Geotechnical Report

for

Frankfort Plant Board Administration Building

Frankfort, Kentucky

July 22, 2014

Prepared for

Frankfort Plant Board

Frankfort, Kentucky

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July 22, 2014

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ATTN: Ms. Sharmista Dutta, PE
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COPY: Mr. Aaron Nickerson, AIA
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Subject: **Geotechnical Report**
FPB Administration Building
Frankfort, Kentucky
CSI Project No. LX140194

Dear Ms. Dutta:

Consulting Services Incorporated of Kentucky (CSI) is pleased to present our report for the geotechnical services completed at 151 Flynn Avenue in Frankfort, Kentucky. We provided our services in general accordance with CSI Proposal Number 3157, dated May 27, 2014.

Our report represents information provided to us, readily available published data relevant to the site and site area, our observations and subsurface conditions encountered and our opinion of primary geotechnical conditions (discussion and recommendations) affecting design, construction and performance of the proposed earth and rock supported portions of the project.

We appreciate the opportunity to provide our geotechnical services to you and the design team. Please do not hesitate to contact us for questions or comments about the information contained herein.

Cordially,

Jessica Workman

Jessica Workman, EIT
Staff Professional

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7-22-14

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INTRODUCTION

1 SCOPE OF THE GEOTECHNICAL EXPLORATION

As we proposed, we conducted geotechnical services which are summarized in the following report. Our services included a review of the project information provided, conducting a subsurface exploration that utilized soil borings and rock coring to obtain samples for modeling the soil/rock conditions at the subject site, an analysis of the data and information obtained and providing recommendations for the earth and rock supported portions of the project as listed in our proposal.

2 PROVIDED INFORMATION

The Frankfort Plant Board is constructing a new administration building and associated site improvements on a 30-acre site located at the corner of Sower Boulevard and Flynn Avenue in Franklin County. Specifically, the site is located at 151 Flynn Avenue in Frankfort, Kentucky. Please reference the Site Location Plan in the Appendix for details.

CSI previously conducted a preliminary geotechnical exploration of the site (CSI Report No. 1676, dated September 19, 2011). The project will consist of a new 3-story Administration Building (approximately 45,000 square feet) with associated pavement areas, retaining walls, and concrete courtyards. The building will have a walk-out basement on the south and east sides with the north and west sides of the building being below grade.

We were provided with the following structural loading information. The anticipated continuous foundation loads are not expected to exceed 10 kips per linear foot and isolated foundation loads are not expected to exceed 250 kips. Additionally, concrete slab-on-grade floor loads are anticipated to be less than 125 pounds per square foot.

The site is currently a grass and brush covered vacant lot. The site elevations are sporadic with a maximum vertical relief of 40 feet across the site based on top of borehole elevations. Therefore, up to 30 feet of cut/fill are anticipated to reach final site grades and retaining walls are proposed for this development. Recommendations for below grade structures are included in this report.

We expect that both heavy/light duty pavement (either asphalt and/or concrete) will be required for the parking areas. Therefore, a California Bearing Ratio (CBR) test was performed for pavement design recommendations.

If any of the aforementioned information is in error or if the information changes during the course of the project, please contact our office so that we can re-evaluate the new information with respect to our findings and recommendations.

3 AREA/SITE INFORMATION

3A AREA TOPOGRAPHY/PHYSIOGRAPHY

The site is located near the northern limits of the Inner Blue Grass Region of the Blue Grass Physiographic Region of Kentucky. This area generally consists of gently rolling topography and rich, fertile soils. Published topographic mapping by the United States Geological Survey (USGS) indicates the elevations in the site vicinity range from 750 feet to 1000 feet. Below is a figure of the location of the site with respect to the regional physiography.

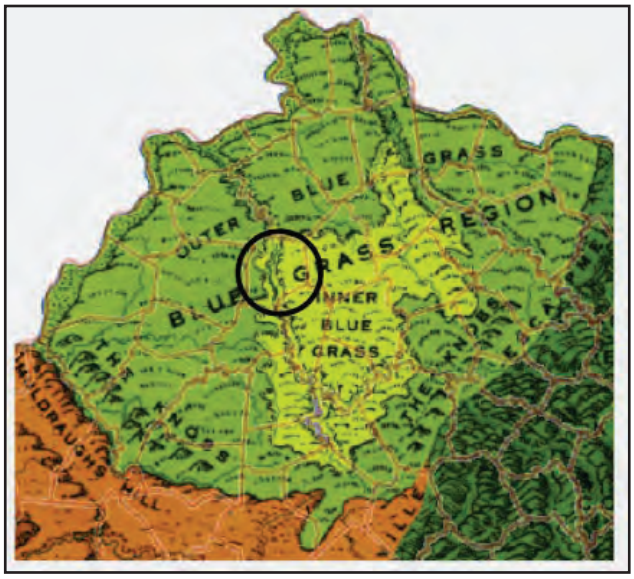


Figure 1. Kentucky Physiographic Map (site vicinity shown in the circle)

3B REGIONAL GEOLOGY

A review of the *USGS Geologic Map of the Frankfort East Quadrangle, Franklin and Woodford Counties, Kentucky* (dated 1968), indicates the project site is underlain by Middle and Upper Ordovician aged rock deposits, specifically, the Brannon Member of the Lexington Limestone Formation.

The Brannon Member is composed primarily of interbedded limestone and shale. The limestone is described as light-gray to medium-light gray, micro-grained to very fine grained, and very thin to thin tabular-bedded. The shale is described as light to dark gray and fissile. High-level fluvial deposits were encountered during our geotechnical exploration. High-level fluvial deposits are water transported soils that are deposited by nearby rivers. High-level fluvial deposits are mapped on the USGS Frankfort East Quadrangle in the vicinity of the project site. However, they are not mapped at this specific location.

The geologic dip in the area is approximately 1 percent to the northeast. There are no faults mapped within 1 mile of the project site. Figure 2 (on the following page) depicts the site location with respect to regional geology.

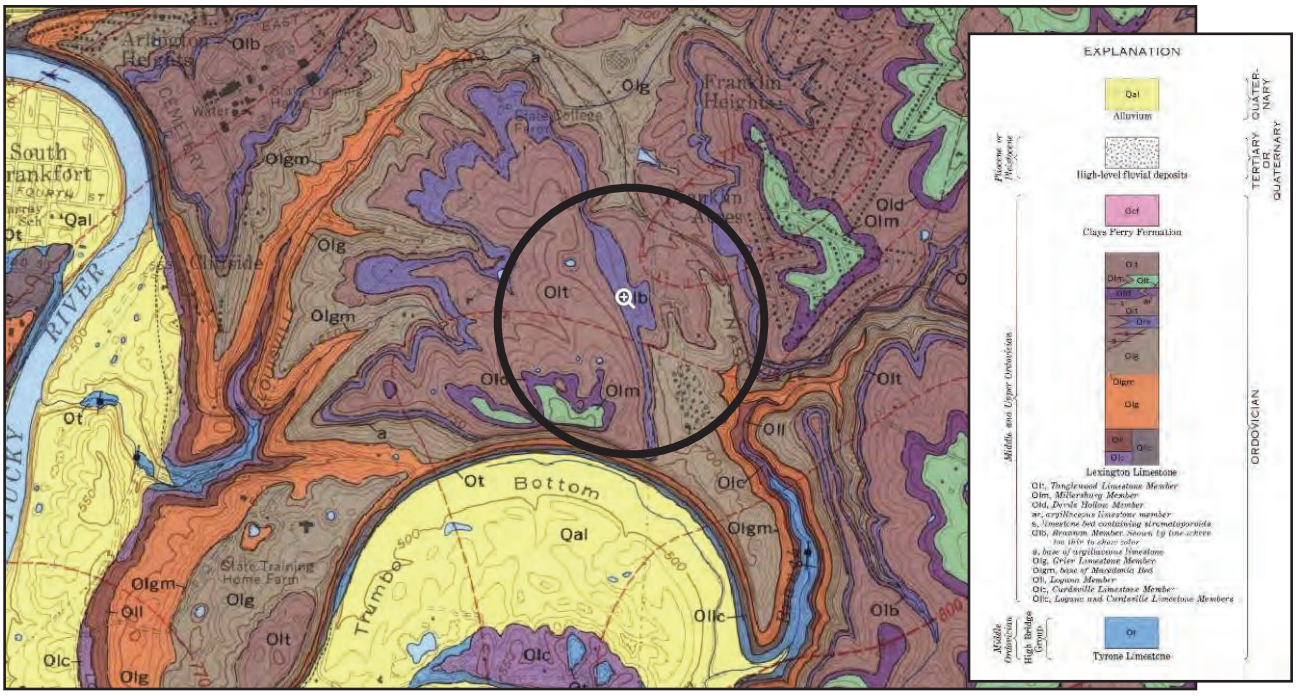


Figure 2. Regional Geology (USGS Frankfort East Geologic Quadrangle, dated 1968)
(Site vicinity shown in circle)

As with most of the geology of this portion of Kentucky, Karst (sinkholes, weathered bedrock, caverns, erratic bedrock, etc.) is associated with the regional geology. There is a large closed depression mapped immediately to the northeast of the project site. The site (and the surrounding areas) is in a developed area and has been regraded, thus obvious signs of sinkhole activity may have been filled or otherwise occluded. No surficial indicators of Karst activity were noted during our field exploration and site reconnaissance. However, core water loss was observed at boring location B-4, which can be an indicator of voids in the underlying bedrock. The Franklin County Karst Areas map published by the Kentucky Geological Survey (KGS) indicates that the project site is in an area that is prone to Karst development. Figure 3 below indicates the likelihood of Karst occurrence.

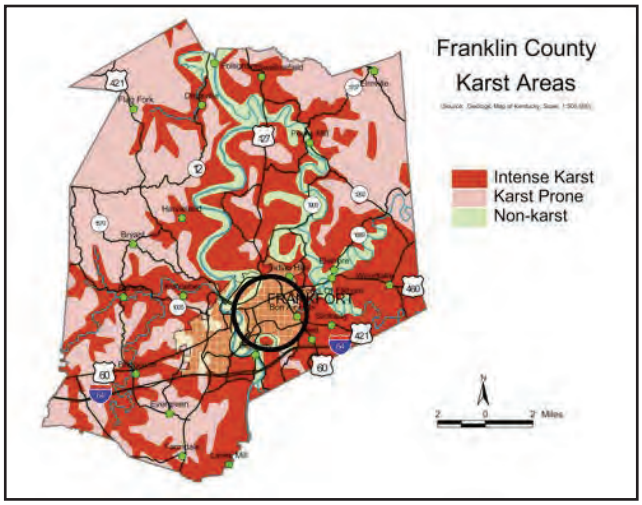


Figure 3. Franklin County Karst Areas Map, KGS (site vicinity shown in circle)

3C PUBLISHED SITE SOIL CONDITIONS

According to the USDA Soil Survey of Franklin County (NRCS website), the soils underlying the project site vicinity consist of the following series:

- Elk silt loam (EkB), 2 to 6 percent slopes
- McAfee silt loam (McC), 6 to 12 percent slopes

The following are issues listed as characteristics of this series, which we believe could be of interest to the project:

- The soil series are listed as well drained.
- The soil series are listed as being more than 80 inches to restrictive feature (i.e. - lithic bedrock).
- The soil series are listed as being more than 80 inches to water table.
- The soil series EkB is listed as being not limited to the construction of dwellings with basements. The soil series McC is listed as being very limited to the construction of dwellings with basements due to depth to hard bedrock, shrink-swell potential, and slope.
- The soil series EkB is listed as being not limited to the construction of dwellings without basements. The soil series McC is listed as being somewhat limited to the construction of dwellings without basements due to shrink-swell potential, depth to hard bedrock, and slope.
- The soil series EkB is listed as being not limited to the construction of small commercial buildings. The soil series McC is listed as being very limited to the construction of small commercial buildings due to slope, shrink-swell potential, and depth to hard bedrock.
- The soil series EkB is listed as being somewhat limited and the soil series McC is listed as being very limited to the construction of shallow excavations. Potential problems include being dusty and unstable excavation walls.
- The soil series are listed as being very limited for the construction of local roads and streets due to low strength and frost action.

Due to the development within the site vicinity, the soil survey information listed above may no longer be useful since the site soils may have been altered. Thus, the soils described above may be on-site but not in their natural condition. Figure 4 on the following page is the soils map from the USDA website.

Figure 4. USDA Soil Survey Map of Project Site (site vicinity outlined in blue)

3D OTHER PUBLISHED SITE INFORMATION

We have reviewed aerial photographs of the site dating back to April 9, 1993. The project site is located at 151 Flynn Avenue in Frankfort, Kentucky. The project site is a vacant lot located to the east of the Environmental Services Branch (100 Sower Boulevard). The reviewed aerial photographs indicate that the construction of Flynn Avenue and the Commonwealth Credit Union began between April 1993 and March 1997. Please reference the aerial photographs below for further details.

Figure 5. Aerial Photo dated April 9, 1993 from Google Earth (site is located in the circle)

Figure 6: Aerial Photo dated September 12, 2010 from Google Earth (site is located in the circle)

4 SITE SURFACE OBSERVATIONS

Ms. Jessica Workman, EIT of CSI conducted a site visit, performed a field reconnaissance, logged soil borings and rock coring, and directed drilling operations within the proposed project area on June 30, 2014 through July 2, 2014. CSI personnel observed and documented site surface conditions that could have an impact on the proposed construction.

The project site is located south of the intersection of Flynn Avenue and Sower Boulevard. In general, the site cover consisted of grass and brush. A drainage swale and high pressure gas line bisects the site running east to west. Based on the top of boring elevations, there appears to be roughly 40 feet of vertical relief across the site. The following are photos of areas of the site at the time of drilling.

Photo 1: View from the intersection looking east across the project site along Flynn Avenue.

Photo 2: View from Sower Boulevard looking east across the project site at the high pressure gas line.

Photo 3: View from the eastern perimeter of the project site looking west at the drainage swale.

Photo 4: View from Flynn Avenue looking south across the project site.

5 SUBSURFACE CONDITIONS

The subsurface conditions encountered at each of our soil boring locations are shown on the Test Boring Logs in the Appendix. It should be noted that our soil borings were sampled according to the procedures presented in the Appendix. The Boring Logs represent our interpretations of the subsurface conditions based on field logs, visual examination of field samples by an engineer, and tests of the samples collected. The letters in parentheses following the soil descriptions are the soil classifications in accordance with the Unified Soil Classification System. It should be noted that the stratification lines shown on the soil boring logs represent approximate transitions between material types. In-situ stratum changes could occur gradually or at slightly different depths. Water levels shown on the Test Boring Logs represent the conditions only at the time of our exploration.

5A SOIL CONDITIONS

We utilized twenty-two (22) soil test borings for the proposed development. Borings B-1 through B-8 were located within the proposed building footprint, borings R-1 through R-5 were performed for the proposed retaining walls, and borings S-1 through S-9 were located within the pavement areas. Reference the Boring Location Plan in the Appendix for the approximate boring locations. Please note that borings B-5, R-1, and S-5 were offset due to their close proximity to an underground gas line. Offset distances are noted on the boring logs. Boring locations were staked in the field by the project surveyor prior to CSI's arrival on-site. Coordinates and elevations of the boring locations are listed in the Appendix for reference.

In general, our borings encountered a layer of topsoil, overlying a till zone or previously placed fill material, overlying residual soils, overlying weathered rock (where encountered), overlying bedrock (where encountered).

In all of our 22 borings, we encountered a layer of topsoil. The topsoil ranged in thickness from approximately 4 to 6 inches.

In 17 of our 22 soil borings, we encountered a till zone. The till zone generally consisted of a brown clay with fine roots and has a topsoil appearance. The thickness of the till zone ranged from about 1.0 to 3.1 feet.

In 5 of our 22 soil borings, we encountered a layer of previously placed fill material. The fill material generally consisted of medium to dark gray clay with fine roots. Rock fragments were encountered in some of our boring locations. Tree roots were encountered at boring location B-5. Wood fragments were observed in recovered soil samples from boring S-3. The thickness of the old fill material ranged from 2.0 to 8.2 feet. The old fill was generally sampled as firm to very stiff. Please note that the inclusion of rock fragments within the fill material (i.e.- borings B-5, S-4, R-2, and R-3) may have inflated the SPT N-counts. Thus, the soils encountered may be softer than indicated.

Residual soils were encountered at all 22 of our soil boring locations. The residual soil consisted of brown clay with tan mottling, black oxide nodules, and varying amounts of sand. Rock fragments were observed in some of the recovered soil samples. The thickness

of the residual soil ranged from approximately 1.6 to 42.7 feet. The residual soil was generally firm to very stiff and extended to the top of weathered rock (where encountered).

Weathered rock (where encountered) was underlying the residual soil in 14 out of our 22 soil borings. Please note that 6 borings were terminated at their planned depths of 10.5 feet. Thickness of the weathered rock (where encountered) ranged from approximately 0.1 to 1.0 feet.

5B GROUNDWATER CONDITIONS

Free water was observed at boring locations B-1 and B-2 at depths of 23 feet and 39 feet, respectively, upon completion of soil augering. Groundwater was not encountered within any of our other borings. Groundwater readings were not taken at our rock coring locations since water was used to cool the rock coring bit. In this area of Frankfort, water conditions that usually affect construction and performance of projects consist of trapped/perched water zones which occur in variable areas in the soil mass, at or near existing or former structures, at or near the bedrock bedding planes, or at or near the soil/rock interface. Perched water sources are often not linked to the more continuous relatively stable ground water table that typically occurs at greater depths. Site excavation activities or ground disturbance can expose these features and the resulting seepage can vary greatly. Finally, water issues are also dependent upon recent rainfall activity and surface and subsurface drainage patterns in the area.

5C BEDROCK INFORMATION

Auger refusal was achieved at 16 of our 22 boring locations. Please note that 6 pavement borings were terminated at their planned depths of 10.5 feet. The auger refusal depths (where encountered) ranged from about 4.1 feet to 46.2 feet. We have interpreted auger refusal to be the top of the bedrock surface. Refusal material was explored by rock coring methods at borings B-4, B-7, and B-8, where 10 feet of rock core was obtained from each of the previously mentioned boring locations. The recovered rock cores generally consisted of light to medium gray, medium grained limestone with tan staining, with interbedded shale, and some clay seams. The percent recovery for the obtained rock cores ranged from 90 to 95 percent. The rock quality designation (RQD) for our recovered rock cores ranged from 32 to 85 percent (of poor to good engineering quality). Core water loss was observed at approximately 20.0 feet at boring B-4, it returned at 21.0 feet, and then was lost again at 22.3 feet. No voids or other core water loss were observed during rock coring operations.

6 LABORATORY TESTING

During the course of our work, we selected representative soil samples for laboratory testing. Detailed descriptions of these tests and the results of our testing are included in the Appendix. Tests performed included:

- Natural moisture contents
- Atterberg limits

- Percent fines analyses
- Unconfined compressive strength (soil and rock)
- California Bearing Ratio (CBR) test which includes a standard Proctor test
- Remolded swell test

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

7 DISCUSSION-GEOTECHNICAL ISSUES

Based on our experience with similar projects and the conditions observed during our subsurface exploration, we believe the primary geotechnical concerns for this project are:

- **Previously Developed Areas/Overhead and Underground Utilities**
- **Topsoil/Till Zone**
- **Previously Placed (Old) Fill**
- **High-Level Fluvial Soils**
- **High Plasticity (Fat) Clay Soils**
- **Shallow and Varying Depth to Bedrock**
- **Grade Selection**
- **Sandy Soils**
- **Soft/Wet Soil Conditions**
- **Karst Geology**

The following sections of this report discuss each issue. However, recommendations to address the issues are contained in later sections of the report.

7A PREVIOUSLY DEVELOPED AREAS/OVERHEAD AND UNDERGROUND UTILITIES

Existing underground utilities (i.e. - sanitary sewer, water, cable, etc.) run parallel to Sower Boulevard and Flynn Avenue (along the northern and western perimeter of the vacant lot). A high pressure gas line runs east to west then north to south through the northern and western portion of the project site. Some of the utility lines mentioned above may need to be relocated or removed at the time of construction. Expect that the previous utility construction may have left old fill or other buried deleterious material within the project boundaries. Your budget should include a contingency for remediation of any encountered buried deleterious material.

Also, expect that previous construction activities could have left underground elements (such as wells, cisterns, septic tanks, septic fields, waste pits, old foundations, old basements, abandoned utilities, etc.), within the construction limits. Thus, your project budget should include a contingency for remediation of any encountered buried underground structures.

7B TOPSOIL/TILL ZONE

Topsoil was observed at all of our soil boring locations. The thickness of the topsoil varied from 4 to 6 inches. Also, a till zone (with a topsoil appearance) was observed in 17 of our 22 soil borings with a thickness ranging from 1.0 to 3.1 feet. Thus, it is likely that a thick topsoil/till zone will be encountered across the entire project site. Commonly, topsoil stripping is based solely on color of the soils. As such, over-stripping of topsoil could be of concern for this project. CSI engineering personnel should be on-site during stripping operations to ensure adequate (but not excessive) topsoil stripping is performed. Some of the till zone may be left in-place if it holds up well to a heavy proofroll.

7C PREVIOUSLY PLACED (OLD) FILL

Old fill was encountered at 5 of our 22 boring locations. The old fill generally consisted of brown to gray clay with fine roots. Rock fragments and tree roots were encountered in some boring locations. Pieces of wood were observed in recovered soil samples from boring S-3. The thickness of the old fill was approximately 2.0 to 8.2 feet. The old fill was generally sampled as firm to very stiff. Please note that the inclusion of rock fragments may have inflated the SPT N-counts. Thus, the soils encountered may be softer than indicated.

Old fill materials are often improperly compacted, commonly contain organics and debris, and can be poor bearing materials. Fills placed in an uncontrolled manner have proven to be problematic. The problems generally arise not from general settlement, but from erratic differential settling of the fill. The settlement of old fill masses is dependent upon several factors such as fill thickness, degree of compaction, fill contents, and age of the fill mass.

The old fill material was observed in borings B-5, R-2, R-3, S-3, and S-4. Since the building will have a full basement, we expect that all of the old fill (along with some residual soil) will be removed during the basement foundation excavation. Fill was also encountered in the borings for the western retaining wall. Depending upon the foundation elevations in this area, this existing fill may be removed. Please note that foundations should <u>not</u> bear on old fill.

7D HIGH-LEVEL FLUVIAL SOILS

We encountered high-level fluvial deposit soils (water transported soils) in borings B-1 and B-2. High-level fluvial deposit soils are typically soft/wet inconsistent soils (both vertically and horizontally). Generally, fluvial soils are soft to firm to stiff, sandy soils with silt and clay that are non-uniform. Sandy and silty soils are typically unstable in this geologic setting unless they are confined deep within the ground. This is due in part to the way these soils were deposited originally (very loosely) and also due to the rise and fall of both the permanent water table and fluctuations in the perched/temporary water pockets. As previously mentioned, high-level

fluvial soils were mapped by the KGS within the vicinity of the site, but not specifically at the site.

7E HIGH PLASTICITY (FAT) CLAY SOILS

Atterberg limits testing was performed on three representative samples taken from boring B-1, boring B-7, and a bulk sample. Our laboratory testing indicated that two out of the three tested soil samples were fat clay (CH). The Atterberg limits testing on the two representative samples indicated a maximum Plasticity Index (PI) of 45 percent. Soils with a PI above 30 percent can have a tendency to shrink/swell with changes in moisture content. Soils with a PI greater than 50 are generally highly susceptible to volume change. Soils with a PI between these limits have moderate volume change potential. The laboratory test results for soil samples from this site fall in the moderate to high susceptibility range with a maximum PI of 45 percent. Please reference the table below for details.

Table 1. Atterberg Limits Testing Results

Boring No.	Depth (ft)	LL	PL	PI
B-1	4.0 - 5.5	36	20	16
B-7	6.5 - 8.0	66	29	37
Bulk*	2.0 - 4.0	74	29	45

*Composite bulk sample taken from borings S-5 and S-6

Shrinking and swelling of foundation and bearing soils are generally not as severe in the central Kentucky area as in other areas because long periods of excessively wet or dry weather do not normally occur. However, if site grading takes place during the dry summer or fall months, significant drying of the exposed subgrade soils may occur. If these soils re-saturate after completion of construction, structural distress may be experienced. Also, moisture content loss typically results in settlement of soil supported building components. Where the soil moisture fluctuates, movement may be ongoing throughout the building's life, resulting in deterioration and building distress. Strength loss may also affect building components, but is more likely to adversely affect parking lots - especially flexible asphalt pavements. Accumulation of water beneath pavement followed by repeated traffic loads, may result in the failure of both pavement and the subgrade materials. Therefore, the volume change potential of the soils should be considered for this project.

Due to the fat clay (CH) soils encountered on-site, a swell pressure test was performed to observe the shrink/swell potential of the on-site soils. We elected to perform a remolded swell pressure test which required the performance of a standard Proctor test to determine the optimum moisture content and maximum dry density of the soil sample. For the tested sample, an optimum moisture content of 29.9 percent and a maximum dry density of 91.4 pounds per cubic foot (pcf) were obtained. These standard Proctor values determined the correct parameters for preparation of the remolded swell pressure test sample. Based on the results of our remolded swell pressure test, the tested sample exhibited 1,438 pounds per square foot (psf) of swell pressure.

Methods to control the adverse effects of these soils include soil modification methods (i.e.- undercut/replace, lime stabilization, etc.), providing efficient drainage around the building and pavements, installation of foundation components at depths below levels where moisture contents are subject to significant fluctuation, and implementing more stringent moisture control specifications for new fill placement. Please reference the later sections of this report for specific details pertaining to these fat clay soils.

7F SHALLOW AND VARYING DEPTH TO BEDROCK

At 16 of our 22 borings locations, we encountered auger refusal (interpreted as bedrock) at depths ranging from 4.1 to 46.2 feet. The shallow auger refusal depths were generally encountered on the western perimeter of the project side along Sower Boulevard. Therefore, any planned cuts (especially deep excavations for the building and west retaining wall) may encounter bedrock. As such, selection of final grades may have a significant impact on the construction budget since rock removal is expensive. Mass earthwork cuts and deep excavations could intersect the soil/rock interface. The encountered underlying bedrock appeared to consist of limestone and shale, thus hard rock removal (i.e.- blasting, hoe-ramming, etc.) could be required for this project.

Due to the drastically different depths to auger refusal, differing bearing conditions will likely be an issue. Bearing project foundations on any combination of both soil and rock will likely result in unwanted differential settlement. Recommendations for this scenario will be presented later in the report.

7G GRADE SELECTION

Portions of the project site are located on a gently sloping hillside with roughly 40 feet of vertical relief between the uphill and downhill sides of the site (according to supplied topographic information and top of hole elevations). Thus, structure locations and grade selection will have a major impact on this project. Additionally, the presence of swelling fat clay (CH) soils further complicates grade selection as removal and replacement of the existing soils will be costly. Selecting grades which reduce the amount of fill needed to achieve the desired grades may be of significant cost benefit.

7H SANDY SOILS

Our borings encountered sandy soils at the site. Sandy soils will not remain stable and will slough/slump in excavations. Also, sandy soils will not remain stable when left exposed to weathering conditions (i.e.- if left open in foundation or other excavations).

Recommendations for slope construction were beyond our scope of services, but sandy soils typically will not remain stable (even in temporary slopes) steeper than about 2H:1V (horizontal to vertical). Also, sandy soils tend to hold/have water pockets when surrounded by more clayey soils.

7I SOFT/WET SOIL CONDITIONS

Moist to wet (mostly wet) high-level fluvial, inconsistent soils were found in two of our borings (B-1 and B-2). The soils were very inconsistent, fluctuating between loose to firm and firm to loose in the clayey sand horizon. These soils will provide inconsistent support for soil supported foundations. Since these soils were encountered deep (well below the bottom of footer for the building), we do not expect that the foundations will bear on these soils. These soils have the potential to compress if they are within the zone of influence of the project foundations, possibly causing differential settlement.

7J KARST GEOLOGY

The site is located in an area that is prone to Karst development. Karst features such as sinkholes, dropouts, weathered bedrock, caverns, erratic bedrock, etc. are typically exposed during grading activities and foundation and/or utility construction. Karst topography consists of limestone or dolomite that is weathered which results in sinkholes (i.e.- closed depressions), irregular top of rock profiles, pinnacled bedrock, slots, or troughs in the bedrock, internal drainage system, and open voids in either the bedrock itself or in the soil overburden (typically at the soil/rock interface). Additionally, soft/wet soils are commonly encountered at the soil/rock interface and in slots or troughs in the bedrock. Core water loss was observed at boring location B-4, which can be an indicator of voids in bedrock. However, no obvious signs of Karst activity were observed in our auger cuttings, obtained soil samples, or rock cores during our work performed at the site.

Any construction in Karst topography is accompanied by some degree of risk for future internal soil erosion and ground subsidence that could affect the stability of structures situated above the Karst features. The risks associated with Karst geology are common for the project vicinity and are not unique to this site. The Owner should understand and accept these risks prior to proceeding with this project. The risks can be further quantified by performing geophysical tests across the site to map the Karst features within the underlying limestone. Based on these tests and mapping, corrective measures can be undertaken to reduce (but not eliminate) the risk. We can provide these services as an addition to the current scope of work upon request.

The site grading plan in areas near proposed structures should be developed in a manner than minimizes the potential for introduction of water into the bedrock formation which is susceptible to dissolution and development of Karst features. Detention/retention basins that extend into bedrock should be designed and constructed with low permeability liners.

8 EARTHWORK

Based upon the grading information supplied to us, we expect that deep cuts and fills (up to 30 feet) will be required for this project. We expect that deep cuts will intersect the soil-rock interface, especially near the southwest corner of the building. Additionally, we believe that some of the on-site soils will not be suitable for use as structural fill unless soil modification methods are employed to reduce their shrink/swell potential. Thus, we have included lime (or kiln dust) treatment of existing soils -OR- importing of off-site lean clay (CL) soil fill considerations for this project.

Historically, more change orders (in total number and costs) occur during the earthwork portion of construction than in almost any other part of the project. Further, the site preparation phase of construction always affects the future performance of project structures and pavements. Add into this, the fact that earthwork is the portion of work most influenced by wet weather and unknown conditions and time-wise, this section of the report could be the most important to prevent and minimize delays and costs during construction and for the life of the project.

Please review the concerns listed in section 7 prior to reading the following recommendations. If problems occur that the recommendations do not address or do not adequately remedy, please contact CSI as soon as possible.

8A SITE PREPARATION (WORK PRIOR TO FILLING)

- When ready to commence construction, the high pressure gas line running east to west through the building footprint will need to be relocated.
- The site should be cleared/grubbed removing all brush, trees, and debris. These materials should be wasted off-site.
- All topsoil and organic materials should be removed (stripped) from the construction area and all structural fill areas. These materials should be wasted from the site or stockpiled for use as topsoil in landscape areas.
- Areas ready to receive new fill should be proofolled with a heavily loaded dump truck or similar equipment judged acceptable by a CSI geotechnical engineer.
- The level of proofroll should be determined by a CSI geotechnical engineer on a case-by-case basis.
- Perform the proofrolling after a suitable period of dry weather to avoid degrading the subgrade.
- Areas which pump, rut, or wave during proofrolling may require undercutting, depending on the location of the area and the use of the area, so a CSI geotechnical engineer should be contacted for guidance.
- Backfill of undercut areas should be performed in accordance with sections 8B and 8C of this report.
- Retain CSI to observe the proofrolling operations and make recommendations for any unstable or unsuitable conditions encountered. This can save time on the construction schedule and save unnecessary undercutting.

We recommend that site grading should take place between about late April to early November. Earthwork taking place outside this time period will likely encounter wet conditions and weather conditions that will provide little to no assistance with drying the soils.

8B NEW FILL OPERATIONS - SOIL FILL

Three Atterberg limit tests were performed on representative soil samples from this site. Two of the tested samples classified as fat clay (CH) with a maximum Plasticity Index (PI) of 45 percent. Based on the results of our remolded swell pressure test, the tested sample exhibited 1,438 pounds per square foot (psf) of swell pressure. We recommend that lime stabilization -OR- select fill (i.e.- low PI soils) be considered beneath all of the proposed site improvements. The 2 feet of select fill (PI less than 30 percent) would provide separation between the existing on-site fat clays and the foundations/floor slabs.

Lime stabilization methods could be implemented in order to reduce the shrink/swell potential of on-site highly plastic soils beneath the floor slab. Soil stabilization is the permanent physical and chemical alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load-bearing capacity of a sub-grade to support floor slabs, pavements, or foundations. Proper design and testing is an important component of any stabilization project. This allows for the establishment of design criteria as well as the determination of the proper chemical additive and admixture with similar projects, we recommend that 5 percent lime (or kiln dust) be added (in slurry form) to the final 16 inches of soil below subgrade elevation in the new structure area (to at least 5-feet outside the site improvements in each direction). The lime or kiln dust slurry should be placed using a lime spreader machine. Other equipment involved in the stabilization processes could also include: soil mixers (reclaimers), portable pneumatic storage containers, water trucks, deep lift compactors, and motor graders.

In-place mixing is usually used to add the appropriate amount of lime or kiln dust to soil, mixed to an appropriate depth. Pulverization and mixing is used to thoroughly combine the lime (or kiln dust) and soil. For high plasticity clays, preliminary mixing may be followed by 24 to 48 hours (or more) of moist curing, followed by final mixing. Proper compaction is necessary for maximum development of strength and durability.

If off-site fill material is imported to the project site, representative samples should be obtained of the proposed fill material to determine the moisture-density relationship and overall classification of the material. **Off-site soils with a plasticity index (PI) greater than 30 percent should not be used for new fill**.

On-site fat clay soil can be used as structural fill material; however, more stringent compaction and moisture conditioning must be implemented.

After the exposed subgrade has been approved to receive new fill, the fill may commence with the following procedures and guidelines recommended:

- Place fill in maximum 8-inch thick loose lifts.
- Fill lifts should be compacted to at least 98 percent of the soil's maximum dry density (ASTM D 698).

- Maintain the moisture content of compacted fill within 2 percent of optimum moisture.
- Fill compaction requirements should extend to at least 5 feet outside the structure perimeter.
- Off-site fill soils with a plasticity index (PI) of greater than 30 should not be used as new fill.
- Maximum particle size of the should should be limited to 4 inches in any one dimension. Additionally, no concentration of large fragments should be permitted.
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted.
- Observation of fill "stability" is also critical, so it is recommended to observe the operation of the filling equipment traversing over the new fill to document movement (similar to proofrolling).
- Soils should not be "overcompacted" and construction traffic should be kept to a minimum to assure compaction is achieved and that the soil is not allowed to "break down".
- Retain a representative of CSI to observe and document fill placement and compaction operations.

As previously stated, the soil beneath the floor slabs should be either low plasticity (PI< 30) soils or be lime (or kiln dust) treated due to the high swell potential of the on-site soils.

8C BACKFILL OPERATIONS (FOUNDATION WALLS, UTILITIES, ETC.)

These materials are placed in more confined areas than mass earthwork materials or pavement materials and therefore cannot be placed in full compliance with sections 8A or 8B. The following are general recommendations for backfill areas:

- Fill lift thicknesses will vary dependent on compaction equipment available and material types, but in no case should exceed 8 inches.
- For crushed stone/aggregate backfills in trenches or wall backfill and when using smaller compaction equipment (such as a plate compactor or trench compactor or similar) the lift thickness should not exceed 4 inches.
- Compaction/moisture percentages and density testing frequency should be the same as in section 8B.
- CSI should be retained to provide addition recommendations for backfill.

8D GENERAL NOTES

- For all earthwork operations, positive surface drainage is prudent to keep water from ponding on the surface and to assist in maintaining surface stability.

- The surface should be sealed prior to expected wet weather. This can usually be accomplished with rubber-tired construction equipment or a steel-drum roller.

- If any soil placement problems occur, CSI should be retained to provide additional recommendations, as needed.

9 SITE DRAINAGE

During construction, water should not be allowed to pond in excavations or undercutting will likely be required. Additionally, allowing water to pond in excavations (especially deep excavations) greatly increases the risk for activating latent Karst features. During the life of the project, slope the subgrade and other site features so that surface water flows away from the site structures. Structure roof drains should be piped away to proper storm drainage systems. Diversion ditches should be used at the toe of all slopes to keep surface water from accumulating at or near site structures. This is very important due to the high plasticity soils on-site. Also, **no irrigation systems should be installed near the building** to avoid repeated wetting of the on-site soils beneath structure foundations due to the risk of shrink/swell potential associated with these high plasticity soils.

For excavations during construction, most free water from the subsurface conditions could likely be removed via sump pumps and open channel flow (ditches) at or near the source of seepage. Due to the presence of High Level Fluvial Deposits encountered on-site, water could be encountered in deep excavations. However, if normal dewatering measures prove insufficient, CSI should be retained to provide recommendations on the issue.

As previously mentioned, wet conditions are possible in excavations on-site during site construction. Daylighting wet zones for drainage or the use of french/rock drains may be prudent or cost effective methods of de-watering wet areas of the site. Pumping with long-flexible hoses day-lighted hundreds of feet away or other types of sumping could also be utilized if necessary. CSI should be retained to observe all excavations in locations of springs or other water-bearing features.

10 FOUNDATIONS

Based on the information provided and the conditions encountered, shallow spread foundations bearing on soil should be a suitable foundation system to support the proposed building. However, we expect shallow rock in the buildings southwest corner. We understand that the proposed retaining wall locations are preliminary and subject to change. Therefore, the retaining wall foundations could be either soil -OR- rock bearing. Bearing project foundations on any combinations of both soil and rock will likely result in unwanted differential settlement. The foundation bearing conditions should be the same for the entire structure (i.e.- soil bearing -OR- rock bearing, not a combination of both) in order to reduce the risk of differential settlement caused by differing bearing conditions. If

there are any changes in the project criteria or building location, CSI should be allowed to review the recommendations to determine if any modifications are required.

10A SHALLOW SPREAD FOUNDATIONS ON SOIL

We believe that shallow spread foundations may be suitable for the proposed building. Shallow spread footings (continuous, isolated, or combination thereof) may be sized using a **maximum allowable bearing pressure of 2,500 pounds per square foot (psf)**. Foundations should bear on stiff or better natural clay soils or properly compacted soil fill. Footings should not bear on old fill material. We expect that rock will likely be encountered in some of the foundation excavations (especially in the southwest building corner). If rock is encountered within 2 feet of the bottom of the foundation (BOF) elevation, we recommend that the rock be undercut at least 2 feet below bottom of footing and the excavation backfilled with compacted soil up to the design BOF elevation to provide a "cushion". Please note that the fat clay residual soil on-site affects the design BOF elevation (due to deeper embedment depths required in the fat clay).

A detailed settlement analysis was beyond the scope of this exploration. However, based on the estimated structure loads, the anticipated behavior of soil types encountered during field activities, and our experience with similar projects, we expect that total settlements will not exceed 1 inch, and that differential settlements will not exceed 1/2 inch between columns or along continuous footing distances of 30 feet or less. We recommend the structure be designed to accommodate these magnitudes of total and differential settlements.

Settlement estimates are based, in part, upon the assumption that site preparation is performed in accordance with our recommendations and with good quality control of the earthwork. Removal of unsuitable old fill and proper placement and compaction of new fill is particularly important in keeping settlements within tolerable limits.

Additional design considerations for project foundations are outlined as follows:

- Design all footings with a minimum 18 inches width.
- All exterior footing bottoms should bear at least 36 inches below finished exterior grading (due to the existing fat clay (CH) soils on-site).
- Interior footings (those not exposed to freezing) may be placed at nominal depths or 18 inches deep, whichever is deeper.
- Include control joints at suitable intervals in the walls of structures and in areas where changes in support from native soil to fill are anticipated, to help accommodate differential foundation movements.

10B SHALLOW FOUNDATIONS ON SOIL FILL - CONSTRUCTION NOTES

Any soils can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundations construction, we also recommend the following procedures.

- For soils that will remain exposed overnight or for an extended period of time, place a "lean" concrete mudmat over the bearing areas. The concrete should be at least 4 inches thick. Flowable fill concrete or low-strength concrete is suitable for this cover, as conditions allow.

- Disturbed soil should be removed prior to foundation concrete placement.

- Foundation bearing conditions should be benched level.

- Areas loosened by excavation operations should be recompacted prior to reinforcing steel placement.

- Loose soil, debris, and excess surface water should be removed from the bearing surface prior to concrete placement.

- The bearing conditions of foundation soils should be checked by means of portable dynamic cone penetration (DCP) testing at the direction of the CSI geotechnical engineer.

- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

10C SHALLOW SPREAD FOUNDATIONS ON ROCK

At this time, we believe that the western retaining wall foundations may bear on rock. Shallow spread foundations bearing on rock may be sized using a maximum **allowable bearing pressure of 5,000 pounds per square foot (psf)**. Any existing soil or weathered rock should be excavated until competent rock is exposed in the bottom of the foundation excavation. We interpret competent rock by observing the teeth of the backhoe or trackhoe being dragged vertically across the top of exposed rock. Upon approval by a CSI geotechnical engineer, the excavation can be backfilled to the design bottom of footing elevation with lean concrete (2,000 psi minimum) or flowable fill (500 psi minimum).

Based on the expected structural loads and foundations bearing on competent bedrock, we expect that both total settlements and differential settlements will not exceed 1/4 inch.

Additional design considerations for spread foundations bearing on bedrock are outlined as follows:

- Foundations bearing on bedrock are <u>not</u> subject to a minimum frost embedment depth.

10D SHALLOW FOUNDATIONS ON ROCK - CONSTRUCTION NOTES

For foundations constructed on top of competent bedrock, we also recommend the following procedures:

- Loose soil, mud, debris, and excess water should be removed from the bearing surface immediately prior to concrete placement.

- Foundation bearing surfaces should be benched (as much as practical) to provide nearly-level bearing surfaces.

- A CSI geotechnical engineer should observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

11 SEISMIC SITE CLASSIFICATION

The latest edition of the Kentucky Building Code (KBC) was reviewed to determine the Site Seismic Classification. Based on our review of geologic data, our experience, and subsurface conditions encountered, and foundations bearing on soil for the proposed building, we recommend a **Seismic SITE CLASS "C"** for foundation design purposes.

A detailed geotechnical earthquake engineering analysis was not performed since it was beyond the scope of our authorized work. However, based on a review of published literature and our experience with similar subsurface conditions, we believe the potential for slope instability, liquefaction, and surface rupture due to faulting or lateral spreading resulting from earthquake motions is low. However, this potential could be elevated during wet periods of the year unless adequate drainage is provided.

12 CONCRETE SLABS-ON-GRADE

As previously stated, fat clays (CH) were encountered on-site. A swell test indicated a swell pressure of 1,438 psf for the on-site soils. Swell pressures above 100 psf are of concern to lightly loaded structural elements (such as floor slabs). Thus, special provisions are necessary for the floor slabs and sidewalks adjacent to the building.

Concrete slabs on-grade (floor slabs, sidewalks, etc.) are suitable for the project, provided the subgrade is prepared according to the recommendations contained within this report. We recommend that lime (or kiln dust) stabilization methods be implemented -OR- select fill (soil with a PI less than 30 percent) be placed as structural fill, in order to reduce the shrink/swell potential of on-site soils beneath the slabs or to provide a separation between the on-site high plasticity clays (if left in-place) and the grade supported slabs. Floor slabs should not bear on old fill (not expected after the basement excavation).

For exposed slabs-on-grade (i.e.- not contained within buildings), we recommend that all existing soil material be either lime (or kiln dust) treated or removed and replaced with select fill material in order to reduce the adverse affects of the potentially expansive existing fat clay (CH) soils. For the slabs-on-grade that will not be exposed to the elements, an undercut of 2-feet below the finished subgrade elevation and replacement with select fill may be adequate to reduce the risk associated with the potentially expansive soils.

As previously stated, we expect that rock will be encountered beneath some of the proposed floor slabs (especially in the buildings southwest corner). If rock is encountered within 12 inches of finished subgrade elevation, we recommend that the rock be undercut at least 12 inches below subgrade and the excavation backfilled with compacted soil up to the design finished subgrade elevation to provide a “cushion”.

The following features are recommended as part of the floor slab construction:

- Provide isolation joints between the slab and columns and along footing supported walls. Do not use turned-down slab edges or thickened floor slab sections to support load bearing walls.

- Adequate joint patterns (ACI and ICC guidelines) should be used to permit slab movement due to normal soil settlement, normal subgrade disturbance and material expansion/contraction.

- Place a minimum of 4 inches of compacted crushed stone beneath the slab to provide a working base. The actual thickness of the gravel layer should be based on design requirements.

- Keep the crushed stone or gravel moist, but not wet, immediately prior to slab concrete placement to minimize curling of the slab due to differential curing conditions between the top and bottom of the slab.

- Retain CSI to review the actual subgrade conditions prior to slab construction and make recommendations for any unsuitable conditions encountered.

Note: Slab subgrade conditions are also considered earthwork areas; thus, the recommendations contained in the Earthwork section of the report apply.

13 LATERAL EARTH PRESSURES

We understand that retaining walls will be required to achieve the desired grades for this project. Additionally, the below grade basement walls will act as retaining walls. Therefore, these retaining walls will be subjected to lateral earth pressures due to the backfill behind them. Below-grade walls should be designed to provide sufficient drainage at the rear of the wall to relieve hydrostatic pressure.

- We recommend the walls be backfilled using a compacted, open-graded, granular material. The granular material should be clean and free draining. We recommend the use of Kentucky Transportation Cabinet (KYTC) No. 57 stone for backfill.

- To utilize the following granular material earth pressure values, the granular material must occupy a triangular shaped minimum backfill zone. The minimum zone starts at the base of the wall from the outside face of the footing. At the top of the backfill, the zone should extend from the edge of footing a distance of three-fifths of the backfill height.

- The backfill zone should be drained using a perforated pipe placed at the base of the footing or by weep holes in the face of the wall. Gravity drainage should be used to remove accumulated water from the perforated pipe system.

- A minimum thickness of 2 feet of low plasticity clay should be provided on top of the granular wall backfill material where the backfill material will be exposed to the weather.

- A geotextile material (i.e.- filter fabric) must be used as a separator between the No. 57 crushed stone backfill and the surrounding soils or bedrock to prevent soil piping.

The following table represents granular backfill, earth pressures design parameters for Equivalent Hydrostatic Pressures (EHP) and Earth Pressure Coefficients. The values given assume the backfill surface is nearly level, the granular backfill is drained, the zone of backfill conforms to the minimum zone detailed above, and no surcharge is placed on the backfill. A unit weight of 100 pounds per square foot (psf) was used for the backfill stone.

Table 2. Granular Material Equivalent Hydrostatic Pressures (EHP) and Earth Pressure Coefficients

Condition	EHP (pcf)	Coefficients
Active	30	K_a = 0.30
At Rest	50	K_o = 0.50
Passive	300*	K_p = 3.0*

*Unfactored

All temporary slopes should be in compliance with OSHA and any other applicable safety regulations. During construction, temporary slopes should be regularly evaluated for signs of movement or unstable conditions. Soil slopes should be covered for protection from rain and surface runoff should be diverted away from slopes.

14 PAVEMENT RECOMMENDATIONS

No traffic loads were supplied to us for this project. However, we expect that the traffic in the pavement areas will be limited primarily to automobiles, occasional delivery trucks, and possibly a garbage truck. Adequate soil/subgrade support is critical for any pavement area. Please refer to the recommendations contained in the Earthwork section of this report for subgrade preparation. We expect that remediation of the pavement area subgrade will be needed periodically during construction. Prior to stone base placement, we recommend an additional heavy proofroll of the subgrade should be performed to verify subgrade conditions. Recommendations for undercutting/repair of the subgrade can be made at that time by a CSI geotechnical engineer.

Adequate drainage and slope of the pavement subgrade and pavement section should be provided to promote adequate drainage. Edges of the pavement should be provided a means of water outlet by extending the aggregate base course through to side ditches or providing drain pipes and weep holes at catch basin walls.

The following pavement recommendations are based on our experience with similar materials and loading conditions. The recommendations are based on the assumption that the soil subgrade will be compacted according to the recommendations contained in this report.

14A ASPHALT PAVEMENT

A bulk sample was collected on-site. Laboratory analysis performed on the bulk sample indicates a California Bearing Ratio (CBR) of 3.4 percent. This CBR value is typical of the moderate to high plasticity soils encountered on-site. Typically, pavement design is based on supplied traffic loads and CBR values. However, no traffic loads were provided to us for this project. We expect that the project traffic will be limited to mostly automobiles, delivery trucks, and garbage trucks. We recommend that the light duty pavement section be utilized in areas restricted mostly to automobiles (i.e. - parking areas, etc.) and that the heavy duty pavement section be used in the main drive lanes or where other heavy traffic loads are expected. Generalized pavement designs for both light duty and heavy duty pavement are given below.

Table 3. Light Duty Asphalt Pavement Section

Pavement Section Component	Thickness (in)
Bituminous Surface Course	1.5
Bituminous Binder Course	1.5
Dense Graded Aggregate (DGA)*	8.0

*DGA to be placed in 6 inch thick maximum, compacted lifts

Table 4. Heavy Duty Asphalt Pavement Section

Pavement Section Component	Thickness (in)
Bituminous Surface Course	1.5
Bituminous Binder Course	2.5
Dense Graded Aggregate (DGA)*	8.0

*DGA to be placed in 6 inch thick maximum, compacted lifts

The dense graded aggregate (DGA) should be placed and compacted in accordance with Kentucky Department of Highways Standard Specifications, latest edition. The asphalt should be mixed, placed, and compacted in accordance with Kentucky Department of Highways Standard Specifications, latest edition. It is common practice to place the base stone and binder course prior to completion of construction without placing the surface course. It should be noted that repeated passes of heavily loaded construction traffic on the binder course will likely decrease the service life of your pavement.

14B RIGID PAVEMENT (CONCRETE)

We anticipate reinforced concrete will be used in areas where the pavement is subjected to high stresses such as entrances/exits, dumpster pads, and possibly other areas of the project site.

We recommend a minimum DGA thickness of 8 inches beneath new concrete pavement and a minimum concrete thickness of 6 inches for new concrete pavement areas. Obviously,

thicker concrete pavement sections can be used in select areas where heavy wheel loads are expected. We also recommend that the concrete pavement be reinforced with heavy welded wire fabric or reinforcing steel. For dumpster pads and refuse container pads, the concrete pads should be large enough to accommodate both the refuse container and all axles of the truck.

15 NOTES ON THE REPORT AND RECOMMENDATIONS

We recommend that this report be provided to the various design team members, the contractors and the project Owner. Potential contractors should be informed of this report in the "Instruction to Bidders" section of the bid documents. A geotechnical exploration, such as the one we performed, uses widely spaced borings to attempt to model the subsurface conditions at the site. Because no exploration contains complete data or a complete model, there is always a possibility that conditions between borings will be different from those at specific boring locations. Thus, it is possible that some subsurface conditions will not be anticipated by the project team or contractor. If this report is included or referenced in the actual contract documents, **it shall be explicitly understood that this report is for informational purposes only**. CSI shall not be responsible for the opinions of, or conclusions drawn by, others.

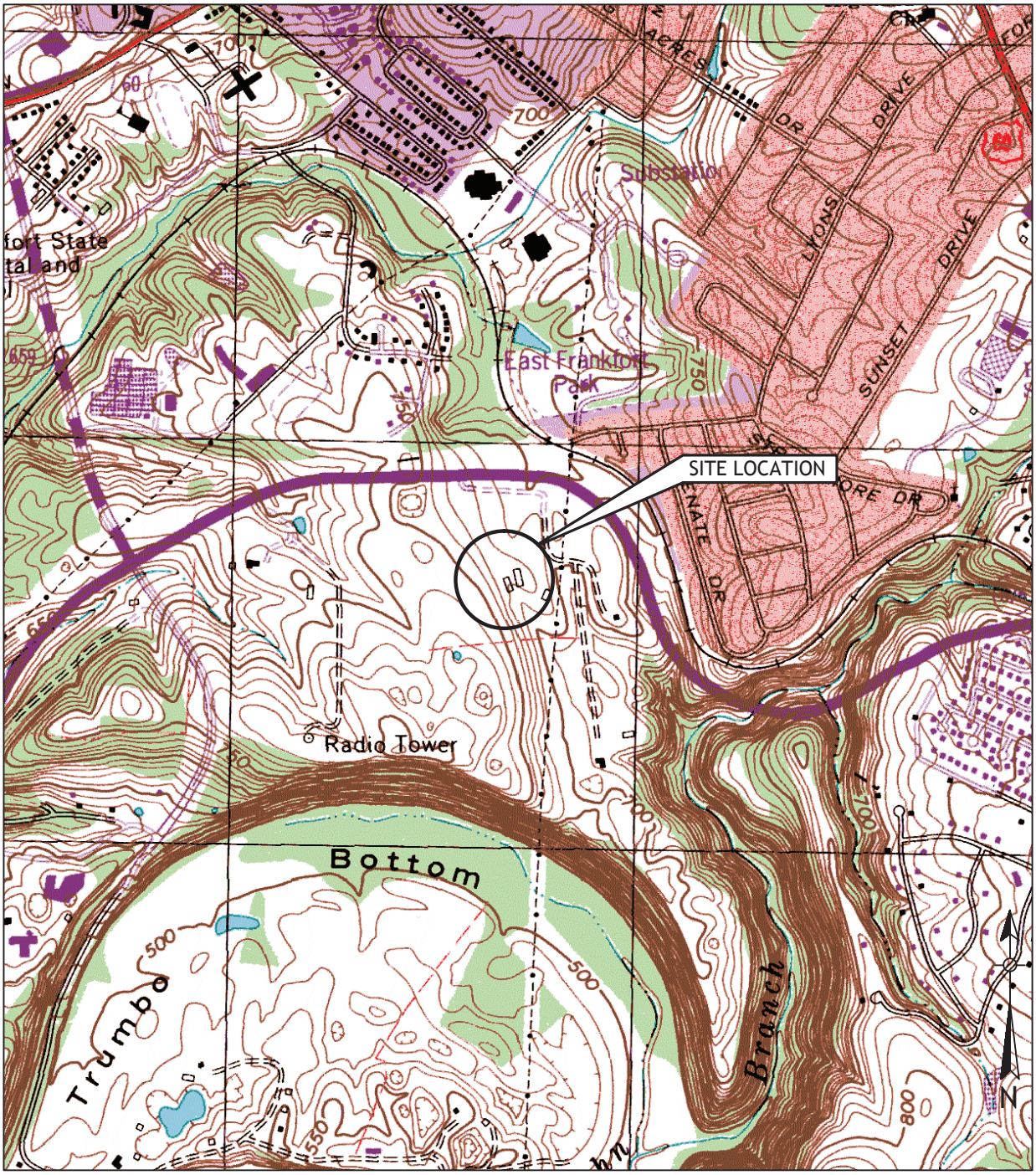
It has been our experience that the construction process often disturbs soil conditions and this process, no matter how much experience we use to anticipate construction methodology, is not completely predictable. Therefore, changes or modifications to our recommendations are likely needed due to these possible variances. Experienced CSI geotechnical personnel should be used to observe and document the construction procedures and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. We recommend that the Owner retain CSI to provide this service based upon our familiarity with the project, the subsurface conditions and the intent of our recommendations.

This report is based on the provided project information, the subsurface conditions observed at the time of the report, and our experience with similar conditions. As such, it cannot be applied to other project sites, types, or combinations thereof. If the Project Information section in this report contains incorrect information or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations. Our recommendations may then require modification.

No section or portion of this report (including Appendix information) can be used as a stand alone article to make distinct changes or assumptions. The entire report and Appendix should be used together as one resource. We wish to remind you that our exploration services include storing the soil samples collected and making them available for inspection for 30 days. The soil samples are then discarded unless you request otherwise. Rock cores are kept typically until the foundation installation is complete, and then discarded. Please inform us if you wish to keep any of the obtained samples.

APPENDIX

Site Location Plan
Boring Location Plan
Key to Symbols and Descriptions
Soil Boring Logs
Coordinate Logs
Field Testing Procedures
Summary of Lab Testing Table(s) and Lab Testing Sheets
Laboratory Testing Procedures

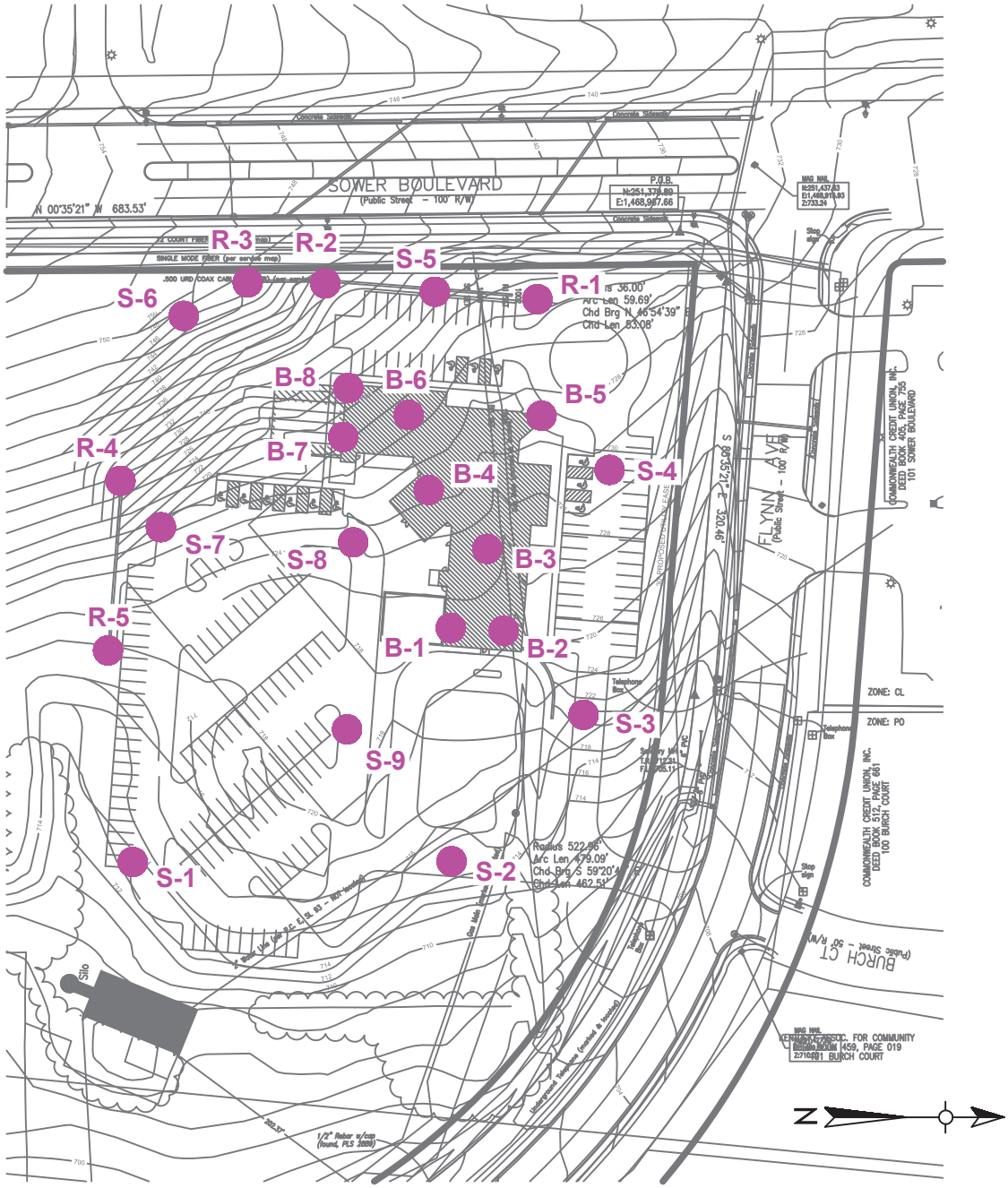


Site Location Plan adapted from USGS Frankfort East Topographic Quadrangle map dated 1996, with further adaptation by CSI personnel.

FOR ILLUSTRATION PURPOSES ONLY

Consulting Services Incorporated of Kentucky
858 Contract Street
Lexington, Kentucky 40505
859.309.6021 Office|888.792.3121 Fax
www.csikentucky.com

TITLE: SITE LOCATION PLAN		Project No: LX140194	Drawn By: JAC
PROJECT: FPB ADMINISTRATION BUILDING FRANKFORT, KENTUCKY		Date: July 22, 2014	Checked By: JNW
		Scale: Not To Scale	Drawing No: 1 of 1



Boring Location Plan adapted from provided Site Layout Plan dated June, 2014, with further adaptation by CSI personnel.

Elevations were provided by project surveyor.

FOR ILLUSTRATION PURPOSES ONLY

LEGEND	
B-XXX	BUILDING BORING LOCATIONS
R-XXX	RETAINING WALL BORING LOCATIONS
S-XXX	PAVEMENT BORING LOCATIONS

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		Scale: Not To Scale	Drawing No: 1 of 1

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Geotechnical Boring Information Sheet

Sample Type Symbols	
Splitspoon (SPT)	
Dynamic Cone Penetrometer (DCP)	
Shelby Tube	
Grab	
Bulk	
Rock Core	

Surface Symbols	
Topsoil	
Asphalt	
Concrete	
Lean Clay	
Fat Clay	
Sandy Clay	
Silt	
Elastic Silt	
Lean Clay to Fat Clay	
Gravelly Clay	
Sandy Silt	
Gravelly Silt	
Sand	
Gravel	
Fill	
Void	
Limestone	
Sandstone	
Shale/Siltstone	
Weathered Rock	

Samples Strength Descriptors	
Cohesive Soils:	**N**
Very Soft	0-1
Soft	2-4
Firm	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31+
Non-cohesive Soils:	
Very Loose	0-4
Loose	5-10
Firm	11-20
Very Firm	21-30
Dense	30-50
Very Dense	51+

Definitions

SPT-"Splitspoon" or standard penetration test. Blow counts are number of drops required for a 140 lb hammer dropping 30 inches to drive the sampler 6 inches.

N-value is the addition of the last two intervals of the 18-inch sample.

Shelby tubes are often called "undisturbed samples". They are directly pushed into the ground, twisted, allowed to rest for a small period of time and then pulled out of the ground. Tops and bottoms are cleaned and then sealed.

Sample classification is done in general accordance with ASTM D2487 and 2488 using the Unified Soil Classification System (USCS) as a general guide.

Soil moisture descriptions are based on the recovered sample observations. The descriptors are dry, slightly moist, moist, very moist and wet. These are typically based on relative estimates of the moisture condition of a visual estimation of the soils optimum moisture content (EOMC). Dry is almost in a "dusty" condition usually 6 or more percent below EOMC. Slightly moist is from about 6 to 2 percent below EOMC at a point at which the soil color does not readily change with the addition of water. Moist is usually 2 percent below to 2 percent above EOMC and the point at which the soil will tend to begin forming "balls" under some pressure in the hand. Very moist is usually from about 2 percent to 6 percent above EOMC and also the point at which it's often considered "muddy". Wet soil is usually 6 or more percent above EOMC and often contains free water or the soil is in a saturated state.

Silt or Clay is defined at material finer than a standard #200 US sieve (<0.075mm) Sand is defined as material between the size of #200 sieve up to #4 sieve. Gravel is from #4 size sieve material to 3". Cobbles are from 3" to 12". Boulders are over 12".

Rock hardness is classified as follows:

Very Soft:	Easily broken by hand pressure
Soft:	Ends can be broken by hand pressure; easily broken with hammer
Medium:	Ends easily broken with hammer; middle requires moderate blow
Hard:	Ends require moderate hammer blow; middle requires several blows
Very Hard:	Many blows with a hammer required to break core

Rock Quality Designation (RQD) is defined as total combined length of 4" or longer pieces of core divided by the total core run length; defined in percentage.

Water or cave-in observed in borings is at completion of drilling each boring unless otherwise noted.

Strata lengths shown on borings represents a rough estimate. Transition may be more abrupt or gradual. Soil borings are representative of that estimated location at that time and are based on recovered samples. Conditions may be different between borings and between sample intervals. Boring information is not to be considered stand alone but should be taken in context with comments and information in the geotechnical report and the means by which the borings are logged, sampled and drilled.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-1
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 720.48

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
720.48	0		TOPSOIL - 5 inches			4-6-7	9		
			TILL ZONE - STIFF to VERY STIFF, brown clay, with fine roots, moist			8-9-9	15		
716.48	4		LEAN CLAY (CL) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, moist			6-11-11	13		
						5-6-8	16		
712.48	8					7-7-8	9		
708.48	12					7-7-7	9		
704.48	16		SAND (SP) - FIRM, brown and tan, wet			6-7-9	14		
700.48	20								
		▽	LEAN CLAY (CL) - STIFF, brown with tan mottling, with black oxide nodules, moist						Encountered water at 23.0 feet
696.48	24		Sounding - no samples taken			6-6-7	16		
692.48	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

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PROJECT: FPB Administration Building
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TOP OF GROUND ELEVATION: 720.48

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
688.48	32		Sounding - no samples taken						
684.48	36								
680.48	40								
676.48	44								
			Auger Refusal at 46.2 feet						
672.48	48								
668.48	52								
664.48	56								
660.48	60								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-1A
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 720.48

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
720.48	0		Sounding - no samples taken Offset from boring B-1 to obtain Shelby Tube sample				24		Dry upon completion of soil augering Qu = 6,188 psf
716.48	4								
712.48	8		Boring Terminated at 6.0 feet						
708.48	12								
704.48	16								
700.48	20								
696.48	24								
692.48	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-2
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 719.53

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
719.53	0		TOPSOIL - 5 inches			6-6-7	9		
			TILL ZONE - STIFF, brown clay, with fine roots, moist			5-7-6	16		
715.53	4		LEAN CLAY (CL) - STIFF, brown with tan mottling, with black oxide nodules, with sand (increasing with depth), moist			3-5-6	14		
						4-6-7	15		
711.53	8					5-6-7	11		
707.53	12		SAND (SP) - VERY FIRM, brown and tan, moist			9-12-15	15		
703.53	16		LEAN CLAY (CL) - VERY STIFF, tan with gray mottling, with black oxide nodules, moist			5-7-11	16		
699.53	20								
695.53	24					5-6-10	16		
691.53	28		LEAN CLAY (CL) - STIFF to VERY STIFF, gray, with sand, moist			5-7-8	16		

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-2
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 719.53

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
687.53	32		LEAN CLAY (CL) - STIFF to VERY STIFF, gray, with sand, moist			5-10-18	18		
683.53	36		SAND (SP) - VERY FIRM, brown and tan, wet			5-10-14	16		Encountered water at 39.0 feet
679.53	40	▽							
675.53	44		Weathered Rock Auger Refusal at 44.1 feet						
671.53	48								
667.53	52								
663.53	56								
659.53	60								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-2A
LOCATION: Frankfort, Kentucky
WEATHER: Clear, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 719.53

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
719.53	0		Sounding - no samples taken Offset from boring B-2 to obtain Shelby Tube sample				21		Dry upon completion of soil augering Qu = 6,583 psf
715.53	4								
			Boring Terminated at 6.0 feet						
711.53	8								
707.53	12								
703.53	16								
699.53	20								
695.53	24								
691.53	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-3
LOCATION: Frankfort, Kentucky
WEATHER: Cloudy, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4 ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 721.82

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
721.82	0		TOPSOIL - 4 inches			4-5-7	14		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist			6-6-7	11		
			LEAN CLAY (CL) - FIRM to STIFF, brown with tan mottling, with black oxide nodules, moist						
717.82	4					2-3-3	11		
						4-5-8	15		
713.82	8								
			Encountered piece of tree root and rock fragments (in bottom of splitspoon) from 9.0 to 10.5 feet			3-6-9	16		
709.82	12								
						3-5-10	15		
705.82	16								
			FAT CLAY (CH) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, moist to wet						
						6-9-11	15		
701.82	20								
697.82	24		Encountered sand and rock fragments layer in bottom of splitspoon from 24.0 to 25.5 feet			3-5-8	13		
			Weathered Rock						
			Auger Refusal at 27.0 feet						
693.82	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-4
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 726.25

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
726.25	0		TOPSOIL - 5 inches			5-8-9	11		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, moist			11-9-9	13		
722.25	4		LEAN CLAY (CL) - STIFF to VERY STIFF, brown with tan mottling, moist			5-6-9	16		
						5-8-10	14		
718.25	8		FAT CLAY (CH) - VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist to wet			6-9-12	11		
714.25	12								Photo of Approx. Boring Location 
						6-7-11	14		
710.25	16								
			Weathered Rock			Run No.	Recovery (%)	RQD (%)	
706.25	20		Auger Refusal at 18.4 feet Begin Coring at 18.4 feet			1 (18.4'-23.4')	90	55	Core water loss observed at 20.0 feet Core water return observed at 21.0 feet
702.25	24		LIMESTONE - light to medium gray, with tan staining, medium grained, with interbedded shale, with clay seams			2 (23.4'-28.4')	90	85	Rock Qu = 866 ksf Core water loss observed at 22.3 feet
698.25	28		Coring Terminated at 28.4 feet						

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-5 (Offset 25 FT North)
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 726.35

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
726.35	0		TOPSOIL - 5 inches			5-10-11	11		Dry upon completion of soil augering
			FILL - sampled as VERY STIFF, brown clay, with fine roots, with tree roots, with rock fragments, moist			9-11-11	7		
722.35	4		LEAN CLAY (CL) - STIFF to VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist			3-4-7	16		
						9-12-14	16		
718.35	8		FAT CLAY (CH) - VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist			6-8-9	14		
714.35	12								
						2-50/0.1	5		
			Weathered Rock						
710.35	16		Auger Refusal at 14.7 feet						
706.35	20								
702.35	24								
698.35	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-6
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 731.42

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
731.42	0		TOPSOIL - 6 inches			5-8-9	8		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, moist			8-9-15	10		
727.42	4		LEAN CLAY (CL) - STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist			4-5-6	17		
			FAT CLAY (CH) - STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, wet to moist			4-6-8	13		
723.42	8					6-4-7	9		
719.42	12		Weathered Rock Auger Refusal at 13.4 feet						
715.42	16								
711.42	20								
707.42	24								
703.42	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-7
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 731.94

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
731.94	0		TOPSOIL - 6 inches			5-5-10	9		Dry upon completion of soil augering
			TILL ZONE - STIFF to VERY STIFF, brown clay, with fine roots, moist			8-9-9	13		
727.94	4		LEAN CLAY (CL) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist			2-4-5	9		
			FAT CLAY (CH) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, wet			5-7-12	17		
723.94	8					4-5-7	14		
719.94	12		Weathered Rock			Run No.	Recovery (%)	RQD (%)	No core water loss observed
			Auger Refusal at 12.7 feet Begin Coring at 12.7 feet			1 (12.7'-17.7')	93	78	Rock Qu = 587 ksf
715.94	16		LIMESTONE - light to medium gray, medium grained, with interbedded shale, with clay seams			2 (17.7'-22.7')	93	57	
711.94	20								
707.94	24		Coring Terminated at 22.7 feet						
703.94	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: B-8
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 735.81

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
735.81	0		TOPSOIL - 6 inches			4-6-12	8		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, moist			12-13-16	4		
731.81	4		FAT CLAY (CH) - VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist to wet			8-9-50/0.4	15		
			Weathered Rock			Run No.	Recovery (%)	RQD (%)	No core water loss observed
			Auger Refusal at 5.8 feet Begin Coring at 5.8 feet			1 (5.8'-10.8')	90	32	
727.81	8								
			LIMESTONE - light to medium gray, with tan staining, medium grained, with interbedded shale, with clay seams			2 (10.8'-15.8')	95	50	
723.81	12								Rock Qu = 382 ksf
719.81	16		Coring Terminated at 15.8 feet						
715.81	20								
711.81	24								
707.81	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: R-1
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 732.58

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
732.58	0		TOPSOIL - 5 inches			5-11-12	11		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, moist			7-11-12	12		
728.58	4		LEAN CLAY (CL) - VERY STIFF to FIRM, brown with tan mottling, with black oxide nodules, moist to wet			6-8-9	14		
						7-9-10	16		
724.58	8					3-2-4	15		
720.58	12		Weathered Rock						
			Auger Refusal at 12.0 feet						
716.58	16								
712.58	20								
708.58	24								
704.58	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: R-2
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 744.25

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
744.25	0		TOPSOIL - 5 inches			4-10-11	10		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, with black oxide nodules, with rock fragments, moist			14-16-18	6		
740.25	4		FAT CLAY (CH) - VERY STIFF, brown, with black oxide nodules, with rock fragments, moist			50/0.1	1		
			Auger Refusal at 4.1 feet						
736.25	8								
732.25	12								
728.25	16								
724.25	20								
720.25	24								
716.25	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: R-3
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 747.59

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
747.59	0		TOPSOIL - 6 inches			2-4-7	8		Dry upon completion of soil augering
			FILL - sampled as STIFF to VERY STIFF, brown clay, with fine roots, with rock fragments, moist			12-13-13	13		
743.59	4		FAT CLAY (CH) - VERY STIFF, brown, with black oxide nodules, with rock fragments, moist			11-50/0.3	6		
			Weathered Rock						
			Auger Refusal at 5.2 feet						
739.59	8								
735.59	12								
731.59	16								
727.59	20								
723.59	24								
719.59	28								

Photo of Approx. Boring Location

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Consulting Services Inc. of Kentucky — Boring Log

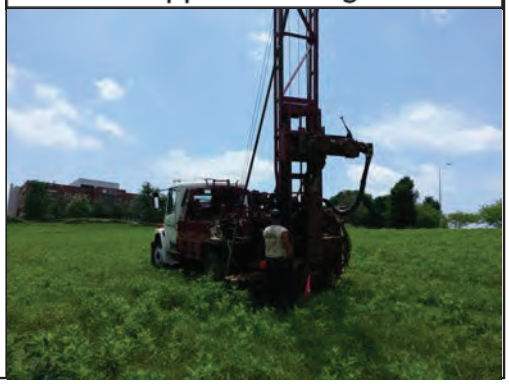
858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: R-4
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 737.08

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
737.08	0		TOPSOIL - 6 inches			4-8-10	8		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, with rock fragments, moist			8-10-14	14		
733.08	4		LEAN CLAY (CL) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, wet			5-6-7	15		
729.08	8		Weathered Rock Auger Refusal at 6.7 feet						
725.08	12								
721.08	16								
717.08	20								
713.08	24								
709.08	28								

Photo of Approx. Boring Location



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Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: R-5
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-01-2014
DRILLING METHOD: 3-1/4" ID HSA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 719.24

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
719.24	0		TOPSOIL - 6 inches			4-5-6	11		Dry upon completion of soil augering
			TILL ZONE - STIFF to VERY STIFF, brown clay, with fine roots, moist			10-9-11	10		
715.24	4		LEAN CLAY (CL) - VERY STIFF to FIRM, brown with tan mottling, with black oxide nodules, with rock fragments, moist to wet			4-7-9	16		
						4-5-7	14		
711.24	8					5-5-7	17		
707.24	12								
						3-4-6	14		
703.24	16								
						2-3-3	10		
699.24	20								
			Weathered Rock						
695.24	24		Auger Refusal at 22.3 feet						
691.24	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-1
LOCATION: Frankfort, Kentucky
WEATHER: Clear, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 712.27

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
712.27	0		TOPSOIL - 6 inches			4-4-5	10		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist			5-7-9	14		
708.27	4		LEAN CLAY (CL) - VERY STIFF, brown with tan mottling, with black oxide nodules, with sand, moist			6-8-10	15		
						6-10-13	12		
704.27	8					3-6-10	8		
			Boring Terminated at 10.5 feet						
700.27	12								
696.27	16								
692.27	20								
688.27	24								
684.27	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-2
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 714.34

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
714.34	0		TOPSOIL - 6 inches			4-5-7	9		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist			7-9-10	13		
710.34	4		LEAN CLAY (CL) - VERY STIFF, brown with tan mottling, with black oxide nodules, moist			4-8-12	12		
						4-8-12	12		
706.34	8					3-8-12	11		
			Boring Terminated at 10.5 feet						
702.34	12								
698.34	16								
694.34	20								
690.34	24								
686.34	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-3
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 715.53

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
715.53	0		TOPSOIL - 6 inches			4-7-8	9		Dry upon completion of soil augering
			TILL ZONE - STIFF to VERY STIFF, brown clay, with fine roots, moist			10-10-8	12		
711.53	4		LEAN CLAY (CL) - VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, moist			7-8-8	15		
						5-6-9	12		
707.53	8					7-11-14	14		
			Boring Terminated at 10.5 feet						
703.53	12								
699.53	16								
695.53	20								
691.53	24								
687.53	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

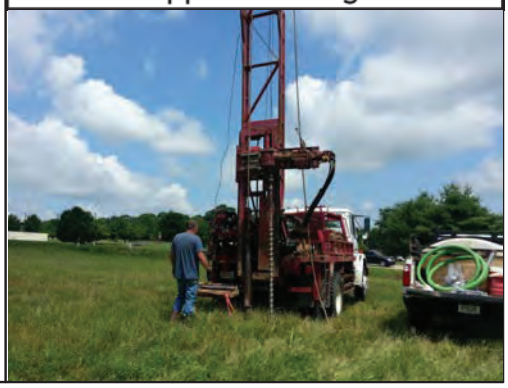
858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-4
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 724.97

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
724.97	0		TOPSOIL - 4 inches			6-10-12	11		Dry upon completion of soil augering
			FILL - sampled as VERY STIFF, brown clay with fine roots, with rock fragments, moist			10-10-11	9		
720.97	4					6-6-8	12		
			FILL - sampled as STIFF, gray clay, with pieces of wood, moist			4-5-7	9		
716.97	8		LEAN CLAY (CL) - STIFF, brown, with black oxide nodules, moist			4-5-6	10		
			Boring Terminated at 10.5 feet						
712.97	12								
708.97	16								
704.97	20								
700.97	24								
696.97	28								

Photo of Approx. Boring Location



Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-5 (Offset 32 FT South)
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 734.20

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
734.2	0		TOPSOIL - 5 inches			4-5-4	9		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist			4-5-6	14		
			FAT CLAY (CH) - STIFF, brown with tan mottling, with black oxide nodules, with fine roots, moist to wet						
730.2	4					3-50/0.1	6		
			Weathered Rock						
			Auger Refusal at 4.8 feet						
726.2	8								
722.2	12								
718.2	16								
714.2	20								
710.2	24								
706.2	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky

Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-6
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 80's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 06-30-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 749.05

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
749.05	0		TOPSOIL - 6 inches			5-9-15	11		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, with black oxide nodules, moist			7-8-11	12		
745.05	4		FAT CLAY (CH) - VERY STIFF, brown with tan mottling, with black oxide nodules, moist			8-9-11	14		
			Weathered Rock						
741.05	8		Auger Refusal at 6.1 feet						
737.05	12								
733.05	16								
729.05	20								
725.05	24								
721.05	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-7
LOCATION: Frankfort, Kentucky
WEATHER: Clear, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 730.93

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
730.93	0		TOPSOIL - 5 inches			3-5-6	8		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist to wet			9-9-11	12		
726.93	4		LEAN CLAY (CL) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, with rock fragments, wet to moist			4-5-7	14		
722.93	8		FAT CLAY (CH) - HARD, brown with tan mottling, with black oxide nodules, with rock fragments, wet			4-20-20	9		
			Weathered Rock						
718.93	12		Auger Refusal at 8.3 feet						
714.93	16								
710.93	20								
706.93	24								
702.93	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-8
LOCATION: Frankfort, Kentucky
WEATHER: Sunny, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 723.84

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
723.84	0		TOPSOIL - 5 inches			5-6-7	10		Dry upon completion of soil augering
			TILL ZONE - STIFF, brown clay, with fine roots, moist			6-8-9	11		
719.84	4		LEAN CLAY (CL) - VERY STIFF to STIFF, brown with tan mottling, with black oxide nodules, moist			5-6-8	14		
715.84	8		FAT CLAY (CH) - STIFF to VERY STIFF, brown with tan mottling, with black oxide nodules, with rock fragments (in splitspoon from 9.0 to 10.5 feet), moist			3-6-8	10		
						5-11-12	10		
711.84	12		Boring Terminated at 10.5 feet						
707.84	16								
703.84	20								
699.84	24								
695.84	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

Consulting Services Inc. of Kentucky — Boring Log

858 Contract Street | Lexington, Kentucky 40505 | 859.309.6021 tel | 888.792.3121 fax

PROJECT: FPB Administration Building
PROJECT NUMBER: LX140194
BORING NUMBER: S-9 (Offset 15 FT North)
LOCATION: Frankfort, Kentucky
WEATHER: Clear, 70's
DRILL RIG TYPE: Mobile B-34
DRILLER: Geo-Drill
DATE DRILLED: 07-02-2014
DRILLING METHOD: 4" OD SFA
CSI FIELD REP: J. Workman
CLIENT: Frankfort Plant Board

TOP OF GROUND ELEVATION: 720.27

ELEV. (feet)	DEPTH (feet)	Water Level	Strata Description	SOIL TYPE	SAMPLES	SPT Blow Counts	Recovery (in)	RQD (%)	Notes
720.27	0		TOPSOIL - 6 inches			6-9-9	8		Dry upon completion of soil augering
			TILL ZONE - VERY STIFF, brown clay, with fine roots, moist			8-11-12	13		
716.27	4		LEAN CLAY (CL) - VERY STIFF, brown with tan mottling, with black oxide nodules, moist			7-9-13	14		
						7-11-14	12		
712.27	8					6-9-10	15		
			Boring Terminated at 10.5 feet						
708.27	12								
704.27	16								
700.27	20								
696.27	24								
692.27	28								

Photo of Approx. Boring Location

Please note: Boring log is for information only. Soil borings only show conditions observed in specific recovered samples at that particular location. Elevations were provided by project surveyor.

LX140194 FPB Administration Building - Coordinates Log

Boring No.	Elevation (ft)	Northing	Easting	Offset
Building Borings				
B-1	720.48	251203.23	1469274.11	
B-2	719.53	251244.43	1469276.07	
B-3	721.82	251231.15	1469212.59	
B-4	726.25	251186.45	1469167.46	
B-5	726.35	251239.44	1469110.50	25 feet North
B-6	731.42	251170.80	1469109.41	
B-7	731.94	251121.04	1469126.36	
B-8	735.81	251123.95	1469087.86	
Retaining Wall Borings				
R-1	732.58	251250.25	1469017.33	15 feet North
R-2	744.25	251107.76	1469005.40	
R-3	747.59	251047.32	1469006.65	
R-4	737.08	250949.48	1469159.97	
R-5	719.24	250939.44	1469291.10	
Pavement Borings				
S-1	712.27	250957.00	1469454.84	
S-2	714.34	251203.19	1469455.01	
S-3	715.53	251306.40	1469339.78	
S-4	724.97	251326.94	1469152.75	
S-5	734.20	251220.59	1469016.58	32 feet South
S-6	749.05	250996.27	1469033.75	
S-7	730.93	250979.44	1469195.45	
S-8	723.84	251127.17	1469207.47	
S-9	720.27	251122.95	1469352.05	

FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by CSI 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 the chief driller. 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 which 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 hollow stem steel auger into the soil. At regular intervals, the drilling tools were removed and soil 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". The penetration resistance, when properly evaluated, is an index to the soil strength and foundation supporting capability.

Representative portions of the soil 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.

Core Drilling: Refusal materials are materials that cannot be penetrated with the soil drilling methods employed. 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.

Prior to coring, casing is set in the drilled hole through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113 using a diamond-studded bit fastened to the

end of a hollow double tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovered is measured, the samples are removed and the core is placed in boxes for storage.

The core samples are returned to our laboratory where the refusal material is identified and the percent core recovery and rock quality designation is determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core which are four inches or longer, and dividing by the total length drilled. The percent core recovery and RQD are related to soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and RQDs are shown on the "Test Boring Records".

Hand Auger Borings and Dynamic Cone Penetration Testing: Hand auger borings are performed manually by CSI field personnel. This consists of manually twisting hand auger tools into the subsurface and extracting “grab” or baggie samples at intervals determined by the project engineer. At the sample intervals, dynamic cone penetration (DCP) testing is performed. This testing involves the manual raising and dropping of a 20 pound hammer, 18 inches. This “driver” head drives a solid-1¾ inch diameter cone into the ground. DCP “counts” are the number of drops it takes for the hammer to drive three 1¾ inch increments, recorded as X-Y-Z values.

Test Pits: Test pits are excavated by the equipment available, often a backhoe or trackhoe. The dimensions of the test pits are based on the equipment used and the power capacity of the equipment. Samples are taken from the spoils of typical buckets of the excavator and sealed in jars or “Ziplock” baggies. Dynamic Cone Penetration or hand probe testing is often performed in the upper few feet as OSHA standards allow. Refusal is deemed as the lack of advancement of the equipment with reasonable to full machine effort.

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.

LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	Sample Type*	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
B-1	0.0-1.5	SS		21.1										
	1.5-3.0	SS		25.5										
	4.0-5.5	SS	CL	22.0	73.6	36	20	16						
	6.5-8.0	SS		27.1										
	9.0-10.5	SS		22.3										
	14.0-15.5	SS		16.0										
	19.0-20.5	SS		20.1										
	24.0-25.5	SS		22.3										
B-1A	4.0-6.0	UD		22.2								6,188		
B-2	0.0-1.5	SS		19.6										
	1.5-3.0	SS		21.0										
	4.0-5.5	SS		21.6										
	6.5-8.0	SS		17.6										
	9.0-10.5	SS		22.4										
	14.0-15.5	SS		15.0										
	19.0-20.5	SS		27.7										
	24.0-25.5	SS		22.2										
	34.0-35.5	SS		20.2										
	39.0-40.5	SS		20.1										
B-2A	4.0-6.0	UD		22.5								6,583		

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

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Fax (888)792-3121

LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	Sample Type*	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
B-3	0.0-1.5	SS		21.2										
	1.5-3.0	SS		29.1										
	4.0-5.5	SS		22.5										
	6.5-8.0	SS		25.5										
	9.0-10.5	SS		23.1										
	14.0-15.5	SS		23.2										
	19.0-20.5	SS		24.4										
	24.0-25.5	SS		34.4										
B-4	0.0-1.5	SS		16.6										
	1.5-3.0	SS		21.0										
	4.0-5.5	SS		21.7										
	6.5-8.0	SS		20.7										
	9.0-10.5	SS		23.5										
	14.0-15.5	SS		31.5										
	21.2-21.6	CORE											866	
B-5	0.0-1.5	SS		15.1										
	1.5-3.0	SS		20.4										
	4.0-5.5	SS		22.2										
	6.5-8.0	SS		23.4										
	9.0-10.5	SS		26.9										
B-6	0.0-1.5	SS		17.3										
	1.5-3.0	SS		23.5										
	4.0-5.5	SS		20.0										
	6.5-8.0	SS		45.2										
	9.0-10.5	SS		9.7										

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	Sample Type*	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
B-7	0.0-1.5	SS		13.9										
	1.5-3.0	SS		20.1										
	4.0-5.5	SS		21.4										
	6.5-8.0	SS	CH	33.0	58.0	66	29	37						
	9.0-10.5	SS		40.1										
	13.5-13.9	CORE											587	
B-8	0.0-1.5	SS		17.1										
	1.5-3.0	SS		18.3										
	4.0-5.4	SS		45.0										
	14.8-15.2	CORE											382	

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	4	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
R-1	0.0-1.5	SS		15.9										
	1.5-3.0	SS		17.9										
	4.0-5.5	SS		20.0										
	6.5-8.0	SS		32.6										
	9.0-10.5	SS		50.6										
R-2	0.0-1.5	SS		15.6										
	1.5-3.0	SS		18.4										
R-3	0.0-1.5	SS		17.6										
	1.5-3.0	SS		16.5										
R-4	0.0-1.5	SS		17.1										
	1.5-3.0	SS		31.3										
	4.0-5.5	SS		42.9										
R-5	0.0-1.5	SS		17.2										
	1.5-3.0	SS		22.5										
	4.0-5.5	SS		26.2										
	6.5-8.0	SS		33.6										
	9.0-10.5	SS		33.9										
	14.0-15.5	SS		37.0										
	19.0-20.5	SS		26.8										

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	Sample Type*	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
S-1	0.0-1.5	SS		18.4										
	1.5-3.0	SS		19.0										
	4.0-5.5	SS		21.7										
	6.5-8.0	SS		18.9										
	9.0-10.5	SS		18.1										
S-2	0.0-1.5	SS		16.2										
	1.5-3.0	SS		17.1										
	4.0-5.5	SS		23.4										
	6.5-8.0	SS		21.5										
	9.0-10.5	SS		16.9										
S-3	0.0-1.5	SS		15.5										
	1.5-3.0	SS		17.9										
	4.0-5.5	SS		21.9										
	6.5-8.0	SS		21.7										
	9.0-10.5	SS		20.0										
S-4	0.0-1.5	SS		13.2										
	1.5-3.0	SS		16.3										
	4.0-5.5	SS		18.8										
	6.5-8.0	SS		22.8										
	9.0-10.5	SS		21.7										
S-5	0.0-1.5	SS		27.4										
	1.5-3.0	SS		31.6										
S-6	0.0-1.5	SS		17.6										
	1.5-3.0	SS		28.3										
	4.0-5.5	SS		19.5										

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

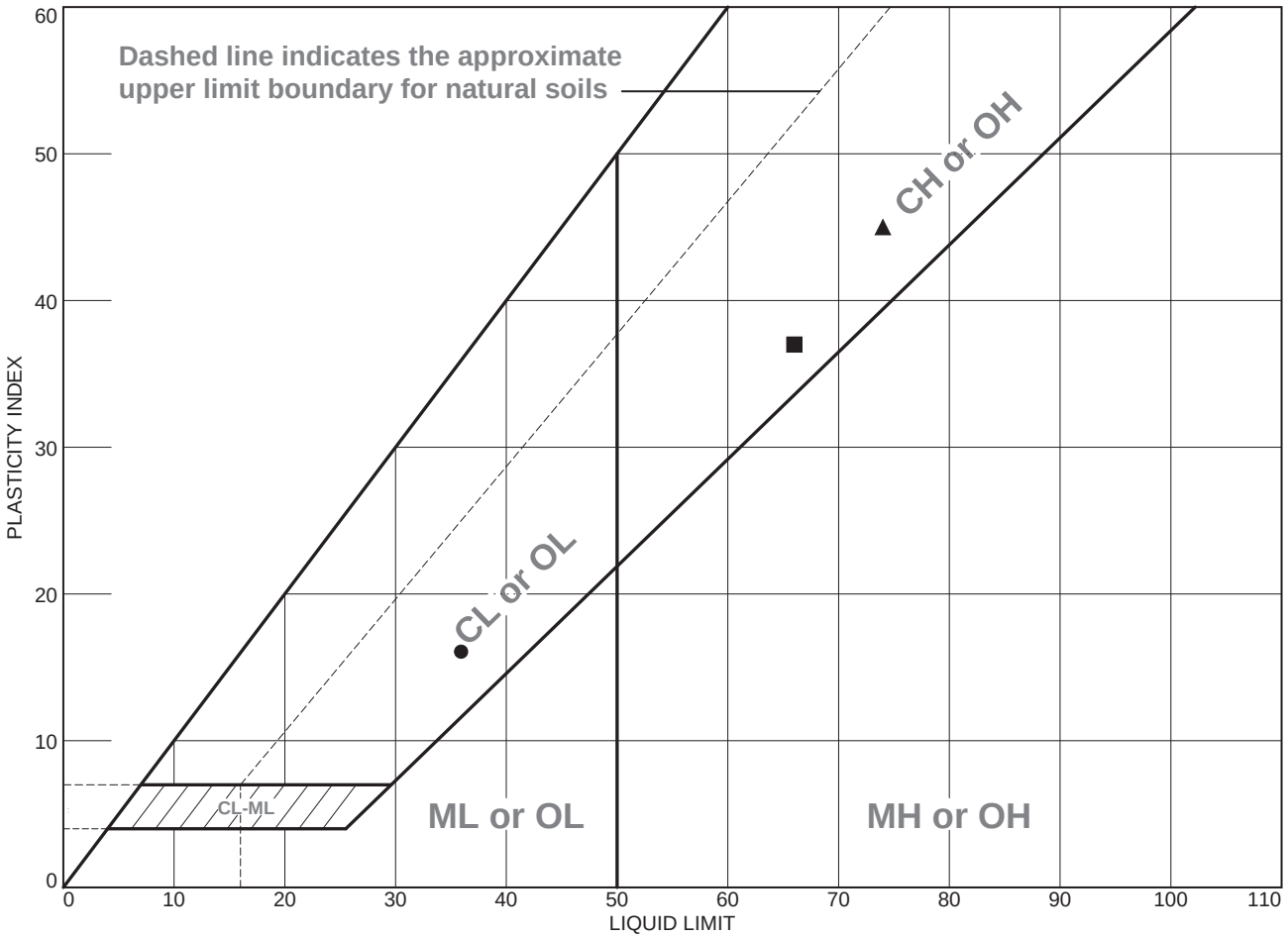
LABORATORY TESTING SUMMARY SHEET

FPB Administration Building - Frankfort, Kentucky
CSI PROJECT NUMBER - LX140194

Boring No.	Depth (feet)	Sample Type*	USCS Classification	Natural Moisture Content %	% Finer No. 200	Atterberg Limits Information			CBR (Percent at 0.1")	Max. DD (pcf)	OMC (%)	Qu (psf)	Rock Qu (ksf)	Swell Pressure (psf)
						LL	PL	PI						
Bulk (S-5 & S-6)	2.0-4.0	BULK	CH	35.3	74.0	74	29	45	3.4	91.4	29.9			1,438
S-7	0.0-1.5	SS		19.5										
	1.5-3.0	SS		32.4										
	4.0-5.5	SS		17.2										
	6.5-8.0	SS		38.6										
S-8	0.0-1.5	SS		18.6										
	1.5-3.0	SS		18.7										
	4.0-5.5	SS		25.3										
	6.5-8.0	SS		22.8										
	9.0-10.5	SS		28.0										
S-9	0.0-1.5	SS		18.7										
	1.5-3.0	SS		19.2										
	4.0-5.5	SS		23.7										
	6.5-8.0	SS		19.4										
	9.0-10.5	SS		20.0										

* SS = splitspoon sample, UD = undisturbed (Shelby tube) sample, BULK = bulk sample, GRAB = grab sample, CORE = rock core sample

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown LEAN CLAY with sand	36	20	16		73.6	CL
■	brown SANDY FAT CLAY	66	29	37		58.0	CH
▲	brown FAT CLAY with sand	74	29	45		74.0	CH

Project No. LX140194 **Client:** Frankfort Plant Board

Project: FPB Administration Building - Frankfort, Kentucky

●**Source of Sample:** Borings **Depth:** 4.0-5.5 **Sample Number:** B-1

■**Source of Sample:** Borings **Depth:** 6.5-8.0 **Sample Number:** B-7

▲**Source of Sample:** Borings **Depth:** 2.0-4.0 **Sample Number:** Bulk

Remarks:

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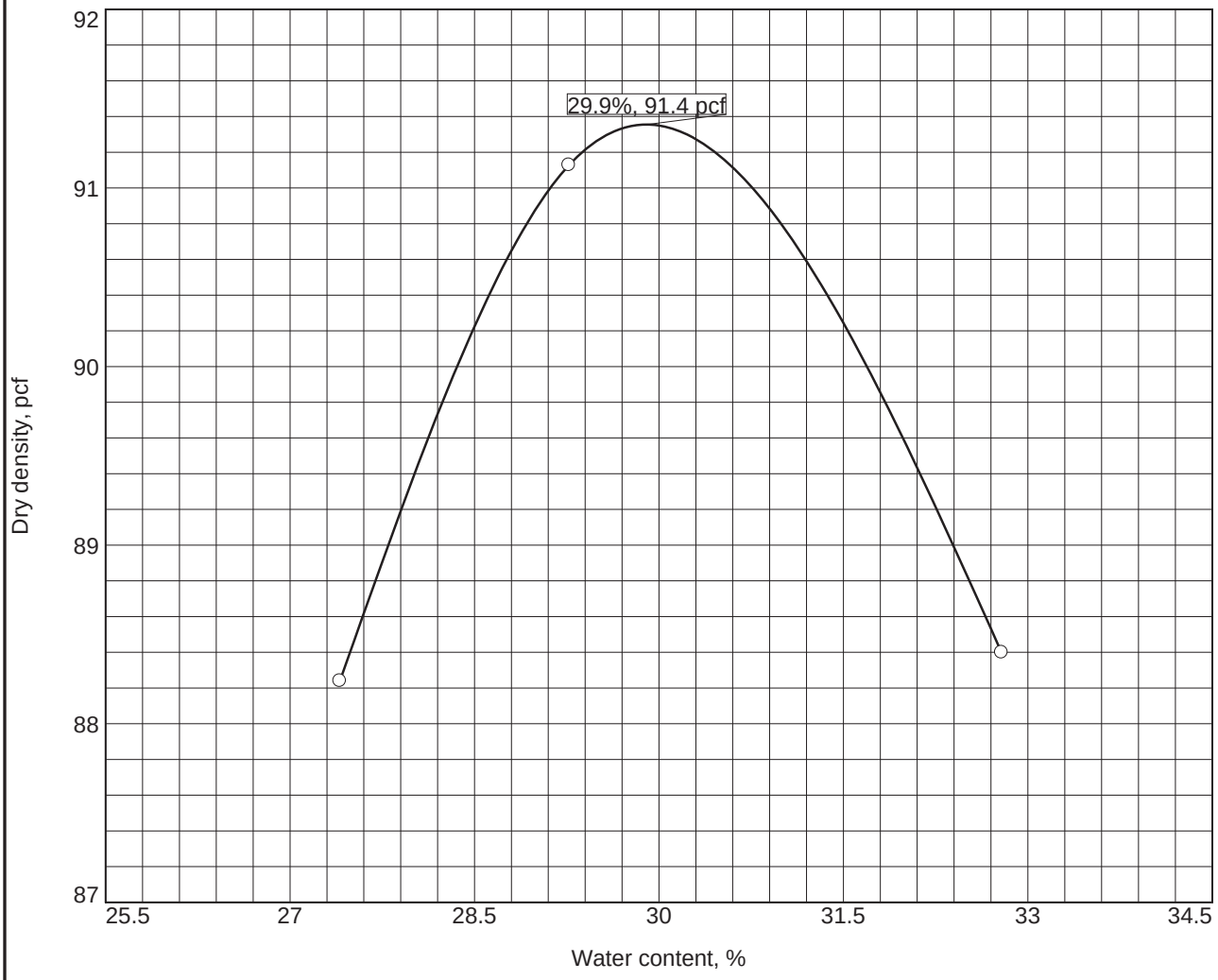
Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-00a Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
2.0-4.0	CH		35.3		74	45		74.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 91.4 pcf Optimum moisture = 29.9 %	brown FAT CLAY with sand

Project No. LX140194 **Client:** Frankfort Plant Board
Project: FPB Administration Building - Frankfort, Kentucky

○**Source of Sample:** Borings **Sample Number:** Bulk

Remarks:

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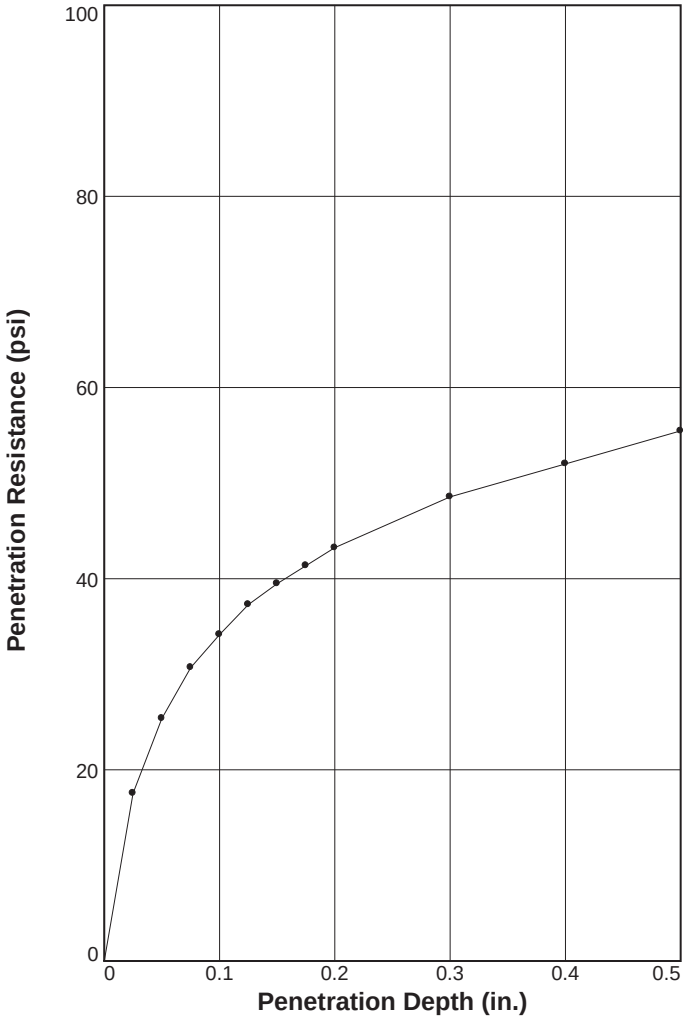
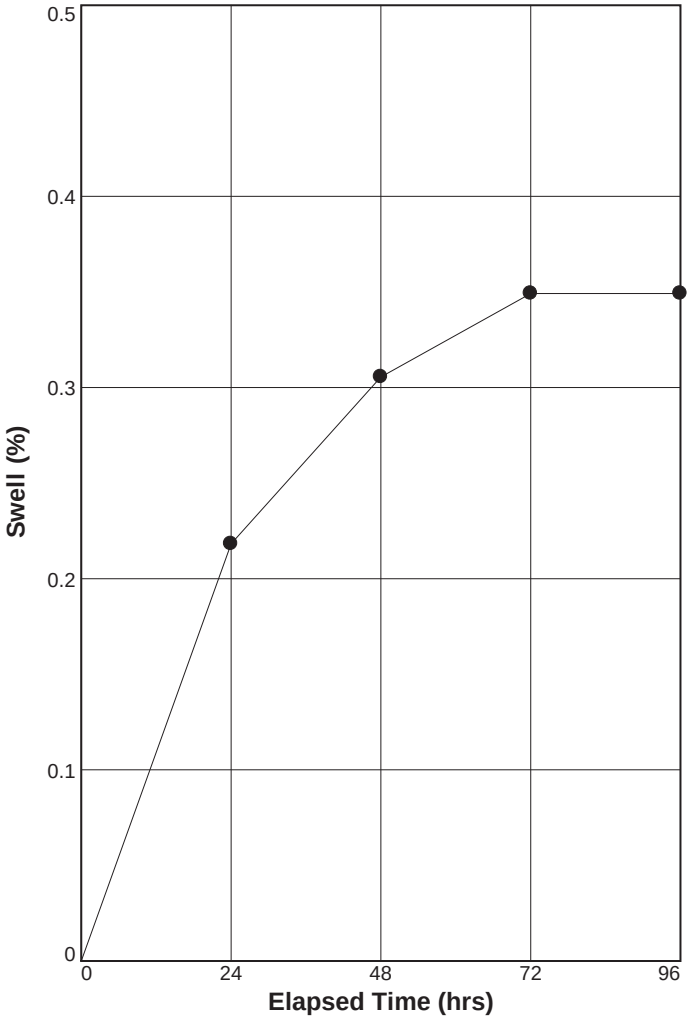
Figure

BEARING RATIO TEST REPORT
ASTM D 1883-07





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	87.0	95.2	33.3	86.7	94.9	33.7	3.4	2.9	0.000	15	0.3
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
brown FAT CLAY with sand	CH	91.4	29.9	74	45

Project No: LX140194

Project: FPB Administration Building - Frankfort, Kentucky

Source of Sample: Borings **Depth:** 2.0-4.0

Sample Number: Bulk

Date:

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Test Description/Remarks:

Figure _____

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.

Rock Classification: Rock classifications provide a general guide to the engineering properties of various rock types and enable the engineer to apply past experience to current situations. In our explorations, rock core samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The rock cores are classified according to relative hardness and RQD (see Guide to Rock Classification Terminology), color, and texture. These classification descriptions are included on our Test Boring Records.

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.

Percent Finer Than 200 Sieve: Selected samples of soils are washed through a number 200 sieve to determine the percentage of material less than 0.074 mm in diameter.

Rock Strength Tests: To obtain strength data for rock materials encountered, unconfined compression tests are performed on selected samples. In the unconfined compression test, a cylindrical portion of the rock core is subjected to increasing axial load until it fails. The pressure required to produce failure is recorded, corrected for the length to diameter ratio of the core and reported.

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 three alternate methods.

Test	Method	Hammer Wt./Fall	Mold Diam.	Run on Material 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 Material 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.

Laboratory California Bearing Ratio Tests: The California Bearing Ratio, generally abbreviated to CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil. The CBR is used with empirical curves to design pavement structures.

A laboratory CBR test is performed according to ASTM D 1883. The results of the compaction tests are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.58-inch-thick disc of compacted soil that is confined in a cylindrical steel mold. The sample is compacted in accordance with Method C of ASTM D 698 or D 1557.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inch per minute to a depth of 0.5 inch to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1 inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth. Test results are typically shown graphically.

August 11, 2014

Frankfort Plant Board
317 West Second Street
P.O. Box 308
Frankfort, KY 40602

ATTN: Ms. Sharmista Dutta, PE
E: sdutta@fewpb.com

COPY: Mr. Aaron Nickerson, AIA
E: ANickerson@grwinc.com

Subject: **Geotechnical Report - Addendum 1**
FPB Administration Building
Frankfort, Kentucky
CSI Project No. LX140194

Dear Ms. Dutta,

Consulting Services Incorporated of Kentucky (CSI) is pleased to provide the following additional geotechnical data and research in support of the above referenced project. This report serves as an addendum to our previously issued *Geotechnical Engineering Report, FPB Administration Building*, dated July 22, 2014 (CSI Project No. LX140194). This addendum and information contained herein are considered part of, and should be attached to, our geotechnical report for the project. All recommendations, opinions and limitations contained in the original geotechnical report that are not specifically addressed in this addendum remain valid.

Project Information and Findings

We understand that the design team is concerned about previous limestone quarries in the project site vicinity. The purpose of this addendum letter is to present our research and findings based on our review of publicly available records and conversations with knowledgeable personnel in the industry. The following paragraphs present our results and references.

Based on our review of the Kentucky Geological Survey's (KGS) online mapping system (kgs.uky.edu), the limits of the closest limestone quarry, are approximately 1.2 miles south of the project site. Figure 1, on the following page, depicts the project site in reference to a mapped limestone quarry.

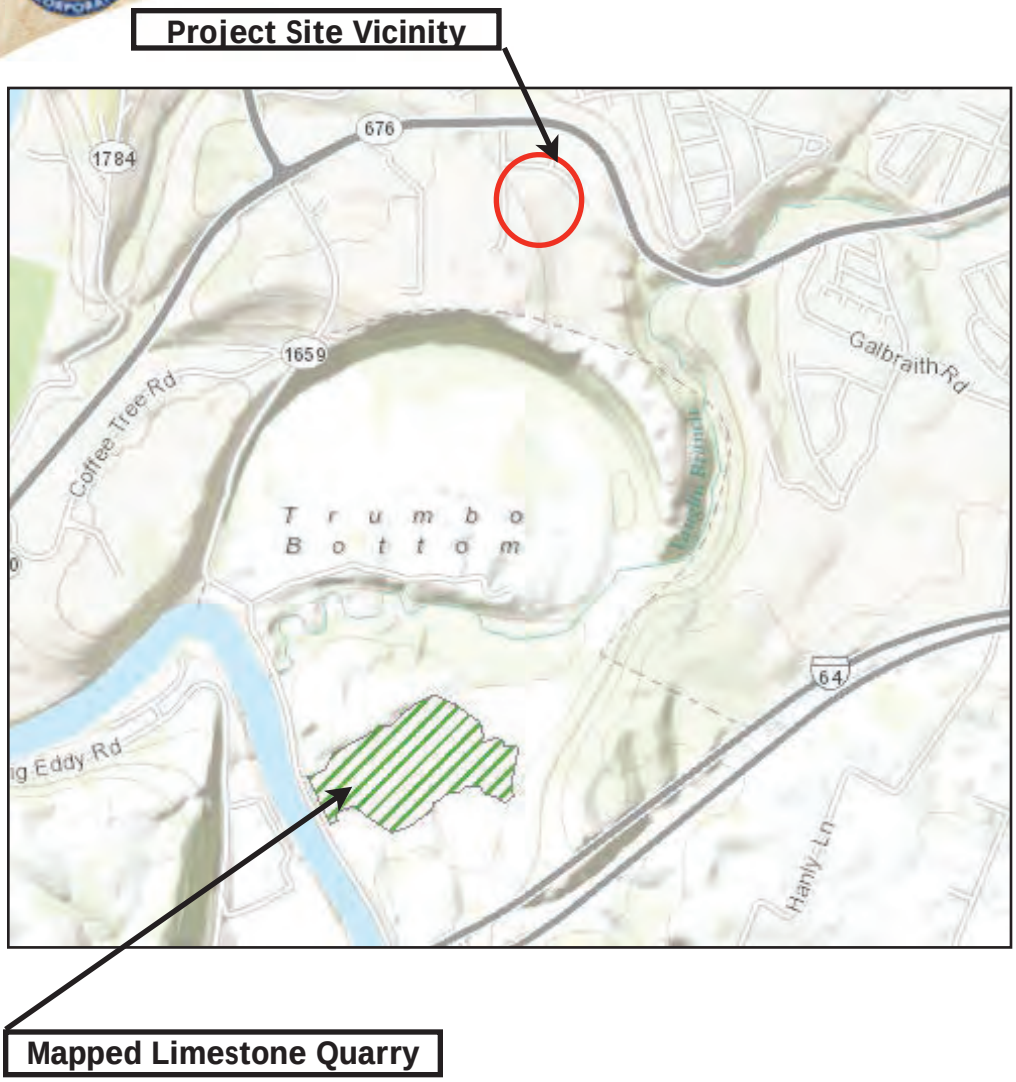

Figure 1: Mapped limestone quarry from KGS online mapping

In addition to our research, we also contacted Mr. David Harrod with Harrod Concrete and Stone Company. Mr. Harrod has extensive knowledge of limestone quarrying operations and their history in Franklin County, Kentucky. According to Mr. Harrod, no previous limestone quarrying operations were performed in the immediate vicinity of this project site.

Based on the information presented above in this addendum letter, we generally conclude that underground limestone works do not exist at this site and are not a geotechnical concern for the proposed building design and construction.

Closure

We appreciate the opportunity to provide our geotechnical services to you and the design team. Please do not hesitate to contact us for questions or comments about the information contained herein.

Cordially,

Consulting Services Incorporated of Kentucky,

Christopher L. Yohe, PE
Senior Engineer

STATE OF KENTUCKY
BRUCE L. HATCHER
14,527
LICENSED PROFESSIONAL ENGINEER
8-11-14

Bruce L. Hatcher, PE, SI
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