

Subsurface Exploration and
Geotechnical Engineering Evaluation
Proposed Addition
Barnwell Elementary School
Alpharetta, Fulton County, Georgia
ATC Project Number 066.19607.5577

Prepared For:

Fulton County Schools
Meadows Operations Center
5270 Northfield Boulevard
College Park, Georgia 30349

Henry J. Siverio, Jr., RA
Deputy Director Plans and Program

August 16, 2007

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Fulton County Schools

Meadows Operations Center
5270 Northfield Boulevard
College Park, Georgia 30349

Attention: Henry J. Siverio, Jr., RA
Deputy Director Plans and Program

Subject: Subsurface Exploration and
Geotechnical Engineering Evaluation
Proposed Addition
Barnwell Elementary School
Alpharetta, Fulton County, Georgia
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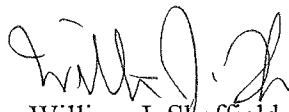
Dear Mr. Siverio:

ATC Associates Inc. has completed the authorized Subsurface Exploration and Geotechnical Engineering Evaluation for the above-referenced project. The attached report reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our evaluations, conclusions and recommendations.

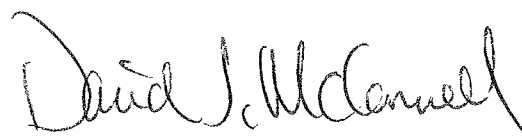
We are prepared assist you with materials testing services during construction. Please contact us if you have any questions about this report, or if we may be of further service.

Sincerely,

ATC Associates Inc.


William J. Sheffield, RE
Senior Engineer




David J. McConnell, PE
Principal Engineer

Copies: Addressee (3)

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EXECUTIVE SUMMARY

For your convenience, the following summary provides our pertinent findings and recommendations for this evaluation. This summary is not all-inclusive. Please refer to the main text for further recommendations and more thorough discussions.

- Five soil test borings were drilled to explore subsurface conditions at the site. The borings encountered fill material, alluvium, residual soil, partially weathered rock, and auger refusal materials.
- Fill was encountered in all the borings to depths ranging from about 2 to 14 feet below the existing ground surface. The fill generally consisted of silty sands (SM) and clayey sands (SC) with occasional rock and wood fragments. Standard Penetration Resistance values ranged from 3 blows per foot (bpf) to in excess of 50 blows per inch. Resistance values were typically between 10 and 20 bpf.
- Alluvial material was encountered beneath the fill material in Boring B-4 between the depths of about 13 to 18 feet. The alluvium consisted of clayey sands (SC). The resistance value of the material was 7 bpf.
- Residual soils were encountered in Borings B-1, B-2, and B-5 from beneath the fill or alluvium to depths ranging from about 3.5 to 20 feet beneath the existing ground surface. The residuum generally consisted of silty sands (SM) with rock fragments. Resistance values ranged from 9 to 42 bpf.
- Partially weathered rock was encountered beneath the fill material, alluvium, or residual soil in all of the borings except B-1. Thicknesses ranged from about 1.5 to 21.5 feet. The partially weathered rock generally consisted of silty sands (SM) with rock fragments.
- Auger refusal within the native materials was encountered in Borings B-1, B-2, and B-3 at depths ranging from about 15 to 20 feet below the existing ground surface.
- No groundwater was encountered in the borings at the time of drilling. Boring cave-in depths ranged from 11 to 17 feet below the existing ground surface. Groundwater levels are subject to seasonal and climatic variations and may be different at other times and locations than those stated in this report.
- Based on this information, some undercutting and replacement of the existing fill materials will likely be necessary to establish a stable subgrade on which to place the basement floor slab. Furthermore, some undercutting of foundations may be necessary if loose fill soils and/or nested wood/organic debris are encountered. We recommend a contingency be included in the grading contract for removal and replacement of unsuitable material, should some be encountered.

- Based on the results of the soil test borings and assuming that the finished grades of the addition will match those of the adjacent existing basement, it appears that materials requiring difficult excavation techniques for removal may be encountered during mass excavation and utility construction.
- We recommend that the proposed building be supported on shallow spread or continuous foundations. We recommend footings be sized for a maximum allowable bearing pressure of 3,000 pounds per square foot (psf). Spread foundations should bear on competent residual soils or competent existing fill underlain by residual soils. Localized undercutting of foundations may be necessary in areas where the available bearing pressure is less than designed. We anticipate that total settlements will be on the order of 1 inch for foundations designed in accordance with these recommendations. Differential settlements between the existing building and the addition will approach total settlement values. The design of the connection between the two structures should accommodate this movement.
- We have reviewed the 2006 International Building Code (IBC 2006) criteria for establishing a Site Class Definition per Sections 1613.5.2 and 1613.5.5 for the project site. Based on our analysis using soil boring information (N-values) developed for the project, it is our opinion that the average subsurface conditions correspond to Site Class “C” as described in Table 1613.5.2.

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING EVALUATION
PROPOSED ADDITION
BARNWELL ELEMENTARY SCHOOL
ALPHARETTA, FULTON COUNTY, GEORGIA
ATC PROJECT NUMBER 066.19607.5577

1.0 INTRODUCTION

1.1 Project Information

Our understanding of the project is based upon conversations with you and the information provided in the request for proposal. We have also been provided with a site plan showing the proposed construction.

The proposed development consists of a new two-story, 23,000 square foot addition to the existing school. The addition will be located east of the gymnasium and be connected to the southern classroom building. The addition will likely be a steel frame structure with load bearing walls. Structural loads have not been established. Based on our experience with similar structures, we anticipate column and wall loads will be on the order of 150 kips and 4 kips per linear foot, respectively. We anticipate that the addition will match grades with the basement level of the existing building at about EL 1071 feet. This will result in cuts on the order of 14 feet and fills less than 5 feet.

1.2 Purpose and Scope of Exploration

The purpose of this exploration was to assess general subsurface conditions in the area of the proposed construction and to evaluate the conditions as they relate to foundation design and construction. The services were provided in general accordance with our Proposal No. 07-21339c dated June 25, 2007. Specifically, the exploration addressed the following:

- Soil nature and origin, including changes resulting from man's activities,
- Depth, thickness, composition of soil strata which will be appreciably stressed by the intended construction,
- Depth to encountered groundwater, dense soil strata or rock, which could affect the construction and performance of the proposed structures,
- Recommendations for foundation types, allowable bearing capacities or foundation capacities,
- Recommendations for retaining wall design,
- Recommendations for soil related construction conditions such as site preparation, fill construction, unsuitable soils, difficult excavation, and groundwater control,
- Seismic Site Class definition per IBC 2006 based on N-values,
- Discussion of other geotechnical related items identified during the exploration.

The scope of our services did not include exploration for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site. Any statements in this report or on the Test Boring Records regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

2.0 EXPLORATION PROCEDURES

2.1 Site Reconnaissance

Prior to the field exploration, the site and surrounding areas were observed by an engineer from our office. The observations made during the site visit were used in planning this exploration and in determining areas of special interest.

2.2 Field Exploration

Per your request, five soil test borings were drilled at the site to assess general subsurface conditions in the areas of the proposed building. The borings were extended to auger refusal or boring termination at depths ranging from 14 to 25 feet below the existing ground surface. These borings were drilled at the approximate locations shown on the attached Boring Location Plan.

Groundwater levels and auger refusal depths were measured and noted. All the borings were backfilled prior to demobilization from the site. Test Boring Records, which graphically depict soil descriptions, penetration resistances, and observed groundwater levels, are included in the Appendix.

Boring locations were selected and established in the field by an ATC engineer using measurements from existing site features. Therefore, the boring locations shown on the attached Boring Location Plan should be considered approximate. Elevations on the Test Borings Records were interpolated from the provided site plan and should be considered approximate.

The soil test borings were advanced by mechanically turning hollow-stem augers into the soil. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-barrel sampler. The sampler was first seated 6 inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final foot was recorded and is designated the "standard penetration resistance." Penetration resistance, when properly evaluated, is an index of the soil's strength and foundation support capability.

All the borings were drilled using an Automatic Hammer to drive the split-spoon sampler. The Automatic Hammer is more efficient than the traditional safety hammer and imparts more energy to the split spoon sampler. Thus the resistance values are slightly lower than the traditional rope-cathead equipment. The type of hammer used is noted on the Test Boring Records.

Representative portions of the soil samples obtained with the split-barrel sampler were sealed in glass jars and transported to our laboratory. In the laboratory, they were examined by a geotechnical engineer and classified in general accordance with the Unified Soil Classification System. The soil descriptions and classifications are based on visual examination and should be considered approximate.

3.0 GENERAL SUBSURFACE CONDITIONS

3.1 Site Description

The site of the proposed addition is located off the back side of the existing school building, east of the gymnasium. The addition will connect with the existing classroom building on the south. The site slopes down from about EL 1085 feet on the west to about EL 1070 feet on the east. The area is grassed with a row of pine trees along the bottom of the slope. A storm water ditch is present at the bottom of the slope. Several sidewalks cross the site from the top of the slope to the bottom. Underground utilities are present at the site.

3.2 Area and Site Geology

The site is located in the Piedmont Physiographic Province, an area underlain by ancient igneous and metamorphic rocks. The upland soils in this area are the residual product of in-place weathering of rock similar to the rock which presently underlies the site. A typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands that generally become less weathered and denser with depth to the top of parent bedrock. The boundary between soil and rock is not clearly defined.

A transitional zone called “partially weathered rock” is normally found above the parent bedrock. Partially weathered rock is defined for engineering purposes, as residual material with standard penetration resistances in excess of 100 blows per foot. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, partially weathered rock and the hard rock profiles are irregular, and zones of partially weathered rock or rock may occur within the soil mantle well above the general bedrock level.

3.3 General Subsurface Conditions

Data from the soil test borings are shown on the Test Boring Records in the Appendix. The subsurface conditions discussed in the following paragraphs and those shown on the Test Boring Records are based on the soil test borings drilled at the site, and represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgements. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Generalized descriptions of subsurface conditions are discussed in the following paragraphs.

3.3.1 Topsoil

Topsoil is a dark-colored surficial material with a high organic content that is generally unsuitable for structural support. Topsoil was encountered in all the borings at thicknesses

ranging from 1 to 2 inches. Variations in topsoil thickness should be anticipated during site stripping operations.

3.3.2 Fill Material

Fill is any material that has been transported and deposited by man. Fill was encountered in all the borings to depths ranging from about 2 to 14 feet below the existing ground surface. The fill generally consisted of silty sands (SM) and clayey sands (SC) with occasional rock and wood fragments. Standard Penetration Resistance values ranged from 3 blows per foot (bpf) to in excess of 50 blows per inch. Resistance values were typically between 10 and 20 bpf.

3.3.3 Alluvium

Alluvium is material that has been transported and deposited by flowing water, and is typically associated with streams. Material described as alluvium was encountered beneath the fill material in Boring B-4 between the depths of about 13 to 18 feet. The alluvium consisted of clayey sands (SC). The resistance value of the material was 7 bpf.

3.3.4 Residuum

Residual soils, formed by in-place weathering of the parent rock, were encountered in Borings B-1, B-2, and B-5 from beneath the fill or alluvium to depths ranging from about 3.5 to 20 feet beneath the existing ground surface. The residuum generally consisted of silty sands (SM) with rock fragments. Resistance values ranged from 9 to 42 bpf.

3.3.5 Partially Weathered Rock

Partially weathered rock is a transitional material between soil and rock, which retains the relic structure of the rock and has very hard or very dense consistencies. Partially weathered rock is locally defined as material with standard penetration resistances greater than 100 blows per foot, which can be penetrated by the power auger. Partially weathered rock was encountered beneath the fill material, alluvium, or residual soil in all of the borings except B-1. Thicknesses ranged from about 1.5 to 21.5 feet. The partially weathered rock generally consisted of silty sands (SM) with rock fragments.

3.3.6 Auger Refusal

Refusal is a designation applied to any material which cannot be further penetrated by the power auger and is normally indicative of very hard to very dense material, such as boulders, lenses, or the upper surface of bedrock. Auger refusal within the native materials was encountered in Borings B-1, B-2, and B-3 at depths ranging from about 15 to 20 feet below the existing ground surface.

3.3.7 Groundwater

No groundwater was encountered in the borings at the time of drilling. Boring cave-in depths ranged from 11 to 17 feet below the existing ground surface. Groundwater levels are subject to seasonal and climatic variations and may be different at other times and locations than those stated in this report.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

The following conclusions and recommendations are based on our observations at the site, interpretation of the field data obtained during the exploration, and our experience with similar subsurface conditions. Subsurface conditions in unexplored locations will vary from those encountered. If the location, design, or structural conditions of the proposed construction change, we should be allowed to review our recommendations and make appropriate changes.

4.2 Site and Subgrade Preparation

Before proceeding with construction, all vegetation, root systems, topsoil, and other deleterious non-soil materials should be stripped from proposed construction areas. Clean topsoil may be stockpiled and reused later in landscaped areas. Existing underground utilities should be removed from the ground and routed around proposed construction areas.

After the necessary clearing and stripping, areas intended to support floor slabs, pavement, new fill, and foundations should be carefully evaluated by a geotechnical engineer. At that time, the engineer may require proofrolling of the subgrade with a 20- to 30-ton loaded tandem-axle dump truck or other pneumatic-tired vehicle of similar size and weight. The purpose of the evaluation is to locate soft, weak, or excessively wet soils present at the time of construction. Any unsuitable materials observed during the evaluation and/or proofrolling operations should be undercut and replaced with compacted fill or stabilized in-place.

4.3 Existing Fill Materials

Existing fill materials were encountered in all the borings drilled at the site. Considering the planned finished floor elevation of 1071 feet, it appears that portions of the existing fill will be excavated to establish the design grade. However, a majority of the existing fill will remain in place, particularly on the central and eastern portions of the building footprint.

Wood fragments were encountered within the fill material in several samples. However, the auger cuttings only encountered a small amount of wood fragments, suggesting that nesting of debris is not present. Information such as field reports documenting fill placement is not available. However, the resistance values suggest that compactive effort was applied during placement. The resistance values may be somewhat inflated because of rock fragments within the fill.

Based on this information, some undercutting and replacement will likely be necessary to establish a stable subgrade on which to place the basement floor slab. Furthermore, some undercutting of foundations may be necessary if loose fill soils and/or nested wood/organic debris are encountered.

When existing fill materials are encountered at a site, the potential exists that bury pits are present between the boring locations. While the borings drilled at this site do not suggest bury pits are present, the limited number of borings and their wide spacing do not preclude the presence of bury pits between boring locations. We recommend a contingency be included in the grading contract for removal and replacement of unsuitable material, should some be encountered.

4.4 Groundwater Conditions

Based on the boring data, we do not anticipate that groundwater will be encountered during construction. Groundwater levels are subject to seasonal, climatic and other variations and may be different at other times and locations than those stated in this report.

4.5 Excavation Conditions

Based on the results of the soil test borings and assuming that the finished grades of the addition will match those of the adjacent existing basement, it appears that materials requiring difficult excavation techniques for removal may be encountered during mass excavation and utility construction. Therefore, we are providing the following information on difficult excavation for use in specifications.

In mass excavations for general sitework, dense soils and partially weathered rock can usually be removed by ripping with a single-tooth ripper attached to a large crawler tractor or by breaking it out with a large front-end loader. In confined excavations such as foundations, utility trenches, elevator pits, etc., removal of partially weathered rock typically requires the use of large backhoes, pneumatic spades, or light blasting. Refusal materials will normally require blasting for removal in all types of excavations. Any blasting in footing excavations must be done carefully to prevent damage to the bearing materials.

The gradation of the material removed by ripping or blasting probably will be erratic. Excavated rock and partially weathered rock are difficult to reuse as structural fill. It is sometimes feasible to use rocky material in the deeper parts of driveway, parking lot, or landscaped fills provided future additions to the structures are not anticipated for these areas. Rock or partially weathered rock placed in these areas should be well-choked with soil fill and compacted. The maximum particle size should be limited to the maximum layer thickness. Any soil/rock fill should be capped with a minimum of 5 feet of clean soil fill.

The definition of rock can be a source of conflict during construction. The following definitions have been incorporated into specifications on other projects and are provided for your general guidance:

GENERAL EXCAVATION:

Rip Rock – Any material that cannot be removed by scrapers, loaders, pans, bulldozers, or graders; and requires the use of a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent).

Blast Rock – Any material which cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent; and occupying an original volume of at least one (1) cubic yard.

TRENCH EXCAVATION:

Blast Rock – Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half ($\frac{1}{2}$) cubic yard.

4.6 Slope Stability

Our study did not include a detailed analysis of slope stability for any temporary or permanent condition. Based upon common local practice and our experience with stable slopes, we recommend temporary slopes no steeper than 1.5(H):1(V) and permanent slopes no steeper than 2(H):1(V) for construction in competent existing fills, undisturbed residual soils, partially weathered rock, or new structural fill placed in accordance with our recommendations. In building and pavement areas, minimum top of slope setbacks of 10 feet and 5 feet are recommended, respectively. The slope recommendations are appropriate for slopes with a maximum height of 20 feet. Higher slopes should be further evaluated on a case by case basis.

During construction, temporary slopes should be regularly evaluated for signs of movement or unsafe conditions. Soil slopes should be covered for protection from rain, and surface runoff should be diverted away from the slopes. For erosion protection, a protective cover of grass or other vegetation should be established on permanent soil slopes as soon as possible.

4.7 Structural Fill

Fill used to replace undercut areas or achieve finished grades should not be excessively plastic (Plasticity Index less than 30) and should be free of deleterious materials and rock fragments larger than 3 inches in diameter. Portions of the existing fill material on site may not be suitable for reuse as compacted fill due to the presence of deleterious material.

Proposed fill soils should be laboratory tested prior to construction to determine their compaction characteristics and suitability for use as structural fill. Fill soils should have a minimum Proctor dry unit weight of at least 95 pcf.

Structural fill should be placed in lifts of 6 to 8 inches or less loose measure. We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698). The upper 12 inches beneath slabs and pavements should be compacted to at least 98 percent of the same criteria. The moisture content of the fill should be maintained within a range of +/- 3% of the optimum moisture. All fill material should be placed in horizontal lifts and adequately keyed into stripped and scarified subgrade soils.

In excavated areas, the upper 12 inches of soils intended to support floor slabs and pavements should be scarified and recompactd to at least 98 percent maximum dry density. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 to 4 inches may be necessary to achieve specified degrees of compaction.

During fill placement, density tests should be performed by an ATC soils technician to determine the degree of compaction and compliance with the project specifications. For underfloor areas, at least one field density test should be made per 2,000 square feet of fill area for each 1-foot thickness of compacted soil. Testing frequency should be increased in confined areas. Any areas that do not meet the compaction specifications should be reworked to achieve compliance.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moistures within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain.

4.8 Foundations

We recommend that the proposed building be supported on shallow spread or continuous foundations. We recommend footings be sized for a maximum allowable bearing pressure of 3,000 pounds per square foot (psf). Spread foundations should bear on competent residual soils or competent existing fill underlain by residual soils. Localized undercutting of foundations may be necessary in areas where the available bearing pressure is less than designed.

We anticipate that total settlements will be on the order of 1 inch for foundations designed in accordance with these recommendations. Differential settlements between the existing building and the addition will approach total settlement values. The design of the connection between the two structures should accommodate this movement.

We recommend widths of not less than 24 inches for rectangular foundations and not less than 18 inches for continuous foundations for ease of construction and to reduce the possibility of localized shear failures. Exterior foundation bottoms should be at least 18 inches below exterior grades.

Bottoms of foundation excavations should be evaluated by a geotechnical engineer prior to placement of reinforcing steel and concrete to verify that adequate bearing materials are present and that all debris, mud, and loose, frozen or water-softened soils have been removed.

Foundation excavations should be concreted as soon as practical after they are excavated. Water should not be allowed to pond in any excavation. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Foundation concrete should not be placed on frozen or saturated subgrades.

4.9 Slabs-On-Grade

Soil-supported slabs should be jointed around columns and along foundation walls to reduce cracking as a result of differential movement. As noted above, some undercutting and replacement may be necessary to provide a stable subgrade for slab construction. We recommend use of an impermeable membrane to reduce dampness from soil moisture. To reduce degradation of the soil subgrade due to weather and construction activity, it might be prudent to place a 4-to 6-inch layer of compacted graded aggregate base (GAB) or other gravel product to serve as a working surface.

4.10 Retaining/Below Grade Walls

Earth pressures on walls below grade are 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. The most common conditions assumed for earth retaining wall design are the active and at-rest conditions. Active conditions apply to relatively flexible earth retention structures, such as free-standing walls, where some movement and rotation may occur to mobilize soil shear strength. Walls, which are rigidly restrained, such as basement, tunnel, or loading dock walls, should be designed for the at-rest condition. A third condition, the passive state, represents the maximum possible pressure when a structure is pushed against the soil, and is used in wall foundation design to help resist active or at-rest pressures. Because significant wall movements are required to develop the passive pressure, the total calculated passive pressure should be reduced to one-half to two-thirds for design purposes.

Based on previous experience with similar soils and construction, we recommend the following earth pressure coefficients and equivalent fluid pressures for design of reinforced concrete retaining or below grade walls on this project:

Earth Pressure Conditions	Coefficient	Recommended Equivalent Fluid Pressure (pcf)
Active (K_a)	0.36	43
At-Rest (K_o)	0.53	64
Passive (K_p)	2.77	--

A moist soil unit weight of 120 pounds per cubic foot (pcf) should be used for design calculations. Our recommendations assume that the ground surface above the wall is level. A coefficient of friction value between soil and concrete of 0.35 is recommended.

The recommended equivalent fluid pressures assume that constantly functioning drainage systems are installed between walls and soil backfill to prevent the accidental buildup of hydrostatic pressures and lateral stresses in excess of those stated.

Tractors and other heavy equipment should not operate within 10 feet of below grade walls to prevent lateral pressures in excess of those cited. If footings or other surcharge loadings are located a short distance outside below grade walls, they may also exert appreciable additional lateral pressures that must be considered.

These retaining wall/below grade wall recommendations should not be correlated with soil parameters for use in Mechanically Stabilized Earth (MSE) wall design. We recommend that soil parameters for any MSE retaining wall design be established through appropriate laboratory testing by the specialty wall designer.

4.11 Seismic Criteria

We have reviewed the 2006 International Building Code (IBC 2006) criteria for establishing a Site Class Definition per Sections 1613.5.2 and 1613.5.5 for the project site. Based on our analysis using soil boring information (N-values) developed for the project, it is our opinion that the average subsurface conditions correspond to Site Class "C" as described in Table 1613.5.2.

5.0 QUALIFICATIONS OF RECOMMENDATIONS

Our evaluation of foundation design and construction conditions has been based on our understanding of the site and project information and the data obtained during our field exploration. The general subsurface conditions used were based on interpolation of the subsurface data between the borings. Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, geotechnical engineers should evaluate earthwork and foundation construction to verify that the conditions anticipated in design actually exist. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, we should be permitted to determine if the recommendations must be modified.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations then appear evident, it will be necessary to re-evaluate our recommendations after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. This company is not responsible for the conclusions, opinions, or recommendations of others based on these data.

APPENDIX



1841 West Oak Parkway, Suite F
 Marietta, GA 30062
 770-427-9456
 Fax 770-427-1907

TEST BORING RECORD

PROJECT NAME BARNWELL ELEMENTARY ADDITION
 PROJECT NUMBER 066.19607.5577
 DATE STARTED 8/4/07 DATE COMPLETED 8/4/07

BORING # B-1
 DRILL FOREMAN MESSER
 BORING METHOD HSA (AUTO HAMMER)

Elevation Scale	Depth Scale	SOIL CLASSIFICATION	Sample No.	Sample Type (Laboratory Testing)	Sampler Graphics	Groundwater	Standard Penetration Test, N blows/foot	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)											
								5	10	20	40	60	100						
1077.8		2" TOPSOIL																	
		FILL: Medium dense brown red micaceous silty fine SAND (SM), with rock fragments	1	SS	X		11												
			2	SS	X		13												
1072.0	5	Very loose brown gray micaceous silty medium to fine SAND (SM), with trace organics	3	SS	X		3												
1070.0		RESIDUUM: Medium dense red slightly micaceous clayey silty fine SAND (SM)	4	SS	X		18												
1065.0	10	Loose tan gray micaceous silty fine SAND (SM)	5	SS	X		9												
1062.0	15	Medium dense brown micaceous silty fine SAND (SM)	6	SS	X		15												
1058.0	20	AUGER REFUSAL																	

Sample Type
 SS - Driven Split Spoon
 UD - Shelby Tube
 RC - Rock Core
 CU - Cuttings

Laboratory Testing
 MC - Moisture Content
 GS - Grain Size
 C - Consolidation
 A - Atterberg Limits
 T - Triaxial

Depth to Groundwater
 ● Noted on Drilling Rods --- ft.
 ▽ At Completion NONE ft.
 ▽ After --- hours --- ft.
 ⊗ Cave Depth 15.0 ft.

Boring Method
 HSA - Hollow Stem Augers
 MD - Mud Drilling



1841 West Oak Parkway, Suite F
 Marietta, GA 30062
 770-427-9456
 Fax 770-427-1907

TEST BORING RECORD

PROJECT NAME BARNWELL ELEMENTARY ADDITION BORING # B-2
 PROJECT NUMBER 066.19607.5577 DRILL FOREMAN MESSER
 DATE STARTED 8/3/07 DATE COMPLETED 8/3/07 BORING METHOD HSA (AUTO HAMMER)

Elevation Scale	Depth Scale	SOIL CLASSIFICATION	Sample No.	Sample Type (Laboratory Testing)	Sampler Graphics	Groundwater	Standard Penetration Test, N blows/foot	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)										
								5	10	20	40	60	100					
1069.8		2" TOPSOIL																
		FILL: Loose red brown micaceous clayey fine SAND (SC)	1	SS			8											
1067.0		Medium dense dark gray black silty clayey fine SAND (SC), with wood fragments and organic odor	2	SS			13											
1064.0	5	Loose red slightly micaceous clayey fine SAND (SC)	3	SS			8											
1062.0		Very dense brown gray micaceous silty fine SAND (SM), with rock fragments	4	SS			50/2"											
1057.0	10																	
		RESIDUUM: Medium dense gray brown micaceous silty fine SAND (SM), with rock fragments	5	SS			15											
1052.0	15																	
1050.5		PARTIALLY WEATHERED ROCK: Sampled as very dense white tan micaceous silty fine SAND (SM), with rock fragments	6	SS			50/0.5"											
		AUGER REFUSAL																
		Boring encountered auger refusal at 10 feet in fill. Boring offset 10 feet north and extended.																

Sample Type	Laboratory Testing	Depth to Groundwater	Boring Method
SS - Driven Split Spoon	MC - Moisture Content	● Noted on Drilling Rods	HSA - Hollow Stem Augers
UD - Shelby Tube	GS - Grain Size	∇ At Completion	MD - Mud Drilling
RC - Rock Core	C - Consolidation	∇ After <u>24</u> hours	
CU - Cuttings	A - Atterberg Limits	☒ Cave Depth	
	T - Triaxial		
		--- ft. <u>NONE</u> ft.	
		<u>NONE</u> ft.	
		<u>14.5</u> ft.	



1841 West Oak Parkway, Suite F
 Marietta, GA 30062
 770-427-9456
 Fax 770-427-1907

TEST BORING RECORD

PROJECT NAME BARNWELL ELEMENTARY ADDITION BORING # B-3
 PROJECT NUMBER 066.19607.5577 DRILL FOREMAN MESSER
 DATE STARTED 8/4/07 DATE COMPLETED 8/4/07 BORING METHOD HSA (AUTO HAMMER)

Elevation Scale	Depth Scale	SOIL CLASSIFICATION	Sample No.	Sample Type (Laboratory Testing)	Sampler Graphics	Groundwater	Standard Penetration Test, N blows/foot	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)									
								5	10	20	40	60	100				
		SURFACE ELEVATION 1082.0															
1081.9		1" TOPSOIL															
		FILL: Medium dense red brown micaceous silty fine SAND (SM)	1	SS			11										
	5		2	SS			15										
			3	SS			13										
1073.5		PARTIALLY WEATHERED ROCK: Sampled as very dense brown micaceous silty fine SAND (SM)	4	SS			50/4"										50/4"
	10																
1068.0		AUGER REFUSAL	5	SS			50/0.5"										50/0.5"

Sample Type	Laboratory Testing	Depth to Groundwater	Boring Method
SS - Driven Split Spoon	MC - Moisture Content	● Noted on Drilling Rods -- ft.	HSA - Hollow Stem Augers
UD - Shelby Tube	GS - Grain Size	▽ At Completion <u>NONE</u> ft.	MD - Mud Drilling
RC - Rock Core	C - Consolidation	∇ After --- hours --- ft.	
CU - Cuttings	A - Atterberg Limits	⊠ Cave Depth <u>11.0</u> ft.	
	T - Triaxial		



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TEST BORING RECORD

PROJECT NAME BARNWELL ELEMENTARY ADDITION BORING # B-4
 PROJECT NUMBER 066.19607.5577 DRILL FOREMAN MESSER
 DATE STARTED 8/4/07 DATE COMPLETED 8/4/07 BORING METHOD HSA (AUTO HAMMER)

Elevation Scale	Depth Scale	SOIL CLASSIFICATION	Sample No.	Sample Type (Laboratory Testing)	Sampler Graphics	Groundwater	Standard Penetration Test, N blows/foot	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)									
								5	10	20	40	60	100				
1069.8		2" TOPSOIL															
		FILL: Medium dense brown purple micaceous clayey fine SAND (SC), with wood fragments	1	SS	X		18										
	5		2	SS	X		16										
			3	SS	X		17										
1062.0		Loose dark gray black silty fine SAND (SM), with wood fragments and organic odor	4	SS	X		6										
	10																
1057.0		ALLUVIUM: Loose gray micaceous clayey coarse to fine SAND (SC)	5	SS	X		7										
	15																
1052.0		PARTIALLY WEATHERED ROCK: Sampled as very dense brown gray very micaceous silty fine SAND (SM)	6	SS	X		50/5"										50/5"
	20																
			7	SS	X		50/1"										50/1"
1045.0	25	BORING TERMINATED															

Sample Type	Laboratory Testing	Depth to Groundwater	Boring Method
SS - Driven Split Spoon	MC - Moisture Content	● Noted on Drilling Rods --- ft.	HSA - Hollow Stem Augers
UD - Shelby Tube	GS - Grain Size	▽ At Completion <u>NONE</u> ft.	MD - Mud Drilling
RC - Rock Core	C - Consolidation	▽ After --- hours --- ft.	
CU - Cuttings	A - Atterberg Limits	⊗ Cave Depth <u>16.0</u> ft.	
	T - Triaxial		



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TEST BORING RECORD

PROJECT NAME BARNWELL ELEMENTARY ADDITION BORING # B-5
 PROJECT NUMBER 066.19607.5577 DRILL FOREMAN MESSER
 DATE STARTED 8/4/07 DATE COMPLETED 8/4/07 BORING METHOD HSA (AUTO HAMMER)

Elevation Scale	Depth Scale	SOIL CLASSIFICATION	Sample No.	Sample Type (Laboratory Testing)	Sampler Graphics	Groundwater	Standard Penetration Test, N blows/foot	STANDARD PENETRATION RESISTANCE (BLOWS PER FOOT)										
								5	10	20	40	60	100					
1077.9		1" TOPSOIL																
1076.0		FILL: Loose tan micaceous silty fine SAND (SM)	1	SS			42											
1074.5		RESIDUUM: Very dense brown gray micaceous silty fine SAND (SM), with rock fragments	2	SS			50/2"											50/2"
	5	PARTIALLY WEATHERED ROCK: Sampled as very dense brown very micaceous silty fine SAND (SM), with rock fragments	3	SS			50/2"											50/2"
			4	SS			50/3"											50/3"
1065.0		Very dense brown gray white very micaceous silty coarse to fine SAND (SM)	5	SS			50/4"											50/4"
	15		6	SS			50/3"											50/3"
	20		7	SS			50/2"											50/2"
1053.0	25	BORING TERMINATED																

Sample Type	Laboratory Testing	Depth to Groundwater	Boring Method
SS - Driven Split Spoon	MC - Moisture Content	● Noted on Drilling Rods <u> </u> ft.	HSA - Hollow Stem Augers
UD - Shelby Tube	GS - Grain Size	∇ At Completion <u>NONE</u> ft.	MD - Mud Drilling
RC - Rock Core	C - Consolidation	∇ After <u> </u> hours <u> </u> ft.	
CU - Cuttings	A - Atterberg Limits	⊗ Cave Depth <u>17.0</u> ft.	
	T - Triaxial		



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KEY TO SYMBOLS AND CLASSIFICATIONS

I	Undisturbed sample (UD) recovered
•	Standard penetration resistance (ASTM D 1586-67)
100/2"	Number of blows (100) to drive the spoon a number of inches (2)
AX, BX, NX	Core barrel sizes that obtain cores 1- 1/8, 1-5/8, and 2 -1/8 inches in diameter respectively
65%	Percentage of rock core recovered
RQD	Rock quality designation -% of core segments 4 or more inches long
☐	Caved level
▽	Water table after at least 24-hours after drilling
▽	Water table one hour or less after drilling
U	Unit weight test performed
A	Atterberg Limits test performed
C	Consolidation Test performed
GS	Grain Size Test performed
T	Triaxial Shear Test performed
P	Permeability Test performed
V	Field Shear Test performed

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	No. of Blows, N	Approximate Relative density
Sands	0 - 4	Very loose
	5 - 10	Loose
	11 - 30	Medium dense
	31 - 50	Dense
	Over 50	Very dense
		Approximate Consistency
Silts and Clays	0 - 1	Very soft
	2 - 4	Soft
	5 - 8	Firm
	9 - 15	Stiff
	16 - 30	Very stiff
	Over 30	Hard

Soil sampling and standard penetration testing performed in accordance with ASTM D - 1586-84. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive 2 inch O.D. 1.4 inch I.D. split barrel sampler one foot. Core drilling in accordance with ASTM designation D 2113 - 83. The undisturbed sampling procedure is described by ADSTM specification D-1587 - 83. Soil and rock samples will be discarded 30 days after the date of the final report unless otherwise directed.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
				GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
				SM	SILTY SANDS, SAND - SILT MIXTURES	
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
			SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS			
		CH	INORGANIC CLAYS OF HIGH PLASTICITY			
HIGHLY ORGANIC SOILS		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS			

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Important Information About Your Geotechnical Engineering Report

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

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

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

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

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

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

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

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

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

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

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the

report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Rely on Your Geotechnical Engineer for Additional Assistance

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



8811 Colesville Road Suite G106 Silver Spring, MD 20910
Telephone: 301-565-2733 Facsimile: 301-589-2017
email: info@asfe.org www.asfe.org