



Report of Preliminary Subsurface Exploration and Geotechnical Engineering Evaluation

Apex Area Site (H-12/E-46)

Apex, North Carolina

F&R Project No. 66U-0033

Prepared For:

The Wake County Board of Education

1429 Rock Quarry Road, Suite 116

Raleigh, NC 27610

Prepared By:

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May 27, 2016



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May 27, 2016

The Wake County Board of Education
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Attention: Ms. Betty L. Parker
Senior Director, Real Estate Services

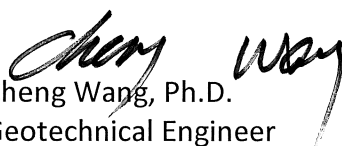
**Subject: Report of Preliminary Subsurface Exploration & Geotechnical Engineering Evaluation
Apex Area Site (H-12/E-46)**
Apex, North Carolina
F&R Project No. 66U-0033

Ladies & Gentlemen:

Froehling & Robertson, Inc. (F&R) has completed a preliminary subsurface exploration and geotechnical engineering evaluation for the Apex Area Site (H-12/E-46) in Apex, North Carolina. Our services were performed in general accordance with F&R Proposal No. 1766-00014 dated April 12, 2016 as authorized by a Wake County Board of Education Individual Project Proposal Agreement (IPPA) dated April 12, 2015 and Purchase Order #185583 dated April 14, 2015. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents preliminary geotechnical engineering recommendations for the proposed construction.

Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
FROEHLING & ROBERTSON, INC.


Cheng Wang, Ph.D.
Geotechnical Engineer



Daniel K. Schaefer, P.E.
Raleigh Branch Manager





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GBA Document “Important Information about Your Geotechnical Engineering Report”



1.0 PURPOSE & SCOPE OF SERVICES

The purpose of the preliminary subsurface exploration and geotechnical engineering evaluation was to explore the subsurface conditions on a parcel of undeveloped land that has a plan area of 66.48 acres and to provide preliminary geotechnical engineering recommendations that can be used during the design and construction phases of the project.

F&R's scope of services included the following:

- Completion of 67 soil test borings (identified as B-1 to B-67) to depths ranging from 13.6 to 50 feet below the existing ground surface;
- Preparation of typed Boring Logs and development of Subsurface Profiles;
- Performing geotechnical laboratory testing on representative soil samples;
- Performing a preliminary geotechnical engineering evaluation of the subsurface conditions with regard to their suitability for the proposed construction;
- Preparation of this preliminary geotechnical report by professional engineers.

2.0 PROJECT INFORMATION

2.1 Site Location and Description

The project site is located west of the termini of Thriftwood Drive and Derry Down Lane at a point approximately ¼-mile west of the intersections with Stephenson Road in Apex, Wake County, North Carolina (see Figure No. 1 in Appendix I). The project site consists of an undeveloped parcel with a plan area of approximately 66 acres. The project site consists of wooded land.

Several drainage features and small streams are located on the site. One stream is located in the central portion of the site traversing in an east-west orientation and sloping down to the west. This stream drains water that is discharging from a pond located on the abutting property to the east. Other significant drainage features are located in the following areas: 1) in the central-south portion of the site traversing in an east-west orientation and sloping down to the west, 2) along the south boundary of the site traversing in an east-west orientation and sloping down to the west. All of the stream and drainage features flow into an off-site stream that is located west of the project site and roughly parallel to the west property line. The ground surface on the project



site generally slopes down the west, and also towards these drainage features at grades typically ranging from about 5 to 10 percent. The highest elevations of the site are located near the east side of the north property line and along much of the east property line (elevation 410 to 430). The lowest elevations of the site are along the west property line where ground surface elevations range from about 380 to 390.

2.2 Proposed Construction

It is F&R's understanding that the project site will become part of a future elementary school or high school development. However, specific details regarding site layout, proposed site grading and type of structure are not available at this stage of the project. Although structural loads are not currently available, F&R assumes that any future school building will be light to moderately loaded, one to three-story structures with maximum wall and column loads on the order of 5 kips per linear foot (klf) and 200 kips, respectively. F&R assumes that maximum cut and fill depths on the order of 10 feet or less will be required establish finished grades.

Once the site layout has been established, building locations are known, a grading plan has been prepared and structural loads have been determined, F&R requests that we be afforded an opportunity to review this information for further evaluation of geotechnical considerations.

3.0 EXPLORATION PROCEDURES

3.1 Subsurface Exploration

F&R advanced a total of 67 soil test borings (B-1 to B-67) as part of this exploration at the approximate locations shown on the Boring Location Plan presented as Figure No. 2 in Appendix I. The borings were advanced to depths ranging from 13.6 to 50 feet. Several borings were extended deeper than the proposed 20-foot termination depth due to the presence of relatively soft soils. The test boring locations were established in the field by F&R on an approximate 200 x 200 foot grid using a hand held GPS unit. Ground surface elevations at the boring locations were interpolated from Wake County GIS topographic data. Given the method of determination, the boring locations and ground surface elevations should only be considered approximate.



The test borings were advanced by track and ATV-mounted drill rigs using 2-1/4" inside diameter (I.D.) hollow stem augers for borehole stabilization. Representative soil samples were obtained using a standard two-inch outside diameter (O.D.) split barrel sampler in general accordance with ASTM D 1586, Penetration Test and Split-Barrel Sampling of Soils (Standard Penetration Test). The number of blows required to drive the split barrel sampler three consecutive 6-inch increments with an automatic hammer is recorded and the blows of the last two 6-inch increments are added to obtain the Standard Penetration Test (SPT) N-values representing the penetration resistance of the soil. Standard Penetration Tests were performed almost continuously to a depth of 10 feet and at a nominal interval of approximately 5 feet thereafter.

A representative portion of the soil was obtained from each SPT sample, sealed in a glass jar, labeled and transported to our laboratory for final classification and analysis by a geotechnical engineer. The soil samples were classified in general accordance with the Unified Soil Classification System (USCS), using visual-manual identification procedures (ASTM D2488). A Boring Log for each test boring is presented in Appendix II.

Groundwater level measurements were obtained from the boreholes immediately after drilling (IAD) and after a stabilization period of approximately 24 hours.

3.2 Laboratory Testing

F&R selected representative soil samples and subjected them to routine geotechnical index testing consisting of natural moisture content, sieve analysis and Atterberg Limits determinations. The purpose of the index testing was to aid in our classification of the soil samples and development of engineering recommendations. The laboratory testing was performed in general accordance with applicable ASTM standards. The laboratory test results are presented in Appendix III of this report.



4.0 REGIONAL GEOLOGY & SUBSURFACE CONDITIONS

4.1 Regional Geology

The project site is geologically located in the Piedmont Physiographic Province of North Carolina. The Piedmont Province region generally consists of relatively small hills and ridges that are intertwined with an established system of draws and streams and is predominately underlain by igneous rock (formed from molten material) and metamorphic rock (formed by heat, pressure and/or chemical action), initially formed during the Precambrian and Paleozoic eras. Based on review of Geology and Mineral Resources of Wake County (Parker, 1979) published by the Department of Natural Resources and Community Development, the site is underlain by Metavolcanic and Metasedimentary rocks of the Carolina Slate Belt.

The soils encountered at the site primarily appear to be the residual product of in-place chemical weathering of the parent bedrock that underlies the site. In areas not altered by erosion or disturbed by the activities of man, 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. The boundary between the residual soils and underlying rock is not sharply defined. This transitional zone termed “Partially Weathered Rock” is typically found overlying the parent bedrock. Partially weathered rock (PWR) is defined, for engineering purposes, as residual materials exhibiting standard penetration resistances in excess of 100 blows-per-foot (bpf). Weathering is facilitated by fractures, joints and by the presence of less resistant rock types. Consequently, the profile of the PWR and hard rock is quite irregular and erratic, even over short horizontal distances. Commonly, lenses and boulders of hard rock and zones of PWR can be encountered within the soil mantle, well above the general bedrock level. PWR was only encountered in a few of the borings at the project site. Most of the borings were terminated in residual soils.



4.2 Subsurface Conditions

4.2.1 General

The subsurface conditions discussed in the following sections and those shown on the attached Boring Logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs. Sometimes the relatively small sample obtained in the field is insufficient to definitively describe the origin of the subsurface material. Although individual soil 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. Data from the specific soil test borings are shown on the attached Boring Logs presented in Appendix II of this report.

Subsurface Profiles have been prepared from the boring data to graphically illustrate the subsurface conditions encountered at the site. The Subsurface Profiles are presented as Figures 3 through 8 in Appendix I.

4.2.2 Surficial Materials

Surficial Organic Soils encountered in the test borings extended from the ground surface to depths ranging from approximately 0.1 to 0.8 feet. In many of the borings, roots typically extended to depths of 2 to 6.5 feet. The Surficial Organic Soils generally consisted of dark colored soil with roots, fibrous matter and/or other organic materials. Surficial Organic Soil is generally unsuitable for engineering purposes. F&R has not performed any laboratory testing to determine the organic content or other horticultural properties of the observed Surficial Organic Soil materials. Therefore, the term Surficial Organic Soil is not intended to indicate suitability for landscaping and/or other purposes. The Surficial Organic Soil depths provided in this report are based on driller observations and should be considered approximate. We note that the transition from Surficial Organic Soil to underlying materials may be gradual, and therefore the observation and measurement of Surficial Organic Soil depths is subjective. Actual Surficial Organic Soil depths should be expected to vary.



4.2.3 Alluvial Soils

Alluvial soils were encountered at 12 of 67 borings from the ground surface to a depth of approximately 2 to 3.5 feet. Alluvial soils are defined as soils that have been transported by water. The alluvial soils generally consisted of very loose, silty sand (USCS – SM) with SPT N-values 2 bpf, and very soft to firm, clayey or sandy silt (USCS – MH and ML) with SPT N-values ranging from 0 to 7 bpf. The alluvial soils typically contained trace organics and gravel and were typically wet to saturated.

4.2.4 Native Soils

Beneath the Surficial Organic Soils and alluvial soils, native (residual) soils were encountered. In most of the borings (57 of 67), the residual soils consisted of layers of moderately to highly plastic clay and clayey silt (CH, CL/CH, MH and ML/MH) to depths typically ranging from 2 to 8.5 feet (average depth of approximately 6.5 feet). The highly plastic clays and clayey silts were encountered to greater depths in a few borings.

Underlying the moderately to highly plastic soils, the residual soils consisted predominantly of low plasticity fine sandy silt (ML). In some of the borings, layers of silty sand (SM) were also encountered.

The consistency of the native soils in more than half of the borings was relatively soft (SPT N-values of 5 bpf or less) from the ground surface to depths ranging from about 1.5 to 3.5 feet. These surficial soft conditions were noted in 41 of 67 borings. Beneath the near surface soft soils, the consistency of the residual soils improved in many of the borings, and generally firm to very stiff soils were encountered to depths of at least 5 to 10 feet. However, in many of the borings, relatively soft to firm soils were again encountered beneath the firm to stiff zone (*e.g.*, B-5, B-34, B-36, B-37, B-38, B-40, B-43, B-44, B-47, B-48, B-49 to B-52, B-54, B-55 to B-59, B-61 and B-67). In some borings, relatively soft to firm soils were noted for the full depth of the boring and a discernable firm to stiff layer was not noted (*e.g.*, B-11, B-24, B-29, B-30, B-33 and B-60).



4.2.5 Partially Weathered Rock

Partially Weathered Rock (PWR) was encountered in 6 of the 67 test borings at depths ranging from 4 to 14 feet. The average depth to PWR in these borings was about 9 feet. The SPT N-values in the PWR ranged from 50 blows per 1.5 inches of penetration (50/1.5") to 50 blows per 5.5 inches of penetration (50/5.5"). PWR is defined for engineering purposes as residual material that exhibits an SPT N-value of more than 100 blows per foot (bpf).

4.3 Soil Moisture and Groundwater Conditions

A majority of the recovered soil samples were generally observed to be in either a moist condition (*i.e.*, estimated to be within 3 to 5 percent of the optimum moisture content) or in a moist to wet condition (*i.e.*, observed to contain moisture in excess of "moist" condition and less than "wet" conditions, and estimated to be more than 5 to 6 percent over the estimated optimum moisture content). In general, the moist to wet soils were noted below depths of 5 to 10 feet in borings in the higher elevations of the site. Zones of wet or saturated soils were noted in some borings, but generally in lower lying areas of the site, near streams and drainage features, or below observed groundwater levels.

Groundwater level measurements were recorded in the test borings upon completion of drilling and after a stabilization period of at least 24 hours. Groundwater was encountered in 39 of 67 at completion of drilling at depths ranging from 6.5 to 30.5 feet. After a stabilization period of approximately 24 hours, groundwater was encountered in 49 of 67 at depths ranging from 2 to 19.5 feet. It is noted that the 22 borings where stabilized groundwater readings were encountered at depths of less than 10 feet are generally located in drainage features where shallow groundwater levels are not uncommon, and areas of the site that are more likely to be designed as fill areas than cut areas.

Based on the observed groundwater conditions, it is not anticipated that groundwater will be encountered during mass grading activities where maximum earth cuts depths are not generally expected to exceed 5 to 10 feet. However, due to the presence of relatively impervious clay soils and PWR on the project site, trapped or perched water conditions should be anticipated during



periods of inclement weather and during seasonally wet periods. It should be noted that groundwater levels fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary or be different from those described in this report.

5.0 PRELIMINARY GEOTECHNICAL ENGINEERING RECOMMENDATIONS

The preliminary conclusions and recommendations contained in this section of the report are based upon the results of the 67 widely spaced soil test borings performed and preliminary information provided to F&R regarding the proposed development. It is our opinion that the subsurface conditions encountered on the project site are suitable for the proposed development from a geotechnical engineering perspective, provided the recommendations presented in this report are followed throughout the design and construction phases of this project. Firm to stiff native soils and properly placed and compacted structural fill should be suitable for support of the school structures on conventional shallow spread foundations. The subsurface conditions revealed by the borings are typical of this area. However, the following conditions encountered in the test borings should be considered during the planning and design phases of the project to minimize impact during site development and building construction.

- Moderately to highly plastic clay and clayey silt soils (USCS – CH, MH, CL/CH and ML/MH) were encountered in most of the test borings from the ground surface to depths typically ranging from 2 to 8.5 feet (average depth of approximately 6.5 feet). The highly plastic clays and clayey silts were encountered to greater depths in just a few borings. Beneath the moderately to highly plastic soils, lower plasticity fine sandy silts and silty sands (USCS ML and SM soils) were typically encountered. The lower plasticity silts and silty sands are generally considered fair to good materials for use as structural fill. However, the highly plastic clays and clayey silts are generally considered poor material for use as structural fill and poor material for direct support of building foundations, slabs and roadways. As such, if highly plastic soils are excavated from cut areas, it is generally recommended that they be used in non-load bearing areas or in the lower portion of deeper roadway fills. The highly plastic soils are also not desirable subgrade soils, and if present at finished subgrade (*e.g.*, roadway and building pad subgrades), undercutting and repair with lower plasticity materials or other methods of ground improvement may be required to create stable and suitable subgrades for pavement and building construction.



- Zones of moist to wet and wet/saturated soils were noted in some of the borings. Depending upon conditions at the time of construction, excessively wet soils could be encountered and moisture conditioning (e.g., drying of wet soils) may be required prior to using cut soils as structural fill. In addition, temporary and/or permanent open ditches and/or interceptor drains may be required to improve site and soil profile drainage, and improve soil moisture conditions.
- Zones of relatively soft residual soils were noted at variable intervals and thicknesses throughout the site. Depending upon the location of development and the proposed site grades, relatively soft residual soils could be encountered at subgrades (e.g., for pavements and slabs) and at structure foundation bearing grades. If these soft soils are encountered, subgrade repairs will be required to create stable conditions for support of foundations, slabs, pavement and other ground-supported structures. If the soft soils are present at foundation bearing grades, undercutting and replacement or other ground improvement methods may be required.
- PWR was encountered in 6 of the test borings located on the northern portion of the site at depths ranging from 4 to 18.5 feet. The boring where PWR was encountered are in lower elevation areas of the site where earth cuts are not anticipated during mass grading activities. As such, widespread PWR or difficult excavation conditions are not anticipated during site mass grading activities. Depending upon the location and depth of proposed utility excavations, it is possible that PWR and hard excavation conditions could be encountered in isolated areas of the site, and require ripping, hammering and/or blasting for removal.

The soils encountered in the test borings have sufficient silt and clay content to render them moisture sensitive. These soil types can become unstable during normal construction traffic and activities when wet. Ideally, earthwork operations should be performed during the seasonally drier months (typically May to October) when the weather is generally more conducive to controlling and modifying the moisture content of the on-site soils. As previously indicated, it is expected that some cut soils and subgrade soils will require moisture conditioning/drying. Earthwork construction during seasonally wet times of the year (typically November to April) may result in difficulties in properly placing and compacting the on-site soils, soft subgrade conditions, and possible undercutting in excess than would otherwise be expected.

As previously discussed, soft soils represented by SPT-N values of 4 to 5 bpf or less were encountered at variable depths and thicknesses throughout the site. Depending upon proposed site layout and grading, soft unstable soils may be present following stripping and at final subgrades, and may require repair. Methods of repair may include, but are not necessarily limited to drying and re-



compaction; undercutting and replacement with suitable structural fill; use of geotextiles and/or geogrids with select fill; use of lime stabilization; or other methods deemed appropriate by the project geotechnical engineer.

PWR was encountered in just 6 of the test borings at depths ranging from 4 to 18.5 feet; these borings are located on the northern portion of the site. Since site grading and utility plans are not available, the magnitude of PWR excavation cannot be determined at this time. However, it appears likely that widespread PWR will not be encountered during mass grading, but could be encountered in deeper utility excavations. In the event PWR is encountered, heavy excavating equipment with ripping tools (e.g., D-8 dozer with single shank ripper) is typically effective in removing the softer PWR (i.e., PWR with SPT blow counts of 50/4" to 50/6") during mass grading activities. Removal of harder PWR (i.e., PWR with SPT blow counts of 50/1" to 50/3" or less penetration) during mass grading in open areas may not be possible with ripping equipment and may require hammering, chipping or blasting. Based on the results of the test borings, some of the PWR had SPT blow counts of 50/4" or softer and should be able to be ripped in mass excavations. Removal of PWR from confined excavations (e.g., utility or foundation excavations) is typically more difficult than from large open mass excavations. Removal of softer PWR, (i.e., PWR with N-values of (50/4" to 50/6") from confined excavations may be possible using a large trackhoe (e.g., CAT 330 with new rock teeth); however, excavation will likely be slow and blasting is typically performed to pre-loosen the PWR. Removal of harder PWR and rock, (i.e., PWR with N-values of 50/0" to 50/3") in confined excavations will likely require blasting. The speed and ease of PWR and rock excavation will depend upon the equipment utilized, experience of the equipment operators and geologic structure of the PWR.

It appears that the soils encountered in the test borings are suitable to support the anticipated structure on conventional shallow spread foundations. Since site grading plans and finished floor elevations are not available at this time, it is assumed that foundations will bear in a combination of compacted structural fill material and firm to stiff residual soils. For foundations bearing in these soils, we anticipate that a net allowable bearing capacity on the order of 2,000 pounds per square foot should be available. However, the presence of relatively thick layers of soft residual soils will



require careful evaluation of foundation settlement if these soft layers are present at and below proposed foundation elevations. At this time, it is F&R's opinion that the structures will be able to be supported on shallow spread foundations and we do not anticipate that intermediate foundations systems (e.g., aggregate piers) or deep foundations (e.g., driven piles) will be required. However, future settlement evaluation may indicate that some planned foundation bearing grade repairs (e.g., undercutting and replacement with clean washed stone) may need to be incorporated during the foundation design phase of the project. Further evaluation of foundation bearing capacity and settlement should be performed after the site grades have been better determined and structural loading information is available.

We request that F&R be afforded the opportunity to review preliminary and final grading and utility plans for evaluation of geotechnical considerations. Once the building locations are known, a grading plan has been prepared, and structural loads have been determined, F&R recommends that a final geotechnical engineering evaluation be performed to provide final geotechnical design and construction recommendations for site development (earthwork), foundations, floor slabs, pavements, slopes and retaining structures. This evaluation may include recommendations for additional subsurface exploration (e.g., test pits, soil test borings) and in-situ testing within specific areas of the site. It would be prudent to have F&R involved during preliminary site development meetings with the design team to discuss the site geotechnical conditions and methods of minimizing geotechnical related issues during construction.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of The Wake County Board of Education and/or their agents for specific application to the referenced project. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our evaluations and recommendations are based on design information furnished to us; the data obtained from the subsurface exploration program, and generally accepted geotechnical engineering practice. The evaluations and recommendations do not reflect variations in subsurface conditions which could exist intermediate of the boring locations



or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our recommendations based upon on-site observations of the conditions.

There are important limitations to this and all geotechnical studies. Some of these limitations are discussed in the information prepared by GBA, which is included in Appendix IV. We ask that you please review this GBA information.

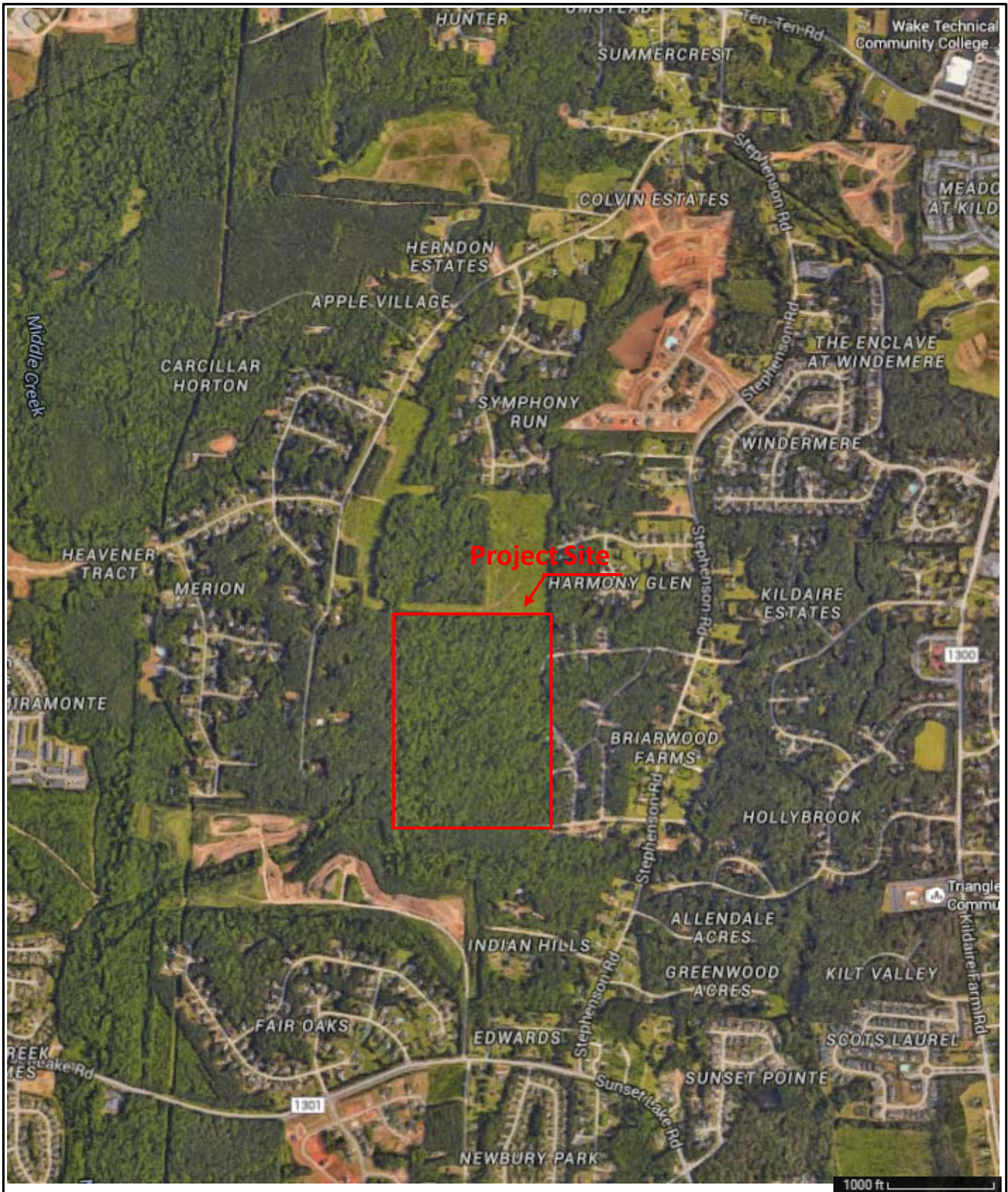
Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork, pavement, 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.

If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid. As previously indicated, a final geotechnical engineering evaluation should be performed as the site and structure design progresses.



APPENDIX I

FIGURES



SITE VICINITY MAP

North ▲



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CLIENT: Wake County Board of Education

PROJECT: Area Site H-12, E-46

LOCATION: Apex, Wake County, North Carolina

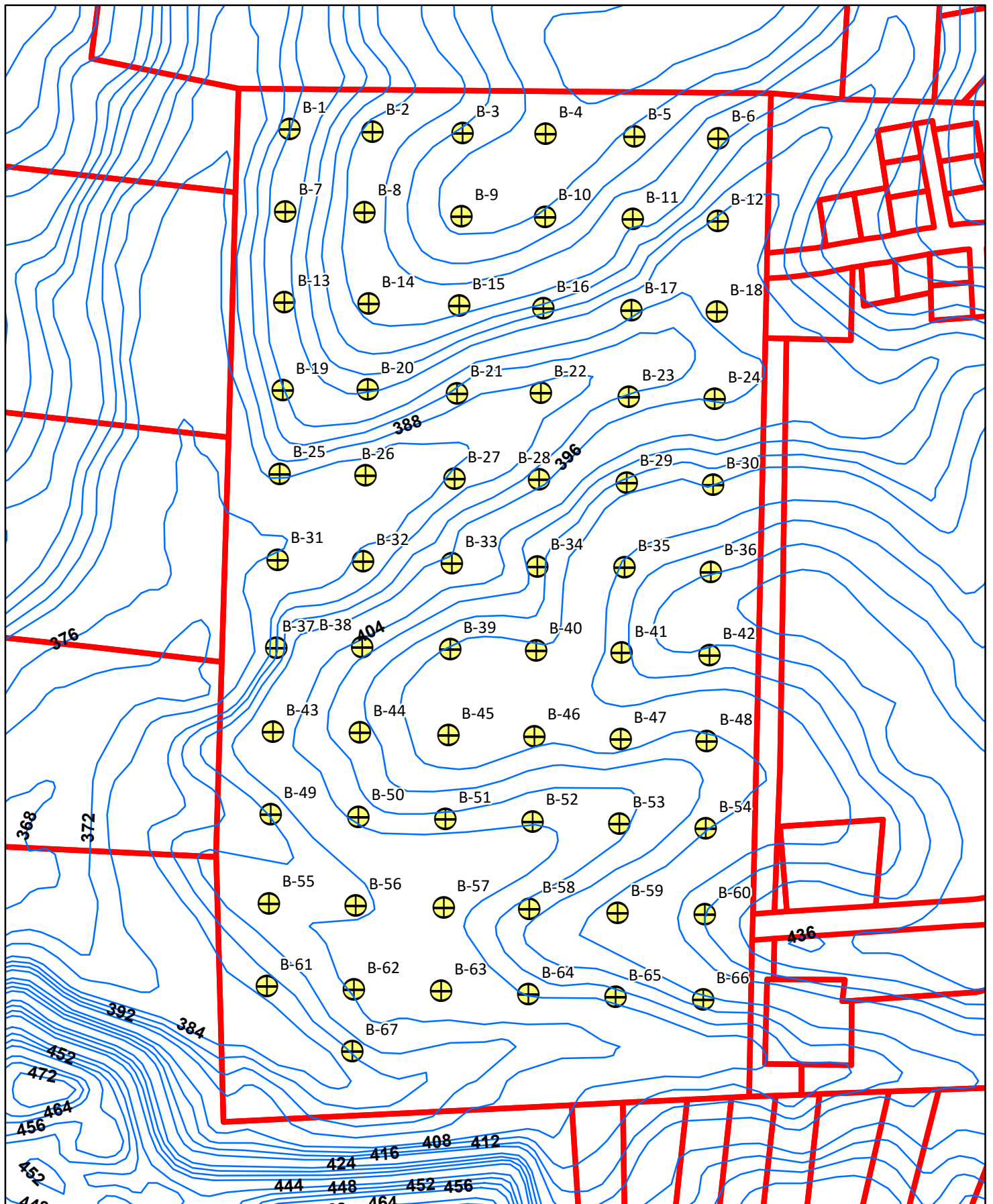
F&R PROJECT No.: 66U-0033

DRAWN BY: C. Wang

DATE: May 2016

SCALE: As shown

FIGURE
No.: 1



Boring Location Plan

0 75 150 300 450 600 Feet



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Client:	Wake County Board of Education
Project:	Area Site H-12, E-46
Location:	Apex, Wake County, NC
F&R Project No.:	66U-0033
Date:	May 2016

Disclaimer: F&R makes no warranties or guarantees regarding the accuracy or completeness of geographic features shown on this map. Spatial accuracy of measurement provided by source agencies can be obtained by contacting F&R.

FIGURE No.: 2

SUBSURFACE PROFILE

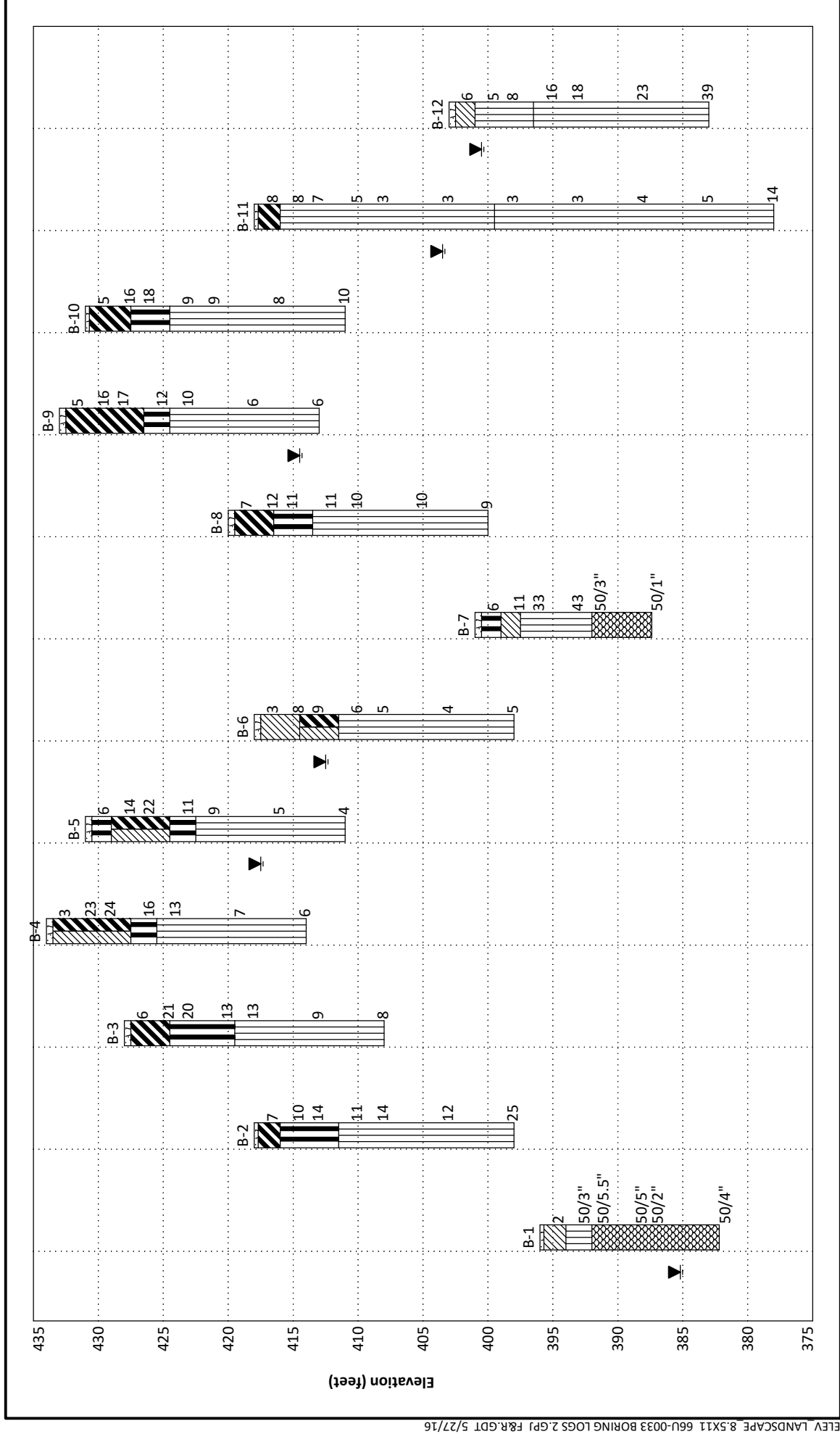
Plot Based on Elevation
Profile Name: Figure No.3

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC



SUBSURFACE PROFILE

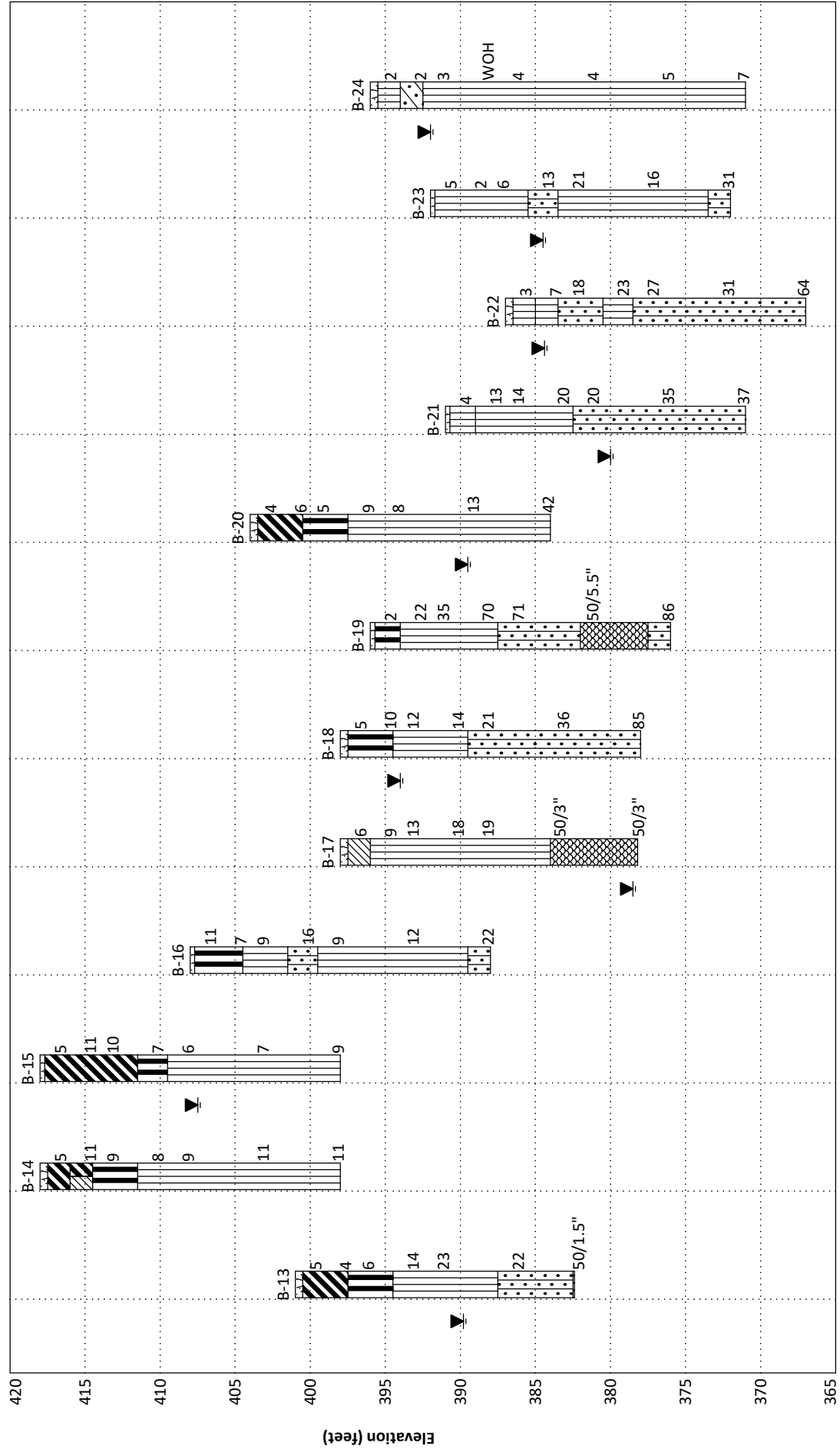
Plot Based on Elevation
Profile Name: Figure No.4

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC



SUBSURFACE PROFILE

Plot Based on Elevation

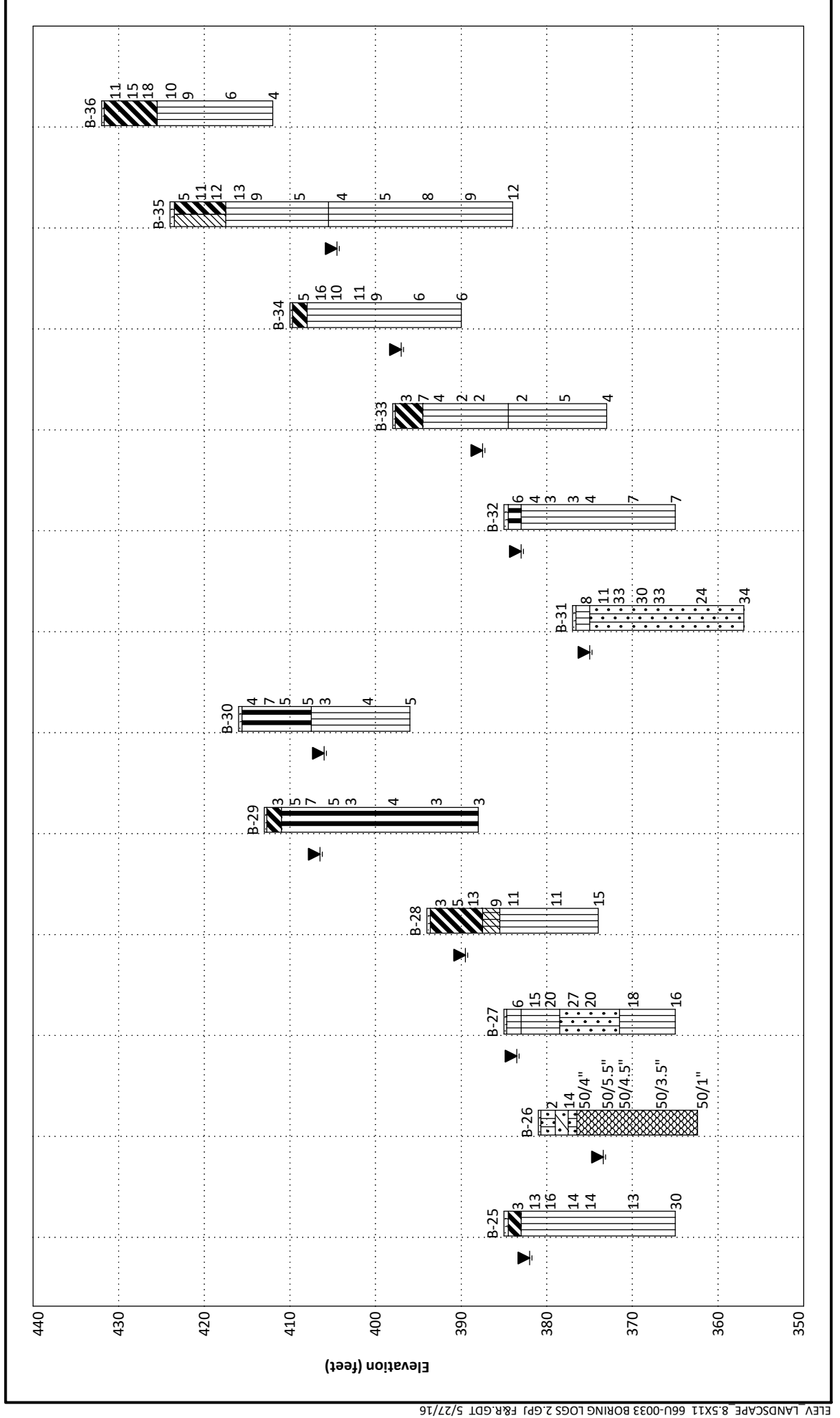
Profile Name: Figure No.5

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC



SUBSURFACE PROFILE

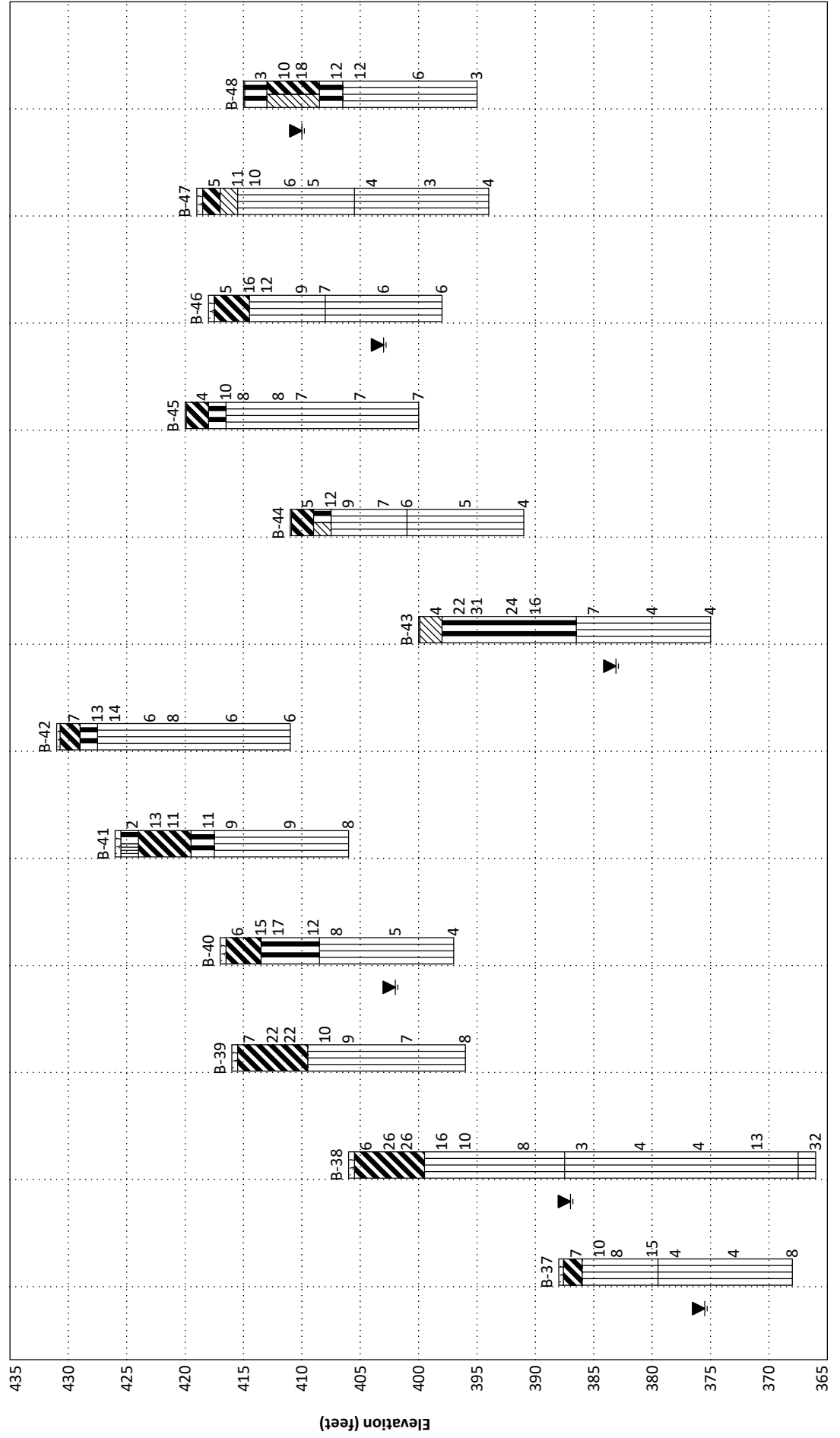
Plot Based on Elevation
Profile Name: Figure No.6

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC





FROEHLING & ROBERTSON, INC.

SUBSURFACE PROFILE

Plot Based on Elevation

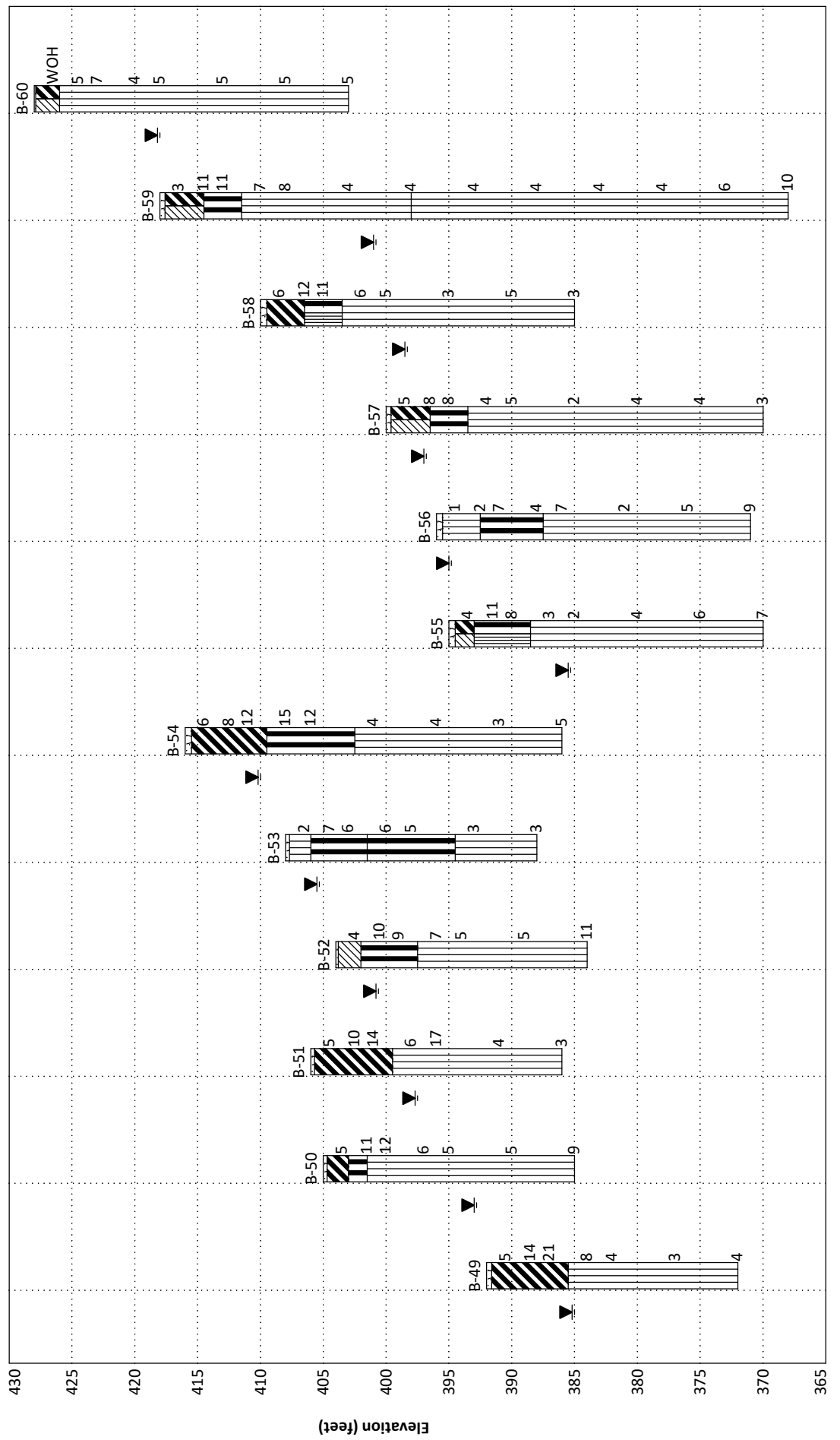
Profile Name: Figure No.7

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC



SUBSURFACE PROFILE

Plot Based on Elevation

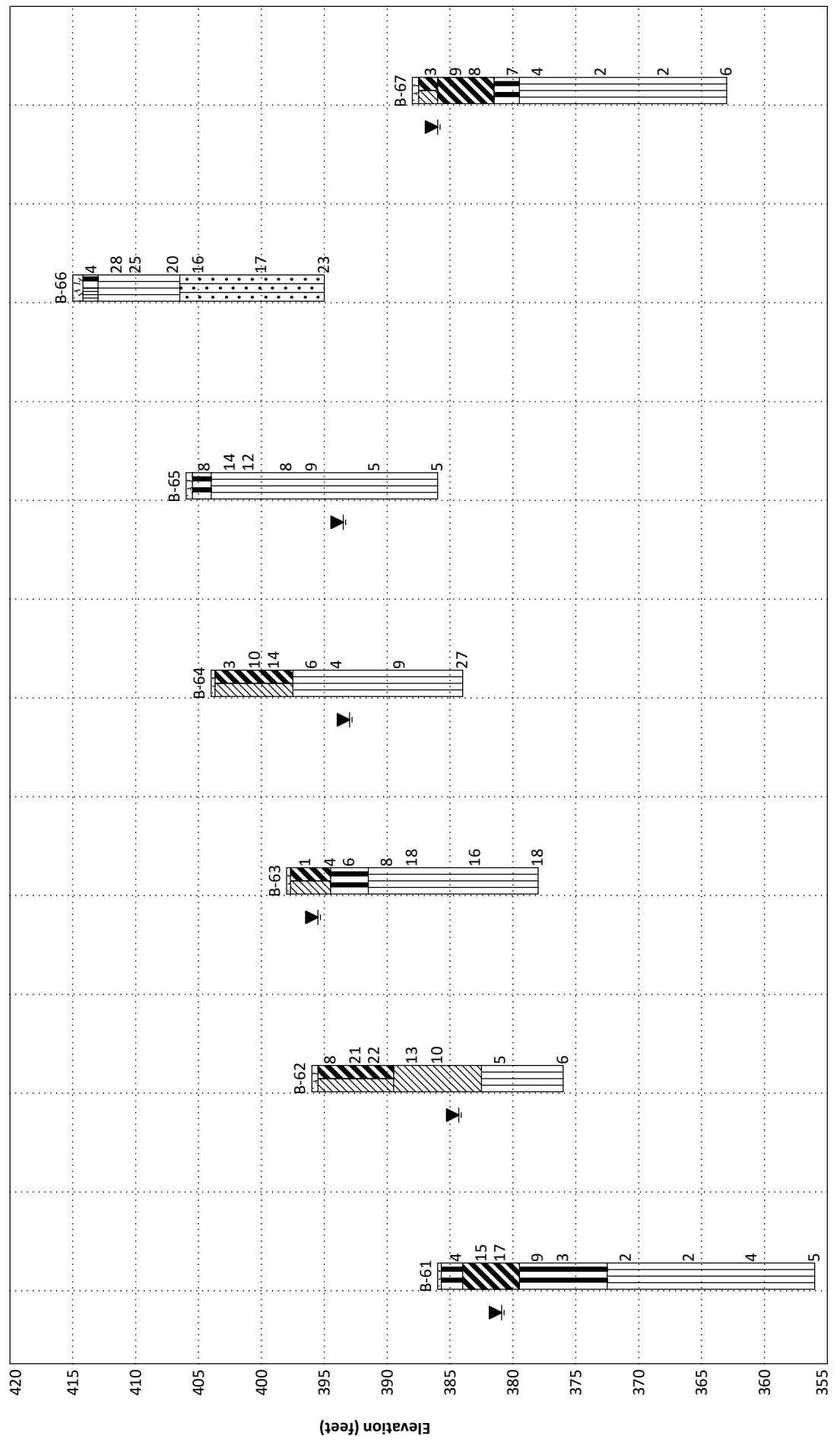
Profile Name: Figure No.8

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC





APPENDIX II

BORING LOGS

KEY TO SOIL CLASSIFICATION

Correlation of Penetration Resistance with Relative Density and Consistency

<u>Sands and Gravels</u>		<u>Silts and Clays</u>	
<u>No. of Blows, N</u>	<u>Relative Density</u>	<u>No. of Blows, N</u>	<u>Relative Density</u>
0 - 4	Very loose	0 - 2	Very soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Medium dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very dense	16 - 30	Very stiff
		31 - 50	Hard
		Over 50	Very hard

Particle Size Identification (Unified Classification System)

Boulders:	Diameter exceeds 8 inches
Cobbles:	3 to 8 inches diameter
Gravel:	<u>Coarse</u> - 3/4 to 3 inches diameter <u>Fine</u> - 4.76 mm to 3/4 inch diameter
Sand:	<u>Coarse</u> - 2.0 mm to 4.76 mm diameter <u>Medium</u> - 0.42 mm to 2.0 mm diameter <u>Fine</u> - 0.074 mm to 0.42 mm diameter
Silt and Clay:	Less than 0.07 mm (particles cannot be seen with naked eye)

Modifiers






















The modifiers provide our estimate of the amount of silt, clay or sand size particles in the soil sample.

<u>Approximate Content</u>	<u>Modifiers</u>
≤ 5%:	Trace
5% to 12%:	Slightly silty, slightly clayey, slightly sandy
12% to 30%:	Silty, clayey, sandy
30% to 50%:	Very silty, very clayey, very sandy

<u>Field Moisture Description</u>
Saturated: Usually liquid; very wet, usually from below the groundwater table
Wet: Semisolid; requires drying to attain optimum moisture
Moist: Solid; at or near optimum moisture
Dry: Requires additional water to attain optimum moisture



UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION					TYPICAL NAMES
	GRAVELS More than 50% of coarse fraction larger than No. 4 sieve	CLEAN GRAVEL (little or no fines)		GW	Well graded gravels
				GP	Poorly graded gravels
		GRAVELS with fines		GM	Silty gravels
				GC	Clayey gravels
	SANDS More than 50% of coarse fraction smaller than No. 4 sieve	CLEAN SAND (little or no fines)		SW	Well graded sands
				SP	Poorly graded sands
		SAND with fines		SM	Silty sands, sand/silt mixtures
				SC	Clayey sands, sand/clay mixtures
	SILTS AND CLAYS Liquid Limit is less than 50			ML	Inorganic silts, sandy and clayey silts with slightly plasticity
				CL	Sandy or silty clays of low to medium plasticity
				OL	Organic silts of low plasticity
	SILTS AND CLAYS Liquid Limit is greater than 50			MH	Inorganic silts, sandy micaceous or clayey elastic silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity
	HIGHLY ORGANIC SOILS				PT
MISCELLANEOUS MATERIALS					PWR (Partially Weathered Rock)
					Rock
					Asphalt
					ABC Stone
					Concrete
					Surficial Organic Soil



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-1 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 396 ±

Total Depth: 13.9'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
395.7	0.3	SURFICIAL ORGANIC SOIL.	WOH-1-1	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 10.8', Caved at 11.0'
394.0	2.0	NATIVE SOILS: Very soft, gray-brown, moist to wet, fine sandy CLAY (CL) with trace roots.	10-43-50/3"	1.5	2	
392.0	4.0	Hard, light-gray, moist, fine sandy SILT (ML)	43-50/5.5"	2.0		
		PARTIALLY WEATHERED ROCK: Sampled as light-gray, moist, fine sandy SILT.		3.3	100+	
				4.5		
				6.5	100+	
				7.4	100+	
				8.5	100+	
					100+	
382.2	13.8	Boring Terminated at 13.8 feet.	50/4"	13.5	100+	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-2 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.7	0.3	SURFICIAL ORGANIC SOIL.	2-2-5	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry inside PVC
416.0	2.0	NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots.	3-5-5	1.5	7	
		Stiff, red-brown, moist, clayey fine sandy SILT (MH) with trace organics.	3-6-8	2.0	10	
				3.5	14	
				5.0	14	
411.5	6.5	Stiff to very stiff, gray-brown, moist, fine sandy SILT (ML)	4-5-6	6.5	11	
			4-6-8	8.0	11	
				8.5	14	
				10.0	14	
			4-6-6	13.5	12	
				15.0	12	
			6-11-14	18.5		
398.0	20.0	Boring Terminated at 20 feet.		20.0	25	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-3 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 428 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
427.5	0.5	SURFICIAL ORGANIC SOIL.	WOH-2-4	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: Dry, Caved at 17.0'
		NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CH) with trace roots.		1.5	6	
			4-10-11	2.0		
424.5	3.5	Very stiff to stiff, red-brown, moist, clayey SILT (MH) with trace roots at 3.5' to 5.0'.	5-9-11	3.5	21	
				5.0	20	
			4-6-7	6.5		
				8.0	13	
419.5	8.5	Stiff to firm, light-brown, moist, fine sandy SILT (ML)	5-6-7	8.5		
				10.0	13	
			3-4-5	13.5		
				15.0	9	
			2-3-5	18.5		
408.0	20.0	Boring Terminated at 20 feet.		20.0	8	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-4 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 434 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
433.5	0.5	SURFICIAL ORGANIC SOIL	1-1-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry inside PVC
		NATIVE SOILS: Soft to very stiff, red-brown, moist, silty CLAY (CL/CH) with trace roots and trace quartz from 3.5' to 5.0'.		1.5	3	
			6-10-13	2.0		
			7-10-14	3.5	23	
				5.0	24	
427.5	6.5		4-7-9	6.5		
425.5	8.5			8.0	16	
			3-5-8	8.5		
				10.0	13	
				13.5		
			2-3-4	15.0	7	
				18.5		
			1-4-2	20.0	6	
414.0	20.0	Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-5 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 431 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
430.5	0.5	SURFICIAL ORGANIC SOIL.	2-3-3	0.0		GROUNDWATER DATA 0 Hr: 17.5' inside HSA 24 Hrs: 13.5', Caved at 16.0'
429.0	2.0	NATIVE SOILS: Firm, dark brown, moist, fine sandy clayey SILT (MH) with trace roots.	4-6-8	1.5	6	
		Stiff to very stiff, red-brown, moist, silty CLAY (CL/CH) with trace roots 2.0' to 3.5'.	6-10-12	2.0	14	
				3.5	22	
424.5	6.5			5.0		
		Stiff, red-brown, moist, clayey fine sandy SILT (MH)	4-4-7	6.5	11	
422.5	8.5		2-4-5	8.0		
		Stiff to soft, red-brown, moist, fine sandy SILT (ML)		8.5	9	
				10.0		
			2-2-3	13.5	5	
				15.0		
			1-2-2	18.5		
411.0	20.0	Boring Terminated at 20 feet.		20.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-6 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.5	0.5	SURFICIAL ORGANIC SOIL.	1-1-2	0.0		GROUNDWATER DATA 0 Hr: 18.0' inside HSA 24 Hrs: 5.5' inside PVC
		NATIVE SOILS: Soft to firm, dark brown, moist to wet, fine sandy CLAY (CL) with trace roots.		1.5	3	
			2-3-5	2.0		
414.5	3.5	Stiff, light gray-brown, moist, silty CLAY (CL/CH) with trace quartz.	3-4-5	3.5	8	
				5.0	9	
				6.5		
411.5	6.5	Firm to soft, brown, moist to wet, fine sandy SILT (ML)	2-3-3	6.5		
				8.0	6	
			2-2-3	8.5		
				10.0	5	
			2-2-2	13.5		
				15.0	4	
			1-2-3	18.5		
398.0	20.0	Boring Terminated at 20 feet.		20.0	5	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-7 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 401 ±

Total Depth: 13.6'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
400.5	0.5	SURFICIAL ORGANIC SOIL.	1-1-5	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: Dry, Caved at 11.0'
399.0	2.0	NATIVE SOILS: Firm, brown, moist, clayey fine sandy SILT (MH) with trace quartz and roots.	3-5-6	1.5	6	
397.5	3.5	Stiff, brown, moist, fine sandy CLAY (CL) with trace roots.	5-14-19	2.0	11	
		Hard, gray-brown, moist, fine sandy SILT (ML) with trace coarse sand at 6.5' to 9.0'.		3.5	33	
			14-20-23	5.0	43	
			36-50/3"	6.5	100+	
392.0	9.0	PARTIALLY WEATHERED ROCK: Sampled as gray, moist, fine sandy SILT		8.0		
387.4	13.6	Boring Terminated at 13.6 feet.	50/1"	8.5		
				13.5	100+	

BORING LOG 66U-0033 BORING LOGS 2.GPJ F&R.GDT 5/27/16

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-8 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 420 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
419.5	0.5	SURFICIAL ORGANIC SOILS	1-3-4	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry inside PVC
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots from 0.0'-1.5'		1.5	7	
			3-6-6	2.0		
416.5	3.5	Stiff, red-brown, moist, clayey fine sandy SILT (MH)	3-6-5	3.5	12	
				5.0	11	
413.5	6.5	Stiff, orange-brown, moist, fine sandy SILT (ML) with trace mica, moist to wet (13.5'-20.0')	3-5-6	6.5		
				8.0	11	
			3-5-5	8.5		
				10.0	10	
			2-5-5	13.5		
				15.0	10	
			2-4-5	18.5		
400.0	20.0	Boring Terminated at 20 feet.		20.0	9	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-9 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 433 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
432.5	0.5	SURFICIAL ORGANIC SOILS	1-1-4	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 18.5' inside PVC
		NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CH) with trace roots (0.0'-3.5')	4-7-9	1.5	5	
			5-7-10	2.0	16	
				3.5	17	
				5.0	17	
426.5	6.5	Stiff, red-brown, moist, clayey fine sandy SILT (MH)	4-6-6	6.5	12	
424.5	8.5		4-4-6	8.0	10	
		Stiff to firm, orange-brown, moist, fine sandy SILT (ML)		8.5		
				10.0		
			2-3-3	13.5	6	
				15.0		
			2-2-4	18.5		
413.0	20.0	Boring Terminated at 20 feet.		20.0	6	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-10 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 431 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
430.7	0.3	SURFICIAL ORGANIC SOILS	2-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 17.0'
		NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CH) with trace roots		1.5	5	
			5-7-9	2.0		
427.5	3.5	Very stiff, orange-brown, moist, clayey fine sandy SILT (MH)	5-8-10	3.5	16	
				5.0	18	
424.5	6.5	Firm to stiff, tan-brown, moist, fine sandy SILT (ML)	3-4-5	6.5		
				8.0	9	
			3-4-5	8.5		
				10.0	9	
			3-3-5	13.5		
				15.0	8	
			3-4-6	18.5		
411.0	20.0	Boring Terminated at 20 feet.		20.0	10	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-11 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 40.0'


Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.7	0.3	 SURFICIAL ORGANIC SOILS	1-3-5	0.0		GROUNDWATER DATA 0 Hr: 30.5' 24 Hrs: 14.5', Caved at 32.0'
416.0	2.0		NATIVE SOILS: Firm, red-brown, silty CLAY (CH) with trace roots Firm to soft, orange-brown, moist, fine sandy SILT (ML)		1.5	
		3-4-4		2.0		
		2-3-4		3.5	8	
				5.0	7	
		1-3-2		6.5		
				8.0	5	
		1-1-2		8.5		
				10.0	3	
		1-1-2	13.5			
			15.0	3		
399.5	18.5	Soft to stiff, red-brown, moist to wet, fine sandy SILT (ML), saprolitic	WOH-1-2	18.5		
			20.0	3		
			1-1-2	23.5		
				25.0	3	
			1-2-2	28.5		
				30.0	4	
			1-2-3	33.5		
			35.0	5		
			38.5			
			3-5-9	40.0	14	
378.0	40.0	Boring Terminated at 40 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-12 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 403 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
402.5	0.5	SURFICIAL ORGANIC SOILS	1-4-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 2.5', Caved at 15.5' inside PVC
401.0	2.0	NATIVE SOILS: Firm, light gray, moist, fine sandy CLAY (CL) with trace roots	2-2-3	1.5	6	
		Firm, gray-brown, moist, fine sandy SILT (ML) with trace gravel sized fragments (3.5'-5.0')	3-2-6	2.0	5	
				3.5	5	
				5.0	8	
396.5	6.5	Very stiff to hard, brown-gray, moist, fine sandy SILT (ML)	4-7-9	6.5	8	
			7-8-10	8.0	16	
				8.5	16	
				10.0	18	
			3-8-15	13.5	23	
				15.0	23	
			12-12-27	18.5		
383.0	20.0	Boring Terminated at 20 feet.		20.0	39	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-13 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 401 ±

Total Depth: 18.6'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
400.5	0.5	SURFICIAL ORGANIC SOILS	1-2-3	0.0	5 4 6 14 23 22	GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 11.5' inside PVC
				1.5		
		NATIVE SOILS: Firm to soft, orange-brown, moist, slightly fine sandy silty CLAY (CH) with trace roots	1-2-2	2.0		
397.5	3.5		2-3-3	3.5		
		Firm, orange-brown, moist, clayey fine sandy SILT (MH) with trace roots		5.0		
394.5	6.5		6-7-7	6.5		
		Stiff to very stiff, tan-brown, moist, fine sandy SILT (ML) with trace roots at 6.5'-8.0'		8.0		
			10-11-12	8.5		
				10.0		
				13.5		
387.5	13.5	Medium dense, gray, moist, silty fine SAND (SM)	11-12-10	13.5		
				15.0		
382.5	18.5	PARTIALLY WEATHERED ROCK: Sampled as white, moist, silty fine SAND	50/1.5"	18.5	100+	
382.4	18.6					
		Boring Terminated at 18.6 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-14 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.5	0.5	SURFICIAL ORGANIC SOILS	1-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry, Caved at 14.5'
416.0	2.0	NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots	3-5-6	1.5	5	
414.5	3.5	Stiff, red-brown, moist, fine sandy silty CLAY (CL/CH)	3-4-5	2.0	11	
				3.5		
				5.0	9	
411.5	6.5	Stiff, red-brown, moist, clayey fine sandy SILT (MH)	3-3-5	6.5		
		Firm to stiff, brown-gray, moist, fine sandy SILT (ML)	3-4-5	8.0	8	
				8.5		
				10.0	9	
			4-5-6	13.5		
				15.0	11	
				18.5		
			5-4-7	20.0	11	
398.0	20.0	Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-15 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/20/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.7	0.3	SURFICIAL ORGANIC SOILS	2-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 10.5' inside PVC
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots		1.5	5	
			4-5-6	2.0		
			4-4-6	3.5	11	
				5.0	10	
411.5	6.5		3-3-4	6.5		
409.5	8.5	Firm, red-brown, moist, clayey fine sandy SILT (MH)		8.0	7	
		Firm to stiff, red-tan, moist, fine sandy SILT (ML)	2-3-3	8.5		
				10.0	6	
				13.5		
			3-3-4	15.0	7	
				18.5		
398.0	20.0	Boring Terminated at 20 feet.		20.0	9	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-16 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 408 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/23/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
407.7	0.3	SURFICIAL ORGANIC SOILS	1-5-6	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 17.5'
		NATIVE SOILS: Stiff to firm, red-brown, moist, clayey fine sandy SILT (MH) with trace quartz from 1.0'-1.5' and roots		1.5	11	
			2-3-4	2.0		
404.5	3.5	Stiff, red-brown, moist, fine sandy SILT (ML)	3-3-6	3.5	7	
				5.0	9	
401.5	6.5	Medum dense, orange-brown, moist, silty fine SAND (SM)	6-8-8	6.5		
				8.0	16	
399.5	8.5	Stiff, tan-brown, moist, fine sandy SILT (ML)	3-4-5	8.5		
				10.0	9	
				13.5		
			4-5-7	15.0	12	
389.5	18.5	Medium dense, tan-brown, moist, silty fine SAND (SM)	9-10-12	18.5		
388.0	20.0			20.0	22	
		Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-17 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 398 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/23/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
397.5	0.5	SURFICIAL ORGANIC SOILS	1-2-4	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 19.5' inside PVC
396.0	2.0	NATIVE SOILS: Firm, orange-brown, moist, fine sandy CLAY (CL) with trace roots Stiff to very stiff, tan-white, moist, fine sandy SILT (ML)	3-4-5	1.5	6	
			4-5-8	2.0	9	
				3.5	13	
				5.0	18	
			9-10-8	6.5	19	
			7-10-9	8.0		
				8.5		
				10.0		
384.0	14.0	PARTIALLY WEATHERED ROCK: Sampled as white, moist, fine sandy SILT	49-50/3"	13.5	100+	
378.2	19.8	Boring Terminated at 19.8 feet.	12-21-50/3"	18.5	100+	
				19.8		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-18 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 398 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/23/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
397.5	0.5	SURFICIAL ORGANIC SOILS	1-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 4.0', Caved at 11.0'
		ALLUVIAL: Firm to stiff, gray-brown, moist, fine sandy clayey SILT (MH) with trace roots		1.5	5	
			3-4-6	2.0		
394.5	3.5	NATIVE SOILS: Stiff, gray-brown, moist, fine sandy SILT (ML)	5-6-6	3.5	10	
				5.0	12	
			4-5-9	6.5		
				8.0	14	
389.5	8.5	Medium dense to very dense, brown-white, moist, silty fine SAND (SM)	7-9-12	8.5		
				10.0	21	
				13.5		
			14-15-21	15.0	36	
				18.5		
			48-41-44	20.0		
378.0	20.0	Boring Terminated at 20 feet.			85	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-19 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 396 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
395.7	0.3	SURFICIAL ORGANIC SOIL.	2-1-1	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: Dry, Caved at 15.0'
394.0	2.0	NATIVE SOILS: Very soft, brown, moist to wet, clayey fine sandy SILT (MH) with trace roots.	3-10-12	1.5	2	
		Very stiff to very hard, white-brown, moist, fine sandy SILT (ML)	10-14-21	2.0	22	
				3.5	35	
				5.0	70	
				6.5	71	
				8.0		
				8.5		
				10.0		
				13.5		
				14.5	100+	
387.5	8.5	Very dense, dark-gray, moist, silty fine SAND (SM)	30-36-35	18.5		
382.0	14.0	PARTIALLY WEATHERED ROCK: Sampled as dark gray, moist, silty fine SAND.	40-50/5.5"	20.0	86	
377.5	18.5	Very dense, dark-gray, moist, silty fine to coarse SAND (SM) with trace mica.	31-48-38			
376.0	20.0	Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-20 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 404 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
403.5	0.5	SURFICIAL ORGANIC SOIL	1-1-3	0.0		GROUNDWATER DATA 0 Hr: not measured 24 Hrs: 14.5' inside PVC
		NATIVE SOIL: Soft to firm, red-brown, moist, silty CLAY (CH) with trace roots.		1.5		
			2-3-3	2.0	4	
400.5	3.5	Firm, red-brown, moist, clayey fine sandy SILT (MH) with trace roots.		3.5	6	
			4-2-3	5.0	5	
397.5	6.5	Firm to hard, brown, moist, fine sandy SILT (ML) with trace roots at 6.5' to 8.0'.	3-4-5	6.5		
				8.0	9	
			2-3-5	8.5		
				10.0	8	
				13.5		
			4-5-8	15.0	13	
				18.5		
			12-20-22	20.0	42	
384.0	20.0	Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-21 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 391 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
390.7	0.3	SURFICIAL ORGANIC SOIL	1-2-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 11.0' inside PVC
389.0	2.0	NATIVE SOILS: Soft, orange-brown, moist to wet, fine sandy SILT (ML) with trace roots.	3-5-8	1.5	4	
		Stiff to very stiff, gray-brown, moist, fine sandy SILT (ML)	3-4-10	2.0	13	
				3.5	14	
				5.0	20	
				6.5	20	
				8.0	20	
382.5	8.5	Medium dense to dense, gray-brown, moist, silty fine SAND (SM)	11-9-11	8.5	20	
				10.0	20	
				13.5	35	
				15.0	35	
				18.5	37	
371.0	20.0	Boring Terminated at 20 feet.		20.0	37	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-22 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 387 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
386.5	0.5	SURFICIAL ORGANIC SOIL	1-1-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: 2.6' inside PVC
385.0	2.0	ALLUVIAL SOIL: Soft, dark gray, wet, fine sandy SILT (ML) with trace roots.	1-2-5	1.5	3	
383.5	3.5	Firm, gray-brown, wet, fine sandy SILT (ML) with trace roots.	8-8-10	3.5	7	
				5.0	18	
380.5	6.5	Medium dense, dark brown, moist, silty fine SAND (SM)	12-12-11	6.5		
378.5	8.5	Very stiff, brown, moist, fine sandy SILT (ML)	9-13-14	8.0	23	
		Medium dense to very dense, brown, moist, silty fine SAND (SM)		10.0	27	
				13.5		
			9-13-18	15.0	31	
				18.5		
367.0	20.0	Boring Terminated at 20 feet.	17-28-36	20.0	64	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-23 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 392 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
391.7	0.3	SURFICIAL ORGANIC SOIL.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 7.5' inside PVC
		NATIVE SOILS: Very soft to firm, gray-brown, wet, fine sandy SILT (ML) with trace quartz and roots at 0.3' to 1.5' and mica at 2.0' to 6.5'.		1.5	5	
			1-1-1	2.0	2	
			1-2-4	3.5	6	
				5.0	13	
385.5	6.5	Medium dense, gray-brown, moist to wet, silty fine SAND (SM) with trace mica.	4-5-8	6.5	21	
383.5	8.5		7-8-13	8.0	16	
		Very stiff, gray-brown, moist to wet, fine sandy SILT (ML) with trace mica.		8.5		
				10.0		
			5-6-10	13.5		
				15.0		
373.5	18.5	Dense, gray-brown, moist to wet, silty fine SAND (SM) with trace mica.	10-15-16	18.5	31	
372.0	20.0			20.0		
		Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-24 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 396 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
395.5	0.5	SURFICIAL ORGANIC SOIL.	1-1-1	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: 4.0' inside PVC
394.0	2.0	ALLUVIAL SOIL: Very soft, brown, wet, fine sandy SILT (ML) with trace roots.	1-1-1	1.5	2	
392.5	3.5	Very loose, dark gray, wet, clayey fine SAND (SC) with trace organics.	1-1-2	3.5	2	
		NATIVE SOILS: Very soft to firm, gray-brown, wet at 3.5' to 10.0' and moist to wet at 13.5' to 25.0', fine sandy SILT (ML) WOH-WOH-WOH		5.0	3	
				6.5		
				8.0	0	
			1-2-2	8.5		
				10.0	4	
			1-2-2	13.5		
				15.0	4	
			2-2-3	18.5		
				20.0	5	
			2-3-4	23.5		
371.0	25.0	Boring Terminated at 25 feet.		25.0	7	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-25 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 385 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
384.5	0.5		1-1-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: 3.0', Caved at 11.0'
383.0	2.0			1.5	3	
			2-5-8	2.0		
				3.5	13	
			6-6-10	5.0	16	
				6.5		
			5-5-9	8.0	14	
				8.5		
			6-5-9	10.0	14	
			5-6-7	13.5		
				15.0	13	
			7-13-17	18.5		
365.0	20.0	Boring Terminated at 20 feet.		20.0	30	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-26 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 381 ±

Total Depth: 18.6'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/18/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
380.7	0.3	SURFICIAL ORGANIC SOIL	1-1-1	0.0		GROUNDWATER DATA 0 Hr: 17.5' inside PVC 24 Hrs: 7.6' inside PVC
379.0	2.0	ALLUVIAL SOIL: Very loose, gray-brown, wet, silty fine SAND (SM) with trace roots.	6-4-10	1.5	2	
377.5	3.5	NATIVE SOILS: Medium dense, gray-brown, moist to wet, clayey fine SAND (SC) with trace mica.	23-39-50/4"	2.0	14	
376.5	4.5	Very dense, gray-brown, moist, silty fine SAND (SM) with trace mica.	39-50-50/5.5"	3.5	100+	
		PARTIALLY WEATHERED ROCK: Sampled as gray-brown, moist, silty fine SAND with trace mica.	40-44-50/4.5"	4.8	100+	
				6.5	100+	
				8.0	100+	
				8.5	100+	
				9.9	100+	
			50/3.5"	13.5	100+	
362.4	18.6	Boring Terminated at 18.6 feet.	50/1"	18.5	100+	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-27 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 385 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
384.7	0.3	SURFICIAL ORGANIC SOIL	1-2-4	0.0		GROUNDWATER DATA 0 Hr: 6.5' inside PVC 24 Hrs: 1.5', Caved at 9.6'
383.0	2.0	ALLUVIAL SOIL: Firm, dark gray, moist to wet, fine sandy SILT (ML) with trace roots.	12-5-10	1.5	6	
		NATIVE SOILS: Stiff to very stiff, brown, moist, fine sandy SILT (ML) with some fine to coarse trace gravel size quartz at 2.0' to 3.5'.	9-10-10	2.0	15	
				3.5	15	
				5.0	20	
378.5	6.5	Medium dense, brown, moist, silty fine SAND (SM)	8-11-16	6.5	20	
			9-9-11	8.0	27	
				8.5	27	
				10.0	20	
371.5	13.5	Very stiff, light-brown, moist, fine sandy SILT (ML)	5-9-9	13.5		18
				15.0		
			6-6-10	18.5		
365.0	20.0	Boring Terminated at 20 feet.		20.0	16	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-28 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 394 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
393.6	0.4	SURFICIAL ORGANIC SOIL	1-1-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 4.5' inside PVC
		NATIVE SOILS: Soft to stiff, gray-brown, moist to wet, slightly fine sandy silty CLAY (CH) with trace roots and gravel at (2.0' to 3.5')	1-2-3	1.5	3	
			3-5-8	2.0	5	
				3.5		
				5.0	13	
387.5	6.5	Stiff, gray-brown, moist to wet, silty CLAY (CL/ML)	3-3-6	6.5		
385.5	8.5		3-4-7	8.0	9	
		Stiff, gray-brown, moist to wet, fine sandy SILT (ML)		8.5		
				10.0	11	
			3-4-7	13.5		
				15.0	11	
			4-7-8	18.5		
374.0	20.0	Boring Terminated at 20 feet.		20.0	15	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-29 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 413 ±

Total Depth: 25.0'




Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
412.7	0.3	 SURFICIAL ORGANIC SOIL.  NATIVE SOILS: Soft, red-brown, moist to wet, silty CLAY (CH) with trace roots.  Soft to firm, orange-brown, moist to wet, fine snady clayey SILT (MH) with trace roots from 2.0' to 10.0'	1-1-2	0.0		GROUNDWATER DATA: 0 Hr: 22.2' 24 Hrs: 6.5'
411.0	2.0			1.5	3	
			2-2-3	2.0		
			2-3-4	3.5	5	
				5.0	7	
			1-2-3	6.5		
				8.0	5	
			1-1-2	8.5		
				10.0	3	
			1-2-2	13.5		
				15.0	4	
			1-1-2	18.5		
				20.0	3	
			1-1-2	23.5		
388.0	25.0	Boring Terminated at 25 feet.		25.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-30 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 416 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
415.6	0.4	SURFICIAL ORGANIC SOIL.	1-2-2	0.0		GROUNDWATER DATA 0 Hr: 17.5' inside PVC 24 Hrs: 10.0' inside PVC
		NATIVE SOILS: Firm, red-orange-brown, moist to wet, fine sandy clayey SILT (MH) with trace roots at 0.4' to 5.0'		1.5	4	
			2-3-4	2.0		
				3.5	7	
			1-2-3	5.0		
				6.5	5	
			1-2-3	8.0		
				8.5	5	
407.5	8.5		1-1-2	10.0	3	
				13.5		
		Soft to firm, red-orange, moist to wet, slightly clayey fine sandy SILT (ML)	1-2-2	15.0	4	
				18.5		
			1-2-3	20.0	5	
396.0	20.0	Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-31 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 377 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
376.6	0.4	SURFICIAL ORGANIC SOIL	2-3-5	0.0		GROUNDWATER DATA 0 Hr: 18.1' inside PVC 24 Hrs: 2.0', Caved at 3.0'
375.0	2.0	ALLUVIAL SOIL: Firm, dark gray, wet, fine sandy SILT (ML) with trace roots and fine gravel.	2-2-9	1.5	8	
		NATIVE SOILS: Medium dense to dense, gray-brown, moist, silty fine SAND (SM) with trace gravel and roots at (2.0' to 3.5').	17-16-17	2.0	11	
				3.5	11	
				5.0	33	
			13-14-16	6.5	33	
			12-14-19	8.0	30	
				8.5	30	
				10.0	33	
			12-11-13	13.5	24	
				15.0	24	
			17-16-18	18.5		
357.0	20.0	Boring Terminated at 20 feet.		20.0	34	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-32 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 385 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
384.5	0.5	SURFICIAL ORGANIC SOIL	3-3-3	0.0		GROUNDWATER DATA 0 Hr: 15.5' 24 Hrs: 2.0' inside PVC
383.0	2.0	ALLUVIAL SOIL: Firm, brown, moist, clayey fine sandy SILT (MH) with trace fine gravel and roots.	3-2-2	1.5	6	
		NATIVE SOILS: Soft to firm, white-brown, moist to wet, fine sandy SILT (ML)	1-1-2	2.0	4	
				3.5	4	
				5.0	3	
			1-1-2	6.5	3	
			1-2-2	8.0	3	
				8.5	4	
				10.0	4	
			2-3-4	13.5	7	
				15.0	7	
			2-3-4	18.5	7	
365.0	20.0	Boring Terminated at 20 feet.		20.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-33 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 398 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
397.7	0.3	SURFICIAL ORGANIC SOIL	1-1-2	0.0		GROUNDWATER DATA 0 Hr: 13.6' 24 Hrs: 10.5', Caved at 13.5'
		NATIVE SOILS: Soft to firm, red-brown, moist, silty CLAY (CH) with trace roots.		1.5	3	
			2-3-4	2.0		
394.5	3.5	Soft to very soft, orange-brown, moist to wet, fine sandy SILT (ML) with trace roots at 3.5' to 8.0'.	1-2-2	3.5	7	
				5.0	4	
			1-1-1	6.5		
				8.0	2	
			1-1-1	8.5		
				10.0	2	
384.5	13.5	Very soft to firm, gray-brown, wet, fine sandy SILT (ML) with trace mica.	1-1-1	13.5		
				15.0	2	
			1-2-3	18.5		
				20.0	5	
			2-2-2	23.5		
373.0	25.0	Boring Terminated at 25 feet.		25.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-34 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 410 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
409.7	0.3		1-2-3	0.0		GROUNDWATER DATA 0 Hr: 19.7' inside PVC 24 Hrs: 13.0' inside PVC
408.0	2.0			1.5	5	
			3-7-9	2.0		
			3-4-6	3.5	16	
				5.0	10	
			4-4-7	6.5		
				8.0	11	
			2-4-5	8.5		
				10.0	9	
			2-2-4	13.5		
				15.0	6	
			2-2-4	18.5		
390.0	20.0	Boring Termination at 20 feet.		20.0	6	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-35 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 424 ±

Total Depth: 40.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
423.5	0.5	SURFICIAL ORGANIC SOIL	2-2-3	0.0		GROUNDWATER DATA 0 Hr: 29.0' 24 Hrs: 19.5' Caved at 20.0'
		NATIVE SOILS: Firm to stiff, orange-brown, moist, silty CLAY (CL/CH) with trace roots.	4-5-6	1.5	5	
			3-5-7	2.0	11	
				3.5	12	
				5.0	13	
417.5	6.5	Stiff to firm, orange-brown, moist, fine sandy SILT (ML)	4-6-7	6.5	9	
			3-4-5	8.0	5	
				8.5		
				10.0		
			3-2-3	13.5		
				15.0		
405.5	18.5	Soft to stiff, gray-brown, moist to wet, fine sandy SILT (ML) with trace mica.	1-2-2	18.5	4	
				20.0		
			1-2-3	23.5	5	
				25.0		
			2-3-5	28.5	8	
				30.0		
			3-4-5	33.5	9	
				35.0		
			4-4-8	38.5		
				40.0		
384.0	40.0	Boring Terminated at 40 feet.			12	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-36 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 432 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
431.7	0.3	SURFICIAL ORGANIC SOIL NATIVE SOILS: Stiff to very stiff, red-brown, moist, silty CLAY (CH) with trace roots.	3-5-6	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry inside PVC
				1.5	11	
			4-7-8	2.0		
			5-9-9	3.5	15	
				5.0	18	
425.5	6.5	Stiff to soft, red-brown, moist at (6.5' to 10.0'), fine sandy SILT (ML), moist to wet at (13.5' to 20.0').	3-5-5	6.5		
				8.0	10	
			2-4-5	8.5		
				10.0	9	
			2-3-3	13.5		
				15.0	6	
			1-2-2	18.5		
412.0	20.0	Boring Terminated at 20 feet.		20.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-37 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 388 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/17/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
387.6	0.4	SURFICIAL ORGANIC SOIL	1-2-5	0.0		GROUNDWATER DATA 0 Hr: 17.0' 24 Hrs: 12.5', Caved at 13.0'
386.0	2.0	NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots.	3-4-6	1.5	7	
		Firm to stiff, orange-brown, moist, fine sandy SILT (ML) with some fine to coarse gravel size quartz.	3-3-5	2.0	10	
				3.5	8	
				5.0	15	
				6.5	4	
			11-9-6	8.0		
379.5	8.5	Soft to firm, gray-brown, moist to wet, fine sandy SILT (ML) with trace mica.	1-2-2	8.5		
				10.0	4	
			1-2-2	13.5		
				15.0	4	
			3-3-5	18.5		
368.0	20.0	Boring Terminated at 20 feet.		20.0	8	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-38 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 406 ±

Total Depth: 40.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
405.5	0.5	SURFICIAL ORGANIC SOIL NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CH) with trace quartz.	1-3-3	0.0		GROUNDWATER DATA 0 Hr: 23.0' 24 Hrs: 19.0', Caved at 20.0'
				1.5	6	
			6-10-16	2.0		
			7-11-15	3.5	26	
			5.0	26		
399.5	6.5	Very stiff to firm, orange-brown, moist, fine sandy SILT (ML)	8-7-9	6.5		
				8.0	16	
			4-4-6	8.5		
				10.0	10	
				13.5		
			15.0	8		
387.5	18.5	Soft to stiff, gray-brown, moist to wet, fine sandy SILT (ML) with trace mica.	4-1-2	18.5		
				20.0	3	
				23.5		
			1-2-2	25.0	4	
				28.5		
			1-1-3	30.0	4	
				33.5		
			2-5-8	35.0	13	
367.5	38.5	Hard, white, moist to wet, fine sandy SILT (ML)	9-14-18	38.5		
366.0	40.0			40.0	32	
		Boring Terminated at 40 feet.				

BORING LOG 66U-0033 BORING LOGS 2.GPJ F&R.GDT 5/27/16

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-39 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 416 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
415.5	0.5	SURFICIAL ORGANIC SOIL	1-4-3	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 17.0'
		NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CH) with trace roots at 0.5' to 1.5'.		1.5	7	
			6-8-14	2.0		
			7-8-14	3.5	22	
				5.0	22	
409.5	6.5	Stiff to firm, orange-brown, moist, fine sandy SILT (ML)	3-4-6	6.5		
				8.0	10	
			2-4-5	8.5		
				10.0	9	
			2-3-4	13.5		
				15.0	7	
			2-3-5	18.5		
396.0	20.0	Boring Termination at 20 feet.		20.0	8	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-40 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 417 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
416.5	0.5	SURFICIAL ORGANIC SOIL	1-2-4	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: 15.0' inside PVC
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots.		1.5	6	
			4-7-8	2.0		
413.5	3.5	Very stiff to stiff, red-brown, moist, clayey fine sandy SILT (MH)	4-7-10	3.5	15	
				5.0	17	
			4-5-7	6.5		
				8.0	12	
408.5	8.5		2-3-5	8.5		
				10.0	8	
			2-2-3	13.5		
				15.0	5	
			2-1-3	18.5		
397.0	20.0	Boring Terminated at 20 feet.		20.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-41 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 426 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/16/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
425.5	0.5	SURFICIAL ORGANIC SOIL	1-1-1	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 17.0'
424.0	2.0	ALLUVIAL SOIL: Very soft, brown, moist to wet, fine sandy clayey SILT (ML/MH) with trace roots	2-5-8	1.5	2	
		NATIVE SOILS: Stiff, red-brown, moist, silty CLAY (CH)	4-4-7	2.0	13	
				3.5		
				5.0	11	
419.5	6.5	Stiff, brown, moist, clayey fine sandy SILT (MH)	4-4-7	6.5		
417.5	8.5	Stiff to firm, brown-gray, moist to wet, fine sandy SILT (ML)	3-4-5	8.0	11	
				8.5		
				10.0	9	
				13.5		
			2-4-5	15.0	9	
				18.5		
406.0	20.0	Boring Terminated at 20 feet.	2-3-5	20.0	8	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-42 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 431 ±

Total Depth: 20.0'



Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
430.7	0.3	 SURFICIAL ORGANIC SOIL	1-3-4	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 14.5'
					1.5	
429.0	2.0	 NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots.	4-6-7	2.0	7	
					3.5	
427.5	3.5	Stiff, red-brown, moist, clayey SILT (MH) with trace roots.	4-6-8	5.0	14	
					6.5	
		Firm to stiff, red-brown, wet, fine sandy SILT (ML) with trace mica from 6.5' to 10.0'.	3-3-3	8.0	6	
					8.5	
			2-3-5	10.0	8	
			2-3-3	13.5		
				15.0	6	
			1-2-4	18.5		
411.0	20.0	Boring Terminated at 20 feet.			20.0	6

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-43 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 400 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
399.9	0.1	SURFICIAL ORGANIC SOIL.	1-2-2	0.0		GROUNDWATER DATA 0 Hr: not measured 24 Hrs: 16.9', Caved at 17.0'
398.0	2.0	NATIVE SOILS: soft, gray-brown, wet, fine sandy CLAY (CL) with trace roots.	5-10-12	1.5	4	
		Stiff to hard, red-orange-brown, moist, clayey SILT (MH) with trace fine gravel.	8-12-19	2.0	22	
				3.5	31	
				5.0	24	
				6.5	16	
				7-10-14		
				8.0		
				8.5		
				10.0		
386.5	13.5	Soft, tan-gray, moist to wet, fine sandy SILT (ML) with trace mica. Wet from 23.5' to 25'	2-3-4	13.5	7	
				15.0	4	
				18.5		
			2-1-3	20.0		
				23.5		
375.0	25.0	Boring Terminated at 25 feet.	1-2-2	25.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-44 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 411 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
410.9	0.1	SURFICIAL ORGANIC SOIL.	WOH-2-3	0.0		GROUNDWATER DATA 0 Hr: Dry inside PVC 24 Hrs: Dry inside PVC
409.0	2.0	NATIVE SOILS: Firm, red, moist, silty CLAY (CH) with trace organics.	3-6-6	1.5 2.0	5	
407.5	3.5	Stiff, red, moist, fine sandy silty CLAY (CL/MH) with trace roots.	3-4-5	3.5	12	
		Stiff to firm, moist, red, fine sandy SILT (ML) with trace roots.	2-3-4	5.0 6.5	9	
			2-2-4	8.0 8.5	7	
401.0	10.0	Firm to soft, moist to wet, red, fine sandy SILT (ML)		10.0	6	
			1-3-2	13.5		
				15.0	5	
			1-2-2	18.5		
391.0	20.0	Boring Terminated at 20 feet.		20.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-45 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 420 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
419.9	0.1	SURFICIAL ORGANIC SOIL.	WOH-1-3	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: Dry, Caved at 15.0'
418.0	2.0	NATIVE SOILS: Soft, red, moist, silty CLAY (CH) with trace roots.	3-4-6	1.5	4	
416.5	3.5	Stiff, red-brown, moist, clayey SILT (MH) with trace roots.	3-4-4	2.0	10	
		Firm, tan-brown-red, moist to wet, slightly clayey fine sandy SILT (ML) with trace wood fragments from 3.5' to 5.0' and 13.5' to 15.0'.		3.5	8	
				5.0	8	
				6.5	8	
				8.0	8	
				8.5	7	
				10.0	7	
				13.5	7	
				15.0	7	
				18.5	7	
400.0	20.0	Boring Terminated at 20 feet.	3-3-4	20.0	7	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-46 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.5	0.5	SURFICIAL ORGANIC SOIL.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: 18.5' 24 Hrs: 15.0' inside PVC
		NATIVE SOILS: Firm to very stiff, dark red, moist, silty CLAY (CH) with trace roots.		1.5	5	
			5-8-8	2.0		
414.5	3.5	Firm to stiff, red-brown, moist, fine sandy SILT (ML) with trace roots at (3.5' to 8.0').	4-6-6	3.5	16	
				5.0	12	
			2-4-5	6.5		
				8.0	9	
			2-3-4	8.5		
408.0	10.0	Firm, red-orange, moist to wet, fine sandy SILT (ML) with trace mica.		10.0	7	
			2-2-4	13.5		
				15.0	6	
			2-2-4	18.5		
398.0	20.0	Boring Terminated at 20 feet.		20.0	6	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-47 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 419 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
418.5	0.5	SURFICIAL ORGANIC SOIL.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: 16.5' 24 Hrs: Dry, Caved at 12.0'
417.0	2.0	NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots.	3-5-6	1.5	5	
415.5	3.5	Stiff, red-brown, moist, silty CLAY (CL) with trace roots.	3-4-6	2.0	11	
		Stiff to firm, red-orange, moist, fine sandy SILT (ML)		3.5	10	
			2-3-3	5.0	6	
			2-2-3	6.5	5	
				8.0		
				8.5		
				10.0		
405.5	13.5	Soft, tan-brown, wet at (13.5' to 15.0') to saturated at (18.5' to 25.0') fine sandy SILT (ML)	1-2-2	13.5	4	
				15.0		
			1-1-2	18.5	3	
				20.0		
			2-1-3	23.5		
394.0	25.0	Boring Terminated at 25 feet.		25.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-48 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 415 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
414.9	0.1	SURFICIAL ORGANIC SOIL.	1-1-2	0.0		GROUNDWATER DATA 0 Hr: 14.0' inside PVC 24 Hrs: 5.0' inside PVC
413.0	2.0	ALLUVIAL SOIL: Soft, dark brown, moist to wet, clayey SILT (MH) with trace roots.	3-4-6	1.5	3	
		NATIVE SOILS: Stiff to very stiff, dark brown, moist, silty CLAY (CL/CH) with trace organics.	4-7-11	2.0	10	
				3.5	18	
408.5	6.5	Stiff, red-orange, moist, clayey SILT (MH)	4-5-7	5.0	12	
406.5	8.5	Stiff to soft, red-brown, moist to wet at 8.5' to 18.5', fine sandy SILT (ML) with trace gravel size quartz fragments at (8.5' to 10.0') and wet at (18.5' to 20.0').	3-6-6	6.5	12	
				8.0	12	
				8.5	12	
			1-2-4	10.0	6	
				13.5		
				15.0		
			1-1-2	18.5		
395.0	20.0	Boring Terminated at 20 feet.		20.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-49 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 392 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
391.6	0.4	SURFICIAL ORGANIC SOIL.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: 12.0' inside PVC 24 Hrs: 6.8' inside PVC
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots.		1.5	5	
			4-6-8	2.0		
			6-10-11	3.5	14	
				5.0	21	
				6.5		
385.5	▼6.5	Firm to soft, brown to gray, moist to wet at 6.5' to 13.5', fine sandy SILT (ML) wih trace mica, wet from 13.5' to 20.0'.	2-4-4	8.0	8	
			2-1-3	8.5		
				10.0	4	
			1-1-2	13.5		
				15.0	3	
			1-2-2	18.5		
372.0	20.0	Boring Terminated at 20 feet.		20.0	4	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-50 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 405 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
404.7	0.3	SURFICIAL ORGANIC SOIL.	2-2-3	0.0		GROUNDWATER DATA 0 Hr: 13.5' 24 Hrs: 12.0', Caved at 13.0'
403.0	2.0	NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CH) with trace roots.	5-5-6	1.5	5	
401.5	3.5	Stiff, red-brown, moist, clayey SILT (MH) with trace roots.	3-5-7	2.0	11	
		Firm to stiff, red-orange, moist to wet at 3.5' to 18.5', fine sandy SILT (ML) with some quartz at 6.5' to 8.0', wet at 18.5' to 20.0" and trace roots at 3.5'to 6.5'		3.5	12	
				5.0		
			5-3-3	6.5		
				8.0	6	
			2-2-3	8.5		
				10.0	5	
			2-2-3	13.5		
				15.0	5	
			3-4-5	18.5		
385.0	20.0	Boring Terminated at 20 feet.		20.0	9	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-51 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 406 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
405.7	0.3	SURFICIAL ORGANIC SOIL. NATIVE SOILS: Firm to stiff, dark red, moist, silty CLAY (CH) with trace roots.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: 19.5' inside PVC 24 Hrs: 8.3' inside PVC
				1.5	5	
			4-4-6	2.0		
			4-7-7	3.5	10	
				5.0	14	
399.5	6.5	Very stiff to soft, dark red, moist to wet, fine sandy SILT (ML) with trace gravel sized quartz fragments from 8.5' to 10.0' and trace mica.	2-3-3	6.5		
				8.0	6	
			2-6-11	8.5		
				10.0	17	
			2-2-2	13.5		
				15.0	4	
			1-1-2	18.5		
386.0	20.0	Boring Terminated at 20 feet.		20.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-52 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 404 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
403.8	0.2	SURFICIAL ORGANIC SOIL.	1-2-2	0.0		GROUNDWATER DATA 0 Hr: 15.0' 24 Hrs: 3.2', Caved at 7.3'
402.0	2.0	ALLUVIAL SOIL: Soft, dark brown, moist to wet, silty CLAY (CL) with trace roots.	4-5-5	1.5	4	
		NATIVE SOILS: Stiff, tan-brown-black, moist, clayey SILT (MH)	3-5-4	2.0	10	
				3.5	9	
397.5	6.5			5.0		
		Firm to stiff, brown-gray, moist to wet at 8.5' to 20.0', fine sandy SILT (ML) with trace roots from 6.5' to 8.0', wet at 6.5' to 8.0'.	2-4-3	6.5	7	
			2-2-3	8.0		
				8.5		
				10.0	5	
			1-2-3	13.5		
				15.0	5	
			3-5-6	18.5		
384.0	20.0	Boring Terminated at 20 feet.		20.0	11	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-53 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 408 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
407.7	0.3	SURFICIAL ORGANIC SOIL.	WOH-1-1	0.0		GROUNDWATER DATA 0 Hr: 10.5' inside PVC 24 Hrs: 2.5' inside PVC
406.0	2.0	ALLUVIAL SOIL: Very soft, dark brown, saturated, fine sandy SILT (ML) with trace roots.	2-3-4	1.5	2	
		NATIVE SOILS: Firm, brown, wet, clayey SILT (MH) with trace roots and some graveled size quartz fragments.	2-3-3	2.0	7	
				3.5		
				5.0	6	
401.5	6.5	Firm, light gray-brown, saturated, clayey SILT (MH) with trace roots at 6.5' to 8.0'.	2-2-4	6.5		
			2-2-3	8.0	6	
				8.5		
				10.0	5	
394.5	13.5	Soft, gray-brown, saturated, fine sandy SILT (ML) with trace mica.	2-1-2	13.5		
				15.0	3	
			1-1-2	18.5		
388.0	20.0	Boring Terminated at 20 feet.		20.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-54 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 416 ±

Total Depth: 30.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/9/16

Driller: David Tignor

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
415.5	0.5	SURFICIAL ORGANIC SOIL.	1-2-4	0.0		GROUNDWATER DATA 0 Hr: 20.0' 24 Hrs: 5.8', Caved at 15.3'
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots.		1.5	6	
			3-4-4	2.0		
			3-5-7	3.5	8	
				5.0	12	
409.5	6.5	Stiff, red-orange, moist, clayey SILT (MH)	4-6-9	6.5		
			3-5-7	8.0	15	
				8.5		
				10.0	12	
402.5	13.5	Soft to firm, red-brown, wet, fine sandy SILT (ML), saturated at 28.5' to 30.0'	2-2-2	13.5		
				15.0	4	
				18.5		
			2-2-2	20.0	4	
				23.5		
			1-2-1	25.0	3	
				28.5		
			1-3-2	30.0	5	
386.0	30.0	Boring Terminated at 30 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-55 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 395 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
394.5	0.5	SURFICIAL ORGANIC SOIL.	1-1-3	0.0		GROUNDWATER DATA 0 Hr: 22.0' 24 Hrs: 9.5', Caved at 10.0'
393.0	2.0	NATIVE SOILS: Soft, orange-brown, moist, silty CLAY (CL/CH) with trace wood fragments.	3-5-6	1.5	4	
		Firm to stiff, orange-brown, moist, clayey SILT (ML/MH) with trace roots.	3-3-5	2.0	11	
				3.5	8	
388.5	6.5		1-1-2	5.0		
				6.5	3	
			1-1-1	8.0		
				8.5	2	
				10.0		
			1-2-2	13.5		
				15.0	4	
			2-2-4	18.5		
				20.0	6	
			2-2-5	23.5		
370.0	25.0	Boring Termination at 25 feet.		25.0	7	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-56 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 396 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
395.5	0.5	SURFICIAL ORGANIC SOIL.	WOH-WOH-1	0.0		GROUNDWATER DATA 0 Hr: 1.3' inside PVC 24 Hrs: 1.0' inside PVC
				1.5	1	
				2.0		
		ALLUVIAL SOIL: Very soft, black, saturated, fine sandy SILT (ML) with trace roots and trace gravel.	1-1-1	3.5	2	
392.5	3.5		2-3-4	5.0	7	
		NATIVE SOILS: Firm to soft, gray-brown, moist, clayey SILT (MH) with trace roots.		6.5		
			1-1-3	8.0	4	
387.5	8.5		2-3-4	8.5		
		Firm to very soft, gray-brown, moist at 8.5' to 10.0' and wet at 13.5' to 25.0', fine sandy SILT (ML) with trace mica.		10.0	7	
				13.5		
			1-1-1	15.0	2	
				18.5		
			1-2-3	20.0	5	
				23.5		
			2-3-6	25.0	9	
371.0	25.0	Boring Terminated at 25 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-57 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 400 ±

Total Depth: 30.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
399.6	0.4	SURFICIAL ORGANIC SOIL.	1-2-3	0.0		GROUNDWATER DATA 0 Hr: 21.1' 24 Hrs: 3.0'
		NATIVE SOILS: Firm, red-brown, moist, silty CLAY (CL/CH) with trace roots.		1.5	5	
			2-3-5	2.0		
396.5	3.5	Firm, red-brown, moist, clayey SILT (MH) with trace roots.		3.5	8	
			2-2-6	5.0	8	
393.5	6.5	Firm to soft, red-brown, moist to wet at 6.5' to 13.5', fine sandy SILT (ML) with trace mica, wet at 13.5' to 30.0'.	1-1-3	6.5		
				8.0	4	
			1-2-3	8.5		
				10.0	5	
			1-1-1	13.5		
				15.0	2	
			1-2-2	18.5		
				20.0	4	
			1-2-2	23.5		
				25.0	4	
			1-1-2	28.5		
370.0	30.0	Boring Terminated at 30 feet.		30.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-58 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 410 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
409.5	0.5	SURFICIAL ORGANIC SOIL.	1-3-3	0.0		GROUNDWATER DATA 0 Hr: 15.0' inside PVC 24 Hrs: 11.5' inside PVC
		NATIVE SOILS: Firm to stiff, red-brown, moist, silty CLAY (CH) with trace roots and leaves		1.5	6	
			3-5-7	2.0		
406.5	3.5	Stiff, red-orange, moist, clayey fine sandy SILT (ML/MH)	3-4-7	3.5	12	
				5.0	11	
403.5	6.5	Firm to soft, red-orange, moist to wet, fine sandy SILT (ML) with trace gravel with fines at 18.5' to 20.0'.	2-2-4	6.5		
				8.0	6	
			2-2-3	8.5		
				10.0	5	
			1-1-2	13.5		
				15.0	3	
			2-2-3	18.5		
				20.0	5	
			1-1-2	23.5		
385.0	25.0	Boring Terminated at 25 feet.		25.0	3	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-59 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 418 ±

Total Depth: 50.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/12/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
417.6	0.4	SURFICIAL ORGANIC SOIL.	1-1-2	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 17.0' inside HSA
		NATIVE SOILS: Soft to stiff, red-brown, moist, silty CLAY (CL/CH) with trace roots and fine gravel at 0.4' to 2.0'.		1.5	3	
			4-4-7	2.0		
414.5	3.5	Stiff, red-brown, moist, clayey SILT (MH) with trace roots	3-5-6	3.5	11	
				5.0	11	
411.5	6.5	Firm to soft, red-brown, moist to wet, fine sandy SILT (ML)	2-2-5	6.5		
			2-2-6	8.0	7	
				8.5		
				10.0	8	
			1-2-2	13.5		
				15.0	4	
			1-2-2	18.5		
398.0	20.0	Soft to stiff, red-orange-brown, moist to wet, fine sandy SILT (ML), saprolitic, wet from 38.5'-50.0'		20.0	4	
			1-2-2	23.5		
				25.0	4	
			1-2-2	28.5		
				30.0	4	
			1-2-2	33.5		
				35.0	4	
			1-1-3	38.5		
				40.0	4	
			1-3-3	43.5		
				45.0	6	
			2-4-6	48.5		
368.0	50.0	Boring Terminated at 50 feet.		50.0	10	

BORING LOG 66U-0033 BORING LOGS 2.GPJ F&R.GDT 5/27/16

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-60 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 428 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/9/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
427.9	0.1	SURFICIAL ORGANIC SOIL.	1-WOH-WOH	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 9.8' inside PVC
426.0	2.0	NATIVE SOILS: Very soft, moist, orange-brown, fine sandy CLAY (CL/CH) with trace roots.	2-2-3	1.5	0	
		Soft to firm, moist, orange-tan-brown, fine sandy SILT (ML)	2-3-4	2.0	5	
				3.5	7	
				5.0	4	
				6.5	5	
				8.0		
				8.5		
				10.0		
				13.5		
				15.0		
				18.5		
				20.0		
				23.5		
403.0	25.0	Boring Terminated at 25 feet.		25.0	5	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-61 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 386 ±

Total Depth: 30.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/10/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
385.7	0.3	SURFICIAL ORGANIC SOIL.	1-1-3	0.0		GROUNDWATER DATA 0 Hr: 28.0' inside HSA 24 Hrs: 5.1', Caved at 15.4'
384.0	2.0	NATIVE SOILS: Soft, orange-brown, moist, fine sandy clayey SILT (MH) with trace roots.	5-7-8	1.5	4	
		Stiff to very stiff, orange-brown, moist, silty CLAY (CH) with trace quartz fragments.	4-8-9	2.0		
				3.5	15	
				4.5		
					17	
379.5	6.5	Stiff to soft, light gray-brown, moist, clayey SILT (MH)	3-3-6	6.5		
			1-1-2	8.0	9	
				8.5		
				10.0	3	
372.5	13.5	Very soft to firm, brown, wet, slightly clayey fine sandy SILT (ML)	1-1-1	13.5		
				15.0	2	
			WOH-1-1	18.5		
				20.0	2	
			1-2-2	23.5		
				25.0	4	
			2-2-3	28.5		
356.0	30.0	Boring Terminated at 30 feet.		30.0	5	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-62 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 396 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/11/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
395.5	0.5	SURFICIAL ORGANIC SOIL.	2-3-5	0.0		GROUNDWATER DATA 0 Hr: 19.0' inside PVC 24 Hrs: 11.7' inside PVC
		NATIVE SOILS: Firm to very stiff, red-brown, moist, silty CLAY (CL/CH) with trace roots and quartz at 0.5' to 1.5'	7-8-13	1.5	8	
			7-8-14	2.0		
				3.5	21	
				5.0	22	
389.5	6.5	Stiff, gray-brown-orange, moist, silty CLAY (CL)	4-6-7	6.5		
			3-3-7	8.0	13	
				8.5		
				10.0	10	
382.5	13.5	Firm gray-brown, moist to wet, slightly clayey SILT (ML)	1-2-3	13.5		
				15.0	5	
			1-3-3	18.5		
376.0	20.0	Boring Terminated at 20 feet.		20.0	6	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-63 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 398 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/10/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
397.7	0.3	SURFICIAL ORGANIC SOIL	WOH-WOH-1	0.0		GROUNDWATER DATA 0 Hr: Dry 24 Hrs: 2.5', Caved at 9.5'
		NATIVE SOILS: Very soft to soft, brown, moist, fine sandy silty CLAY (CL/CH) with trace roots	1-1-3	1.5	1	
				2.0		
394.5	3.5	Firm, light gray-brown, moist, clayey SILT (MH)	1-3-3	3.5	4	
				5.0	6	
391.5	6.5	Firm to very stiff, light-gray-brown, moist, fine sandy SILT (ML)	2-3-5	6.5	8	
			4-8-10	8.0		
				8.5		
				10.0	18	
			4-7-9	13.5		
				15.0	16	
			4-6-12	18.5		
378.0	20.0	Boring Terminated at 20 feet.		20.0	18	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-64 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 404 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/10/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
403.7	0.3	SURFICIAL ORGANIC SOIL.	WOH-WOH-3	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: 11.0'
		NATIVE SOILS: Soft to stiff, orange-brown, moist, silty CLAY (CL/CH) with trace roots at 0.3' to 3.5'		1.5	3	
			3-3-7	2.0		
			4-5-9	3.5	10	
				5.0	14	
				6.5		
397.5	6.5	Soft to very stiff, gray-brown, moist, fine sandy SILT (ML)	1-3-3	8.0	6	
			1-2-2	8.5		
				10.0	4	
			4-4-5	13.5		
				15.0	9	
			5-9-18	18.5		
384.0	20.0	Boring Terminated at 20 feet.		20.0	27	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-65 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 406 ±

Total Depth: 20.0'


Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/10/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
405.5	0.5	 <p>SURFICIAL ORGANIC SOIL.</p> <p>NATIVE SOILS: Firm, light gray-brown, moist, clayey fine sandy SILT (MH) with trace roots.</p> <p>Stiff to firm, brown-gray, moist, fine sandy SILT (ML) with trace roots from 2.0' to 10.0' and fine gravel from 3.5' to 5.0'.</p>	1-3-5	0.0		<p>GROUNDWATER DATA</p> <p>0 Hr: Dry inside HSA</p> <p>24 Hrs: 12.5', Caved at 13.0'</p>
404.0	2.0		5-6-8	1.5	8	
			5-5-7	2.0	14	
				3.5	12	
				5.0	12	
			3-3-5	6.5	8	
			3-4-5	8.0	9	
				8.5		
				10.0		
			2-2-3	13.5	5	
				15.0		
			1-2-3	18.5		
386.0	20.0			20.0	5	
		Boring Terminated at 20 feet.				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-66 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 415 ±

Total Depth: 20.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/9/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
414.2	0.8	SURFICIAL ORGANIC SOIL.	2-2-2	0.0		GROUNDWATER DATA 0 Hr: Dry inside HSA 24 Hrs: Dry inside PVC
413.0	2.0	NATIVE SOILS: Soft, gray-brown, moist, fine sandy clayey SILT (ML/MH) with trace roots and fine gravel. Very stiff, orange-brown, moist, fine sandy SILT (ML) with trace quartz at 3.5' to 5.0'.	6-14-14	1.5	4	
			11-12-13	2.0	28	
				3.5	25	
				5.0	20	
			6-9-11	6.5	16	
406.5	8.5	Very stiff, tan-brown, moist, silty fine SAND (SM).	5-7-9	8.0	17	
				8.5		
				10.0		
			7-8-9	13.5		
				15.0		
395.0	20.0		7-11-12	18.5		
		Boring Terminated at 20 feet.		20.0	23	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



FROEHLING & ROBERTSON, INC.

BORING LOG

Boring: B-67 (1 of 1)

Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC

Elevation: 388 ±

Total Depth: 25.0'

Boring Location: See Boring Location

Drilling Method: 2.25" ID HSA

Hammer Type: Automatic

Date Drilled: 5/10/16

Driller: Daniel Aiello

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
387.5	0.5	SURFICIAL ORGANIC SOIL.	WOH-1-2	0.0		GROUNDWATER DATA 0 Hr: 7.0' inside PVC 24 Hrs: 2.0' inside PVC
386.0	2.0	NATIVE SOILS: Soft, orange-brown, moist, fine sandy silty CLAY (CL/CH) with trace roots	3-4-5	1.5	3	
		Stiff to firm, brown, moist, silty CLAY (CH) with trace roots and with trace gravel sized quartz.	5-3-5	2.0	9	
				3.5	8	
381.5	6.5	Firm, light gray-brown, moist, clayey SILT (MH) with trace roots.	2-2-5	5.0	7	
379.5	8.5	Soft to firm, gray-brown, moist to wet, slightly clayey at 8.5' to 10.0', fine sandy SILT (ML)	2-2-2	6.5	4	
				8.0		
				8.5		
				10.0		
				13.5		
			1-1-1	15.0	2	
				18.5		
			1-1-1	20.0	2	
				23.5		
363.0	25.0	Boring Terminated at 25 feet.	2-2-4	25.0	6	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.



APPENDIX III

LABORATORY TEST RESULTS

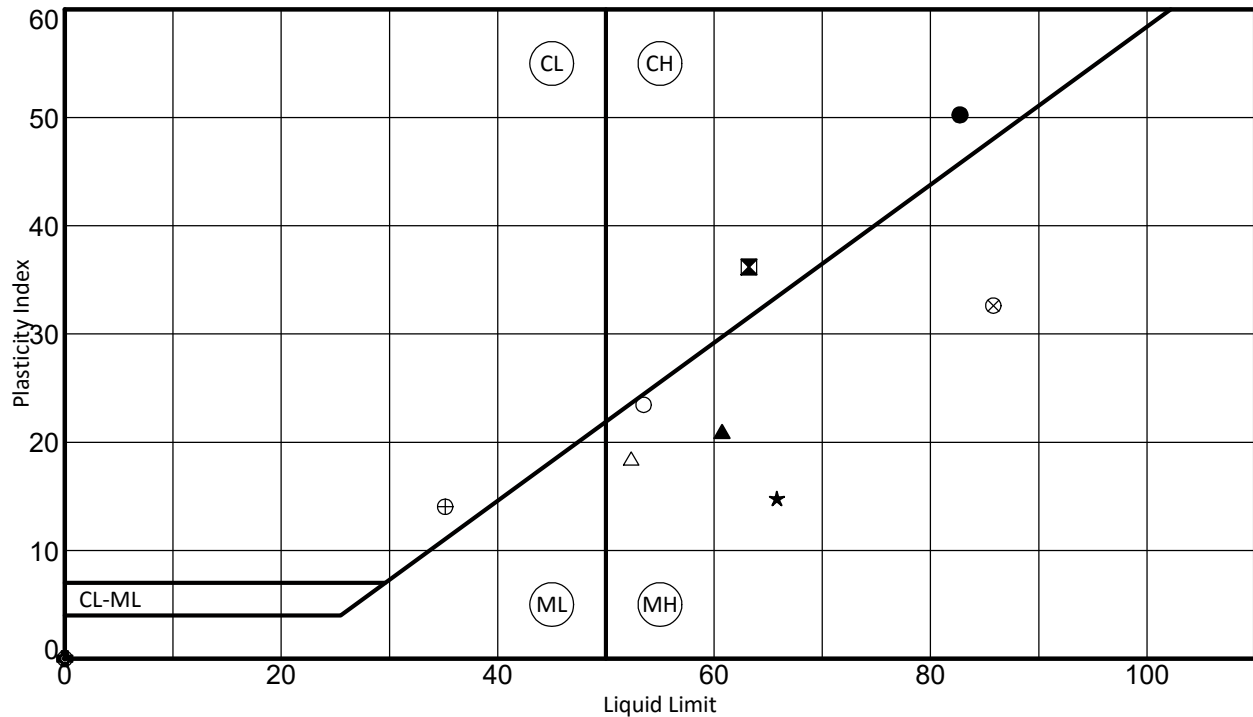


Project No: 66U-0033

Client: Wake County Board of Education

Project: Area Site H-12, E-46

City/State: Apex, NC



Boring No.	Depth	LL	PL	PI	Fines	Classification	% Natural Water Content
● B-13	2.0 - 3.5	83	32	51	90.9	FAT CLAY (CH)	33.4
⊠ B-28	3.5 - 5.0	63	27	36	87.6	FAT CLAY (CH)	26.1
▲ B-29	3.5 - 5.0	61	40	21	77.1	ELASTIC SILT with SAND (MH)	37.4
★ B-30	3.5 - 5.0	66	51	15	92.8	ELASTIC SILT (MH)	44.8
⊙ B-44	8.5 - 10.0	NP	NP	NP	92.5	SILT (ML)	40.9
⊞ B-46	8.5 - 10.0	NP	NP	NP	93.2	SILT (ML)	46.1
○ B-53	2.0 - 3.5	53	30	23	62.5	SANDY ELASTIC SILT (MH)	26.7
△ B-53	6.5 - 8.0	52	34	18	80.2	ELASTIC SILT with SAND (MH)	38.6
⊗ B-56	6.5 - 8.0	86	53	33	86.4	ELASTIC SILT (MH)	46.0
⊕ B-6	0.0 - 1.5	35	21	14	67.3	SANDY LEAN CLAY (CL)	18.6



APPENDIX IV

GBA DOCUMENT

Important Information about Your Geotechnical-Engineering Report

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

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

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

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

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

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

Geotechnical engineers consider many 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, droughts, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

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

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold-prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your GBA-Member Geotechnical Engineer for Additional Assistance

Membership in the GEOPROFESSIONAL BUSINESS ASSOCIATION exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBA-member geotechnical engineer for more information.



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