Final Report of Geotechnical Exploration
KEMI Office Building
Lexington, KY
S&ME Project No. 1183-16-043

Prepared for:
Kentucky Employers' Mutual Insurance (KEMI)
250 W. Main Street, Suite 900
Lexington, Kentucky 40507

Prepared by:
S&ME, Inc.
2020 Liberty Road, Ste 105
Lexington, KY 40505

S&ME

July 8, 2016

Kentucky Employers' Mutual Insurance (KEMI)
250 W. Main Street, Suite 900
Lexington, Kentucky 40507

Attention: Mr. Paul Dillon

Reference: **Final Report of Geotechnical Exploration**
KEMI Office Building
Lexington, KY
S&ME Project No. 1183-16-043

Dear Mr. Dillon:

S&ME, Inc. has completed the exploration and analysis for proposed Kentucky Employers' Mutual Insurance (KEMI) Office building at Lot 22 of the Kingston Hall Property in Lexington, Kentucky. The purpose of this exploration was to obtain subsurface data at the site pursuant to construction of the new office building. We conducted this project in general accordance with our revised proposal 11-1600088, dated May 6, 2016, as authorized by you on May 9, 2016. This report discusses our field and laboratory findings, and provides recommendations for design and development of the site and project.

1.0 EXISTING SITE AND PROJECT DESCRIPTION

The project site is located on the north side of Interstates 64 & 75 (I-64/75), between Newtown Pike (KY 922) and Russell Cave Road (KY 353) in Lexington, Kentucky. S&ME understands that the planned structure will be 3-stories and have an approximate footprint of about 185-feet by 185-feet. The building construction has not yet been determined thus we do not know structural loads or settlement tolerances. Mr. Tom Hatfield, P.E, P.L.S with EA Partners anticipates a finished floor elevation of approximately 973 feet. We anticipate that a 3-story office building will likely be constructed of steel framing with masonry exterior. The first floor will likely be a concrete slab-on-grade while the elevated floors will be lightweight concrete over steel decking. For this type of construction, we anticipate maximum column loads of less than 325 kips.

For our exploration we focused on three potential building sites we noted as the western, central, and eastern options as identified by EA Partners. We understand that the central location is the preferred location thus the following sections of the report will focus on the central portion of the site.

The central and western two-thirds of the property consist of a fallow field with weeds. The eastern third of the property is a mixture of a fallow field and brush with numerous large trees. Elevations across the property range from about 988 feet near to about 950 feet. Elevations within the planned building footprint range from about 982 feet to 964 feet. Based on a preliminary finished floor elevation of 973 feet, we anticipate about eight to nine feet of cut and fill in the planned building footprint.

2.0 SITE GEOLOGY

A review of the USGS (United States Geologic Survey) geologic map of the Lexington East Quadrangle (1968) indicates this project site is underlain by a Tongue of the Tanglewood Limestone and Millersburg Members of the Lexington Limestone Formation. The Tongue of the Tanglewood consists of limestone that is light gray, medium to coarse grained and in medium to thick tabular beds. The Millersburg Member is approximately 50 percent limestone and 50 percent shale. The limestone portion is gray, shaly, fine to medium grained and occurs in irregular beds. The shale portion occurs in dark gray beds between the limestone layers.

The limestone in the area, particularly the Tanglewood, has a moderate potential for Karst development. We reviewed the USGS mapping of the site and region and observed several closed depressions within one mile of the site. However, we did not observe obvious surface signs of sinkhole development at the project site. Boring B-3, located in the middle of the western building location (in the Tanglewood Limestone), did encounter a void in the rock core from 14.5 to 15.4 feet below the ground surface. The other rock cores did not encounter voids or other signs of Karst development. A percentage of the site was wooded thus it is possible some surface indications may not have been visible.

The most common presentations of Karst with the Tanglewood are soil filled, solution widened joints in the bedrock and an erratic top of rock profile. Typically the soil filled joints are less than five feet wide. Our borings did not encounter evidence of these soil filled joints; however, they are an inherent risk with the Tanglewood Limestone. While our borings and rock soundings did encounter an erratic rock surface, particularly on the western portion of the site, the bedrock surface becomes less erratic towards the eastern side where the Millersburg Member is the predominant geology.

3.0 EXPLORATION METHODS

The procedures used by S&ME for field and laboratory sampling and testing are in general accordance with ASTM procedures and established engineering practice.

3.1 Field Exploration

We drilled a total of 15 soil test borings (labeled as B-1 through B-15) and 32 rock soundings (labeled as S-1 through S-32) at the site. The borings were advanced in the following areas:

Borings B-1 through B-5	West Building Footprint
Borings B-6 through B-10	Central Building Footprint
Borings B-11 through B-15	East Building Footprint

We also advanced four rock soundings in each of the proposed building locations as well as 20 additional soundings around the site to delineate the apparent sinkhole and profile the bedrock. The cluster of soundings between the western and central building location were drilled around the apparent sinkhole location. The boring and sounding locations are shown on the attached *Boring and Sounding Location*

Plan. EA Partners surveyors marked the boring and sounding locations selected by S&ME and provided the ground surface elevations at each location.

During drilling Ms. Cate Burton, G.I. with S&ME was on-site to observe pertinent site features, surface indications of the site geology, and to direct the drilling operations. The borings were advanced with a track-mounted Diedrich D-50 drill rig using 4 ¼ inch I.D. hollow stem augers. We obtained soil samples using a split-barrel sampler driven by an automatic hammer system in general accordance with ASTM D1586. We obtained relatively undisturbed (Shelby) tube samples in general accordance with ASTM D1587. Rock coring using an NQ core barrel was performed in three borings from each of the building footprints upon encountering auger refusal. The stratification lines shown on the boring records represent the approximate boundaries between soil or rock types. The transitions may be more gradual than shown.

3.2 Laboratory Testing

The recovered soil samples were sealed in storage bags and returned to our laboratory. The soil samples were visually classified by the geotechnical engineer and geologist according to the Unified Soil Classification System (ASTM D2487). The results of the laboratory testing are included in Appendix III.

4.0 SUBSURFACE CONDITIONS

The following is a general description of the materials encountered in our borings and soundings.

Beneath about 6 to 10 inches of topsoil, we encountered residual clay consisting of low plasticity (lean) clay (CL) overlying high plasticity (fat) clay (CH). The natural moisture content of the lean clay ranged from about 23 percent to 26 percent. An Atterberg Limits test of the lean clay indicated a liquid limit of 37 percent and a plasticity index of 15 percent. The lean clay horizon averaged about two feet thick in the planned central building location.

The fat clay extended to a weathered bedrock horizon which ranged in depth from 4.4 feet to 7.0 feet below the ground surface within the planned building footprint. Natural moisture contents of the fat clay ranged from about 24 to 32 percent. Atterberg Limits of the fat clay indicated liquid limits of 51 to 65 percent with plasticity indices of 26 to 39 percent. The fat clay extended to a weathered limestone horizon that averaged about six feet below the ground surface in the central building location.

The weathered limestone horizon averaged about one and a half feet thick but was as much as three feet thick in the central building location borings and soundings. Within the planned central building location, auger refusal, which we interpret as bedrock, was encountered at depths ranging from 5.5 feet to 8.8 feet with refusal elevations ranging from 962.4 feet in Sounding S-24 to 973.5 feet in Boring B-7.

Groundwater was not observed in the borings during drilling and the borings were dry at the completion of soil augering. For more detailed descriptions, please refer to our attached draft Test Boring Records.

5.0 APPARENT SINKHOLE

During our proposal development, we reviewed provided drawings and available aerial photography and mapping of the site. Based on this review, an apparent sinkhole location was identified in the north-western portion of the site. To explore the area around the identified location we drilled a series of rock soundings around the identified feature.

While the bedrock surface does appear to be erratic in the western portion of the site, we did not encounter features in our borings and soundings indicative of sinkhole development such as a steep drop off in the rock surface, deep silty soil zones, or soil softening with depth. Nor did we observe surface indications of Karst development, such as a depression, in this area. As such, in our opinion the "apparent sinkhole" in the northwest portion of the site does not appear to be a sinkhole and is not a recognized geo-hazard.

6.0 CONCLUSIONS and RECOMMENDATIONS

6.1 GENERAL DISCUSSION

Based on our exploration and experience with similar sites in central Kentucky, we have identified the following issues that must be considered during site design and development. Note that these identified issues are common throughout central Kentucky and not unique to this project site.

- Foundations and Variable Bedrock Elevation Within the Building Footprint
- High Plasticity Clay

Foundations and Variable Bedrock Elevation Within the Building Footprint

With a finished floor elevation of 973 feet (and associated shallow foundation bearing elevation of 971 feet) at least three feet of bedrock excavation will be required in the northeastern corner of the building footprint to achieve the foundation bearing elevation. Ideally, the building foundations will bear on a consistent material (i.e. – either all soil or all bedrock). Additional discussion of foundation design and construction recommendations is included in the following sections of the report.

High Plasticity Clay

Our experience is that soil volume change (shrink/swell) resulting from fluctuations in moisture content is associated with clay with a plasticity index of greater than 30 percent. In clay with a plasticity index below 30 percent, volume change is rare. The shrink/swell associated with high plasticity clay can cause floor slabs, sidewalks, and other lightly loaded elements to crack. The most common approach to mitigate the effect of high plasticity (also referred to as Fat) clay is to keep it at least three feet below the finished grade. Placing the high plasticity clay deeper in the fills, using them in detention pond construction, in lawn areas, or in outslopes are options for utilizing the fat clay on-site without having to waste it off-site.

6.2 Site Preparation

Initial site preparation will include stripping of topsoil and removal of tree stumps and rootballs. We recommend that the entire rootball be removed and the resulting hole be backfilled with compacted structural soil fill. Once the initial site stripping has occurred, we recommend a proofroll of the areas to receive structural soil fill. Proofrolling consists of observing a loaded dump truck traffic over the planned fill area. Areas that are observed to exhibit excessive deflection should be remediated at the engineer's direction. Typically undercutting and backfilling with structural soil fill is recommended.

Structural fill is defined as inorganic natural soil with a maximum particle size of 3 inches and maximum dry density of at least 90 pounds per cubic foot (pcf) when tested by the standard Proctor method (ASTM D698). The top three feet of the building pad or other grade supported improvements sensitive to movement of the underlying fat clay should have a plasticity index (PI) of less than 30 percent.

The on-site lean clay (CL) and some of the fat clay (CH) meet the plasticity requirements. We anticipate that the on-site lean clay can be used; however, standard Proctor testing and plasticity testing (Atterberg Limits) should be performed prior to beginning earthwork operations. Fat clay with a PI of greater than 30 percent can be used as structural fill provided it is kept at least three feet below the planned subgrade elevation or shallower if not supporting heave sensitive improvements.

It is imperative that, during construction, standard Proctor testing and Atterberg limits testing be performed by S&ME for compliance with the project specifications before they are used as fill material. If soils are imported to the site, we recommend that the soils be tested for conformance with the project specifications before being transported to the site. Laboratory conformance testing usually takes three to four business days to complete. Therefore, the Contractor should plan accordingly.

Structural soil fill placement should occur in relatively thin (6 to 8-inch) layers and be compacted to 98 percent of the standard Proctor maximum dry density. The moisture content of the fill should be maintained within 3 percent of the soil's optimum moisture content even though compaction may be achieved at moisture contents outside the specified range.

Observation of the fill placement and in-place density testing must be performed on structural soil fill as a check that the previously recommended compaction criteria have been achieved. This allows our project engineer to monitor the quality of the fill construction and assess that the design criterion is being achieved in the field. We further recommend that these tests be performed on a full-time basis by S&ME. The testing frequency for density tests performed on a full-time basis can be determined by our personnel based on the area to be tested, the grading equipment used, and construction schedule. Tests should be performed at vertical intervals of 8-inches or less (the maximum recommended lift thickness) as the fill is being placed.

6.3 Foundation Recommendations

Based on our presumed foundation loads of 325 kips, we recommend a bedrock supported foundation. The two most common bedrock supported foundation systems are conventional shallow spread footings or drilled shafts. The depth to bedrock relative to the finished floor elevation will dictate which type of foundation type is more economical. We anticipate that a combination of shallow spread footings and drilled shafts will be used and have provided recommendations for both foundation types.

In the central building footprint, auger refusal, which we interpret as bedrock, was encountered at elevations ranging from 962.4 feet in Sounding S-24 to 973.5 feet in Boring B-7. Mr. Tom Hatfield, P.E. wit EA Partners preliminarily anticipates a finished elevation of about 973 feet. To achieve a finished floor elevation of 973 feet (and associated foundation bearing elevation of 971 feet), we anticipate that up to two and a half feet of bedrock removal will be required in the north/northeastern portion of the building pad.

Where bedrock is shallow (5 to 6 feet of the planned shallow spread foundation bearing elevation) excavate through the soil and weathered bedrock to expose intact bedrock and re-establish the foundation bearing elevation with lean concrete or flowable fill. Where bedrock is deeper, drilled shaft foundations are commonly used. Our borings and soundings indicated that bedrock is up to 8.6 feet below an assumed foundation bearing elevation of 971 feet.

6.3.1 Shallow Foundations

We recommend that shallow foundations supported by intact bedrock be designed for a maximum allowable bearing pressure of 30 kips per square foot (ksf). As discussed above, excavating foundations to expose bedrock and backfilling with lean concrete is acceptable. Where bedrock excavation is required to achieve the foundation bearing elevation, expect the exposed bedrock to be rough and un-even. A mud mat, or layer of lean concrete at least 4-inches thick, can be poured to level the excavation. Backfilling with open graded stone is not recommended as crushed stone will not support the recommended 30 ksf allowable bedrock bearing pressure.

We recommend that the foundations be a minimum of 24 inches wide. These dimensions allow for hand cleaning of footing subgrades disturbed by the excavation process and the placement of reinforcing steel. The reinforcing steel should be clean and dry prior to concrete placement. Table 1805.2.1 of the 2013 Kentucky Building Code indicates that a minimum frost protection depth of 24 inches below finished grade is required in Fayette County, Kentucky. However, this frost protection depth for foundations bearing on bedrock or lean concrete poured on bedrock is not required.

6.3.2 Drilled Shaft Foundations

S&ME recommends that the drilled shaft foundations extend through the weathered rock and be designed for an allowable end bearing pressure of 50 ksf. We recommend a minimum rock socket length of 12 inches. A higher allowable bearing pressure is achievable with drilled shaft foundations as the skin friction between the sidewalls of the shafts and bedrock provide additional support.

6.3.2.1 Drilled Shaft Construction Considerations

The following construction considerations are recommended for drilled shaft construction:

- Clean the foundation bearing area so it is nearly level or suitably benched and is free of ponded water or loose material.
- Provide a minimum drilled shaft diameter of 30 inches to reasonably enter the drilled shaft excavation for cleaning, bottom preparation, and inspection.
- Make provisions for groundwater removal from the drilled shaft excavation after rainfall events. Subsurface water often occurs along the soil/rock interface for several days after rain. If water is flowing into the drilled shaft at less than 20 gallons per minute, pumps may be used to maintain less than 2 inches of water in the drilled shaft during cleaning and inspection. After approval of the bearing surface, the pumps should be pulled and concreting commenced immediately. If more than 20 gallons per minute are flowing into the drilled shaft, the water level should be allowed to stabilize before attempting to place the concrete. For this condition, concrete placement should be accomplished using a tremie pipe or concrete pumping equipment.
- Specify a concrete slump of 7 to 9 inches for the drilled shaft construction. This slump is recommended to fill irregularities along the sides and bottom of the drilled shaft, displace water as it is placed, and permit placement of reinforcing cages into the fluid concrete.
- Retain S&ME personnel to observe foundation excavations after the bottom of the hole is leveled, cleaned of any mud or extraneous material, and de-watered.
- Install temporary (if no voids greater than 6 inches are encountered) or permanent (if voids greater than 6 inches are encountered) protective steel casing or Sonotube to prevent side wall collapse, prevent excessive mud and water intrusion, and to allow workers to safely enter, clean and inspect the drilled shaft.
- Where temporary casing is required, the protective steel casing may be extracted as the concrete is placed provided a sufficient head of concrete is maintained inside the steel casing to prevent soil or water intrusion into the newly placed concrete.
- Direct the concrete placement into the drilled shaft through a centering chute or tremie to reduce side flow or segregation.
- For side resistance design, we will require cleaning of the socket "face" prior to concrete placements. Cleaning will require hand cleaning or washing if a mud smear forms on the face of the rock. The geotechnical engineer should approve the rock socket surface prior to concrete placement.

6.3.2.2 Drilled Shaft Rock Excavation

Our experience indicates general drilled shaft construction and delineation of "rock" in the excavation is greatly facilitated if adequate drilling equipment is used. We recommend the use of a drill capable of producing at least 500,000 inch·pounds of torque and 35,000 pounds of downward force. Additionally, we recommend that rock be defined as material which cannot be penetrated by a heavy duty earth auger with hardened teeth at a rate in excess of 3 inches per minute.

6.3.2.3 Drilled Shaft Quality Control Requirements

We recommend that the drilled shaft construction be observed by an S&ME geotechnical engineer or an S&ME, ICC Certified Special Inspector experienced in drilled shaft construction. The observation should address the following items:

- Top location within tolerances
- Correct plan dimensions
- Plumbness within tolerances
- Materials excavated agree with borings
- Statement of bottom cleanliness
- Construction procedure

Drilled shafts with diameters of 30 inches or greater are large enough to allow a down-hole inspection of the bearing conditions by a person. S&ME will assess the rock condition during construction using 2-inch diameter probe holes to evaluate the actual condition at each shaft location. Drill the probe holes at least 5 feet into the rock for all drilled shafts. These probe holes are usually drilled with a pneumatic percussion drill by the Contractor. S&ME will check the probe hole using a hooked-end steel feeler rod to assess the rock continuity and to check for the presence of mud seams or voids. If this check indicates a discontinuity or void in the rock, our Engineer will compute the expected settlement for that shaft using elastic theory. If the calculated settlement exceeds the allowable, our Engineer will require that the drilled shaft be excavated deeper. Additional probe holes may be required by the S&ME Geotechnical Engineer to check if voids or significant mud seams are detected in the initial probe holes.

To reduce the rock excavation associated with discontinuities in the rock, S&ME will:

1. Identify the actual rock condition to a depth of five feet below each shaft (thickness and location of clay seams)
2. Use elastic theory to compute settlement taking the clay seams into consideration.
3. Determine if the shaft bearing conditions are acceptable based on the computed settlement being within the settlement tolerance of the structure.
4. Extend the shaft depth, if needed, to achieve tolerable settlement

6.4 Seismic Site Classification

The current seismic design procedures outlined in the NEHRP (National Earthquake Hazard Reduction Program) guidelines mandate structural design loads to be based on the seismic coefficients of the site. Based on the results of our exploration and the geology of the area, we recommend **a site seismic classification of "C"** for this project site. This classification is further defined in Table 1613.5.2 in the 2013 Kentucky Building Code.

6.5 Floor Slab Recommendations

A grade supported slab is anticipated for the ground floor of the new building. At the anticipated finished floor elevation of 973 feet, the floor slab would be supported on a combination of existing natural soils/bedrock and newly placed and compacted fill.

Easing the floor slab subgrade transition from bedrock to soil is recommended to help control cracking of the slab. Where bedrock excavation is required to achieve the floor elevation, we recommend over-excavation of the bedrock to at least three feet below the floor slab subgrade and re-establishing the floor slab subgrade with compacted structural soil fill. We recommend the upper three feet of the building pad subgrade consist of low plasticity fill with a plasticity index (PI) of less than 30 percent.

Where the bedrock drops off sharply (steeper than 3:1 H:V), we recommend excavating these bedrock drop offs to create a 3:1 H:V slope and re-establishing the floor slab subgrade with compacted soil fill. Where possible, consider adding additional construction joints above the bedrock transition for 10 feet on each side of the transition. This bedrock transition will need to be field located during construction. Also consider placing additional reinforcement in the floor slab in the transition area. Expect that the floor slab will still crack; however, additional reinforcement will help control displacement of cracking. We also recommend avoiding ceramic tile or other sensitive hard floor coverings in the transition area.

We suggest a layer of compacted DGA directly beneath the slab to enhance support and provide a working base for construction of the floor slab. The actual thickness should be based on the floor slab design, but our experience suggests a minimum depth of 4 inches. The DGA should be moist, but not wet, as the concrete is placed to reduce curling of the slab as the concrete cures.

We recommend that control joints be placed in the slab around columns and along footing supported walls to reduce cracking due to minor differential settlements. We recommend that ACI 302.1R-96 “GUIDE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION” be followed for design and placement of concrete floor slabs, see attached form in Appendix IV to this report.

Between completion of grading and slab construction, floor slab subgrades are often disturbed by weather, footing and utility line installation, and other construction activities. For this reason, the subgrade should be evaluated by an S&ME engineer immediately prior to constructing the slab.

7.0 CLOSURE

This report has been prepared for the exclusive use of KEMI for specific application to this project site. Our conclusions and recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the Commonwealth of Kentucky. No other warranty is expressed or implied. This company is not responsible for the conclusions, opinions, or recommendations of others based on these data.

Our conclusions and recommendations are based on the design information furnished to us, the data obtained from the previously described geotechnical exploration, and our experience. They do not reflect variations in the subsurface conditions that are likely to exist between our borings and soundings and in unexplored areas of the site. These variations result from the inherent variability of the general subsurface conditions in this geologic region.

We recommend that the Owner retain S&ME to continue our involvement in the project through the subsequent phases of design and construction. Our firm is not responsible for interpretation of the data contained in this report by others.

Sincerely,
S&ME, Inc.

Andrew M. Fiehler, P.E.
Project Engineer
Kentucky License 23,977

Craig S. Lee, P.E.
Senior Engineer / Vice President

Appendix I – Site Location Map / Boring Location Plan

Appendix II – Test Boring Records / Drilling Summary Table

Appendix III- Laboratory Testing Results

Appendix IV – ACI 302.1 R-96 - Guide for Concrete Floor and Slab Construction

Important Information about This

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 constructor — 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 this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this 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.

Geotechnical Engineers Base Each Report 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;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the 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 geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this 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 geotechnical-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 confirmation-dependent recommendations included in your report. *Confirmation-dependent 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 confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront 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. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical 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 Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors 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 constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors 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 constructors fail to 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.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental 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 environmental 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 GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of 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 you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL
BUSINESS COUNCIL
of the Geoprofessional Business Association

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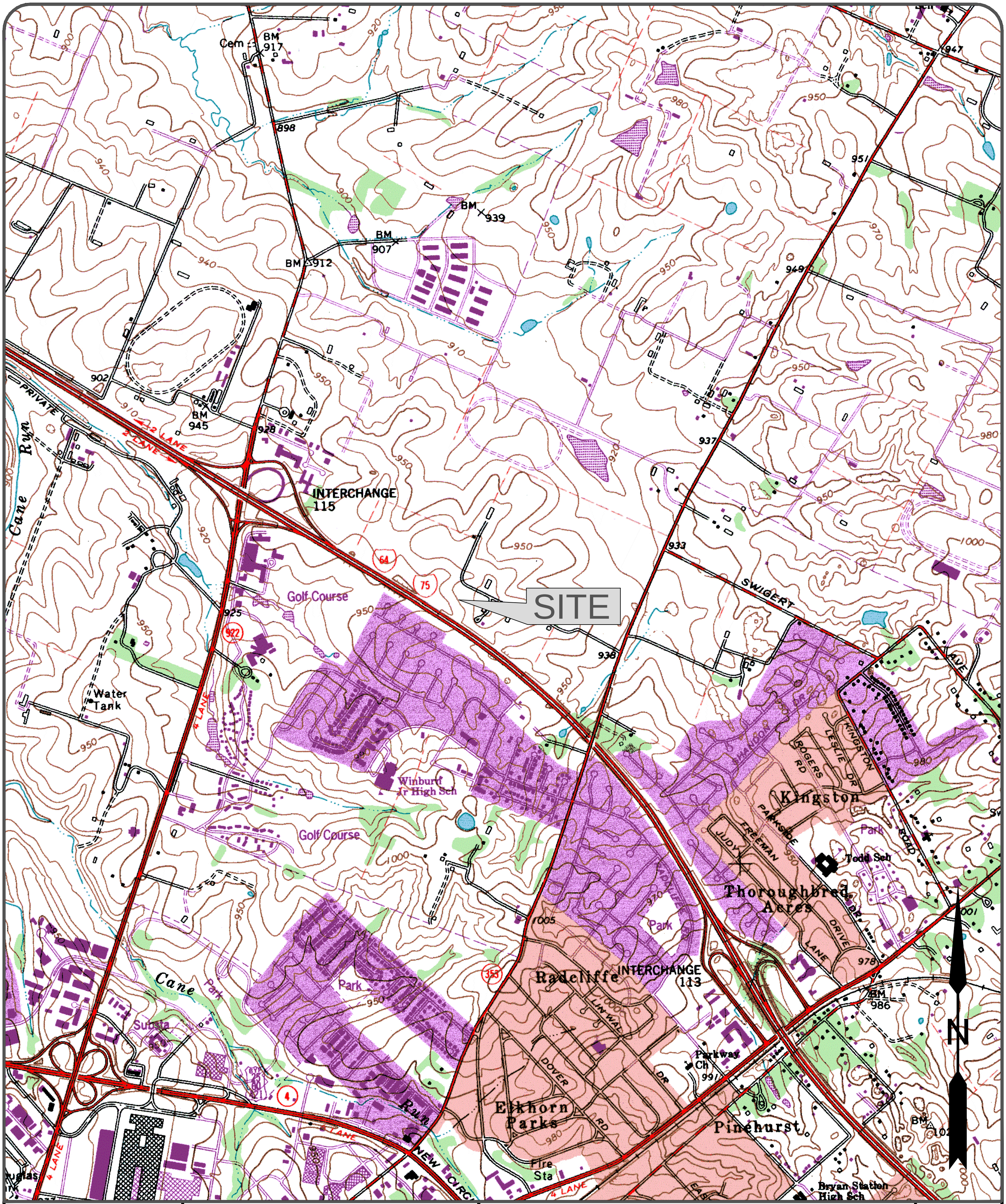
Appendix I – Site Location Map / Boring Location Plan



SCALE:	1 = 2000'
DATE:	05/25/2016
DRAWN BY:	LHR
PROJECT NO:	1183-16-043

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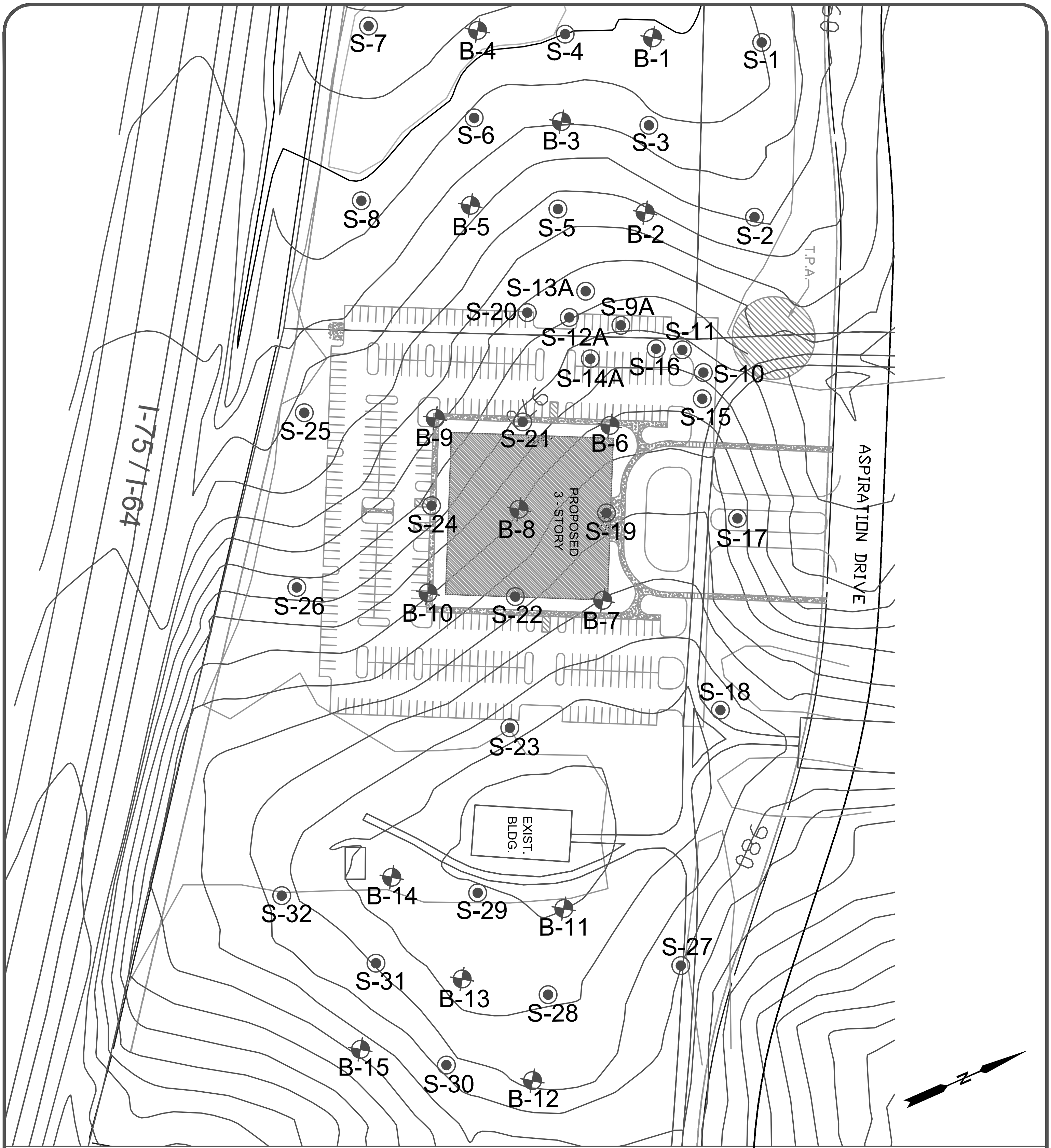
VICINITY PLAN
KEMI OFFICE
LEXINGTON, KENTUCKY

FIGURE NO.
1



LEGEND

Boring Location	B - X
Sounding Location	◎ S - X

Note: Base drawing provided
by EA Partners, PLC.

0 150 300

SCALE: 1 = 150'

DATE: 05/25/2016

DRAWN BY: LHR

PROJECT NO: 1183-16-043

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BORING LOCATION PLAN
KEMI OFFICE
LEXINGTON, KENTUCKY

FIGURE NO.
2

Appendix II – Test Boring Records / Drilling Summary

TEST BORING RECORD LEGEND

FINE AND COARSE GRAINED SOIL INFORMATION

COARSE GRAINED SOILS (SANDS & GRAVELS)

N	Relative Density
0-4	Very Loose
5-10	Loose
11-20	Firm
21-30	Very Firm
31-50	Dense
Over 50	Very Dense

FINE GRAINED SOILS (SILTS & CLAYS)

N	Consistency	Qu, KSF Estimated
0-1	Very Soft	0-0.5
2-4	Soft	0.5-1
5-8	Firm	1-2
9-15	Stiff	2-4
16-30	Very Stiff	4-8
Over 31	Hard	8+

PARTICLE SIZE

Boulders	Greater than 300 mm (12 in)
Cobbles	75 mm to 300 mm (3 to 12 in)
Gravel	4.74 mm to 75 mm (3/16 to 3 in)
Coarse Sand	2 mm to 4.75 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

The **STANDARD PENETRATION TEST** as defined by ASTM D 1586 is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D./2-inch O.D. split-barrel sampler is driven three 6-inch increments with a 140 lb. hammer falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The blow counts required to drive the sampler the final two increments are added together and designate the N-value defined in the above tables.

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

Percent RQD	Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

ROCK HARDNESS

Very Hard:	Rock can be broken by heavy hammer blows.
Hard:	Rock cannot be broken by thumb pressure, but can be broken by moderate hammer blows.
Moderately Hard:	Small pieces can be broken off along sharp edges by considerable hard thumb pressure; can be broken with light hammer blows.
Soft:	Rock is coherent but breaks very easily with thumb pressure at sharp edges and crumbles with firm hand pressure.
Very Soft:	Rock disintegrates or easily compresses when touched; can be hard to very hard soil.

$$\text{Recovery} = \frac{\text{Length of Rock Core Recovered}}{\text{Length of Core Run}} \text{ X100}$$

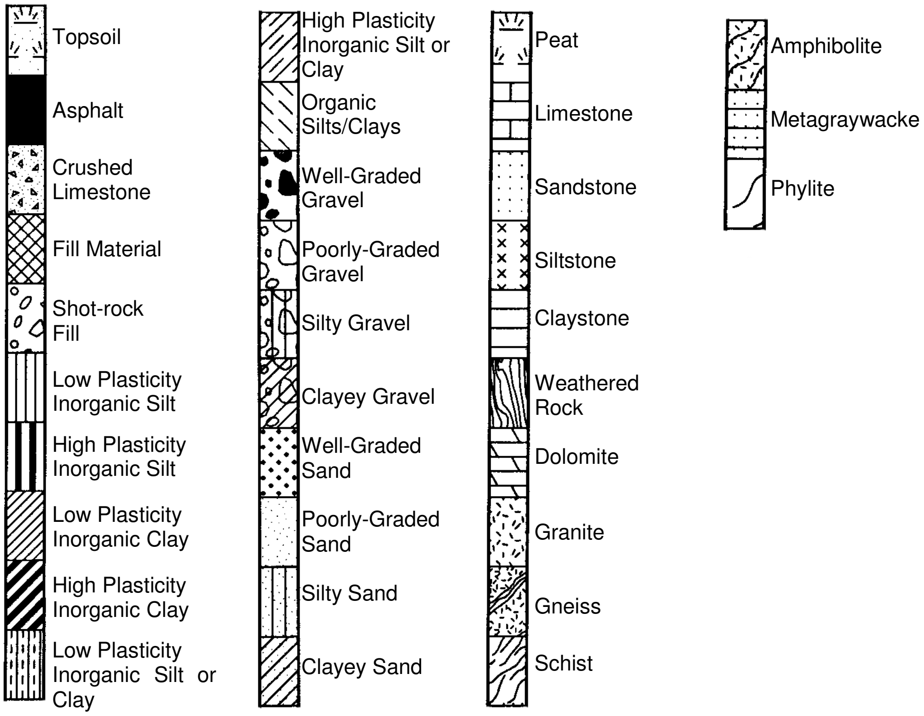
63 REC
NQ
43 RQD

$$\text{RQD} = \frac{\text{Sum of 4 in. and longer Rock Pieces Recovered}}{\text{Length of Core Run}} \text{ X100}$$

Core Diameter	Inches
BQ	1-7/16
NQ	1-7/8
HQ	2-1/2

SYMBOLS

KEY TO MATERIAL TYPES

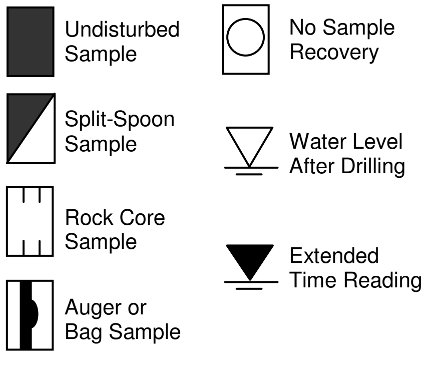


- Topsoil
- Asphalt
- Crushed Limestone
- Fill Material
- Shot-rock Fill
- Low Plasticity Inorganic Silt
- High Plasticity Inorganic Silt
- Low Plasticity Inorganic Clay
- High Plasticity Inorganic Clay
- Low Plasticity Inorganic Silt or Clay
- High Plasticity Inorganic Silt or Clay
- Organic Silts/Clays
- Well-Graded Gravel
- Poorly-Graded Gravel
- Silty Gravel
- Clayey Gravel
- Well-Graded Sand
- Poorly-Graded Sand
- Silty Sand
- Clayey Sand
- Peat
- Limestone
- Sandstone
- Siltstone
- Claystone
- Weathered Rock
- Dolomite
- Granite
- Gneiss
- Schist
- Amphibolite
- Metagraywacke
- Phylite

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 Estimated Qu, TSF
γ_D:	Dry Unit Weight, PCF
F:	Fines Content

SAMPLING SYMBOLS



- Undisturbed Sample
- Split-Spoon Sample
- Rock Core Sample
- Auger or Bag Sample
- No Sample Recovery
- Water Level After Drilling
- Extended Time Reading

BORING NO: **B- 1**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington	JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY		
ELEVATION: 954.5	BORING STARTED: 5/18/2016	BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50	HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering	BORING DIAMETER (IN): 4	SHEET 1 OF 1
Remarks:		

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	954.5	0	TOPSOIL 9 Inches			18				1 - 1 - 3
	953.7		LEAN CLAY (CL) - with silt, SOFT, brown, moist							
	953.0		FAT CLAY (CH) - with black oxide nodules, light brown with gray mottling, moist							
						15		3,653 psf		
		5								
						17				4 - 4 - 7
						5				3 - 5 - 8
						9				4 - 4 - 50/3
	944.7	10	Weathered limestone							
	944.6		Auger refusal encountered at 9.9 feet							
		15								
		20								

BORING NO: **B- 2**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 962.3
BORING STARTED: 5/18/2016
BORING COMPLETED: 5/18/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	962.3	0	TOPSOIL 7 Inches							
	961.7		LEAN CLAY (CL) - with silt, with black oxide nodules, FIRM, brown, moist			13			●	1 - 2 - 3
	961.3		FAT CLAY (CH) - with black oxide nodules, light brown with gray mottling, FIRM, moist			14			●	3 - 5 - 6
	959.4		Weathered limestone							
	958.8		Auger refusal encountered at 3.5 feet / Begin coring LIMESTONE with SHALE partings, slightly weathered to intact, fine to medium grained, gray			109/120	33			
		5								
		10								
	948.8		Coring terminated at 13.5 feet							
		15								
		20								

TEST BORING RECORD

BORING NO: **B- 3**

PROJECT: KEMI Kingston Hall Lexington	JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY		
ELEVATION: 958.0	BORING STARTED: 5/18/2016	BORING COMPLETED: 5/18/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50	HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering	BORING DIAMETER (IN): 4	SHEET 1 OF 1
Remarks:		

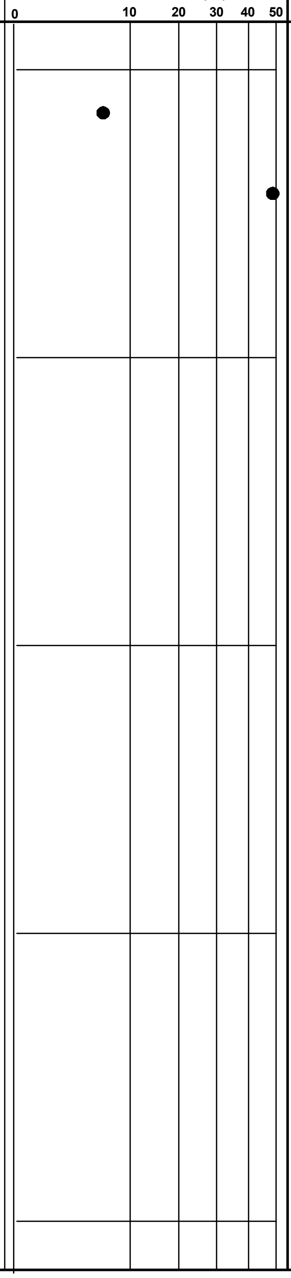
Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	958.0	0	TOPSOIL 8 inches							
	957.3		LEAN CLAY (CL) - with silt, SOFT to FIRM, brown, moist			15			●	1 - 1 - 3
						13			●	2 - 4 - 6
	955.3		FAT CLAY (CH) - with black oxide nodules, STIFF, light brown with gray mottling, moist							
		5				10			●	5 - 5 - 50/5
	952.6		Weathered limestone							
	952.2		Auger refusal encountered at 5.8 feet / Begin coring LIMESTONE - with SHALE partings, slightly weathered, fine grained, gray, moderately fractured							
		10				85/120	16			
		15	VOID 14.5 feet to 15.4 feet							
	942.2		Coring terminated at 15.8 feet							
		20								

BORING NO: **B- 4**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 952.8
BORING STARTED: 5/18/2016
BORING COMPLETED: 5/18/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N)	BLOWS /6"
	952.8	0	TOPSOIL 6 inches							
	952.3		LEAN CLAY (CL) - with silt, FIRM, brown, moist			9				1 - 3 - 3
						12				2 - 4 - 50/4
	950.0		Weathered limestone							
	949.5		Auger refusal encountered at 3.3 feet / Begin coring							
		5	LIMESTONE - with SHALE partings, slightly weathered, fine to medium grained, gray							
						106/120	38			
		10								
	939.5		Coring terminated at 13.3 feet							
		15								
		20								



BORING NO: **B- 5**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington	JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY		
ELEVATION: 959.6	BORING STARTED: 5/18/2016	BORING COMPLETED: 5/18/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50	HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering	BORING DIAMETER (IN): 4	SHEET 1 OF 1

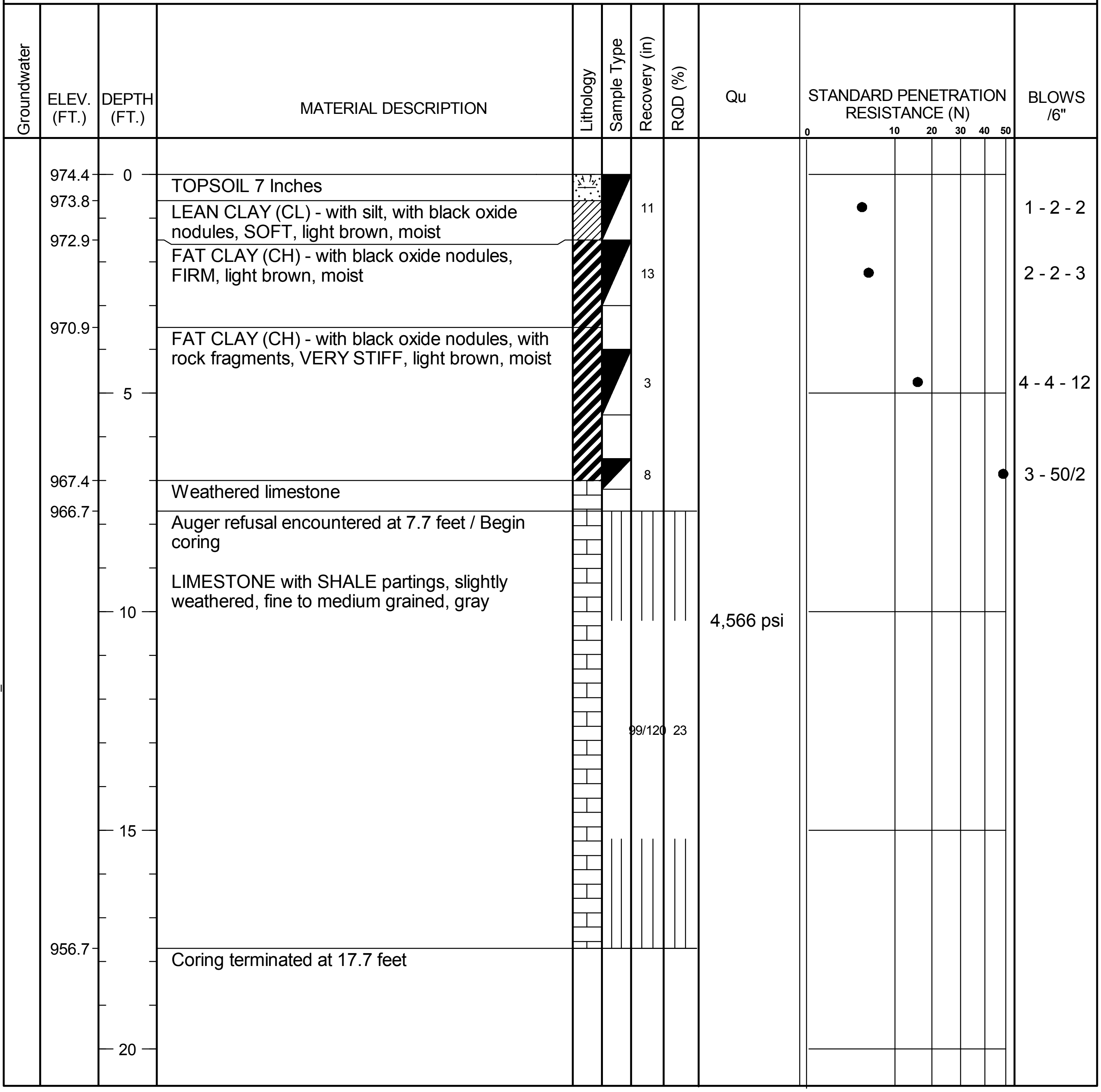
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	959.6	0	TOPSOIL 9 Inches							
	958.8		LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, brown, moist			12			●	1 - 2 - 2
						13		4,186 psf		
	955.9		Auger refusal encountered at 3.7 feet							
		5								
		10								
		15								
		20								

BORING NO: **B- 6**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 974.4
BORING STARTED: 5/18/2016
BORING COMPLETED: 5/18/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:



ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Recovery (in)	RQD (%)	Qu	BLOWS /6"
974.4	0	TOPSOIL 7 Inches				
973.8		LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, light brown, moist	11			1 - 2 - 2
972.9		FAT CLAY (CH) - with black oxide nodules, FIRM, light brown, moist	13			2 - 2 - 3
970.9		FAT CLAY (CH) - with black oxide nodules, with rock fragments, VERY STIFF, light brown, moist	3			4 - 4 - 12
			8			3 - 50/2
967.4		Weathered limestone				
966.7		Auger refusal encountered at 7.7 feet / Begin coring LIMESTONE with SHALE partings, slightly weathered, fine to medium grained, gray	99/120	23	4,566 psi	
956.7		Coring terminated at 17.7 feet				

BORING NO: **B- 7**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington | JOB NO: 1183-16-043 | REPORT NO:

PROJECT LOCATION: Lexington, KY

ELEVATION: 980.8 | BORING STARTED: 5/18/2016 | BORING COMPLETED: 5/18/2016

DRILLING METHOD: 4" HSA | RIG TYPE: D-50 | HAMMER: Automatic

GROUNDWATER (ft): Dry upon completion of soil augering | BORING DIAMETER (IN): 4 | SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	980.8	0	TOPSOIL 10 Inches							
	980.0		LEAN CLAY (CL) - with slit, FIRM, brown, moist			14				1 - 2 - 3
						12				3 - 3 - 3
	978.3		FAT CLAY (CH) - with silt, with black oxide nodules, FIRM, brown with gray mottling, moist							
		5				12		3,678 psf		
						6				7 - 50/4
	974.3		Weathered limestone							
	973.5		Auger refusal encountered at 7.3 feet							
		10								
		15								
		20								

BORING NO: **B- 8**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington		JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY			
ELEVATION: 974.2	BORING STARTED: 5/19/2016		BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50		HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering		BORING DIAMETER (IN): 4	SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	974.2	0	TOPSOIL 6 Inches							
	973.7		LEAN CLAY (CL) - with silt, FIRM, brown, moist			7			●	2 - 3 - 3
	972.7		FAT CLAY (CH) - with black oxide nodules, FIRM, light brown, moist			8			●	2 - 2 - 3
	970.7		FAT CLAY (CH) - with black oxide nodules, STIFF, brown with gray mottling, moist			15			●	4 - 7 - 7
		5								
						7			●	18 - 50/1
	967.2		Weathered limestone							
	966.2		Auger refusal encountered at 8.0 feet / Begin coring LIMESTONE, with SHALE partings, slightly weathered, fine to medium grained, gray							
		10								
						108/120	25			
		15								
	956.2		Coring terminated at 18.0 feet							
		20								

BORING NO: **B- 9**

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:

PROJECT LOCATION: Lexington, KY

ELEVATION: 969.5
BORING STARTED: 5/19/2016
BORING COMPLETED: 5/19/2016

DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic

GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	969.5	0	TOPSOIL 9 Inches							
	968.7		LEAN CLAY (CL) - with silt, FIRM, brown, moist			13			●	1 - 2 - 3
	968.0		FAT CLAY (CH) - with black oxide nodules, with rock fragments, STIFF, brown, moist			9		1,972 psf		
						11			●	2 - 5 - 6
	965.1		Weathered limestone							
		5								
	964.0		Auger refusal encountered at 5.5 feet							
		10								
		15								
		20								

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TEST BORING RECORD

BORING NO: **B-10**

PROJECT: KEMI Kingston Hall Lexington		JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY			
ELEVATION: 973.6	BORING STARTED: 5/19/2016		BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50		HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering		BORING DIAMETER (IN): 4	SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	973.6	0	TOPSOIL 7 Inches							
	973.0		LEAN CLAY (CL) - with silt, with black oxide nodules, FIRM, brown, moist			16			●	2 - 2 - 3
						13			●	2 - 2 - 3
	970.1		FAT CLAY (CH) - with black oxide nodules, FIRM to STIFF, light brown, moist							
		5				14			●	2 - 5 - 9
	966.6		FAT CLAY (CH) - with abundant rock fragments, with black oxide nodules, HARD, light brown, moist to very moist			13			●	7 - 15 - 35
	965.6		Auger refusal encountered at 8.0 feet / Begin coring							
		10	LIMESTONE, with SHALE partings, slightly weathered, fine to medium grained, gray, calcite at 9.2 feet							
						90/120	26			
		15								
	955.6		Coring terminated at 18.0 feet							
		20								

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TEST BORING RECORD

BORING NO: **B-11**

PROJECT: KEMI Kingston Hall Lexington

JOB NO: 1183-16-043

REPORT NO:

PROJECT LOCATION: Lexington, KY

ELEVATION: 986.1

BORING STARTED: 5/19/2016

BORING COMPLETED: 5/19/2016

DRILLING METHOD: 4" HSA

RIG TYPE: D-50

HAMMER: Automatic

GROUNDWATER (ft): Dry upon completion of soil augering

BORING DIAMETER (IN): 4

SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	986.1	0	TOPSOIL 10 Inches							
	985.3		LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, brown with gray mottling, moist			16			●	1 - 1 - 2
						11			●	1 - 1 - 3
	982.6		FAT CLAY (CH) - with black oxide nodules, STIFF, light brown with gray mottling, moist							
		5				11		3,955 psf		
	979.1		Weathered limestone			5			●	15 - 8 - 19
	977.8		Auger refusal encountered at 8.3 feet							
		10								
		15								
		20								

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TEST BORING RECORD

BORING NO: **B-12**

PROJECT: KEMI Kingston Hall Lexington		JOB NO: 1183-16-043	REPORT NO:
PROJECT LOCATION: Lexington, KY			
ELEVATION: 983.4	BORING STARTED: 5/19/2016		BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA	RIG TYPE: D-50		HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering		BORING DIAMETER (IN): 4	SHEET 1 OF 1

Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	983.4	0	TOPSOIL 10 Inches			16				1 - 1 - 3
	982.6		LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, brown, moist							
	981.9		LEAN CLAY (CL) - with black oxide nodules, SOFT, brown with gray mottling, moist			8				2 - 2 - 2
	979.9		FAT CLAY (CH) - with black oxide nodules, STIFF, with brown with gray mottling, moist							
		5				18				2 - 4 - 7
	977.4		FAT CLAY (CH) - with black oxide nodules, with rock fragments, VERY STIFF, light brown with gray mottling, moist			9				13 - 50/3
	974.4		Weathered limestone			10				0.9 - 17 - 50/4
	973.7	10	Auger refusal encountered at 9.7 feet / Begin coring LIMESTONE, with SHALE partings, moderately to intensely weathered, fine to medium grained, gray, intensely to moderately fractured							
		15								
	963.7	20	Coring terminated at 19.7 feet							
		25								

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BORING NO: **B-13**

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TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 985.2
BORING STARTED: 5/19/2016
BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	985.2	0								
	985.0		TOPSOIL 3 Inches							
			LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, brown, moist			13				1 - 2 - 2
	983.7		LEAN CLAY (CL) - with black oxide nodules, FIRM, brown with gray mottling, moist			6				1 - 2 - 3
	982.2		FAT CLAY (CH) - with black oxide nodules, with rock fragments, FIRM to STIFF, with brown with gray mottling, moist							
		5				12				4 - 5 - 5
						2				5 - 6 - 22
	978.2		Weathered limestone							
	977.0		Auger refusal at 8.2 feet / Begin coring LIMESTONE, with SHALE partings, moderately weathered, fine to medium grained, gray							
		10				19/60	0			
		15				60/60	13			
	967.0		Coring terminated at 18.2 feet							
		20								

CRAIG2 1183-16-043 KEMI KINGSTON HALL LEXINGTON.GPJ QOR_CORP.GDT 7/6/16

S&ME

TEST BORING RECORD

BORING NO: **B-14**

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 985.3
BORING STARTED: 5/19/2016
BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	985.3	0	TOPSOIL 12 Inches			14			●	1 - 1 - 3
	984.3		LEAN CLAY (CL) - with silt, with black oxide nodules, SOFT, brown, moist			10			●	1 - 2 - 2
	982.3		FAT CLAY (CH) - with black oxide nodules, STIFF, light brown with gray mottling, moist							
		5				18			●	2 - 4 - 6
						9			●	5 - 18 - 50/4
	977.8		Weathered limestone							
	976.9		Auger refusal encountered at 8.4 feet / Begin coring			5/16	0			
		10	LIMESTONE, with SHALE partings, moderately weathered to intact, fine to medium grained, gray			12/28	0			
		15				66/70	14			
	967.5		Coring terminated at 17.8 feet							
		20								

BORING NO: **B-15**

S&ME

TEST BORING RECORD

PROJECT: KEMI Kingston Hall Lexington
JOB NO: 1183-16-043
REPORT NO:
PROJECT LOCATION: Lexington, KY
ELEVATION: 977.3
BORING STARTED: 5/19/2016
BORING COMPLETED: 5/19/2016
DRILLING METHOD: 4" HSA
RIG TYPE: D-50
HAMMER: Automatic
GROUNDWATER (ft): Dry upon completion of soil augering
BORING DIAMETER (IN): 4
SHEET 1 OF 1
Remarks:

Groundwater	ELEV. (FT.)	DEPTH (FT.)	MATERIAL DESCRIPTION	Lithology	Sample Type	Recovery (in)	RQD (%)	Qu	STANDARD PENETRATION RESISTANCE (N) 0 10 20 30 40 50	BLOWS /6"
	977.3	0	TOPSOIL 10 Inches							
	976.5		LEAN CLAY (CL) - with silt, with black oxide nodules, FIRM, brown, moist			13			●	1 - 2 - 3
	974.3		FAT CLAY (CH) - with black oxide nodules, FIRM, brown with gray mottling, moist			9		1,946 psf		
		5				14			●	3 - 3 - 4
	970.3		FAT CLAY (CH) - with black oxide nodules, with abundant rock fragments, VERY STIFF, brown, moist			12			●	6 - 14 - 15
	968.6		Auger refusal encountered at 8.7 feet							
		10								
		15								
		20								

CRAIG2 1183-16-043 KEMI KINGSTON HALL LEXINGTON.GPJ QOR_CORP.GDT 7/6/16

Kentucky Employer's Mutual Insurance
KEMI New Office Building
S&ME Project No. 1183-16-043

Hole Number	Surface Elevation (ft)	Top of Weathered Rock Depth (ft)	Top of Weathered Rock Elevation (ft)	Auger Refusal Depth (ft)	Auger Refusal Elevation (ft)
B- 1	954.53	9.8	944.7	9.9	944.6
B- 2	962.29	2.9	959.4	3.5	958.8
B- 3	957.95	5.4	952.6	5.8	952.2
B- 4	952.82	2.8	950.0	3.3	949.5
B- 5	959.55	3.4	956.2	3.7	955.9
B- 6	974.35	7.0	967.4	7.7	966.7
B- 7	980.79	6.5	974.3	7.3	973.5
B- 8	974.24	7.0	967.2	8.0	966.2
B- 9	969.49	4.4	965.1	5.5	964.0
B- 10	973.56	7.0	966.6	8.0	965.6
B- 11	986.14	7.0	979.1	8.3	977.8
B- 12	983.42	9.0	974.4	9.7	973.7
B- 13	985.23	7.0	978.2	8.2	977.0
B- 14	985.32	7.5	977.8	8.4	976.9
B- 15	977.29	7.0	970.3	8.7	968.6
S- 1	956.55	N/E	-	2.6	954.0
S- 2	959.83	13.4	946.4	14.1	945.7
S- 3	957.27	N/E	-	4.7	952.6
S- 4	954.05	2.7	951.4	3.6	950.5
S- 5	962.68	3.4	959.3	3.7	959.0
S- 6	956.17	3.1	953.1	3.6	952.6
S- 7	950.84	7.1	943.7	7.5	943.3
S- 8	954.50	4.3	950.2	4.5	950.0
S- 9	969.13	5.5	963.6	7.0	962.1
S- 10	972.10	5.8	966.3	7.3	964.8
S- 11	970.86	5.2	965.7	6.1	964.8
S- 12	968.86	N/E	-	6.0	962.9
S- 13	966.99	5.4	961.6	6.8	960.2
S- 14	970.82	5.7	965.1	7.5	963.3
S- 15	973.37	4.8	968.6	5.0	968.4
S- 16	970.86	5.5	965.4	6.0	964.9
S- 17	975.92	3.5	972.4	4.1	971.8
S- 18	983.52	4.0	979.5	5.2	978.3
S- 19	978.08	5.3	972.8	7.7	970.4
S- 20	966.50	N/E	-	6.2	960.3
S- 21	970.80	5.9	964.9	6.5	964.3
S- 22	977.43	N/E	-	8.8	968.6
S- 23	983.66	5.7	978.0	8.0	975.7
S- 24	969.25	4.8	964.5	6.9	962.4
S- 25	960.28	5.0	955.3	5.5	954.8
S- 26	969.05	5.5	963.6	5.7	963.4
S- 27	979.68	N/E	-	9.2	970.5
S- 28	985.18	N/E	-	9.9	975.3
S- 29	987.07	N/E	-	7.5	979.6
S- 30	981.18	N/E	-	9.7	971.5
S- 31	982.87	N/E	-	7.1	975.8
S- 32	981.39	N/E	-	9.5	971.9

N/E - Not Encountered

FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by S&ME, Inc. are summarized in ASTM D 420 which is entitled "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground water conditions. These methods include geophysical and in situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

a. Continuous 2-1/2 or 3-1/4 inch I.D. hollow stem augers;
b. Wash borings using roller cone or drag bits (mud or water);
c. Continuous flight augers (ASTM D 1425).

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by a field engineer who is on site to direct the drilling operations and log the recovered samples. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observations between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are on file in our office.

The soil and rock samples plus the field boring records are reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records that are the basis for all evaluations and recommendations.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and tests of the field samples. These records depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report. The detailed data collection methods using during this study are discussed on the following pages.

Soil Test Borings: Soil test borings were made at the site at locations shown on the attached Boring Plan. Soil sampling and penetration testing were performed in accordance with ASTM D 1586.

The borings were made by mechanically twisting a 5-5/8" outer diameter auger into the soil. At regular intervals, the drilling tools were removed and samples obtained with a standard 1.4 inch I.D., 2 inch O.D., split tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "penetration resistance".

Representative portions of the samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined to verify the driller's field classifications. Test Boring Records are attached which graphically show the soil descriptions and penetration resistances.

Soil Auger Soundings: Soil auger soundings were made at the site at the locations shown on the attached Boring Location Plan. The soundings were performed by mechanically twisting a steel auger into the soil. However, unlike the soil test borings, a smaller diameter solid stem auger was used and no split-spoon samples were obtained. The driller provided a general description of the soil encountered by observing the soils brought to the surface by the twisting auger. The auger was advanced until refusal materials were encountered and the refusal depth was noted by the driller. The auger is then withdrawn and the depths to water or caved materials are then measured and recorded by the driller.

Soil auger soundings provide a rapid, economical method of obtaining the approximate bedrock depth, groundwater depth, and general soil conditions at locations where detailed soil testing and sampling is not required.

Water Level Readings: Water table readings are normally taken in conjunction with borings and are recorded on the "Test Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field investigation. Where impervious soils are encountered (clayey soils) the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring water level reported on the boring records is determined by field crews as the drilling tools are advanced. The time of boring water level is detected by changes in the drilling rate, soil samples obtained, etc. Additional water table readings are generally obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface. Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is also measured and recorded on the boring records.

Appendix III – Laboratory Testing Results

Form No. TR-2370-LEX-SUM-1
Revision No. : 0
Revision Date: 11/3/15

Lab Summary

S&ME, Inc - Lexington 2020 Liberty Road, Suite 105, Lexington, KY 40505

Project No.: 1183-16-043 Report Date: 06/06/16
Project Name: KEMI Kingston Hall
Client Name: Kentucky Employer's Mutual Insurance
Client Address: 250 West Main Street, Lexington, KY 40507

BORING NO.	SAMPLE DEPTH, FT.	SAMPLE TYPE	USCS	NATURAL MOISTURE CONTENT,%	ATT. LIMITS			MAX. DRY DENSITY PCF / OPTIMUM MOISTURE %	WET UNIT WT, PCF	DRY UNIT WT, PCF	UNCONFINED COMPRESSIVE STRENGTH, PSF	UNCONFINED COMPRESSIVE STRENGTH, PSI
					L.L.	P.L.	P. I.					
B-1	3.0 - 5.0	UD	CH	26.5	53	27	26		125.1	98.9	3,653	
B-1	5.0 - 6.5	SPT		28.9								
B-1	6.5 - 8.0	SPT		29.5								
B-5	1.5 - 3.3	UD	CL	23.9	37	22	15		128.7	103.8	4,186	
B-6	10.0 - 10.5	CORE							166.5	164.3	657,471	4,566
B-7	1.5 - 3.0	SPT		26.5								
B-7	4.0 - 6.0	UD	CH	24.1 *	51	21	30		130.9	105.4	3,678	
B-8	1.5 - 3.0	SPT		35.9								
B-8	4.0 - 5.5	SPT		26.1 *								
B-9	1.5 - 3.5	UD	CH	31.3	55	25	30		117.0	89.1	1,972	
B-11	1.5 - 3.0	SPT		32.0								
B-11	4.0 - 6.0	UD	CH	25.3	65	26	39		125.1	99.8	3,955	
B-15	2.0 - 4.0	UD		37.3					115.6	84.2	1,946	
B-15	4.5 - 6.0	SPT		26.8								
B-15	6.5 - 8.0	SPT		23.9 *								

Notes: * - Gravel excluded.

Jacob Folsom	Project Professional	06/07/16
Technical Responsibility	*Position*	*Date*

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LABORATORY TESTING PROCEDURES

Soil Classification: Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Test Boring Records."

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

Compaction Tests: Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to decrease future settlements, increase the shear strength of the soil and decrease the permeability of the soil.

The two most commonly used compaction tests are the Standard Proctor test and the Modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the Standard Proctor compaction test is run on samples from building or parking areas where small compaction equipment is anticipated. The Modified compaction test is generally performed for heavy structures, highways, and other areas where large compaction equipment is expected. In both tests a representative soil sample is placed in a mold and compacted with a compaction hammer. Both tests have four alternate methods.

Test	**Method**	**Hammer Wt./Fall**	**Mold Diam.**	**Run on Matl. Finer Than**	**No. of Layers**	**No. of Blows/Layer**
Standard	A	5.5 lb./12"	4"	No. 4 sieve	3	25
D 698	B	5.5 lb./12"	4"	3/8" sieve	3	25
	C	5.5 lb./12"	6"	3/4" sieve	3	56

Test	**Method**	**Hammer Wt./Fall**	**Mold Diam.**	**Run on Matl. Finer Than**	**No. of Layers**	**No. of Blows/Layer**
Modified	A	10 lb./18"	4"	No. 4 sieve	5	25
D 1557	B	10 lb./18"	4"	3/8" sieve	5	25
	C	10 lb./18"	6"	3/4" sieve	5	56

The moisture content and unit weight of each compacted sample is determined. Usually 4 to 5 such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight versus moisture content curve. The compaction method used and any deviations from the recommended procedures are noted in this report.

Atterberg Limits: Portions of the samples are taken for Atterberg Limits testing to determine the plasticity characteristics of the soil. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The plastic limit is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into tiny threads. The liquid limit and plastic limit are determined in accordance with ASTM D 4318.

Moisture Content: The Moisture Content is determined according to ASTM D 2216.

Appendix IV – ACI 302.1R-96 - Guide for Concrete Floor and Slab Construction

ADDENDUM
GUIDE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION
(302.1R-96)
Vapor Retarder Location

The report of ACI Committee 302, “Guide for Concrete Floor and Slab Construction (ACI 302.1R-96)” states in section 4.1.5 that “if a vapor barrier or retarder is required due to local conditions, these products should be placed under a minimum of 4 in. (100 mm) of trimable, compactible, granular fill (not sand).” ACI Committee 302 on Construction of Concrete Floors, and Committee 360 on Design of Slabs on Ground have found examples where this approach may have contributed to floor covering problems.

Based on the review of the details of problem installations, it became clear that the fill course above the vapor retarder can take on water from rain, wet-curing, wet-grinding or cutting, and cleaning. Unable to drain, the wet or saturated fill provides an additional source of water that contributes to moisture-vapor emission rates from the slab well in excess of the 3 to 5 lb/1000 ft^2/24 h (1.46 to 2.44 kg/100 m^2/24 h) recommendation of the floor covering manufacturers.

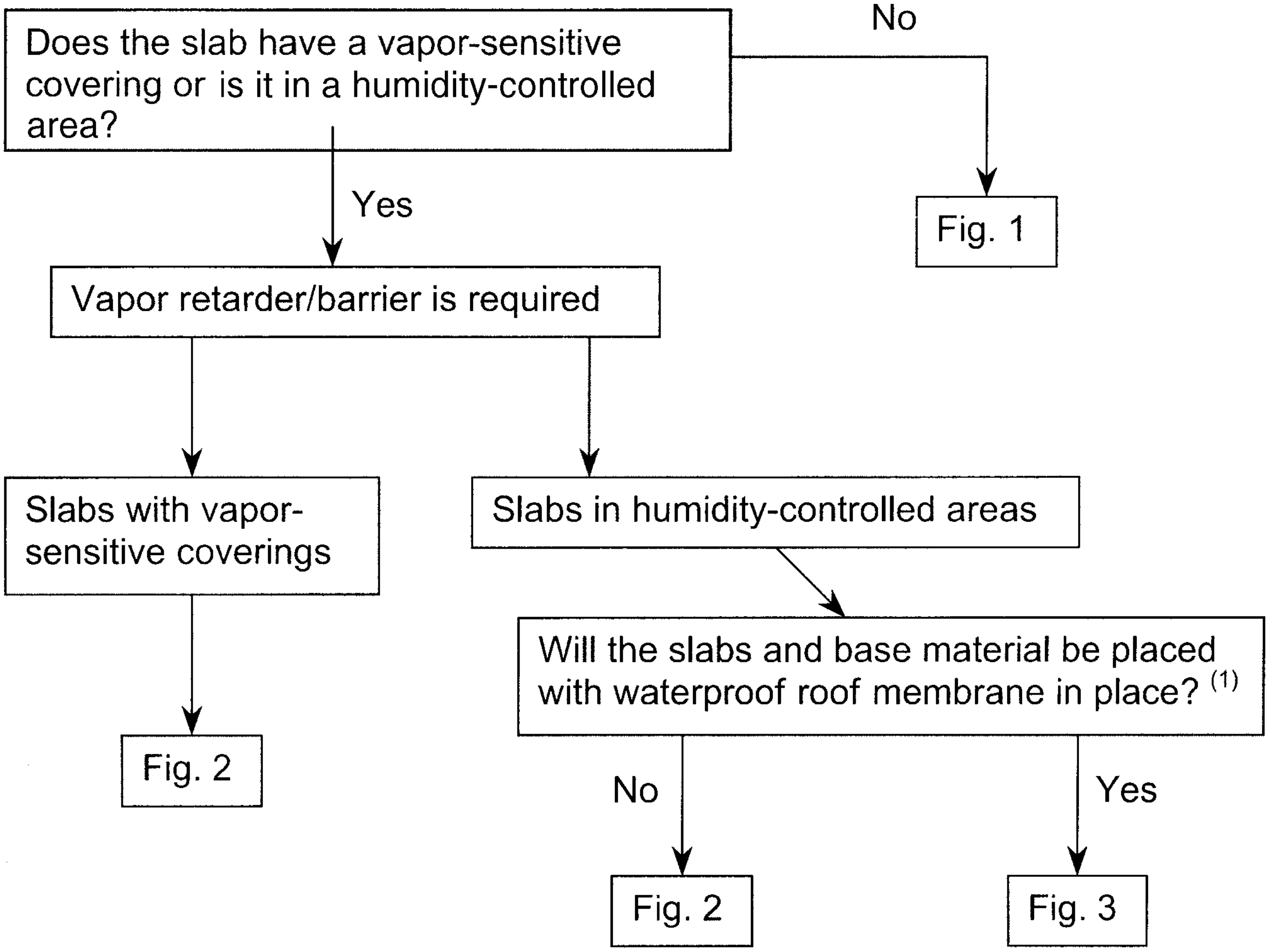
As a result of these experiences, and the difficulty in adequately protecting the fill course from water during the construction process, caution is advised on the use of the granular fill layer when moisture-sensitive finishes are to be applied to the slab surface.

The committees believe that when the use of a vapor retarder or barrier is required, the decision whether to locate the retarder or barrier in direct contact with the slab or beneath a layer of granular fill should be made on a case-by-case basis.

Each proposed installation should be independently evaluated by considering the moisture sensitivity of subsequent floor finishes, anticipated project conditions and the potential effects of slab curling and cracking.

The following chart can be used to assist in deciding where to place the vapor retarder. The anticipated benefits and risks associated with the specified location of the vapor retarder should be reviewed with all appropriate parties before construction.

ADDENDUM
GUIDE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION
(302.1R-96)
Flow Chart for Location of Vapor Retarder/Barrier



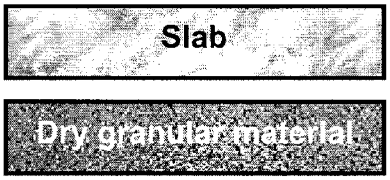


Figure 1

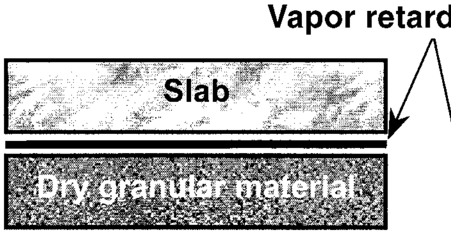


Figure 2 (2)

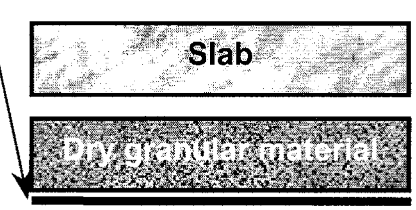


Figure 3

(1) If granular material is subject to future moisture infiltration, use Fig. 2

(2) If Fig. 2 is used, reduced joint spacing, a concrete with low shrinkage potential, or other measures to minimize slab curling will likely be required.