

**KNOXVILLE/KNOX COUNTY METROPOLITAN PLANNING COMMISSION  
 USE ON REVIEW REPORT**

▶ **FILE #:** 12-E-18-UR

**AGENDA ITEM #:** 53

**AGENDA DATE:** 12/13/2018

▶ **APPLICANT:** MICHAEL BRADY INC.

OWNER(S): Hartson Construction LLC

TAX ID NUMBER: 145 P M 025

[View map on KGIS](#)

JURISDICTION: County Commission District 4

STREET ADDRESS: 1933 Cottington Ln

▶ **LOCATION:** Northwest side of S. Northshore Dr., southwest side of Cottington Ln.

▶ **APPX. SIZE OF TRACT:** 2 acres

SECTOR PLAN: Southwest County

GROWTH POLICY PLAN: Planned Growth Area

ACCESSIBILITY: Access is via Cottington Ln., and British Station Ln., local streets with a 26' pavement width within a 50' right-of-way.

UTILITIES: Water Source: First Knox Utility District

Sewer Source: First Knox Utility District

WATERSHED: Tennessee River

▶ **ZONING:** PR (Planned Residential)

▶ **EXISTING LAND USE:** Residence

▶ **PROPOSED USE:** Detached Residential Subdivision

2 du/ac

HISTORY OF ZONING: Property was rezoned to PR (Planned Residential) at a density of up to 4 du/ac by Knox County Commission on August 23, 2004.

SURROUNDING LAND USE AND ZONING: North: Residences - PR (Planned Residential)

South: Vacant land - A (Agricultural) and F (Floodway)

East: Residences - PR (Planned Residential)

West: Residences and Church - PR (Planned Residential) and A (Agricultural)

NEIGHBORHOOD CONTEXT: The site is located in an area of low density residential subdivisions along the north side of S. Northshore Dr. that have developed under PR (Planned Residential) and RA (Low Density Residential) zoning.

**STAFF RECOMMENDATION:**

▶ **POSTPONE** the Use on Review application until the January 10, 2019 MPC meeting as requested by the applicant following discussion on this case and the associated final plat (12-SC-18-F).

**COMMENTS:**

The applicant is proposing to develop this 2.acre lot (Lot 25) within Cottington Court Subdivision into 4 lots for

detached residences at a density of 2 du/ac. With the proposed subdivision, the overall density for Cottingham Court would be 2.69 du/ac which is with the zoning limitation of 4.0 du/ac.

The three additional lots proposed for subdivision are located on the northern portion of Lot 25 in an area that was designated as a sinkhole on the recorded plat for the Subdivision. The property owner has submitted to Knox County Engineering a "Report of Limited Geotechnical Exploration" that was prepared by Geoservices, LLC and dated July 30, 2018 that explored the sites subsurface conditions and provided geotechnical recommendations regarding the potential risk of sinkhole development and for development of the site. Additional documentation has recently been provided to staff by residents within Cottingham Court Subdivision regarding sinkhole activity within the Subdivision. Staff supports the request for the postponement in order to allow additional time to review this new information.

The Subdivision Regulations under Section 3.02.A.1.c includes a lot standard that "Lots shall contain adequate building sites outside of required riparian buffer zones and sinkholes and shall meet the required minimum building setbacks." The applicant must provide clear documentation that this provision is met for the additional lots.

ESTIMATED TRAFFIC IMPACT: 54 (average daily vehicle trips)

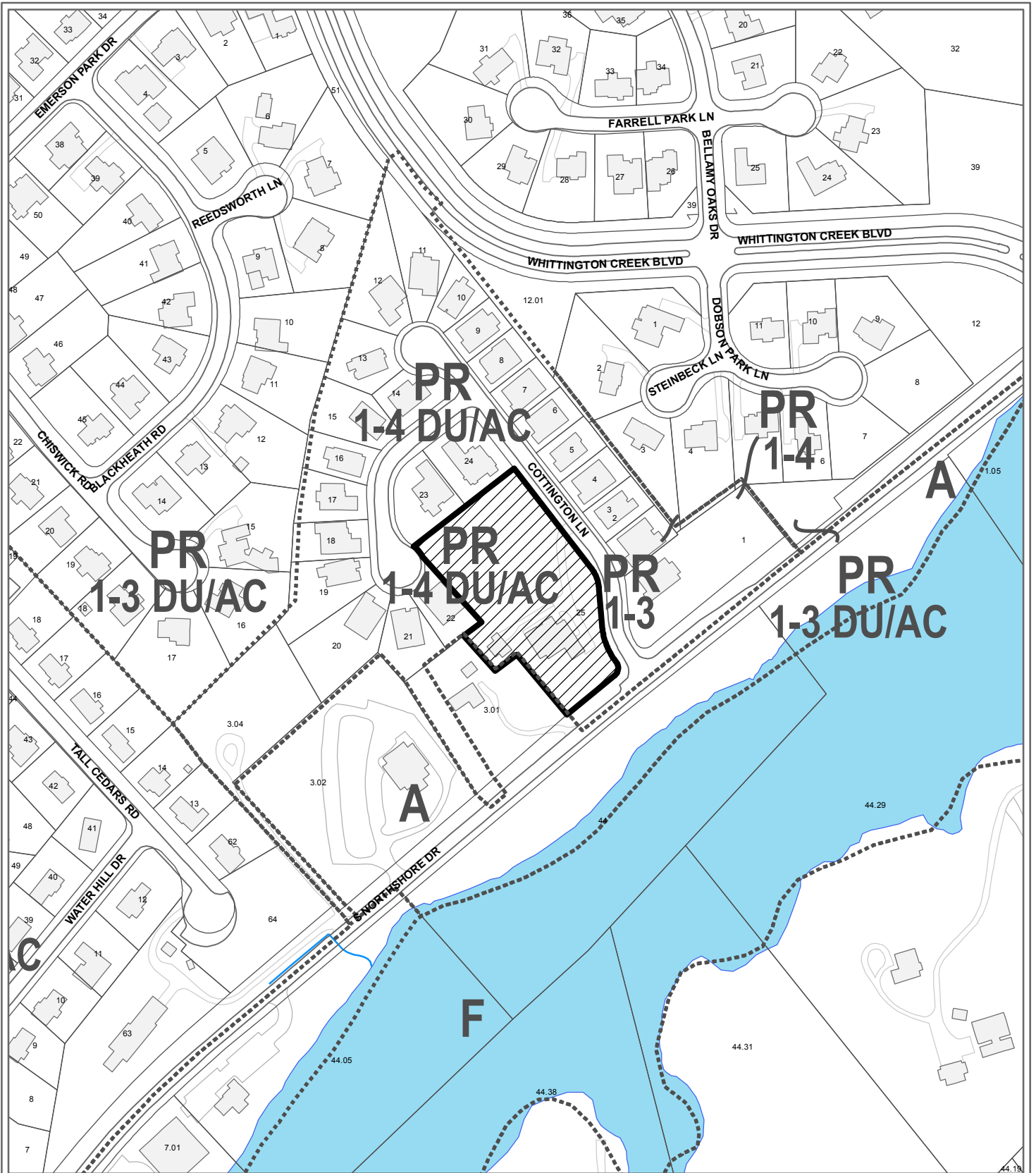
Average Daily Vehicle Trips are computed using national average trip rates reported in the latest edition of "Trip Generation," published by the Institute of Transportation Engineers. Average Daily Vehicle Trips represent the total number of trips that a particular land use can be expected to generate during a 24-hour day (Monday through Friday), with a "trip" counted each time a vehicle enters or exits a proposed development.

ESTIMATED STUDENT YIELD: 2 (public school children, ages 5-18 years)

Schools affected by this proposal: Blue Grass Elementary, West Valley Middle, and Bearden High.

- School-age population (ages 5–18) is estimated by MPC using data from a variety of sources.
- Students are assigned to schools based on current attendance zones as determined by Knox County Schools. Zone boundaries are subject to change.
- Estimates presume full build-out of the proposed development. Build-out is subject to market forces, and timing varies widely from proposal to proposal.
- Student yields from new development do not reflect a net addition of children in schools. Additions occur incrementally over the build-out period. New students may replace current population that ages through the system or moves from the attendance zone.

MPC's approval or denial of this request is final, unless the action is appealed to the Knox County Board of Zoning Appeals. The date of the Knox County Board of Zoning Appeals hearing will depend on when the appeal application is filed. Appellants have 30 days to appeal an MPC decision in the County.



**12-E-18-UR  
USE ON REVIEW**

Petitioner: Michael Brady Inc.



Detached Residential Subdivision in PR (Planned Residential)

Map No: 145  
Jurisdiction: County

Original Print Date: 11/15/2018 Revised:  
Metropolitan Planning Commission \* City / County Building \* Knoxville, TN 37902







December 3, 2018

Mr. William Jenkins  
9100 British Station Ln  
Knoxville, TN 37922

Phone: 865-805-1388  
Email: [wljenks@comcast.net](mailto:wljenks@comcast.net)

**Subject: Review of Report of Limited Geotechnical Exploration  
Cottington Court Development  
Knoxville, Tennessee  
Shield Project No.: 1185000-01**

Dear Mr. Jenkins;

This letter is written in regard to the "Report of Limited Geotechnical Exploration" issued by Geoservices, LLC on July 30, 2018. As you are aware, Shield Engineering, Inc (Shield), has previous experience consulting on the Cottington Court development due to litigation surrounding numerous sinkholes that dropped out post development of the subdivision. Most notably, multiple sinkholes were removed from the Benchmark Surveying's survey that resulted in development of several lots which later resulted in damage to property both in the form of land and structures. As such, Shield has reviewed previous documents generated during design and development of the subdivision, documents generated during litigation and the most recent geotechnical report.

### **Literature Review and Previous Site Experience**

Attached is the expert testimony of Mr. Tant regarding Lot 15 owned by Mr. Brian Dale, survey conducted by Benchmark Surveying prior to the removal of sinkholes from the survey, the Fulghum & MacIndoe (F&M) proposed layout and various boring location plans and borings from the previous reports. As part of the expert testimony, Shield reviewed numerous geotechnical reports issued by Mr. Dennis Huckaba, P.E. while he was at S&ME, Inc. as well as GEOservices, LLC. It was Mr. Huckaba's initial conclusion in the "Report of Geotechnical Exploration" issued by S&ME on August 9, 2004 that the large closed depression identified on F&M's concept plan as Sinkhole #1 and surrounding borings number B-1 and B-2, was in fact a sinkhole and should not be developed. An excerpt of his conclusions from that report is below:

*Report of Geotechnical Exploration  
Closed Depressions at Northshore Subdivision/Knoxville, Tennessee  
S&ME August 9, 2004*

*Based on the results of our exploration, we do not recommend construction in closed depression # 1. Soft to firm soils were encountered from the ground surface to the refusal depth in boring B- 1 and in portions of boring B-2. These soils are indicative of either past or on-going sinkhole activity. Closed depressions # 2 and # 3 appear to have been the result of construction activities around or on the site. We would expect construction in these areas would have sinkhole risk similar to other areas on the site. Stiff residual soils were typically encountered in these borings to the auger refusal depths. A relatively thick layer of topsoil/cultivated soil was encountered in boring B-3 in closed depression # 2. Additional stripping depth may be required in this area to achieve suitable subgrade for fill placement.*

Mr. Huckaba later performed additional subsurface explorations at Geoservices for both lot number 15 and lot number 16. Mr. Huckaba concluded that the area surrounding Lot number 15 was “not at any greater risk than other previous developed lots site in the same area”. However, it was his conclusion that Lot number 16 had “greater potential for sinkhole activity and recommended remedial grouting. The conclusions of both of these reports are below:

*Report of Geotechnical Exploration  
Cottingham Court-Lot 15 Knoxville, Tennessee  
GEOServices - June 20, 2006*

*Although a potential for sinkhole formation and subsidence is present at any site within limestone geologic regions, the results of our field exploration indicate that the upper clay residuum is generally stiff at this site. We anticipate that the areas within the 50 foot buffer included in this study for lot 15 may be developed for light residential construction. There are areas of soft soils near bedrock which can be indicative of karst activity. However, there is also a relatively thick overburden of stiff soils prior to encountering the soft layers. This is common in this geology and we expect the sinkhole risk to be no greater than other previously developed sites in the same geologic setting.*

*Report of Geotechnical Exploration  
Cottingham Court-Lot 16 Knoxville, Tennessee  
GEOServices - June 28, 2006*

*Although a potential for sinkhole formation and subsidence is present at any site within limestone geologic regions, the results of our field exploration indicate that the upper 15 feet of clay residuum is generally stiff on lot 16 and soft from 15 feet to refusal of about 33 feet. The thicker layer of soft soil can be indicative of more advanced karst activity. To reduce the sinkhole risk in such areas, we recommend a ground improvement process known as "cap grouting" to reduce the sinkhole risk. Cap grouting consists of pumping low slump grout through steel casing to the top of bedrock to plug openings in the rock and support the overlying soil. For grouting projects, effective engineering observation is as important as the proper equipment and materials.*

*The area of concern for the planned construction area identified to us by Saddlebrook Homes was cap grouted on June 23 and 26, 2006. The cap grouting locations were determined by GEOServices and the operations were observed by a representative of GEOServices. The cap grouting was performed by*

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*Hayward Baker. Based on our observations of the cap grouting operations, it is our opinion that the area of concern has been properly remediated and the sinkhole risk is now no greater than other sites in the same geologic setting.*

More recently in the 2018 GEOServices report it is concluded that the large closed depression identified as Sinkhole #1 on the subdivision concept plan was now acceptable for building. As shown on both the survey plat and concept plan the depression is rather large and well developed. The survey plat shows the large sinkhole identified as Sinkhole #1 as well as several other limits of sinkholes along the rear of the property. It should be noted that several of these sinkholes were removed from the drawings at the direction of Mr. Huckaba. Later these sinkholes impacted the property and/or homes located on lot number 13, 15 and 16.

The current state of the closed depression as shown on the attached 2018 GEOS boring location plan does not reflect the severity of Sinkhole #1 as shown on the previous drawings. In fact during our review for litigation in 2012, sinkholes are clearly visible in numerous generations of aerial photography available on Google earth.

Shield has also attached the soil test borings from the previously referenced geotechnical reports during the development and investigation of the neighborhood. A comparison of the soil test borings show that similar soils have been identified by Mr. Huckaba during every phase of his investigative work. Furthermore it should be noted that borings number B-1 & B-5 performed in 2004 were drilled in the limits of Sinkhole number #1 and clearly show a karst profile as identified and described in GEOS's most recent geotechnical report. GEOS's recent conclusions are referenced below:

*Report of Limited Geotechnical Exploration  
1933 Cottingham Lane / Knoxville, Tennessee  
GEOServices - July 30, 2018*

*Typical characteristics of karst solutioning consist of SPT N-values decreasing to a soft or very soft consistency (N-values of 4 bpf, or lower) with depth and moisture contents typically increasing significantly with depth. The results of our laboratory testing indicated the moisture contents of the existing fill as well as the underlying residual soils generally remained consistent. Moreover, the SPT N-values observed in the soil test borings conducted on site did not significantly decrease with an increase in depth, although zones of very soft to soft soil were present.*

*Given our site observations and the results of our field exploration, it is our professional opinion that the site does not present a greater risk of karst solutioning (i.e. sinkholes) than other sites located in the immediate vicinity. Moreover, the fact that the site has been filled previously, somewhat decreases the risk of sinkhole development. This is because the placement of a cohesive soil fill over the area effectively caps the area with a relatively impervious "blanket" of remolded soil. Based on the results of this exploration, it is our professional opinion that the mapped closed contour noted on the plat entitled "Subdivision Plat of Cottingham Court" dated September 27, 2005 and prepared by Benchmark Associates, Inc. is not the result of soil migration thorough an active sinkhole.*

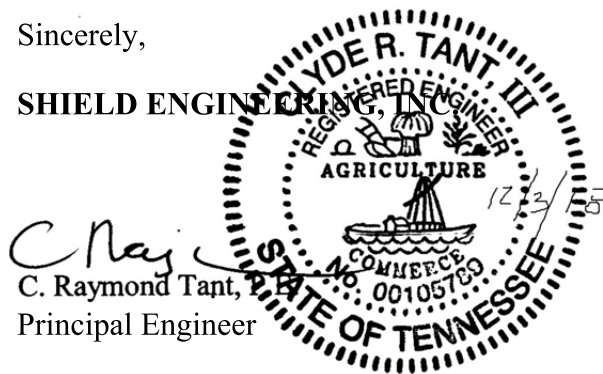
## Conclusions

Based on Shields review of the previous geotechnical reports issued by S&ME and GEOServices as well as the more recent geotechnical report and our extensive knowledge of the site due to serving as an expert witness supporting numerous homeowners affected by the miss identified sinkholes, it is our opinion that Sinkhole #1 is not developable land. The 2018 data collected by GEOS only continues to show that the profile of the soil is similar to that of other soil's previously investigated. Furthermore Sinkhole #1 is part of a very large ancient sinkhole collapse. In the past the sinkhole collapse created the very large depression that is present now. Borings B-1 and B-2 from the S&ME report in 2004 show the classic reverse stiffness profile that occurs as sinkholes form. This has not changed; the current drilling only missed these areas a second time. Furthermore, sinkholes form from water migration from both the top down and bottom up. Although a layer of clay fill has been placed in Sinkhole #1, the site is very close to large bodies of water and the local groundwater is most likely very close to the surface elevation of the bodies of water. Fluctuations in the groundwater table due to increased rainfall as well as drought will eventually cause a drop in the water table which has the same effect at the soil bedrock interface where sinkholes begin as the downward migration of surface water. It is the duty of engineers to hold paramount the safety, health and welfare of the general public. We do not believe any additional information has been presented that justifies development or would be in the interest of the health, safety or welfare of the general public (the future homeowner).

Shield appreciates the opportunity to provide you with geotechnical evaluation services. If you have any questions concerning our proposal, please contact the undersigned at (865) 544-5959.

Sincerely,

SHIELD ENGINEERING, INC.



C. Raymond Tant, P.E.  
Principal Engineer

Justin A. Goss, P.E.  
Project Engineer

Attachments: Expert Testimony  
Benchmark Plat  
FM Concept Plan  
Geo-Services Geotechnical Report 20180730  
Pages from GEOS Study re Lot 15 6-25-06  
Pages from GEOS Study re Lot 16 6-28-06  
Pages from S&ME Geotech Study 8-9-04



## Expert Testimony

## EXPERT REPORT/DISCLOSURE OF RAYMOND TANT, P.E.

After a review of various documents and reports prepared by others, I have concluded that numerous sinkholes were present at the Cottingham Court development. More specifically, it is my opinion that sinkholes were present on lot 15 that were not correctly identified and later removed from design drawings at the direction of S&ME, Inc. (S&ME) and GEO Services, LLC (GEOS). Overall, the project site is situated in a well developed karst topography as evidenced by numerous locally mapped closed topographic depressions both off and on the site as well as depressions that were once mapped and since removed. Closed topographic depressions may not always be due to sinkhole formation (e.g. remnants of old structures, buried debris piles, etc.). However, in a karst topography as well developed as this site, the observed depressions on lot 15 were most likely the ancient remnants of a collapsed dome due to sinkhole activity. Once these sinkholes collapsed, the formation process begins again. Borings conducted by S&ME and GEOS were either not placed in close enough proximity to the depressions in lot 15 or did not have consistent interpretation from one report to the next.

During the preparation of my opinion, I reviewed the following drawings and reports:

- Fulghum, MacIndoe & Associates (FM&A)
  - Sheet C1 entitled “Concept Plan” dated September 9, 2004
  - Sheet C2 entitled “Site Layout and Paving Plan” dated September 24, 2004
  - Sheet C3 entitled “Site Layout and Paving Plan” dated September 24, 2004
  - Sheet C2 entitled “Site Layout and Paving Plan” dated November 9, 2004
  - Sheet C3 entitled “Site Layout and Paving Plan” dated November 9, 2004
- Benchmark Surveying, Inc.
  - Sheet 1 of 1 “General Property Survey” dated October 15, 2004
  - Sheet 1 “Subdivision Plat” dated January 31, 2005
  - Sheet 1 of 1 “Subdivision Plat” dated March 21, 2005
  - Sheet 1 of 1 “Subdivision Plat” dated September 27, 2005
- S&ME Proposal for Services July 13, 2004
- S&ME Geotechnical Report Dated August 9, 2004 & Project Files
- S&ME Geotechnical Report Dated November 11, 2004 & Project Files
- November 23, 2004 S&ME Addendum Report & Project Files
- Field Testing Data S&ME
- GEOS Geotechnical Report June 20, 2006 - Lot 15
- GEOS Field Reports
- Engineering & Testing Solutions (ETS) Field Reports
- Foundations Systems
  - “Proposal for Geotechnical Exploration” dated November 15, 2010
  - “Subsurface Exploration” dated May 10, 2011
- Don W. Byerly “Report of Investigation” dated April 20, 2009.
- TTL & Subsurface Evaluations, Inc. “Combined Geophysical Survey Report” dated March 22, 2010
- Structural Engineering Assessments, PC report dated June 28, 2012
- Correspondence between the Tennessee Department of Environment and Conservation (TDEC) and the Fuller Group as well as GEOS relating to the Class V Injection Well Permit

- Vision Engineering “Sinkhole Location Exhibit” dated October 3, 2013
- Class V Injection Well Permits dated October, 14, 2004 and February 2009

1. **STATEMENT OF OPINIONS:**

A. Project Drawings

I have reviewed drawings prepared by FM&A as well as Benchmark Surveying and have determined that early on during the development, numerous depressions and sinkholes were identified during design. The location of some of these depressions and sinkholes can be confirmed by aerial photographs from Google Earth as well as other reports prepared by S&ME and GEOS. Based on these drawings, the Dale Residence has been placed inside of the 50 foot buffer zone as defined by the City of Knoxville. At some point prior to the Dale Residence being constructed, the depressions and sinkholes were removed from the design drawings. The removed depressions on Lot 15 are located directly beneath the Dale Residence.

B. S&ME Proposal for Services July 13, 2004

It is my expert opinion that a critical step in reviewing a site for the potential for sinkhole development is the closure of the bore holes. Nowhere is it mentioned or suggested in S&ME’s proposal that either bentonite pellets or a cement bentonite grout mixture would be utilized to seal and abandon the boreholes. If the boreholes are not abandoned properly and the method as described by S&ME used, it could possibly lead to future subsidence. The soft soils placed back into the boring will be a conduit for both ground and surface water to infiltrate down into the soil bedrock interface thus resulting in the aggravation of an existing sinkhole feature or the creation of a new dropout.

C. Review of S&ME Geotechnical Report Dated August 9, 2004

In reviewing S&ME’s geotechnical report entitled “Report of Geotechnical Exploration” it was noted in the geotechnical logs and report that the holes were abandoned using the standard method (backfilling with soil cuttings) and no grout or bentonite was used for abandonment as previously discussed.

The geology of the site as identified in the report is the Newala formation which weathers to a reddish or orange-brown clay). As recorded by S&ME in boring B-1, there is an upper 8 foot thick layer of soil that does not match the description for the Newala formation soils. This is the same for boring B-2 that has a 3 ½ foot thick layer.

When investigating a sinkhole or depression it is important to recognize the presence of colluvial soils. Colluvial soils are materials that have been transported to their current location by gravity and are typically a darker coloring such as brown or black due to the inclusion of organic materials (leaves, grass, etc.). When a sinkhole collapses the resulting funnel or depression often traps organic debris.

This layer resides above the residuum and is a tell-tale sign of previous or current activity. It is my opinion the soils above residuum in borings B-1 and B-2 were not identified.

Boring B-3 included a layer of topsoil/cultivated soil 18 inches in thickness. Considering no other borings had topsoil to this depth, it should have raised a red flag. Often when land is cultivated or maintained as a farm, over a long period of time, a cultivated or plow zone of highly organic soil may be formed across the site. The absence of this plow zone layer in other borings but presence, depth and thickness of other dark materials above the residuum in boring B-1 and B -2 should have been red flags. It is very common for farmers to fill collapsed domes, sinkholes or depressions with debris. It would be unusual for a farmer or land owner to excavate numerous pits of these dimensions on their property to waste materials.

Typically, in a karst setting, the resulting soil profile is typically a stiffer crust with a softening soil profile with depth. Although S&ME did not recognize the potential colluvial soils above residuum in B-1 and B-2, B-1 was recognized as being a sinkhole due to the softening with depth and moist profile.

S&ME did not backfill the borings with bentonite or a cement/bentonite mixture.

This report was written and stamped by Joshua Cole, P.E. and reviewed by Dennis Huckaba, P.E.

#### D. Review of S&ME Geotechnical Report Dated November 11, 2004

In the geotechnical report issued by S&ME dated November 11, 2004 there appears to be 2 versions. One version includes a Figure 1 that is centered on Lot 12 and another version that includes a Figure 1 that shows the entire development with the exception of Lot 12. In the Figure 1 that shows the entire development, numerous closed depressions are present on Lots 15 & Lot 16. Although S&ME did drill a boring (B-9) inside of the property boundaries for Lot 15, it appears the boring was drilled at a considerable distance from the two closed topographic depressions located in the building footprint. A review of aerial photography from Google Earth clearly shows in 2003 the two surface features, present in what is now the building pad, are located in a field. Drilling directly adjacent to these surface features should have been easily accomplished and would be critical to evaluating the site.

It is my opinion that boring B-9 was drilled too far of a distance from the two surface features. In addition, the soil profile drilled in B-9 is a very soft to soft soil profile. This is a softer soil profile than was observed in B-1 in the August 9, 2004 S&ME Geotechnical Report which was described as “typically indicative of past or ongoing sinkhole activity”. However in this report that is not considered to be an issue and the recommendation is to move forward with the development of Lot 15. It is my experience when investigating sinkholes that the borings be taken to refusal to obtain a full soil profile. The boring at Lot 15 was terminated at 20 feet in soft soils.

On the field log for B-9, the driller indicates that the boring was stopped due to another boring being located within 10 feet of this boring. A review of the remaining field logs and typed boring logs in this report do not reference or indicate that boring.

S&ME did not backfill the borings with bentonite or a cement/bentonite mixture.

There is no reference to the previous geotechnical report that was issued on August 9, 2004. It should also be noted that the reviewing and stamping engineer for S&ME was Dennis Huckaba, P.E.

E. Review of S&ME Addendum Report dated November 23, 2004

Shield has reviewed an Addendum Report issued by S&ME regarding Lot Number 12. Although it is obvious this report does not relate to the property owner in question, it does show a continued lack of understanding of S&ME's writers. As previously mentioned, the soils described in S&ME's Geology Section of their previous reports indicates residual soils should be reddish or orange-brown clay. A simple review of the boring log B-12 for Lot 12 does not show that consistency. Instead, the full column of the soil is a dark brown and black clay. Typically colluvial soils that are found in the throat of a collapsed dome of a sinkhole are dark brown or black from the collection of highly organic material into the open cone of the formed depression after a dome collapse.

Mr. Dennis Huckaba is the reviewing engineer for S&ME on this project.

F. Review of Field Testing Data S&ME

A review of S&ME's field testing reports indicates that they were responsible for testing and monitoring of soils and preparation of the site. However, there are inconsistencies and what appears to be missing information between the reports. Information provided thus far, either includes field reports referencing density tests that were not attached or field density tests that did not have the daily report with it. In addition, there are loose references to areas of work on the site without clear discussion as to where that was performed or maps to show the locations. Mr. Dennis Huckaba made a visit on July 21, 2005 to observe two cleaned out "trash pits" at the rear of the property. It is ambiguous which depressions were cleaned out.

G. Review of GEOS Services, LLC Geotechnical Report June 20, 2006 - Lot 15

During a review of GEOS Service's LLC (GEOS) Report for Lot 15, I have noted several inconsistencies. Mr. Dennis Huckaba, the reviewing engineer for S&ME on two previous reports, states in the project description that two additional depressions have been identified on Lot 15. This is confusing, considering Mr. Huckaba's involvement with previous geotechnical studies and the availability of drawings detailing the existence of these two depressions on Lot 15. A previous

report on this property reviewed and stamped by Mr. Huckaba clearly shows a total of four closed depressions located directly in the vicinity of or on Lot 15.

Although borings were conducted on Lot 15, I do not believe their location is correctly represented in GEOS's Figure 1 – Boring Location Map. As mentioned previously, Mr. Huckaba had previous access to site layouts, subdivision plans and had visited the site to observe remediation or site preparation of this development. The Figure 1 drawing showing the locations of the borings does not correspond with the shape and location of the property layouts.

GEOS did not reference backfilling the borings with bentonite or a cement/bentonite mixture.

In a separate geotechnical report issued for Lot 16, GEOS recommends the use of cap grouting around the depression that straddles Lot 15 and 16.

#### H. Review of GEOS Field Reports

Shield reviewed the daily records from GEOS Services for June 26, 2006. Representatives of GEOS were present on the site during the cap grouting; however, no drawings or map locations are attached and thus the report has almost no meaning or value relative to Lot 15.

#### I. ETS Reports and Installation of Helical Piers

Documentation has been provided that helical piers were installed along the rear foundation wall of the Dale Residence. There is no information indicating why this was recommended or needed. Mr. Ray Faust with Engineering Testing and Solutions (ETS) recommended and observed the installation of these piers as documented in his letter dated June 18, 2008. Mr. Faust also observed the excavation of the foundations for the home as well as oversaw the undercut of poor soils in the foundation area and backfilling with flowable fill. Mr. Faust also indicated the site had been remediated for the depressions (presumably the ones investigated by S&ME and repairs observed by GEOS) prior to his involvement. To date, no documentation regarding these repairs has been provided by other parties.

There appears to be no documentation presented by any party to date as to the repairs that were made on Lot 15 prior to Mr. Faust consulting on the Dale residence.

#### J. General Opinion of Geotechnical Work to Date

Shield has reviewed reports from S&ME, GEOS, Foundations Systems, Don Byerly, TTL, Subsurface Evaluations, Inc. and Structural Engineering Assessments. As of now, it appears that a hodgepodge of geotechnical and structural report evaluations have been performed on the Dale Residence. It is evident either the borings that were used have either not been in appropriate locations to evaluate the

subsurface conditions or methods that have not been suitable, not useful to render opinions of the structure or recommendations for additional studies followed up. It should be noted that Foundation Systems did backfill the borings with a bentonite mixture. It is my opinion that additional geotechnical studies need to be performed on the Dale Residence located on Lot 15 prior to making any more repairs. This investigation should utilize a drilling system such as hollow stem augers in conjunction with continuous sampling using standard penetration testing or undisturbed sampling as dictated and accepted by ASTM Standards. The use of a dynamic cone penetrometer (DCP) should not be used unless absolutely necessary and only on the inside of the home due to access restrictions. Conventional soil test borings should be performed along the perimeter of the rear half of house, the south side of the home as recommended by TTL/Subsurface Evaluations, Inc. as well as on the interior where areas of distress have been noted. It may be possible to sample the interior of the home utilizing a geo-probe drill rig that has been equipped with standard penetration test capabilities. I recommend continuous sampling be performed until residual soils are encountered. Once residual soils are encountered standard penetration sampling intervals may be changed to 5 foot centers thereafter.

#### K. Review of TDEC Permit Files

Reviewing the 2004 Class 5 Injection Well Permit submitted on behalf of Fuller, reference was made to filling the depressions located on Lot 15, as designated numbers 3 and 4. The permit clearly shows the method to be used in backfilling which is a reverse graded filter. There is no documentation that this repair method was ever utilized. A second permit was also issued in February 2009, but as indicated by TDEC the recommendations in this permit were never completed. In addition, the referenced Figure 3A is missing from documentation.

#### L. Vision Engineering "Sinkhole Location Exhibit" dated October 3, 2013

Shield has reviewed the Mediation Exhibit prepared by Vision Engineering. In review of the sinkhole locations as surveyed by Vision Engineering and FM&A, it is apparent that there was not good control over the location of the drilling or the sinkholes shown in the GEOS reports for Lots 15 and 16. Most likely GEOS did not have a good understanding of the location of the house seat relative to the property lines and the depressions. Most likely the depression that was investigated by GEOS is the same sinkhole located most recently by Vision Engineering that straddles the property line between Lots 15 and 16. In addition, the drawing confirms the location of the depressions that are now under the Dale residence that were eliminated at the direction of S&ME and their November 11, 2004 Report.

## 2. **FACTS OR DATA CONSIDERED BY WITNESS:**

Information gained from personal observations of the site, information from geotechnical reports, field testing reports and project drawings as previously referenced.

3. **EXHIBITS THAT THE WITNESS ANTICIPATES USING AT ANY HEARING IN THIS CAUSE:**

Project site photos and sketches, survey drawings, reports, and standards, including the documents as previously listed.

4. **WITNESS QUALIFICATIONS AS EXPERT WITNESS:**

I am a licensed engineer in Tennessee with extensive training and experience in geotechnical engineering. A copy of my curriculum vitae is attached.

5. **LIST OF CASES IN WHICH WITNESS HAS TESTIFIED BY DEPOSITION OR AT TRIAL WITHIN THE PAST FOUR YEARS:**

- A. Fugate v. Tenn. Farmers Ins. Co., Claiborne County – Docket No. 16,128, trial testimony
- B. Mountain Timbers v. Shield Engineering, Inc. Knox County
- C. Iglis v. Auto Owners, Knox County

6. **WITNESS' COMPENSATION:**

**I am an employee of Shield Engineering, Inc. and I am receiving compensation from Kizer & Black Attorneys, PLLC to be a witness in this case.**



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RAY TANT, P.E.

Date: 12/4/13

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G. Keith Alley, esq  
Kizer & Black, Attorneys, PLLC  
329 Cates Street  
Maryville, Tennessee 37801-4903  
Direct Telephone: (865) 980-1643  
Direct Facsimile: (865) 980-6143



Benchmark Plat



## FM Concept Plan



Geo-Services Geotechnical Report 20180730



July 30, 2018

Hartson Construction  
PO Box 22640  
Knoxville, Tennessee 37933

ATTENTION: Mr. Christopher Hare  
[charejr@hartsonconstruction.com](mailto:charejr@hartsonconstruction.com)

Subject: **REPORT OF LIMITED GEOTECHNICAL EXPLORATION**  
**1933 Cottington Lane**  
Knoxville, Tennessee  
GEO Services Project No. 21-18546

Dear Mr. Hare:

GEO Services, LLC has completed the report of limited geotechnical exploration performed for the subject project. Our services were performed in accordance with our phone and email correspondence dating from July 13, 2018, and authorized by you. The purpose of our exploration was to explore the site subsurface conditions and provide geotechnical recommendations regarding the potential risk of sinkhole development and for the development of the site.

## **PROJECT INFORMATION**

The project site is 1933 Cottington Lane in Knoxville, Tennessee. It is our understanding that there are concerns regarding the development of the site including a documented “sinkhole” occupying a portion of the lot. A plat entitled “Subdivision Plat of Cottington Court” dated September 27, 2005 and prepared by Benchmark Associates, Inc. indicates the location of a closed contour depression and designates this feature as a sinkhole. Additionally, it is our understanding that the project is to consist of the construction of up to three residential structures and its associated parking and drive area. Therefore, the purpose of this exploration is to explore the site subsurface conditions and provide geotechnical recommendations for the development of the site and to provide an opinion of the presence of a sinkhole onsite.

The site is relatively level. Based on a review of available aerial photography, it appears the site has been graded previously. The amount of earthwork (i.e. cut or fill) which has been performed to reach the existing site grades is unknown. Information regarding finished grades for the site was not provided at this time. However, we anticipate maximum earthwork cuts and fills of less than 5 feet may be required to reach planned elevations.

## **FIELD EXPLORATION**

The site subsurface conditions were explored with five (5) soil test borings spread across the site. The boring locations were marked in the field by GEOServices personnel. All depths in this report reference the ground surface that existed at the time of this exploration. Drilling was performed on July 20 and 21, 2018. The borings were advanced using 3.5-inch inside diameter hollow stem augers (HSA) with a Diedrich D-120 track-mounted drill rig. Within each boring, standard penetration test (SPT) and split-spoon sampling were performed at 2.5 foot intervals in the upper 10 feet, and 5 foot intervals thereafter. The drill crew worked in general accordance with ASTM International (ASTM) D 6151 method for HSA drilling. Sampling of overburden soil was performed in general accordance with ASTM D 1586, per the SPT procedure. The borings were backfilled with soil cuttings. Detailed information pertaining to each boring location can be found on the boring logs provided as an attachment to this report.

After completion of the field drilling and sampling phase of this project, the soil samples were returned to our laboratory where they were visually classified in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedures – ASTM D 2488) by a GEOServices geotechnical professional. Selected soil samples were then tested for natural moisture content (ASTM D 2216). The results of the testing program are provided on the boring logs.

## **GEOLOGIC CONDITIONS**

The project site lies within the Appalachian Valley and Ridge Physiographic Province of East Tennessee. This Province is characterized by elongated, northeasterly-trending ridges formed on highly resistant sandstone and shale. Between ridges, broad valleys and rolling hills are formed primarily on less resistant limestone, dolomite and shale.

Published geologic information indicates that the site is underlain by bedrock of the Knox Group, which is not differentiated into its individual formations in this area. The Knox Group, where undivided, consists of siliceous dolomite and interbedded limestone. These rock units weather to produce a thick residual clay overburden. Silica in the form of chert is resistant to weathering and is scattered in various quantities throughout the clay residuum.

## **SUBSURFACE CONDITIONS**

The following subsurface description is of a generalized nature to highlight the subsurface stratification features and material characteristics at the boring locations. The boring logs included at the end of this report should be reviewed for specific information at each boring location. Information on actual subsurface conditions exists only at the specific boring locations and is relevant only to the time that this exploration was performed. Variations may occur and should be expected at the site.

### *Surficial*

A surficial layer of topsoil, approximately 6 inches in thickness was encountered in each of the soil test borings performed on site.

### *Fill*

Beneath the topsoil, fill material was encountered in all of the borings conducted on site to a depth ranging from approximately 5 to 13 feet beneath the existing ground surface. We note that boring B-2 encountered refusal material within the fill. Fill material is classified as soils that have been transported and placed in their current location by man. The existing fill material generally



consisted of brown and reddish brown lean clay (CL) with varying amounts of rock fragments. The SPT N-values used to evaluate the fill materials ranged from 4 to 17 blows per foot (bpf) indicating soft to very stiff consistencies. The moisture contents of the existing fill ranged from about 19 to 30 percent.

### *Residual Soil*

Beneath the existing fill, residual soils were encountered to depths ranging from 34 to 46 feet beneath the existing ground surface. Residual soils are formed from the in-place weathering of the parent bedrock. The residual soil generally consisted of orangish brown and reddish brown lean clays (CL) and fat clays (CH) with varying amounts of chert fragments throughout and some fine root structures were observed in the upper portion of the residual samples. The SPT N-value used to evaluate the consistency of the residual soil ranged from weight of hammer (W.O.H.), essentially 0 bpf to 50 blows to penetrate 3 inches, indicating a consistency of very soft to very hard. However, the very soft and very hard materials were encountered near auger refusal elevations, therefore, the residual soils were judged to be firm to stiff in consistency with isolated soft zones.

## **FINDINGS AND RECOMMENDATIONS**

The conclusions and recommendations presented in this report are based on our site reconnaissance and the results of this exploration. Actual subsurface conditions may vary between or away from the boring locations. If it becomes apparent during site grading / foundation construction that encountered conditions vary substantially from those presented herein, this office should be notified at once. At that time, the conditions can be evaluated and the recommendations of this report can be modified in written form if necessary.

The results of our exploration indicate that the project site is generally overlain by a layer of existing fill soils overlying residual soils. Fill soils were encountered in each of the soil test borings performed on site to depths ranging from 5 to 13 feet below the existing ground surface. The fill soil was relatively clean of deleterious materials and was generally firm to stiff in consistency, with an isolated soft zone near the ground surface in boring B-5. Based on the subsurface

conditions encountered, it is in our professional opinion that the development of this site could possibly present geotechnical challenges that would hinder the proposed construction, including the undocumented fill. However, with the presence of the undocumented fill, there are risks of encountering unsuitable material between our borings. As mentioned, boring B-2 encountered refusal materials within the fill. As such, it is likely that buried concrete or rock boulders could be present.

We recommend GEOServices perform foundation subgrade observations prior to concrete placement to confirm the bearing soils are adequate for support of the structure. Should unsupportive soils be encountered, over-excavation through the lower consistency soils to expose the underlying stiff residual soils will be required.

Typical characteristics of karst solutioning consist of SPT N-values decreasing to a soft or very soft consistency (N-values of 4 bpf, or lower) with depth and moisture contents typically increasing significantly with depth. The results of our laboratory testing indicated the moisture contents of the existing fill as well as the underlying residual soils generally remained consistent. Moreover, the SPT N-values observed in the soil test borings conducted on site did not significantly decrease with an increase in depth, although zones of very soft to soft soil were present.

Given our site observations and the results of our field exploration, it is our professional opinion that the site does not present a greater risk of karst solutioning (i.e. sinkholes) than other sites located in the immediate vicinity. Moreover, the fact that the site has been filled previously, somewhat decreases the risk of sinkhole development. This is because the placement of a cohesive soil fill over the area effectively caps the area with a relatively impervious “blanket” of remolded soil. Based on the results of this exploration, it is our professional opinion that the mapped closed contour noted on the plat entitled “Subdivision Plat of Cottingham Court” dated September 27, 2005 and prepared by Benchmark Associates, Inc. is not the result of soil migration through an active sinkhole.

Based on our experience, corrective actions can be performed to reduce the potential for future sinkhole development at this site. These corrective actions would decrease but not eliminate the

potential for sinkhole development. Much can be accomplished to decrease the potential of future sinkhole activity by proper grade selection and through the establishment of positive site drainage. Although it is our opinion that the risk of ground subsidence associated with sinkhole formation cannot be eliminated, however, we have found that several measures are useful in site design and development to reduce this potential risk. These measures include:

- Maintaining positive site drainage to route surface waters well away from structural areas both during construction and for the life of the structure.
- The scarification and re-compaction of the upper 6 to 10 inches of soil in earthwork cut areas.
- Verifying that subsurface piping beneath structures is carefully constructed and pressure tested prior to its placement in service.
- The use of pavement or lined ditches, particularly in cut areas, to collect and transport surface water to areas away from structures.

Considerations when building within a sinkhole prone area are to provide positive surface drainage away from proposed building or parking areas both during and after construction. Backfill in utility trenches or other excavations should consist of compacted, well-graded material such as dense graded aggregate or compacted on site soils. The use of an open graded stone (such as No. 57 stone) is not recommended unless the stone backfill is provided an exit path and not allowed to pond. If sinkhole conditions are observed, the type of corrective action is most appropriately determined by a geotechnical engineer on a case by case basis.

## **LIMITATIONS**

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

## CLOSURE

We appreciate the opportunity to provide these services. If you have any questions, please feel free to contact us at your convenience.

Sincerely,  
GEOServices, LLC



Matthew B. Haston, P.E.  
Senior Geotechnical Engineer



T. Brian Williamson, P.E.  
Geotechnical Department Manager

Attachments: Site Vicinity Map, Boring Location Plan, Boring Legend, and Boring Logs

## ATTACHMENTS



NOTES:  
 1.) BASE MAP: USGS QUADRANGLE (LOUISVILLE, TENNESSEE)  
 2.) BASE MAP: USGS QUADRANGLE (BEARDEN, TENNESSEE)

**GEOS**  
 GEOS ENGINEERS, INC. - Geotechnical and Materials Engineers  
 2561 Willow Point Way  
 Knoxville, Tennessee 37931  
 Office: 865-539-9242  
 Fax: 865-539-9252

**SITE VICINITY MAP**  
 1933 COTTINGTON LANE  
 KNOXVILLE, TENNESSEE

DRAWN BY:	MRB
APPROVED BY:	TBW
SCALE:	N.T.S.
JOB NO.:	21-18546
DATE:	7/25/18

FIGURE  
**1**



# GENERAL NOTES

## FINE AND COARSE GRAINED SOIL PROPERTIES

### PARTICLE SIZE

BOULDERS:	GREATER THAN 300 mm
COBBLES:	75 mm to 300 mm
GRAVEL:	4.74 mm to 75 mm
COARSE SAND:	2 mm to 4.74 mm
MEDIUM SAND:	0.425 mm to 2 mm
FINE SAND:	0.075 mm to 0.425 mm
SILTS & CLAYS:	LESS THAN 0.075 mm

### COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

### FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0 - 500
3 - 4	SOFT	500 - 1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

## STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATION. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140 LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

### BLOWS/FOOT (N-VALUE)

### DESCRIPTION

25.....	.....25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10".....	.....75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR.....	.....PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

## SAMPLING SYMBOLS

ST:	UNDISTURBED SAMPLE
SS:	SPLIT SPOON SAMPLE
CORE:	ROCK CORE SAMPLE
AU:	AUGER OR BAG SAMPLE

## SOIL PROPERTY SYMBOLS

N:	STANDARD PENETRATION, BPF
M:	MOISTURE CONTENT %
LL:	LIQUID LIMIT %
PI:	PLASTICITY INDEX %
Qp:	POCKET PENETROMETER VALUE, TSF
Qu:	UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW:	DRY UNIT WEIGHT, PCF

## ROCK PROPERTIES

### ROCK HARDNESS

### ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
0 TO 25	VERY POOR

VERY SOFT:	ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.
SOFT:	ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND CRUMBLES WITH FIRM HAND PRESSURE.
MODERATELY HARD:	SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.
HARD:	ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.
VERY HARD:	ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.





1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-1**  
 SHEET 1 OF 2

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-1 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 33.0 FT. ELEV. -33.0 FT.  
 SAMPLED 33.0 FT. 10.1 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 33.0 FT. ELEV. -33.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH		SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
FT.	ELEV.	FROM FT.	TO FT.			N-Value	Qu	LL	PI	%M	
-	-										Topsoil (6 Inches)
2.5	-2.5	1.0	2.5	1	SS	2 - 5 - 5 N = 10				28.6	Lean CLAY (CL) - with gravel - dark reddish brown - moist (FILL)
5.0	-5.0	3.5	5.0	2	SS	2 - 3 - 4 N = 7				21.6	
7.5	-7.5	6.0	7.5	3	SS	4 - 6 - 7 N = 13				39.8	
10.0	-10.0	8.5	10.0	4	SS	4 - 4 - 6 N = 10				40.0	
12.5	-12.5										Fat CLAY (CH) - with chert gravel - orangish brown and reddish brown - moist - very stiff to very soft (RESIDUUM)
15.0	-15.0	13.5	15.0	5	SS	2 - 3 - 4 N = 7				51.1	
17.5	-17.5										
20.0	-20.0	18.5	20.0	6	SS	2 - 3 - 5 N = 8				48.7	

Continued

REMARKS: \_\_\_\_\_





1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-2**  
 SHEET 1 OF 1

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-2 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 6.0 FT. ELEV. -6.0 FT.  
 SAMPLED 6.0 FT. 1.8 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 6.0 FT. ELEV. -6.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL	
0.0 - 0.5										Topsoil (6 Inches)
2.5 - 2.5			1	SS	2 - 4 - 4 N = 8				22.4	Fat CLAY (CH) - with gravel - reddish brown - moist (FILL)
5.0 - 5.0			2	SS	3 - 5 - 12 N = 17				25.1	
7.5 - 7.5										Auger Refusal at 6.0 Feet
10.0 - 10.0										
12.5 - 12.5										
15.0 - 15.0										
17.5 - 17.5										
20.0 - 20.0										

REMARKS: Offset 5 and 15 feet toward B-1 after initial refusals at 5.0 and 6.0 feet, respectively.



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-3**  
 SHEET 1 OF 3

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-3 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 46.0 FT. ELEV. -46.0 FT.  
 SAMPLED 46.0 FT. 14.0 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 46.0 FT. ELEV. -46.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL	
-										Topsoil (6 Inches)
2.5	-2.5		1	SS	3 - 4 - 4 N = 8				22.3	Lean CLAY (CL) - with gravel - dark reddish brown and dark brown - moist (FILL)
5.0	-5.0		2	SS	4 - 5 - 8 N = 13				21.6	
7.5	-7.5		3	SS	3 - 3 - 4 N = 7				28.6	
10.0	-10.0		4	SS	3 - 4 - 6 N = 10				36.7	
15.0	-15.0		5	SS	3 - 3 - 6 N = 9				35.5	
20.0	-20.0		6	SS	3 - 3 - 3 N = 6				40.2	

Continued

REMARKS: \_\_\_\_\_



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-3**  
 SHEET 2 OF 3

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-3 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 46.0 FT. ELEV. -46.0 FT.  
 SAMPLED 46.0 FT. 14.0 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 46.0 FT. ELEV. -46.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL	
22.5 - 22.5										(continued)  Lean CLAY (CL) - with chert gravel - orangish brown and reddish brown - moist to wet - soft to very hard (RESIDUUM)
25.0 - 25.0			7	SS	1 - 1 - 2 N = 3				50.7	
27.5 - 27.5										
30.0 - 30.0			8	SS	1 - 1 - 3 N = 4				45.7	
32.5 - 32.5										
35.0 - 35.0			9	SS	2 - 2 - 2 N = 4				41.9	
37.5 - 37.5										
40.0 - 40.0			10	SS	2 - 2 - 2 N = 4				53.9	

Continued

REMARKS: \_\_\_\_\_



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-3**  
 SHEET 3 OF 3

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-3 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 46.0 FT. ELEV. -46.0 FT.  
 SAMPLED 46.0 FT. 14.0 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 46.0 FT. ELEV. -46.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL	
42.5	-42.5									(continued)
45.0	-45.0	43.5	44.3	11	SS	5 - 50/3" N = 50/3"				44.4 Lean CLAY (CL) - with chert gravel - orangish brown and reddish brown - moist to wet - soft to very hard (RESIDUUM)
47.5	-47.5									Auger Refusal at 46.0 Feet
50.0	-50.0									
52.5	-52.5									
55.0	-55.0									
57.5	-57.5									
60.0	-60.0									

REMARKS: \_\_\_\_\_



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-4**  
 SHEET 1 OF 2

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-4 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 43.0 FT. ELEV. -43.0 FT.  
 SAMPLED 43.0 FT. 13.1 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 43.0 FT. ELEV. -43.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH		SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
FT.	ELEV.	FROM FT.	TO FT.			N-Value	Qu	LL	PI	%M	
-	-										Topsoil (6 Inches)
2.5	-2.5	1.0	2.5	1	SS	2 - 4 - 5 N = 9				26.9	Lean CLAY (CL) - with gravel - dark reddish brown, reddish brown and dark brown - moist (FILL)
5.0	-5.0	3.5	5.0	2	SS	2 - 3 - 5 N = 8				29.4	
7.5	-7.5	6.0	7.5	3	SS	5 - 5 - 6 N = 11				23.4	
10.0	-10.0	8.5	10.0	4	SS	1 - 2 - 3 N = 5				25.6	
15.0	-15.0	13.5	15.0	5	SS	3 - 5 - 6 N = 11				40.9	
20.0	-20.0	18.5	20.0	6	SS	2 - 4 - 6 N = 10				43.9	Lean CLAY (CL) - with chert gravel throughout and trace root structures in the upper foot - orangish brown and reddish brown - moist - stiff to very soft (RESIDUUM)

Continued

REMARKS: \_\_\_\_\_



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-4**  
 SHEET 2 OF 2

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-4 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 43.0 FT. ELEV. -43.0 FT.  
 SAMPLED 43.0 FT. 13.1 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 43.0 FT. ELEV. -43.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION	
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL		PI
22.5	-22.5										(continued)
25.0	-25.0	23.5	25.0	7	SS	2 - 3 - 4 N = 7				45.4	
27.5	-27.5										
30.0	-30.0	28.5	30.0	8	SS	2 - 3 - 4 N = 7				46.0	Lean CLAY (CL) - with chert gravel throughout and trace root structures in the upper foot - orangish brown and reddish brown - moist - stiff to very soft (RESIDUUM)
32.5	-32.5										
35.0	-35.0	33.5	35.0	9	SS	3 - 6 - 5 N = 11				41.9	
37.5	-37.5										
40.0	-40.0	38.5	40.0	10	SS	5 - W.O.H. - W.O.H. N = 0				49.9	

Auger Refusal at 43.0 Feet

REMARKS: W.O.H. - Weight Of Hammer





1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-5**  
 SHEET 1 OF 2

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-5 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 34.0 FT. ELEV. -34.0 FT.  
 SAMPLED 34.0 FT. 10.4 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 34.0 FT. ELEV. -34.0 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.

STRATUM DEPTH		SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
FT.	ELEV.	FROM FT.	TO FT.			N-Value	Qu	LL	PI	%M	
-	-										Topsoil (6 Inches)
2.5	-2.5	1.0	2.5	1	SS	2 - 2 - 2 N = 4				21.9	
5.0	-5.0	3.5	5.0	2	SS	6 - 6 - 9 N = 15				19.0	
7.5	-7.5	6.0	7.5	3	SS	3 - 4 - 5 N = 9				27.3	Lean CLAY (CL) - with gravel - dark brown and dark reddish brown - moist (FILL)
10.0	-10.0	8.5	10.0	4	SS	3 - 3 - 4 N = 7				23.5	
15.0	-15.0	13.5	15.0	5	SS	2 - 2 - 2 N = 4				28.8	Lean CLAY (CL) - with chert gravel throughout and trace root structures in the upper foot - dark brown and orangish brown - moist - soft to very hard (RESIDUUM)
20.0	-20.0	18.5	20.0	6	SS	3 - 3 - 4 N = 7				38.3	

Continued

REMARKS: \_\_\_\_\_



1933 Cottingham Lane  
 Knoxville, Tennessee  
 GEOServices Project # 21-18546

LOG OF BORING **B-5**  
 SHEET 2 OF 2

DRILLER R. Brock  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-5 DRY ON COMPLETION ? Yes

DATE July 21, 2018 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 34.0 FT. ELEV. -34.0 FT.  
 SAMPLED 34.0 FT. 10.4 M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 34.0 FT. ELEV. -34.0 FT.

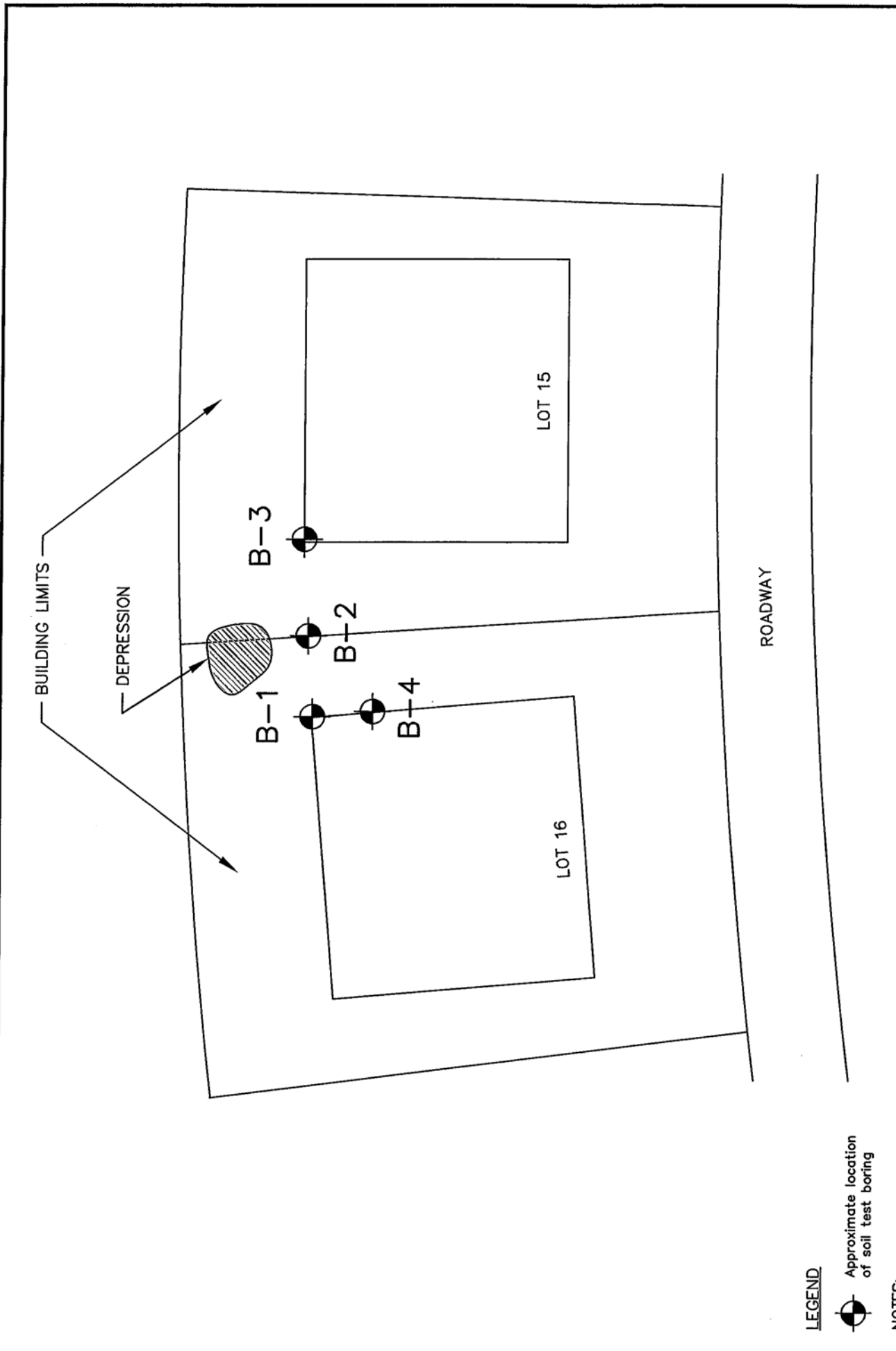
**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH DRY FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 1 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS: DEPTH TNP FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X PROPOSED FFE: \_\_\_\_\_ FT.


STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qu	LL	
22.5 - 22.5										(continued)  Lean CLAY (CL) - with chert gravel throughout and trace root structures in the upper foot - dark brown and orangish brown - moist - soft to very hard (RESIDUUM)
25.0 - 25.0			7	SS	2 - 4 - 4				46.8	
27.5 - 27.5										
30.0 - 30.0			8	SS	3 - 15 - 50/3"				40.7	
32.5 - 32.5										
35.0 - 35.0										Auger Refusal at 34.0 Feet
37.5 - 37.5										
40.0 - 40.0										

REMARKS: \_\_\_\_\_

Pages from GEOS Study re Lot 15 6-25-06  
& GEOS Study re Lot 16 6-28-06



**LEGEND**

 Approximate location of soil test boring

**NOTES:**

- 1) Boring locations are shown in general arrangement only.
- 2) Do not use locations or sketch for determination of distances or quantities.

SCALE:	NTS
CHECKED BY:	DAH
DRAWN BY:	RMS
DATE:	06/20/2006

**GEOS**  
 GEOServices, LLC-Geotechnical and Materials Engineers  
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Boring Location Map  
 Cottingham Court Lots 15 & 16  
 Knoxville, Tennessee

FIGURE NO:  
1

JOB NO: 21-06176



**Cottingham Court Lots 15 and 16**  
**Knoxville, Tennessee**  
 GEOServices Project No. 21-06176

LOG OF BORING B-1  
 SHEET 1 OF 2

DRILLER LJ/JAL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-1 DRY ON COMPLETION ? Yes

DATE June 8, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 33.6 FT. ELEV. -33.6 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 33.6 FT. ELEV. -33.6 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: POWER AUGERING X WASHBORING \_\_\_\_\_

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qp	LL	
2.5	-2.5		1	SS	15					Silty CLAY (CL) with trace root structure and chert fragments - reddish brown, moist, stiff. (Residuum)
5.0	-5.0		2	SS	14					
7.5	-7.5		3	SS	7					
10.0	-10.0		4	SS	6					
12.5	-12.5									
15.0	-15.0		5	SS	8					
17.5	-17.5									Silty CLAY (CL) with trace root structure, black staining, and chert fragments - reddish brown, moist, firm. (Residuum)
20.0	-20.0		6	SS	6					

REMARKS: \_\_\_\_\_



Cottingham Court Lots 15 and 16  
 Knoxville, Tennessee  
 GEOServices Project No. 21-06176

LOG OF BORING B-1  
 SHEET 2 OF 2

DRILLER LJ/AL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-1 DRY ON COMPLETION? Yes

DATE June 8, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 33.6 FT. ELEV. -33.6 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 33.6 FT. ELEV. -33.6 FT.

WATER LEVEL DATA (IF APPLICABLE)  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: POWER AUGERING X WASHBORING \_\_\_\_\_

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qp	LL	
22.5	-22.5									
23.5	-25.0	23.5	25.0	7	SS	5				Silty CLAY (CL) with chert fragments - brown, very moist, firm to very soft. (Residuum)
28.5	-30.0	28.5	30.0	8	SS	2				
35.0	-35.0									Auger Refusal at 33.6 feet

REMARKS: \_\_\_\_\_



Cottingham Court Lots 15 and 16  
 Knoxville, Tennessee  
 GEOServices Project No. 21-06176

LOG OF BORING B-2  
 SHEET 1 OF 1

DRILLER LJ/AL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-2 DRY ON COMPLETION? Yes

DATE June 8, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 18.9 FT. ELEV. -18.9 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 18.9 FT. ELEV. -18.9 FT.

WATER LEVEL DATA (IF APPLICABLE)  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: POWER AUGERING X WASHBORING \_\_\_\_\_

DEPTH FT.   ELEV.	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FROM FT.	TO FT.			N-Value	Qp	LL	PI	%M	
2.5   -2.5	1.0	2.5	1	SS	15					Silty CLAY (CL) with trace root structure - reddish brown, moist, stiff. (Residuum)
5.0   -5.0	3.5	5.0	2	SS	13					Silty CLAY (CL) with chert fragments - dark reddish brown, moist, stiff. (Residuum)
7.5   -7.5	6.0	7.5	3	SS	10					
10.0   -10.0	8.5	10.0	4	SS	8					Silty CLAY (CL) with chert fragments and black staining - reddish brown, very moist, firm to soft. (Residuum)
12.5   -12.5										
15.0   -15.0	13.5	15.0	5	SS	4					Silty CLAY (CL) with chert fragments - light brown, very moist, soft. (Residuum)
17.5   -17.5										
20.0   -20.0	18.5	18.9	6	SS	50/0"					Auger Refusal at 18.9 feet

REMARKS: \_\_\_\_\_



**Cottingham Court Lots 15 and 16**  
**Knoxville, Tennessee**  
 GEOServices Project No. 21-06176

LOG OF BORING **B-3**  
 SHEET 1 OF 2

DRILLER LJ/AL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-3 DRY ON COMPLETION? Yes

DATE June 9, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 37.1 FT. ELEV. -37.1 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 37.1 FT. ELEV. -37.1 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X WASHBORING \_\_\_\_\_

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FT.	ELEV.			FROM FT.	TO FT.	N-Value	Qp	LL	
0.0 - 2.5			1	SS	17					Silty CLAY (CL) with trace root structure, black staining, and chert fragments - reddish brown, moist, very stiff to stiff. (Residuum)
2.5 - 5.0			2	SS	9					
5.0 - 7.5			3	SS	12					
7.5 - 10.0			4	SS	17					Silty CLAY (CL) with black staining and chert fragments - reddish brown, moist, very stiff to stiff. (Residuum)
10.0 - 12.5			5	SS	12					
12.5 - 15.0			6	SS	6					Silty CLAY (CL) with black staining and chert fragments - reddish brown and brown, moist, firm. (Residuum)
15.0 - 17.5										
17.5 - 20.0										

REMARKS: \_\_\_\_\_





**Cottington Court Lots 15 and 16**  
**Knoxville, Tennessee**  
 GEOServices Project No. 21-06176

LOG OF BORING **B-3**  
 SHEET 2 OF 2

DRILLER LJ/AL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-3 DRY ON COMPLETION? Yes

DATE June 9, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 37.1 FT. ELEV. -37.1 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 37.1 FT. ELEV. -37.1 FT.

**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X WASHBORING \_\_\_\_\_

STRATUM DEPTH		SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
FT.	ELEV.	FROM FT.	TO FT.			N-Value	Qp	LL	PI	%M	
22.5	-22.5										Silty CLAY (CL) with black staining and chert fragments - reddish brown and brown, moist, firm. (Residuum)
		23.5	25.0	7	SS	7					
25.0	-25.0										Silty CLAY (CL) with chert fragments - brown, very moist, firm to soft. (Residuum)
		28.5	30.0	8	SS	8					
30.0	-30.0										Auger Refusal at 37.1 feet
		33.5	35.0	9	SS	4					
35.0	-35.0										
37.5	-37.5										
40.0	-40.0										

REMARKS: \_\_\_\_\_



**Cottington Court Lots 15 and 16**  
**Knoxville, Tennessee**  
 GEOServices Project No. 21-06176

LOG OF BORING **B-4**  
 SHEET 1 OF 1

DRILLER LJ/JAL  
 ON-SITE REP. \_\_\_\_\_

BORING NO. / LOCATION B-4 DRY ON COMPLETION ? Yes

DATE June 9, 2006 SURFACE ELEV. \_\_\_\_\_ FT.  
 REFUSAL: Yes DEPTH 12.0 FT. ELEV. -12.0 FT.  
 SAMPLED \_\_\_\_\_ FT. \_\_\_\_\_ M  
 TOP OF ROCK DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 BEGAN CORING DEPTH \_\_\_\_\_ FT. ELEV. \_\_\_\_\_ FT.  
 FOOTAGE CORED (LF) \_\_\_\_\_ FT.  
 BOTTOM OF HOLE DEPTH 12.0 FT. ELEV. -12.0 FT.

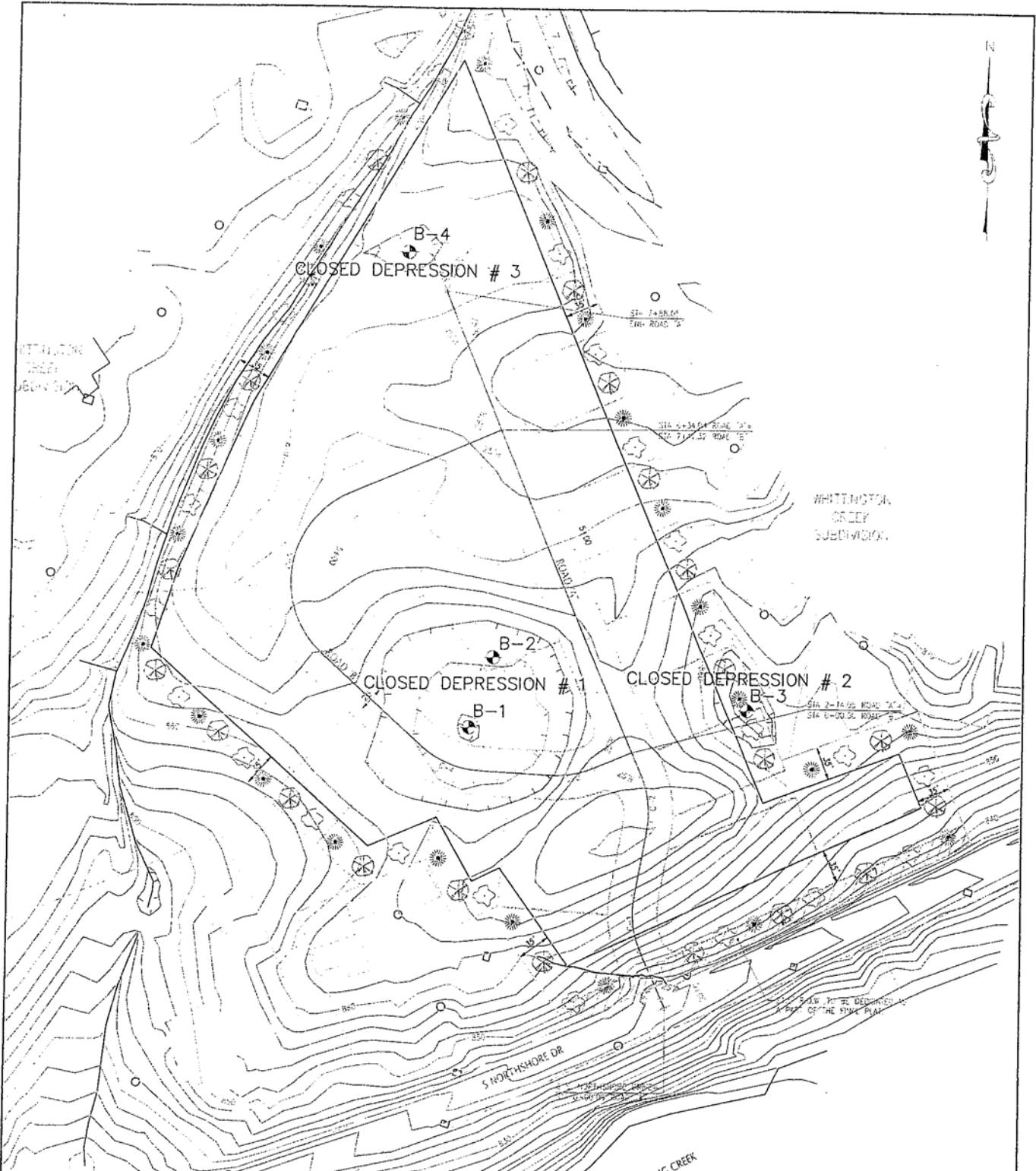
**WATER LEVEL DATA (IF APPLICABLE)**  
 COMPLETION: DEPTH Dry FT.  
 ELEV. \_\_\_\_\_ FT.  
 AFTER 24 HRS. DEPTH \_\_\_\_\_ FT.  
 ELEV. \_\_\_\_\_ FT.

BORING ADVANCED BY: \_\_\_\_\_ POWER AUGERING X WASHBORING \_\_\_\_\_

STRATUM DEPTH	SAMPLE DEPTH		SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS		LABORATORY RESULTS			STRATUM DESCRIPTION
	FROM	TO			N-Value	Qp	LL	PI	%M	
	FT.	FT.								
0.0 - 2.5	1.0	2.5	1	SS	11					Silty CLAY (CL) with black staining and chert fragments - dark reddish brown, moist, stiff. (Residuum)
2.5 - 5.0	3.5	5.0	2	SS	13					Silty CLAY (CL) with chert fragments - dark reddish brown, moist, stiff. (Residuum)
5.0 - 7.5	6.0	7.5	3	SS	8					Silty CLAY (CL) with black staining and chert fragments - tan and dark brown, moist, firm. (Residuum)
7.5 - 10.0	8.5	10.0	4	SS	3					Silty CLAY (CL) - reddish brown and brown, very moist, soft.
10.0 - 12.5										Auger Refusal at 12 feet
12.5 - 15.0										
15.0 - 17.5										
17.5 - 20.0										

REMARKS: \_\_\_\_\_

Pages from S&ME Geotech Study 8-9-04



**NOTES:**

- 1) Boring locations are shown in general arrangement only.
- 2) Do not use boring locations for determination of distances or quantities.
- 3) Base map provided by: Fulghum MacIndoe & Associates, Inc.

**LEGEND**

- B-1  
 APPROXIMATE LOCATION OF SOIL TEST BORING

SCALE:	NTS
CHECKED BY:	DAH
DRAWN BY:	JHC
DATE:	8-9-04




















Boring Location Plan	
Northshore Subdivision	
9117 S. Northshore Drive Knoxville, Tennessee	
JOB NO:	1431-04-503

FIGURE NO:  
 1

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS




## SOIL TYPES

(Shown in Graphic Log)

	Fill
	Asphalt
	Concrete
	Topsoil
	Gravel
	Sand
	Silt
	Clay
	Organic
	Silty Sand
	Clayey Sand
	Sandy Silt
	Clayey Silt
	Sandy Clay
	Silty Clay
	Partially Weathered Rock
	Cored Rock

## WATER LEVELS

(Shown in Water Level Column)

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

## CONSISTENCY OF COHESIVE SOILS

### CONSISTENCY

Very Soft  
Soft  
Firm  
Stiff  
Very Stiff  
Hard  
Very Hard

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 2  
3 to 4  
5 to 8  
9 to 15  
16 to 30  
31 to 50  
Over 50

## RELATIVE DENSITY OF COHESIONLESS SOILS

### RELATIVE DENSITY





Very Loose  
Loose  
Medium Dense  
Dense  
Very Dense

### STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 4  
5 to 10  
11 to 30  
31 to 50  
Over 50

## SAMPLER TYPES

(Shown in Samples Column)

-  Shelby Tube
-  Split Spoon
-  Rock Core
-  No Recovery

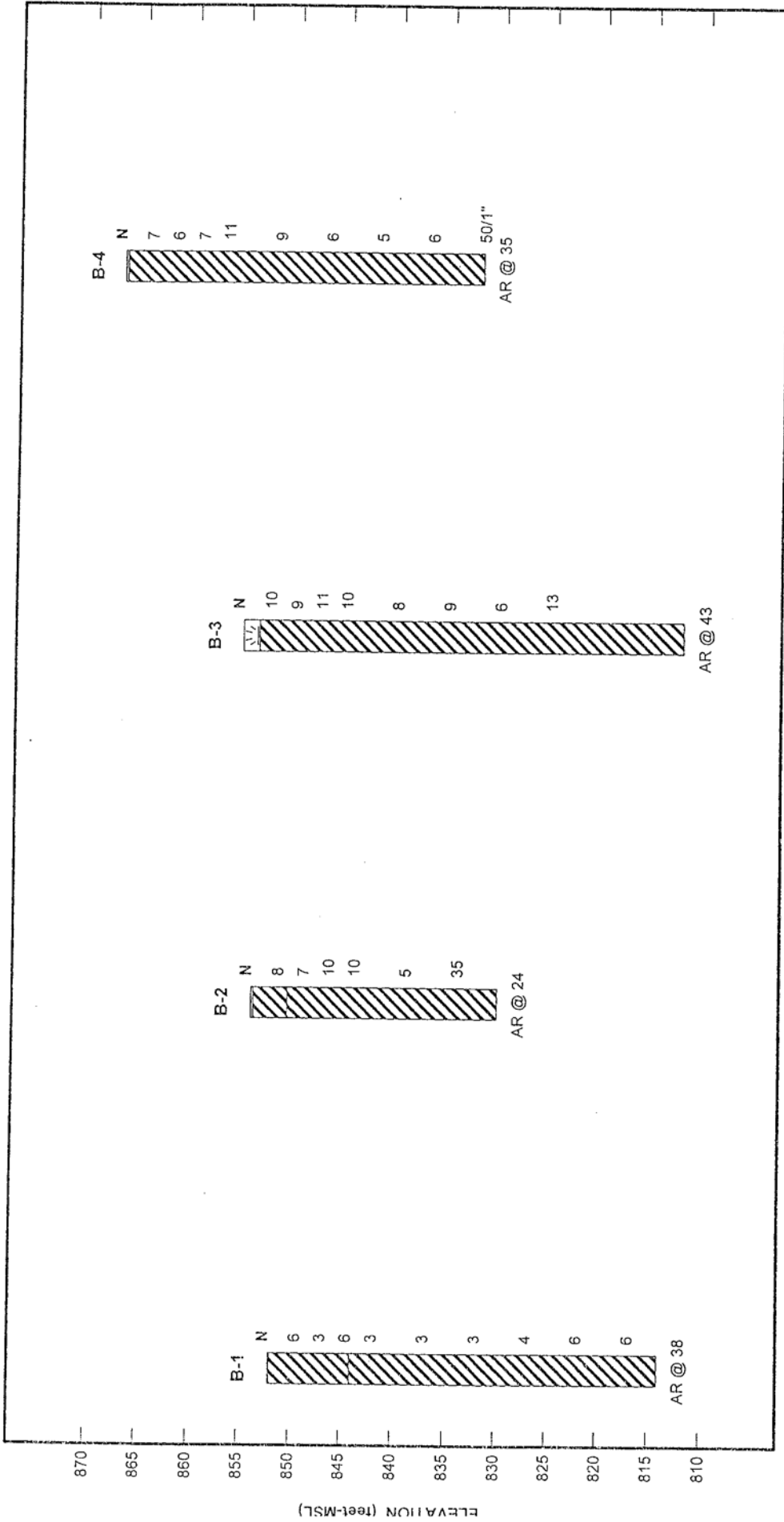
## TERMS

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

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

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





Topsoil  
Clay

ST0016

▽ = Water Level At Termination of Boring  
 ▽ = Water Level Taken After 24 Hours  
 BT = Boring Terminated  
 AR = Auger Refusal  
 CT = Coring Terminated

N = Standard Penetration Test resistance value (blows per foot). The depicted stratigraphy is shown for illustrative purposes only. The actual subsurface conditions will vary between boring locations.

JOB NO: 1431-04-503

DATE: 7/28/04



Project: Fuller-Sims Development / 9117 S. Nol  
 Location: Knoxville, Tennessee

PROJECT: Fuller-Sims Development / 9117 S. Northshore Dr.  
 Knoxville, Tennessee  
 S&ME Project No. 1431-04-503

**BORING LOG B-1**

DATE DRILLED: 7/27/04 ELEVATION: 852  
 DRILLING METHOD: CME 550X, 3/4" H.S.A. BORING DEPTH: 38.0 feet  
 LOGGED BY: J. Cole WATER LEVEL @ TOB: Dry  
 DRILLER: D. Hedges WATER LEVEL @ 24 hrs: N/A

NOTES: Soil descriptions based on visual observation of obtained samples. Top of boring elevations interpolated off of site plan from Fulghum MacIndoe & Associates.

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	STANDARD PENETRATION TEST DATA (blows/ft)					N VALUE	
							10	20	30	60	80		
0 - 1		Topsoil (1 inch)			1	☒							6
1 - 5		Clay (CH) - dark brown; firm to soft; very moist; with trace sand; (Residuum)		847	2	☒							3
5 - 10				842	3	☒							6
10 - 15				837	4	☒							3
15 - 20				832	5	☒							3
20 - 25		Clay (CH) - reddish brown with black staining; soft to firm; very moist to moist; with chert and rock fragments; (Residuum)		827	6	☒							3
25 - 30				822	7	☒							4
30 - 35				817	8	☒							6
35 - 38		Auger Refusal at 38 feet			9	☒							6

BORING LOG NEW 04-503.GPJ S&ME.GDT 7/28/04

**NOTES:**

- THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
- BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
- STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
- WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: Fuller-Sims Development / 9117 S. Northshore Dr.  
 Knoxville, Tennessee  
 S&ME Project No. 1431-04-503

**BORING LOG B-2**

DATE DRILLED: 7/27/04 ELEVATION: 854  
 DRILLING METHOD: CME 550X, 3/4" H.S.A. BORING DEPTH: 24.0 feet  
 LOGGED BY: J. Cole WATER LEVEL @ TOB: Dry  
 DRILLER: D. Hedges WATER LEVEL @ 24 hrs: N/A

NOTES: Soil descriptions based on visual observation of obtained samples. Top of boring elevations interpolated off of site plan from Fulghum MacIndoe & Associates.

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	STANDARD PENETRATION TEST DATA (blows/ft)					N VALUE
							10	20	30	60	80	
0 - 2		Topsoil (2 inches)			1	⊗						8
2 - 5		Clay (CH) - dark brown; firm; very moist; with trace sand; (Residuum)		849	2	⊗						7
5 - 10		Clay (CH) - reddish orange; stiff to firm; moist; with chert fragments; with rock fragments at depth; (Residuum)  Note: Sample # 6 N-value inflated due to abundant rock fragments.		844	3	⊗						10
10 - 15			844	4	⊗							10
15 - 20				839	5	⊗						5
20 - 24				834	6	⊗						35
24 - 24		Auger Refusal at 24 feet										

BORING LOG NEW 04-503.GPJ S&ME\_GDT 7/28/04

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.

**ST0018**





PROJECT: Fuller-Sims Development / 9117 S. Northshore Dr.  
 Knoxville, Tennessee  
 S&ME Project No. 1431-04-503

**BORING LOG B-3**

DATE DRILLED: 7/28/04

ELEVATION: 855

DRILLING METHOD: CME 550X, 3 1/4" H.S.A.

BORING DEPTH: 43.0 feet

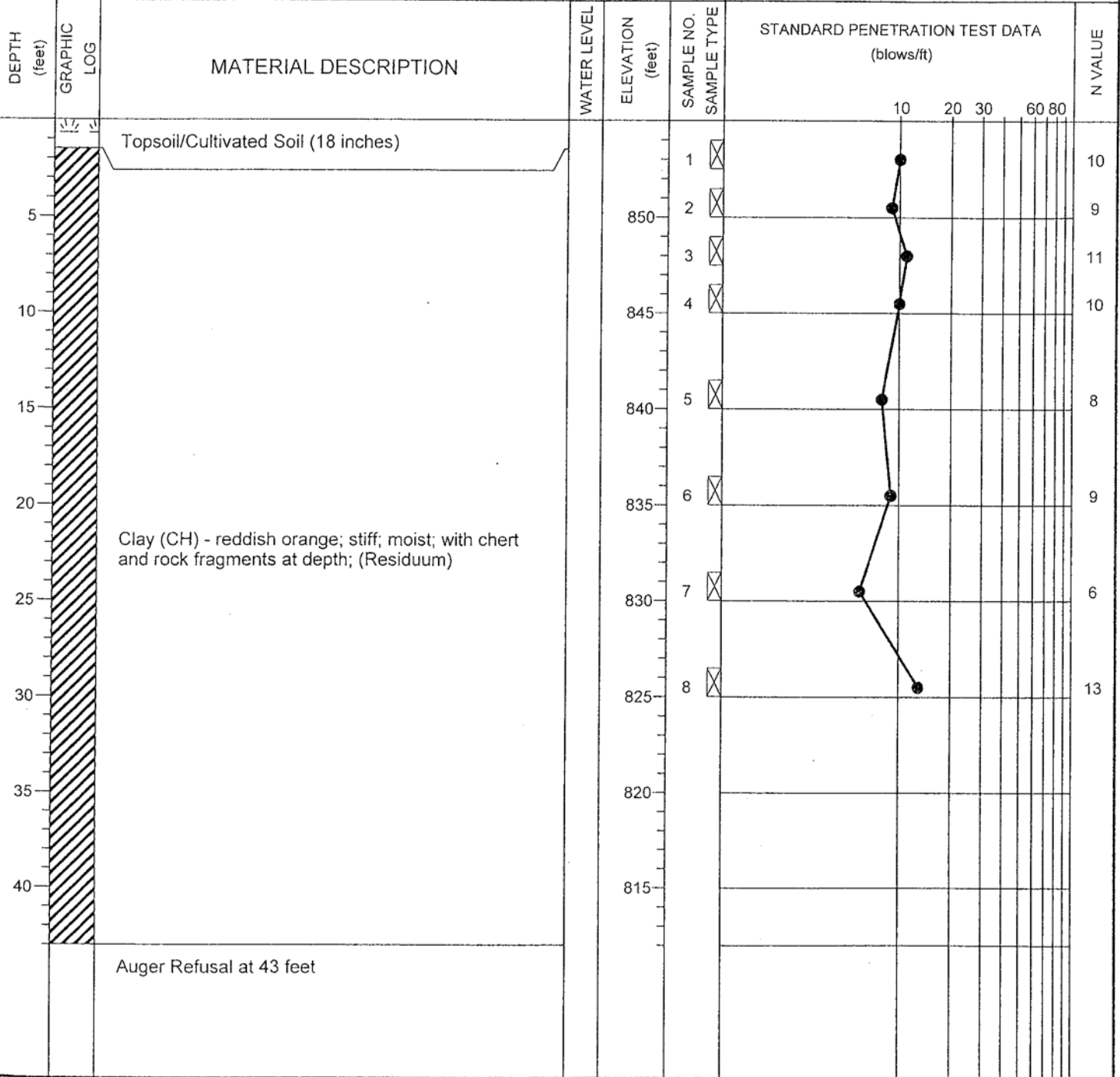
LOGGED BY: J. Cole

WATER LEVEL @ TOB: Dry

DRILLER: D. Hedges

WATER LEVEL @ 24 hrs: N/A

NOTES: Soil descriptions based on visual observation of obtained samples. Top of boring elevations interpolated off of site plan from Fulghum MacIndoe & Associates.



BORING LOG NEW 04-503.GPJ S&ME.GDT 7/28/04

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.

PROJECT: Fuller-Sims Development / 9117 S. Northshore Dr.  
 Knoxville, Tennessee  
 S&ME Project No. 1431-04-503

**BORING LOG B-4**

DATE DRILLED: 7/28/04	ELEVATION: 867
DRILLING METHOD: CME 550X, 3/4" H.S.A.	BORING DEPTH: 35.0 feet
LOGGED BY: J. Cole	WATER LEVEL @ TOB: Dry
DRILLER: D. Hedges	WATER LEVEL @ 24 hrs: N/A

NOTES: Soil descriptions based on visual observation of obtained samples. Top of boring elevations interpolated off of site plan from Fulghum MacIndoe & Associates.

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet)	SAMPLE NO.	SAMPLE TYPE	STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE			
							10	20	30	60 80				
0 - 2		Topsoil (2 inches)			1	⊗						7		
2 - 5		Clay (CH) - reddish orange with black staining; firm to stiff; moist; with chert and rock fragments at depth; (Residuum)		862	2	⊗							6	
5 - 7					3	⊗								7
7 - 10					857	4	⊗							11
10 - 15					852	5	⊗							9
15 - 20					847	6	⊗							6
20 - 25					842	7	⊗							5
25 - 30					837	8	⊗							6
30 - 35					832	9	⊗							50/1"
35		Auger Refusal at 35 feet												

BORING LOG NEW 04-503.GPJ S&ME.GDT 7/28/04

**NOTES:**

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.

ST0020



**Use on Review**     **Development Plan**

Name of Applicant: Michael Brady Inc

Date Filed: 10-29-18    Meeting Date: December 13 2018

Application Accepted by: Thomas Buddle

Fee Amount: \_\_\_\_\_ File Number: Development Plan

Fee Amount: 1200.00 File Number: Use on Review 12-E-18-UR  
 (\$500.00 paid under 12-SB-18-C)



**PROPERTY INFORMATION**

Address: 1933 Cottingham Lane

General Location: Intersection of S Northshore & Cottingham Lane

Tract Size: 2.00 ac    No. of Units: 4

Zoning District: PR

Existing Land Use: SFR

Planning Sector: Southwest County

Sector Plan Proposed Land Use Classification:  
LDR

Growth Policy Plan Designation: Planned Growth

Census Tract: 57.12

Traffic Zone: 169

Parcel ID Number(s): 145P 'M' 025

Jurisdiction:  City Council \_\_\_\_\_ District  
 County Commission 4 District

**PROPERTY OWNER/OPTION HOLDER**

PLEASE PRINT  
 Name: Hartson Construction

Company: \_\_\_\_\_

Address: 10025 Suite 150 Investment Dr

City: Knoxville    State: TN    Zip: 37932

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

**APPLICATION CORRESPONDENCE**

All correspondence relating to this application should be sent to:

PLEASE PRINT  
 Name: John Pattenon

Company: Michael Brady Inc.

Address: 299 N Weisgarber Rd

City: Knoxville    State: TN    Zip: 37919

Telephone: 865-584-0999

Fax: 865-584-5213

E-mail: johnp@mbiarch.com

**APPROVAL REQUESTED**

**Development Plan:**  Residential     Non-Residential

**Home Occupation** (Specify Occupation)  
 \_\_\_\_\_

**Other** (Be Specific)

Detached residences on individual lots.

**APPLICATION AUTHORIZATION**

I hereby certify that I am the authorized applicant, representing ALL property owners involved in this request or holders of option on same, whose signatures are included on the back of this form.

Signature: \_\_\_\_\_

PLEASE PRINT  
 Name: John Pattenon

Company: Michael Brady Inc

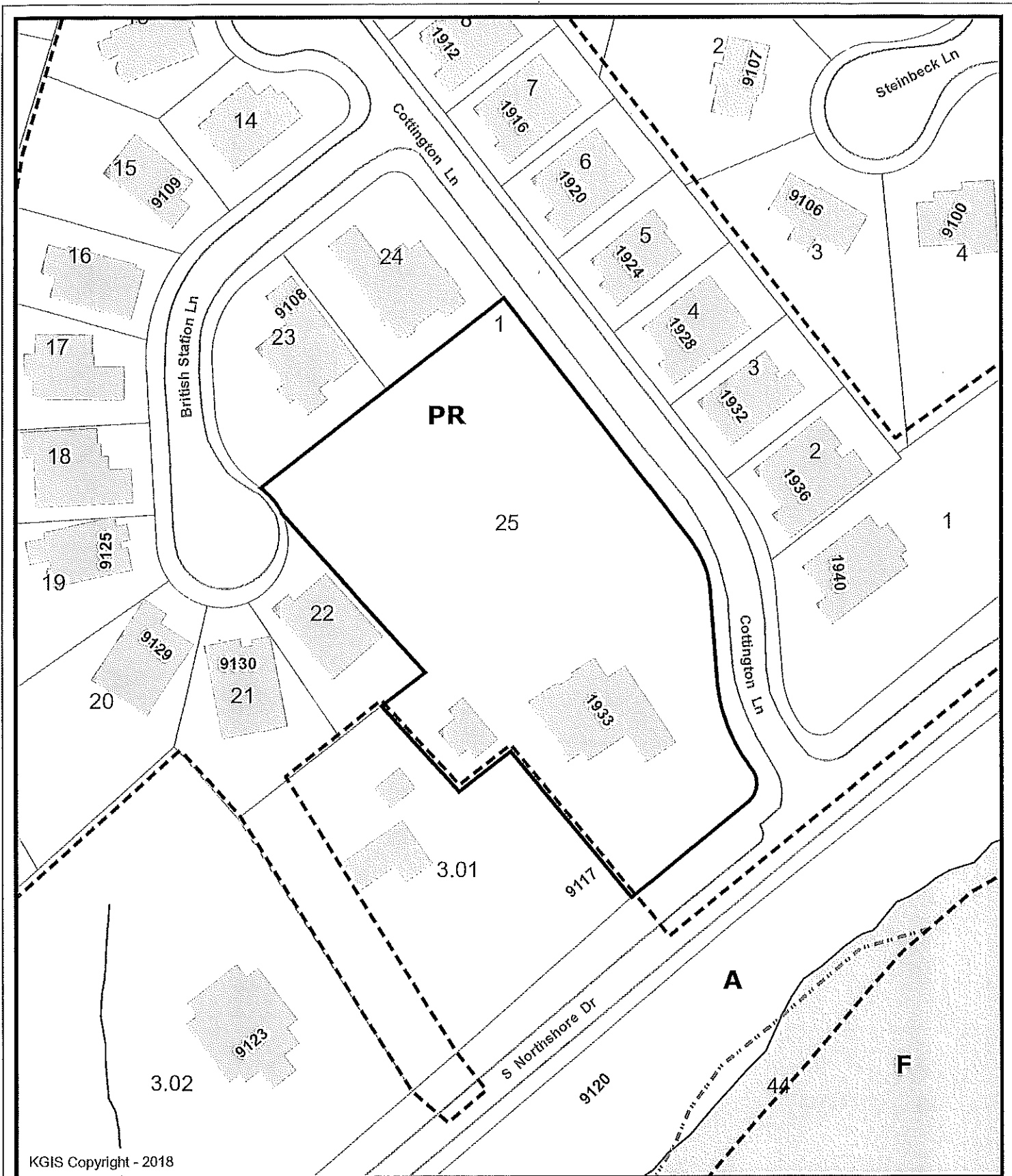
Address: 299 N Weisgarber Rd

City: Knoxville    State: TN    Zip: 37919

Telephone: 865-584-0999

E-mail: johnp@mbiarch.com





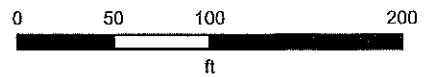
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### Letter Portrait

Knoxville - Knox County - KUB Geographic Information System



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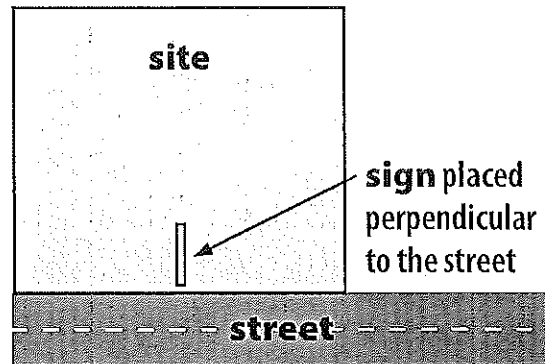
## REQUIRED SIGN POSTING AGREEMENT

For all rezoning, plan amendment, concept plan, use on review, right-of-way closure, and street name change applications, a sign must be posted on the subject property, consistent with the adopted MPC Administrative Rules and Procedures.

At the time of application, MPC staff will provide a sign(s) to post on the property as part of the application process. If the sign(s) go missing for any reason and need to be replaced, then the applicant will be responsible for picking up a new sign(s) from the MPC offices. The applicant will be charged a fee of \$10 for each replacement sign.

### LOCATION AND VISIBILITY

The sign must be posted in a location that is clearly visible from vehicles traveling in either direction on the nearest adjacent/frontage street. If the property has more than one street frontage, then the sign should be placed along the street that carries more traffic. MPC staff may recommend a preferred location for the sign to be posted at the time of application.



### TIMING

The sign(s) must be posted 15 days before the scheduled MPC public hearing and must remain in place until the day after the meeting. In the case of a postponement, the sign can either remain in place or be removed and reposted 15 days before the next MPC meeting.

I hereby agree to post and remove the sign(s) provided on the subject property consistent with the above guidelines and between the dates of:

Nov. 28th

and

Dec 14th

(15 days before the MPC meeting)

(the day after the MPC meeting)

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

Date: \_\_\_\_\_

MPC File Number: \_\_\_\_\_

12-E-18-UR