

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.1 **TOPSOIL**, 1.5 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff to very stiff			X	5-9-11 N=20	
				X	5-7-14 N=21	
		5				
				X	4-5-5 N=10	
				X	4-6-7 N=13	
		10				
	- with mica			X	3-3-6 N=9	
		15				
				X	5-8-7 N=15	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 6/30/2015 | Boring Completed: 6/30/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-19

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	8-9-10 N=19	
				X	4-5-6 N=11	
		5				
				X	4-4-6 N=10	
				X	4-5-4 N=9	
		10				
	13.5 **SILTY SAND (SM)**, with mica, fine grained, brown, gray, medium dense			X	5-6-5 N=11	
		15				
	- gray, very dense			X	31-15-40 N=55	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/2/2015 | Boring Completed: 7/2/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-20

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-4-5 N=9	
				X	4-6-5 N=11	
	6.0	5				
	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND (SM), with mica, fine grained, gray			X	6-7-15 N=22	
	8.5					
	SILTY SAND (SM), with mica, fine grained, gray, white, dense			X	50/1"	
		10				
				X	7-15-20 N=35	
		15				
				X	10-15-17 N=32	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/2/2015 | Boring Completed: 7/2/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-21

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 4 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-3-6 N=9	
				X	6-8-8 N=16	
		5				
				X	5-6-7 N=13	
	8.5					
	SILTY SAND (SM), with mica, fine grained, purple-brown, white, medium dense			X	4-5-6 N=11	
		10				
	- with quartz fragments			X	5-7-7 N=14	
		15				
	18.0					
	PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND (SM), with mica and quartz fragments, fine to coarse grained, multi-colored			X	35-50/5' 50/5"	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/2/2015 | Boring Completed: 7/2/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-22

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	RESIDUUM - SILTY SAND (SM), trace clay and mica, fine grained, white, loose to medium dense				5-6-6 N=12	
		5			3-3-4 N=7	15
	6.0					
	RESIDUUM - SANDY SILT (ML), red-brown, medium stiff to stiff				1-1-3 N=4	
					1-2-3 N=5	
		10				
					3-5-5 N=10	
		15				
	- purple-brown					
	20.0				4-5-5 N=10	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/6/2015

Boring Completed: 7/6/2015

Drill Rig: D50

Driller: Mark

Project No.: 49155065

BORING LOG NO. B-23

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**, 3 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	2-5-7 N=12	
				X	4-6-9 N=15	
	6.0	5				
	SILTY SAND (SM), with mica, fine grained, tan, medium dense			X	4-14-11 N=25	
				X	6-5-6 N=11	
		10				
				X	20-12-16 N=28	
		15				
	20.0			X	8-6-4 N=10	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/2/2015 | Boring Completed: 7/2/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-24

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff to very stiff				3-3-6 N=9	
					6-8-8 N=16	
		5			5-6-7 N=13	
	8.5 **SILTY SAND (SM)**, with mica, fine grained, brown, gray, white, medium dense				6-8-10 N=18	
		10				
					5-11-12 N=23	
		15				
	18.5 **PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND (SM)**, with mica, fine to coarse grained, gray, white				50/1"	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/3/2015 | Boring Completed: 7/3/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-25

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SILTY SAND (SM), with mica, fine grained, red-brown, medium dense			X	8-7-8 N=15	
				X	6-6-7 N=13	
		5				
				X	4-6-5 N=11	
	- brown, black			X	5-9-11 N=20	
		10				
				X	5-12-11 N=23	
		15				
	- gray, white			X	10-11-15 N=26	
	20.0 ***Boring Terminated at 20 Feet***	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/3/2015 | Boring Completed: 7/3/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-26

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	3-3-6 N=9	
				X	5-5-7 N=12	
	6.0	5				
	SILTY SAND (SM), with mica, fine grained, tan, black, medium dense			X	3-4-6 N=10	
				X	4-5-5 N=10	
	13.5	10				
	SANDY SILT (ML), with mica, purple-brown, stiff			X	4-4-5 N=9	
		15				
				X	4-7-7 N=14	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/3/2015 | Boring Completed: 7/3/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-27

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SILTY SAND (SM), with mica, fine grained, red-brown, loose to medium dense			X	3-5-6 N=11	21
				X	3-4-4 N=8	22
		5				
				X	7-8-8 N=16	29
				X	6-7-5 N=12	30
		10				
	- purple, brown			X	8-8-7 N=15	34
		15				
				X	3-5-6 N=11	38
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/2/2015 | Boring Completed: 7/2/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-28

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	RESIDUUM - SANDY SILT (ML), tan, gray, medium stiff				1-2-3 N=5	
					3-4-4 N=8	
	6.0	5				
	SILTY SAND (SM), with mica, fine grained, red-brown, white, loose to medium dense				4-3-4 N=7	
					1-2-3 N=5	
		10				
					4-4-5 N=9	
		15				
	20.0				3-6-7 N=13	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/6/2015 | Boring Completed: 7/6/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-29

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	0.2 **TOPSOIL**, 2 Inches					
	RESIDUUM - SANDY SILT (ML), red-brown, stiff			X	4-5-8 N=13	
				X	4-6-5 N=11	
		5				
	6.0					
	SILTY SAND (SM), trace mica, fine grained, brown, medium dense			X	5-12-14 N=26	
				X	5-9-11 N=20	
		10				
				X	5-12-11 N=23	
		15				
	- gray, white, black					
				X	8-9-14 N=23	
	20.0	20				
	Boring Terminated at 20 Feet					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/6/2015 | Boring Completed: 7/6/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

BORING LOG NO. B-30

PROJECT: Park 53 - Barrow County

CLIENT: Winder Barrow Industrial Authority

SITE: University Parkway at Highway 53
Winder, Georgia

GRAPHIC LOG	LOCATION / DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)
	RESIDUUM - SANDY SILT (ML), multi-colored, medium stiff				4-4-5 N=9	
	3.5					
	SILTY SAND (SM), trace mica, fine grained, purple-brown, loose to medium dense				5-9-9 N=18	
		5			6-6-7 N=13	
					4-4-5 N=9	
		10				
	- multi-colored				6-7-8 N=15	
		15				
	20.0				4-6-8 N=14	
	Boring Terminated at 20 Feet	20				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Backfilled with soil cuttings

See Exhibit A-3 for description of field procedures

See Appendix B for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

None Encountered While Drilling

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

Boring Started: 7/6/2015 | Boring Completed: 7/6/2015

Drill Rig: D50 | Driller: Mark

Project No.: 49155065

APPENDIX B

LABORATORY TESTING

Laboratory Testing

As part of the testing program, all samples were examined in the laboratory by experienced personnel and classified in accordance with the attached General Notes and the Unified Soil Classification System based on the texture and plasticity of the soils. The group symbol for the Unified Soil Classification System is shown in the appropriate column on the boring logs and a brief description of the classification system is included with this report in the Appendix.

At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

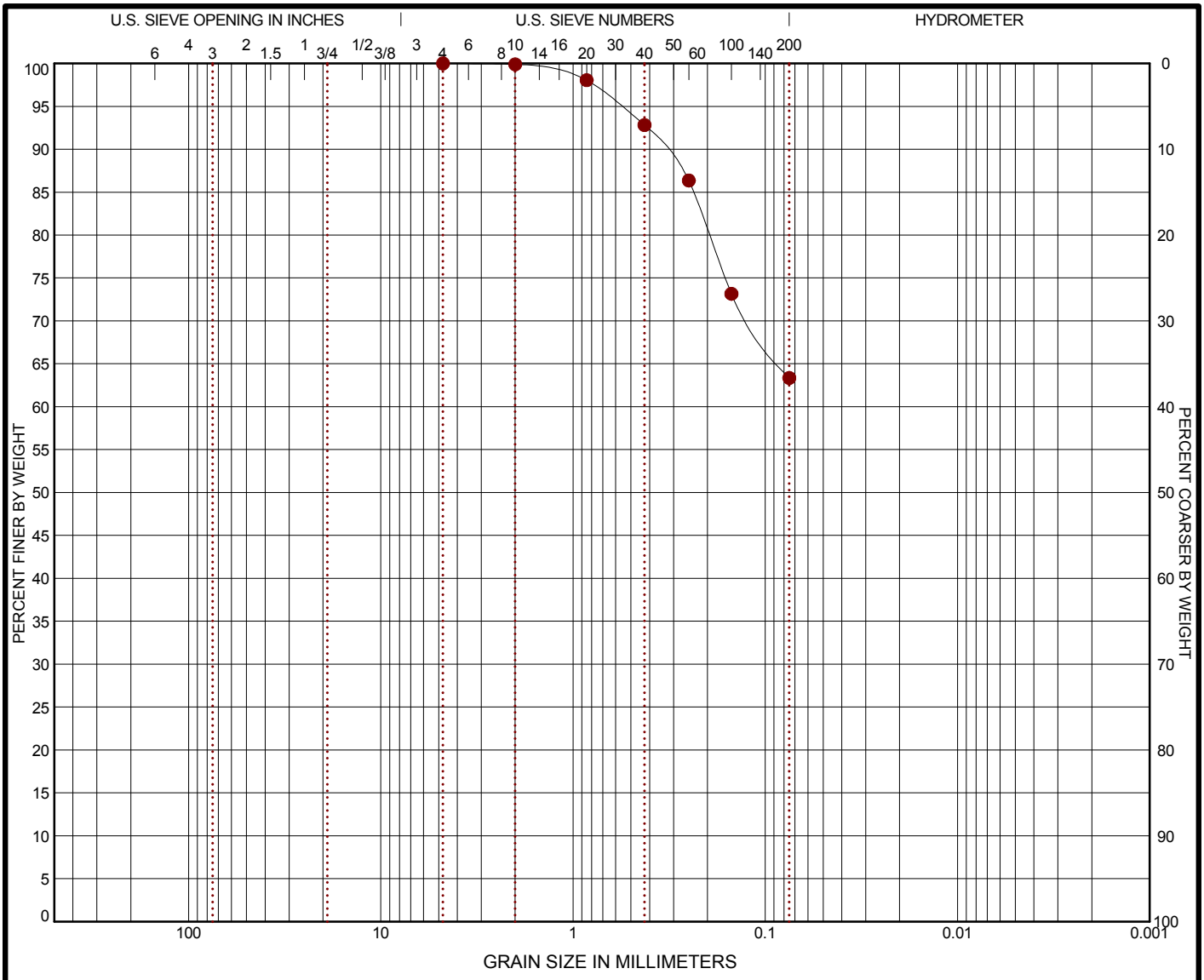
Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Sieve Analysis
- Atterberg Limits
- Standard Proctor
- In-situ Water Content

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B-6**	**8.5 - 10**	**0.0**	**0.0**	**36.6**		**63.4**		**ML**

	GRAIN SIZE
	●
D_{60}	
D_{30}	
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	100.0
#10	99.89
#20	98.05
#40	92.82
#60	86.35
#100	73.15
#200	63.35

SOIL DESCRIPTION

● SANDY SILT, red-brown

REMARKS

●

PROJECT: Park 53 - Barrow County

SITE: University Parkway at Highway 53
Winder, Georgia

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

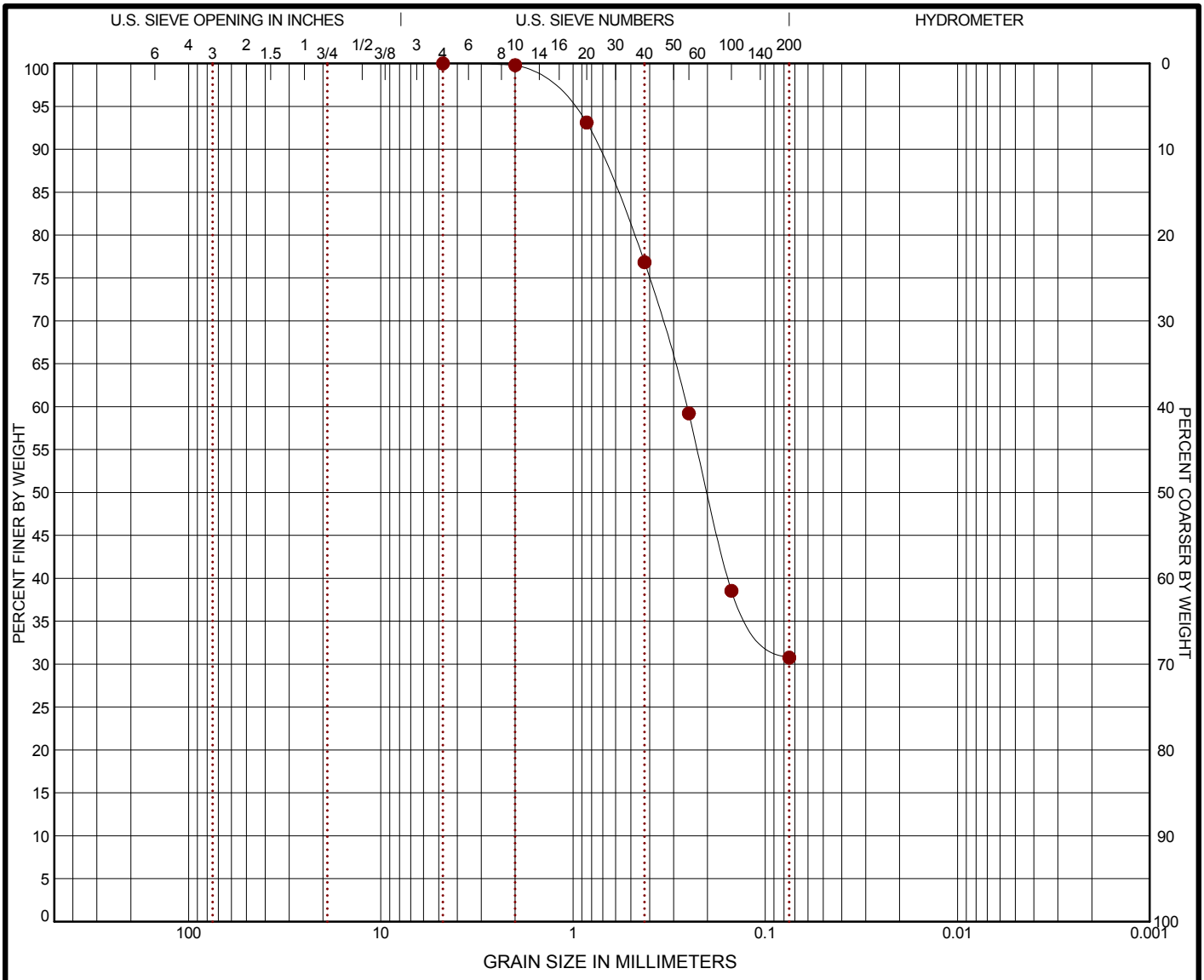
PROJECT NUMBER: 49155065

CLIENT: Winder Barrow Industrial Authority

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 49155065.GPJ TERRACON2012.GDT 10/7/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B-9**	**6 - 7.5**	**0.0**	**0.0**	**69.2**		**30.8**		**SM**

	GRAIN SIZE
	●
D_{60}	**0.256**
D_{30}	
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	**100.0**
#10	**99.8**
#20	**93.11**
#40	**76.83**
#60	**59.23**
#100	**38.55**
#200	**30.76**

SOIL DESCRIPTION

● SILTY SAND, tan

REMARKS

●

PROJECT: Park 53 - Barrow County

SITE: University Parkway at Highway 53
Winder, Georgia

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

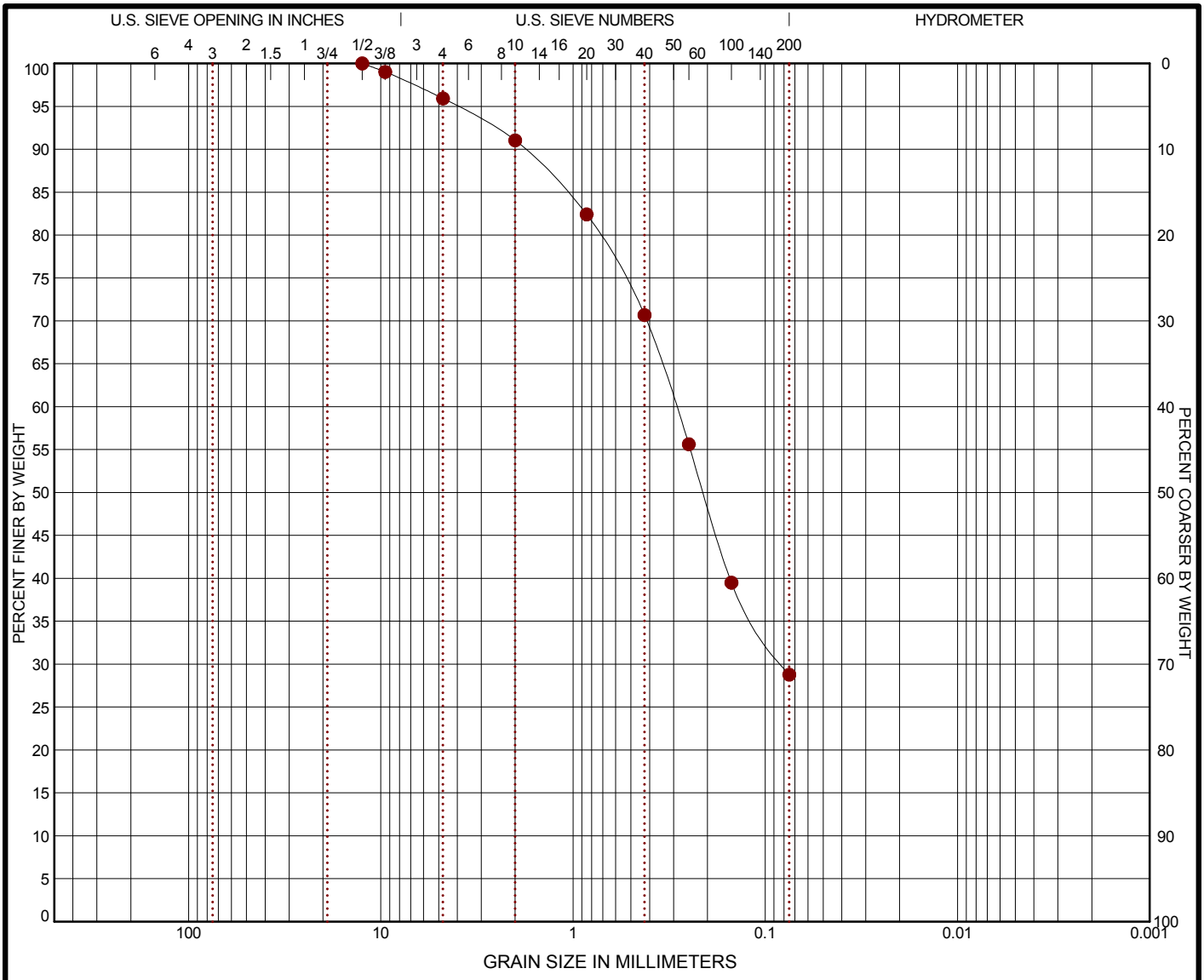
PROJECT NUMBER: 49155065

CLIENT: Winder Barrow Industrial Authority

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 49155065.GPJ TERRACON2012.GDT 10/7/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B-22**	**3.5 - 5**	**0.0**	**4.1**	**67.1**		**28.8**		**SC**

	GRAIN SIZE
	●
D_{60}	**0.292**
D_{30}	**0.081**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	**100.0**
3/8"	**99.01**
#4	**95.91**
#10	**91.03**
#20	**82.41**
#40	**70.68**
#60	**55.62**
#100	**39.5**
#200	**28.78**

SOIL DESCRIPTION

● CLAYEY SAND, trace gravel, white

REMARKS

●

PROJECT: Park 53 - Barrow County

SITE: University Parkway at Highway 53
Winder, Georgia

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

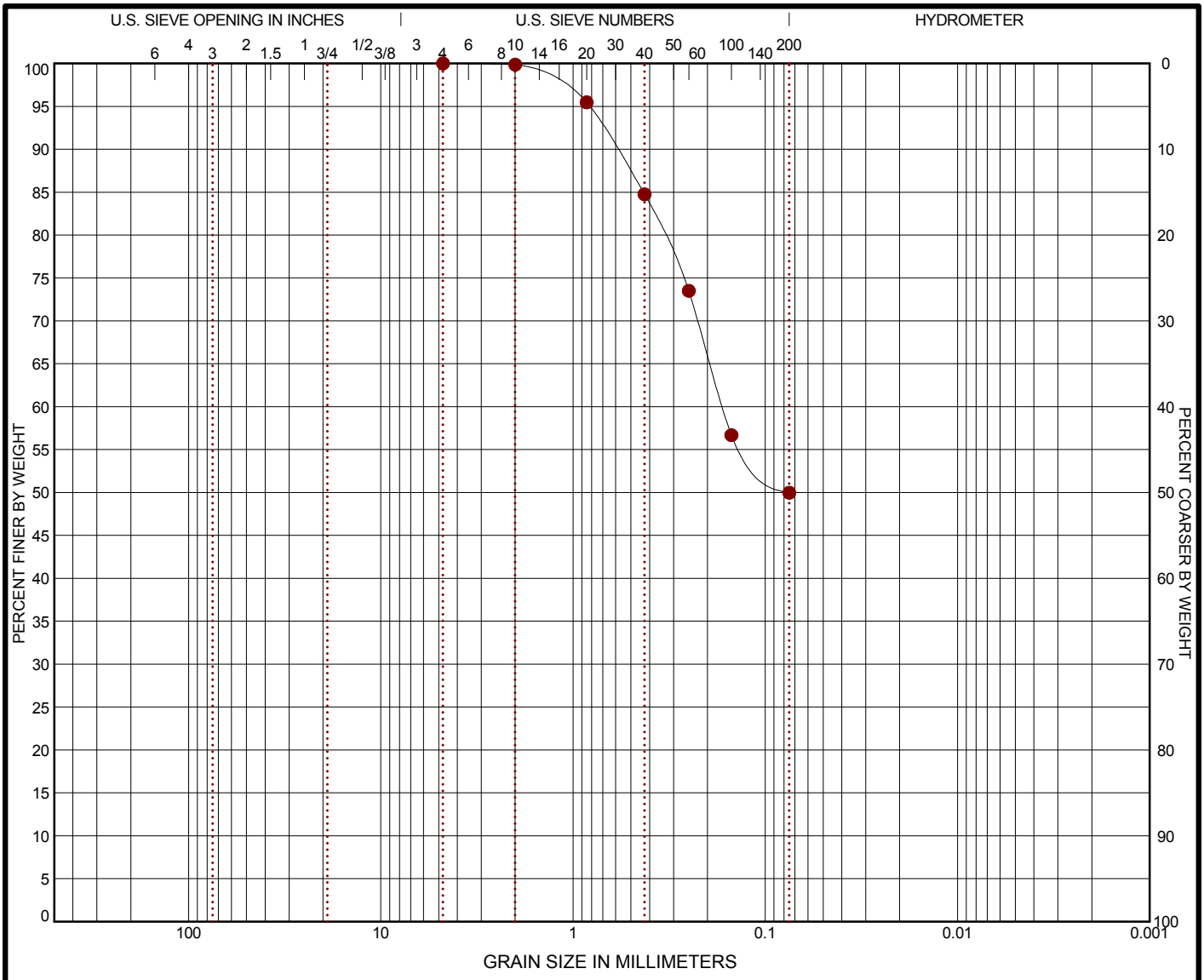
PROJECT NUMBER: 49155065

CLIENT: Winder Barrow Industrial Authority

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 49155065.GPJ TERRACON2012.GDT 10/7/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**B-27**	**3.5 - 5**	**0.0**	**0.0**	**50.0**		**50.0**		**SM**

	GRAIN SIZE
	●
D_{60}	**0.166**
D_{30}	
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●		
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			
#4	**100.0**		
#10	**99.86**		
#20	**95.47**		
#40	**84.76**		
#60	**73.5**		
#100	**56.68**		
#200	**49.97**		

SOIL DESCRIPTION
● SILTY SAND, red-brown

REMARKS
●

PROJECT: Park 53 - Barrow County

SITE: University Parkway at Highway 53
Winder, Georgia

Terracon
2855 Premiere Parkway, Suite C
Duluth, Georgia

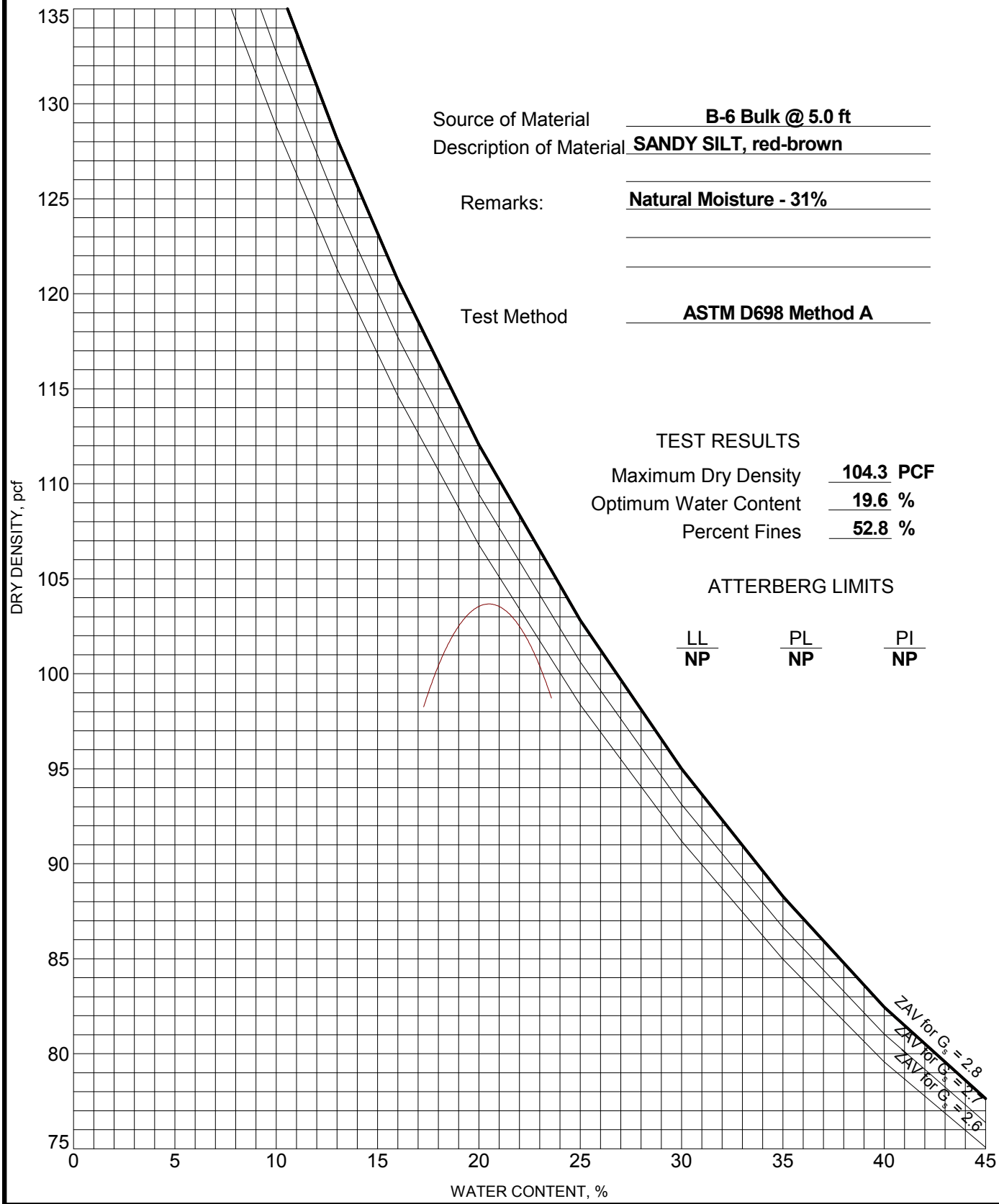
PROJECT NUMBER: 49155065

CLIENT: Winder Barrow Industrial Authority

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 49155065.GPJ TERRACON2012.GDT 10/7/15

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-6 Bulk @ 5.0 ft**

Description of Material: **SANDY SILT, red-brown**

Remarks: **Natural Moisture - 31%**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**104.3**	**PCF**
Optimum Water Content	**19.6**	**%**
Percent Fines	**52.8**	**%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

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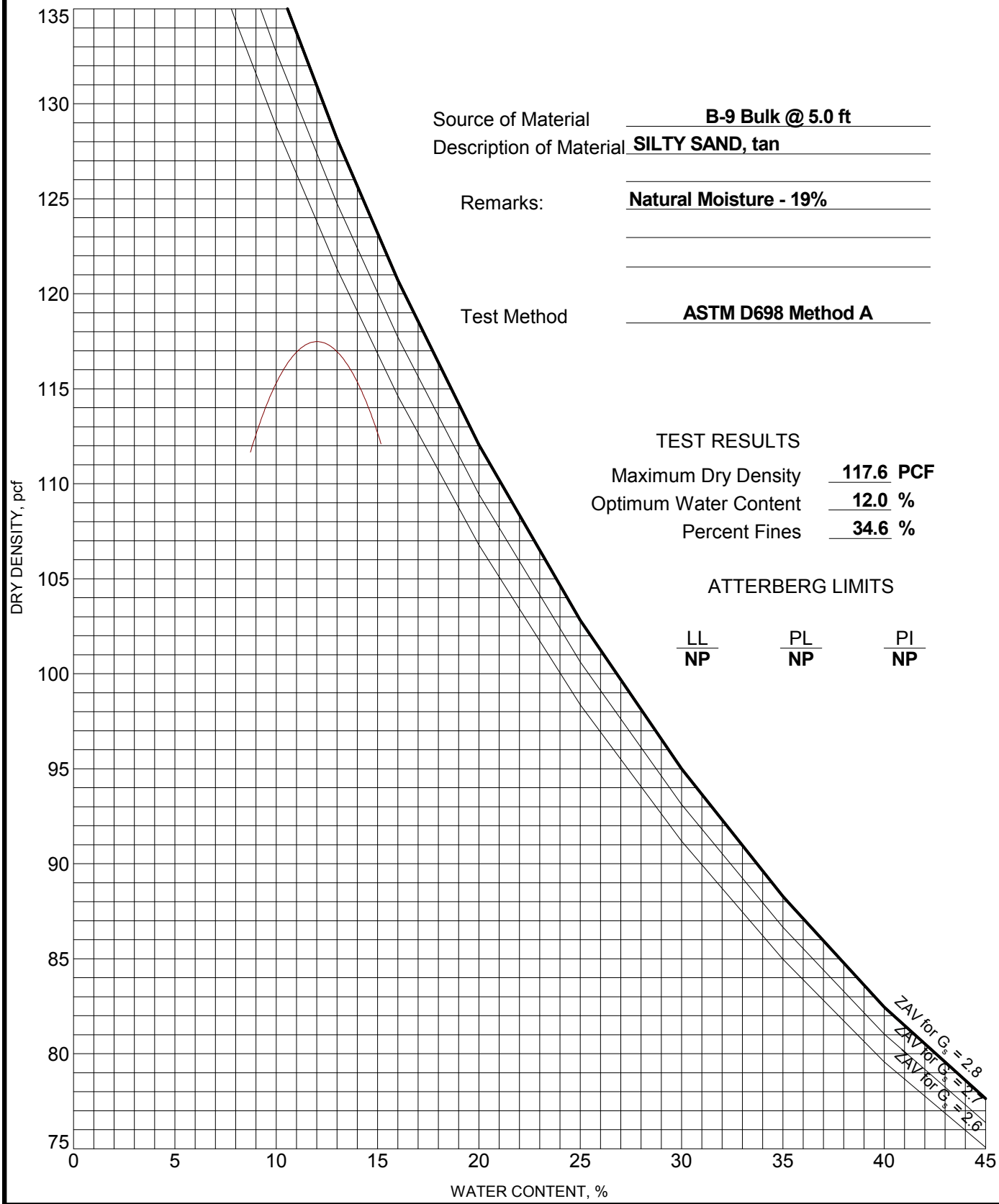
MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-9 Bulk @ 5.0 ft**

Description of Material: **SILTY SAND, tan**

Remarks: **Natural Moisture - 19%**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**117.6**	**PCF**
Optimum Water Content	**12.0**	**%**
Percent Fines	**34.6**	**%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V2 49145079.GPJ TERRACON2012.GDT 7/10/15

PROJECT: Park 53 - Barrow County

SITE: University Parkway at Highway 53
Winder, Georgia

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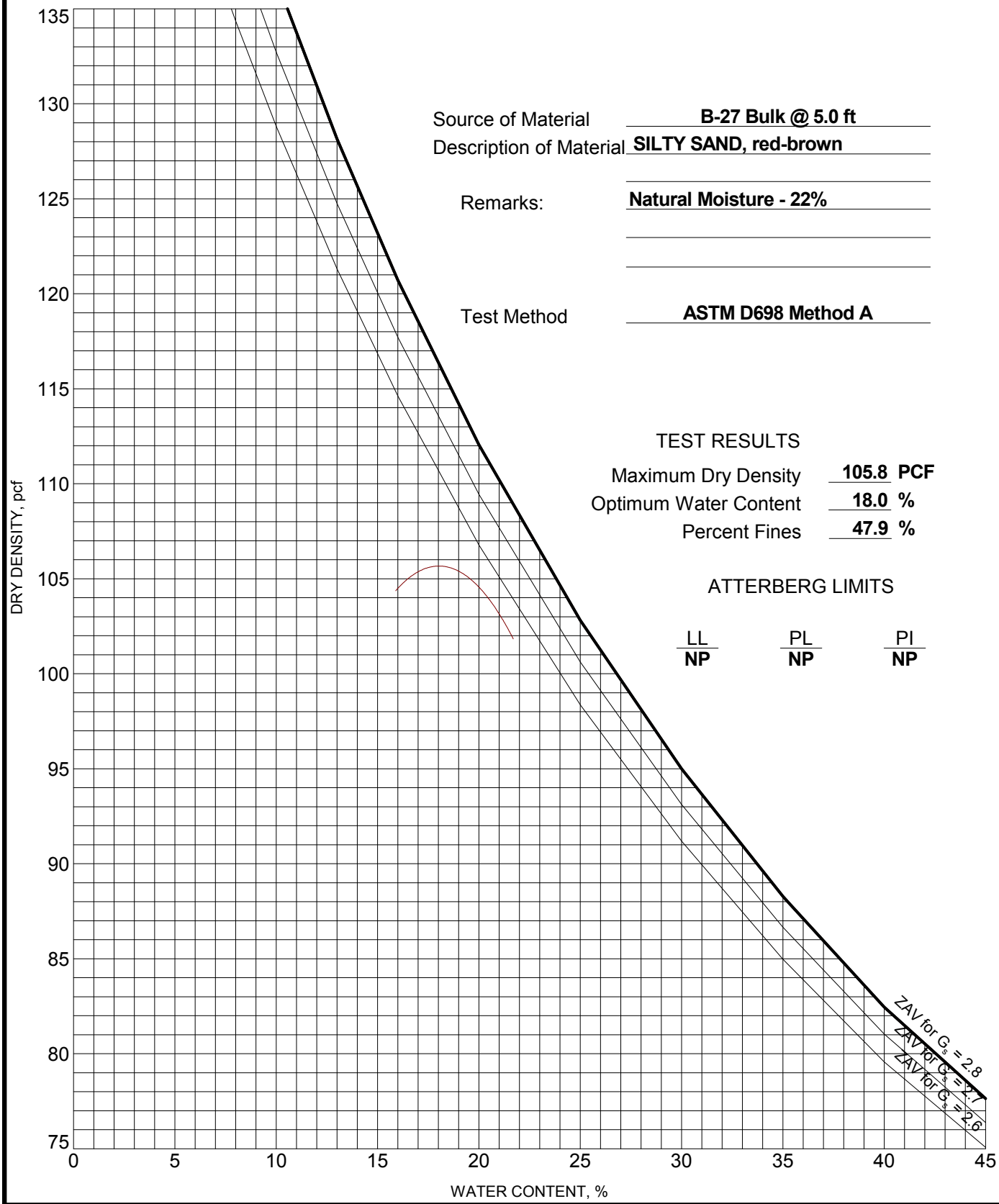
2855 Premiere Parkway, Suite C
Duluth, Georgia

PROJECT NUMBER: 49155065

CLIENT: Winder Barrow Industrial Authority

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-27 Bulk @ 5.0 ft**

Description of Material: **SILTY SAND, red-brown**

Remarks: **Natural Moisture - 22%**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**105.8**	**PCF**
Optimum Water Content	**18.0**	**%**
Percent Fines	**47.9**	**%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

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GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING


Auger


Split Spoon


Shelby Tube


Macro Core


Ring Sampler


Rock Core


Grab Sample


No Recovery

WATER LEVEL


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI lots below "A" line	MH	Elastic Silt[K,L,M]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.