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SOLID GROUND
CONSULTING ENGINEERS, PLLC
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April 4, 2017

Ms. Michelle Kosieniak
LFUCG Division of Parks and Recreation Planning and Design
469 Parkway Drive
Lexington, Kentucky 40504

C/C: Mr. Lee Sims, Sheridan L. Sims/Architect PSC

Subject: **Report for Geotechnical Exploration**
Cardinal Valley Community Care Addition
Lexington, Kentucky
17-0151

Dear Mr. Kosieniak,

Solid Ground Consulting Engineers, PLLC (Solid Ground) is pleased to present our Report of Geotechnical Exploration. This report is for the proposed Valley Community Care Addition in Lexington, Kentucky. This report is prepared in general accordance with our Proposal Number 17-022, dated March 8, 2017.

This report contains our findings and recommendations for the referenced project detailed above. Once completed, it is recommended that Solid Ground have the opportunity to review plans and specifications. In addition, it is our understanding that Solid Ground will be retained to perform observations during earthwork, foundation slab on grade operations with respect to the recommendations detailed in this report. Solid Ground will not be held responsible for interpretations and field observations made by others.

We appreciate the opportunity to provide our consulting services to you. We look forward to working with you on this and future projects.

Sincerely,
SOLID GROUND CONSULTING ENGINEERS, PLLC

STATE OF KENTUCKY
AARON BLAKE DAVIS
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LICENSED PROFESSIONAL ENGINEER

Aaron "Blake" Davis, MSCE, PE
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Project Information

Purpose and Scope of Services

The purpose of this subsurface exploration was to prepare recommendations for foundation and for the proposed new development. Our scope of services included exploring the subsurface conditions by using a trackhoe to perform test pits to refusal or 10 feet, whichever is achieved first, at each proposed pit. More specifically our scope included the following:

- A discussion of site surface conditions.
- A discussion of subsurface conditions encountered as well as a discussion of the published geologic conditions at the site.
- A summary of field and laboratory testing results including a brief review our test procedures.
- Test Pit logs will be summarized in the report and listed in the appendix.
- A discussion of specific geotechnical conditions and concerns which may affect the design or construction of the project.
- Recommendations for site preparation and construction of compacted fills.
- Recommended general design and construction criteria for the project foundations.
- A recommendation for seismic site class according to International Building Code which was adopted by the 2013 Kentucky Building Code (KBC).
- A brief review of our test procedures and the results of all testing conducted.

Project Description

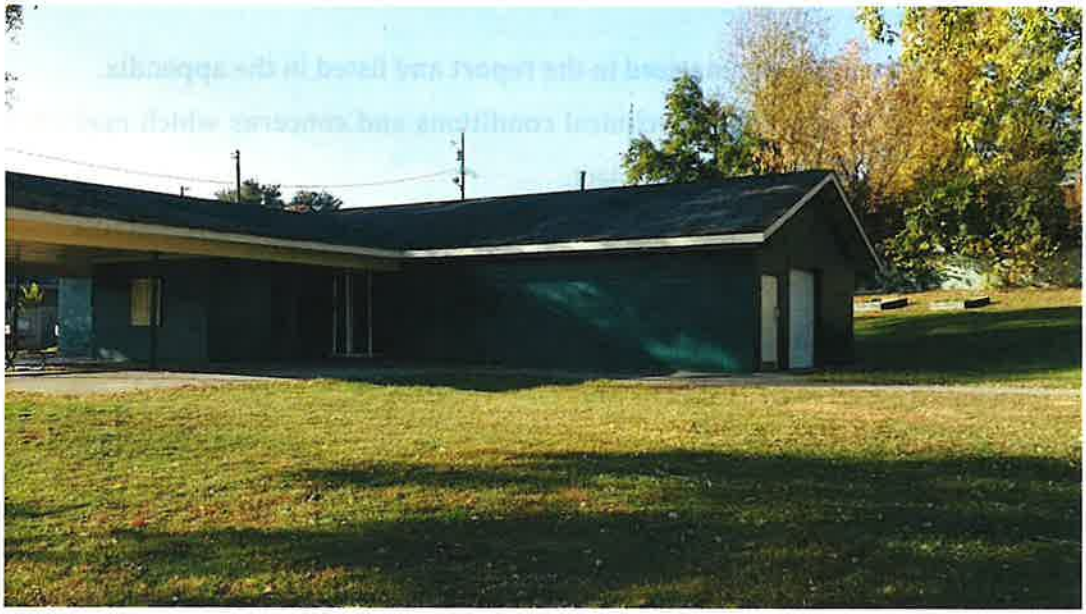
Project information was provided by Mr. Lee Sims, Architect of Record. It is understood that the proposed structure will have an approximate footprint of 35 feet by 45 feet. The project will consist of a single story structure utilizing a wood framed members bearing upon a conventional shallow spread footing system. Column footing loads are not known at this time, but are expected to be light due to the anticipated design of this structure. Column footing loads are anticipated to be less than 25 kips and continuous footings less than 3 kips per linear feet. Minimal earthwork operations are anticipated for this addition.

Site Conditions

Mr. Tim McClure directed by Mr. Blake Davis, PE, of Solid Ground, visited the site on March 22, 2017, to observe conditions, to help interpret the subsurface data and to detect conditions which could affect recommendations.

The site is located along Cambridge Drive in Lexington, Kentucky. The site is bounded by Cambridge Drive to the south and Alexandria Drive to the west. A sports baseball field is located along the north side of the proposed development.

The site is considered to be generally level with ankle high grass. Based on visual observations, the subgrade appeared to be in good condition without obvious indications of standing water or obvious soft subgrade. Site drainage appeared to be adequate. The subgrade appeared to be in good condition.



Photograph 1 – Facing Proposed Development

Subsurface Findings and Conditions Encountered

Published Geological Information

Geologic information was referenced from the Geologic Maps of the Lexington West quadrangle, Fayette and Scott Counties, Kentucky, from the Kentucky Geological Survey (KGS). Materials underlying the site are classified as the Cane Run Bed and Grier Limestone Member. The limestone for both units are light gray to light brownish gray to medium dark gray.

The KGS maps for Karst potential and for closed depressions were reviewed. The KGS indicates the property is of high karst potential. If Karst is encountered during earthwork operations, we should be contacted to provide recommendations for repair.

Subsurface Exploration Program

A trackhoe was utilized to excavate test pits to explore the site subsurface conditions. It should be noted that each test pit was backfilled and compacted with the onsite material with the bucket in approximately 2 foot lifts after completion. The individual Test Pit Logs attached to this report provide specific details at the test pit locations.

A total of two test pits were excavated approximately within the footprint of the structure. Mr. Tim McClure directed the exploration operations. The corners of the building were visually identified in the field, and their location should be considered as approximate in regard to the site civil drawings. The stratification lines shown on the Test Pit Logs represent the approximate boundaries between the soil types. It should be noted that the subsurface conditions will vary between test pits and the representative profile is based upon the number of test pits performed during the field operations.

During the test pit exploration, empirical soil strength values were obtained by using a geoprobe rod. The soil samples were visually classified by Mr. McClure according to Unified Soil Classification System (USCS, ASTM D2487).

It should be noted that an abandoned underground utility line was encountered in Test Pit TP-2 at approximately 3 feet from existing grade.

Subsurface Conditions

The following provides a summary of conditions encountered during our test pit exploration.

Topsoil – Approximately 8 inches of topsoil was observed from existing grade. It should be noted that topsoil depths could fluctuate at varying locations at this project site.

Natural/Residual Soil – The test pits encountered natural residual soil from below the topsoil to refusal (Test Pit TP-1 at ~8 feet) or termination depths (Test Pit TP-2 ~9 feet). The soil is characterized as lean clay underlain by lean to fat clay. Dynamic Cone Penetrometer Test N-values indicate stiff clay consistency.

Refusal Materials - Excavator refusal was encountered in Test Pit TP-1 at approximately 8 feet from existing grade. Based on visual observations, the refusal material consisted of limestone bedrock. It should be noted that without performing rock coring, it cannot be determined the competency of the bedrock, characteristic, or valid refusal.

The following table summarizes refusal or termination depths of each test pit.

Table 1 – Test Pit Information

Test Pit Number	Excavator Refusal (ER) or Excavator Termination (ET)	Excavator Refusal or Excavator Termination Depth (ft.), approximate
TP-1	ER	8 feet
TP-2	ET	9 feet

For details of subsurface conditions encountered at a particular test pit location please refer to the test pit logs contained in Appendix of this report.

Groundwater

Groundwater was not encountered during our exploration. Free groundwater levels fluctuate with seasonal weather conditions and may vary. Therefore, the test pits may not be representative of the actual free water levels. To achieve an accurate measurement of free groundwater levels, water wells or piezometers should be installed.

If groundwater is encountered during construction, Solid Ground should be contacted.

Geotechnical Concerns and Construction Considerations

Based on the results of our test pits and our understanding of the proposed project, we believe the project site is generally suitable for the proposed development. However, some concerns exist with the subsurface conditions as discussed below.

Undocumented Underground Utilities

As previously mentioned, an undocumented underground utility line was encountered during the test pit exploration. Construction plans should adequately address the possibility of encountering buried underground utilities that have not been identified prior to earthwork.

Topsoil

The test pits encountered approximately 8 inches of topsoil. It should be noted that topsoil depths could fluctuate at varying locations at this project site. Construction plans should adequately address the concern of topsoil depths that extend to greater magnitudes than that which was encountered during our exploration.

Soil Plasticity

The subsurface soils and onsite borrow material is field classified as having lean to fat clay. Fat clays are known for their high plasticity characteristics. These soils are subject to volume changes with fluctuations in moisture content. The soils are also known to have strength loss with increases in moisture content. The recommendations for the slab on grade and foundations should be followed. To mitigate the risk of shrink and swell potential, the following can be followed:

- Improved site drainage to minimize exposure of these soils to moisture fluctuations, especially near building foundations and slab on grade.
- Minimize exposure of these soils to excessive wetting or drying.
- Increase slab on grade subbase granular thickness.

Karst Topography

As previously stated, the Kentucky Geological Survey rates the site with a high risk of sinkhole development with a mapped sinkhole in the nearby vicinity. Based on our observations, we do not believe the risk of sinkhole development at this site is any greater than the surrounding area which is highly developed.

We should be contacted if a solution feature or other Karst features are encountered during construction. Repair methods of sinkholes and other Karst features exist. When sinkholes are encountered, the common practice is to excavate the soil from within the solution feature down to hard bedrock. The two most common methods of remediation are a concrete plug or an inverted filter.

Please note, the owner could reduce sinkhole risk at the site with a geophysical study to profile the subsurface to identify possible Karst features. In addition, in depth geotechnical drilling can be performed to further characterize the subsurface soils and bedrock profile.

Site Drainage

Past experience has shown that clay soils are prone to degradation during wet periods of the year and/or under heavy traffic. Surface and ground water should be controlled while the subgrade soils are exposed and use only enough compactive effort to achieve stability and job site requirements for compaction.

The final grade should be sloped away from the structure a minimum of two percent to promote positive drainage. Roof drains and foundation drains should be installed and should discharge surface runoff away from the structure to provide positive site drainage. It should be noted that drainage should be designed and constructed without impacting neighboring properties. Drainage design is beyond our scope of work.

Please note, if positive dewatering methods are not continually applied and maintained, the potential of sinkhole development is greatly increased.

Stability of Existing Structure

It is anticipated that foundations for the proposed building will be installed in close proximity to some of the existing structure. The constructions plans should address the potential of undermining of the existing footings during construction of the proposed structure.

Please note, one possible option to help prevent undermining of the existing foundation is to provide temporary support system such as push piles. If requested, Solid Ground can provide a design for this support.