SUBSURFACE INVESTIGATION, SOIL ANALYSIS AND FOUNDATION DESIGN RECOMMENDATIONS

FOR

Quail Creek Plat 8

Columbia, Missouri

PREPARED FOR:

Ms. Kathy Reuter
Green Meadows Property, LLC
5809 Morning Star Ct.
Columbia, MO 65203

APRIL 3, 2023

PREPARED BY:

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April 3, 2022

Ms. Kathy Reuter
Green Meadows Property,
LLC 5809 Morning Star Ct.
Columbia, MO 65203

RE: Geotechnical Engineering
Quail Creek Plat 8
Columbia, Missouri

Dear Ms. Reuter:

We have conducted a subsurface investigation and evaluated subsurface conditions for the above referenced project. The following report includes the results of the investigation, evaluation of existing site conditions, and our recommendations regarding foundation design and construction considerations.

We appreciate the opportunity to assist you on this project and anticipate inquiries during the design phase. We stand ready to assist during the design phase and through construction with a full range of construction-oriented engineering, surveying, and laboratory services. If we can be of further assistance, please do not hesitate to contact us.

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Enclosures
cc: Reuter

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1 EXECUTIVE SUMMARY

A subsurface investigation has been performed for the proposed development of Quail Creek Plat 8 in Columbia, Missouri. The project site is in the western part of the city and is bordered to the north, south, and west by single family housing and to the east by Louisville Park. The project is located on the south side of West Smith Dr. and on the west side of Louisville Dr.

The property is expected to be sub-divided into four lots for single family homes. Site improvements are expected to include building pad grading, construction of driveways, and possibly retaining wall construction. While the grading plans have not been completed, finished floor elevations of the homes are anticipated to be close to existing elevations. Isolated column loads are not expected to exceed 50 kips and wall loads are not expected to exceed 3,000 pounds per lineal foot (plf).

A total of 27 borings were planned for this investigation. Seven boring locations included rock core sampling, and 7 boring locations were used to help determine top of rock elevation using rock probes. Subsurface soils were consistent throughout the site. The borings revealed clay-rich soils underlying a thin layer of topsoil at all boring locations. The soils encountered consisted of silty clay with varying amounts of sand and gravel, described as tan, brown, gray and reddish brown in color, damp to moist, and firm to hard in consistency. Sand, gravel, and cobble content increased with depth. Borings B3, B10, B12, B13, and B24 were terminated in the clay-rich soils. Limestone bedrock was encountered at a depth as shallow as 11.2 and as deep as 33.5 feet below existing grade in borings B2 and B25, respectively. All borings, other than those five borings terminated in clay-rich soils, were terminated in the limestone bedrock.

The Karst geology of the area resulted in several sinkholes being present on the property (see attached sinkhole exhibit). Sinkholes require special considerations and will limit the development of the site. Sinkholes are created when groundwater erodes the bedrock and creates voids. Overlying soils will become unstable and collapse, filling the voids it the bedrock and forming a sinkhole. Existing sinkhole stability and future sinkhole activity is very hard to predict, however, they can be limited. Controlling water runoff is the primary consideration for reducing the likelihood of future activity and surface subsidence. Any development on a site with Karst geology should reduce or eliminate surface runoff into sink areas. Additionally, maximizing the distance between new construction and known sinkholes, along with limiting fill placement within a sink area, will help to limit the probability of future activity. We do not recommend construction activities go beyond the of the “Possible Build Area” boundaries as shown in the *Sinkhole Exhibit* attached to this report. More information on sinkhole evaluation can be found in section 8.2 of this report.

Analysis of the subsurface soils indicates that a spread footing foundation system is suitable for the proposed structure. Maximum net allowable bearing capacity for shallow isolated and continuous footings is 3,000 pounds per square foot (psf). Settlement is estimated to be on the order of one inch with less than one half inch of differential settlement. Additional information for slab on grade, pavement and retaining wall design recommendations are also provided later in this document.

The exploration and analysis of the foundation conditions are considered to be in sufficient detail and scope to form a reasonable basis for design. The recommendations submitted are based on the results of our geotechnical investigation and analysis, and the typical loading information for single family homes.

This summary should be used in combination with the complete report for design considerations. Additional information and details on the investigation and recommendations, not mentioned in this

summary, are contained within the report. This summary should be used in combination with the complete report for design considerations.

2 PROJECT SCOPE

The scope of the investigation included a reconnaissance of the site, a review of all available subsurface data in the vicinity, a subsurface investigation consisting of twenty-seven soil and rock borings to depths ranging from 12.5 to 42.5 feet, laboratory soil testing, and an engineering analysis and evaluation of the foundation materials present at the site.

The purpose of the investigation was to determine the types of subsurface materials present at the site likely to be encountered or affected by the proposed construction; to determine the general engineering characteristics of the various materials; to determine the seismic site class according to the *2018 International Building Codes*; and to provide a basis for recommendations regarding bearing capacity and compressibility of the foundation and subgrade materials.

3 DESCRIPTION OF THE SITE AND PROJECT

3.1 SITE LOCATION

The project site is located in Boone County in the western part of the city of Columbia. The project site is bordered to the north, south, and west by single family housing and to the east by Louisville Park. The project is located on the south side of West Smith Dr. and on the west side of Louisville Dr. Specifically, the site is located at latitude 38.948814 north and longitude -92.411698 west. A vicinity map in included in the appendix of this report

3.2 PROJECT DESCRIPTION

The subject property is expected to be sub-division of the property into four single family lots. Site improvements are expected to include building pad grading, construction of driveways, and possibly retaining wall construction. While the grading plans have not been completed, finished floor elevations of the homes are anticipated to be close to existing elevations. Isolated column loads are not expected to exceed 50 kips and wall loads are not expected to exceed 3,000 pounds per lineal foot (plf).

3.3 SITE DESCRIPTION, TOPOGRAPHY, AND DRAINAGE

The project site has been modified by man. Trees have been removed from the property and several grading changes have been implemented in order to improve runoff into the northern pond.

The site can best be described as rolling hills, sloping gently in all directions from high points near the northwest corner of the property, near the northeast corner of the property, and near the south-central part of the property. There is an estimated 25 feet of total vertical relief across the site. Site drainage is handled by a combination of infiltration and runoff into the two existing ponds as well as several sinkholes or disappearing streams.

4 GEOLOGY OF AREA

4.1 GENERAL

The following summary of geologic information is from A. G. Unklesbay found in *Geology of Boone County,* 1952. Boone County, Missouri lies near the southern terminus of the Dissected Till Plains Physiographic Providence. The geology of the area is characterized by dissected Pleistocene age glacial drift that unconformably overlays Mississippian aged limestone.

4.2 LOESS

A clayey silt to silty clay blanketed Boone County at one time. Over large areas, especially in the northwestern and eastern parts of the county, the cover of loess has been removed by erosion. This material was present on the project site. These soils are typically variable in strength and consolidation characteristics. Loess is a windblown soil with variable proportions of clay, silt, and fine sand. Shear strength and compressibility of loess is generally low to moderate but may vary dependent upon site specific conditions.

4.3 PLEISTOCENE GLACIAL DEPOSITS

Almost all of Boone County was covered by glacial material in recent geologic time. Glacial till is typically a heterogeneous mixture of silty or sandy clay with fine sand to boulder sized inclusions in the soil matrix. Pockets, or "lenses", of nearly clean sand may also be found in this till. These soils are typically moderately to highly overconsolidated and exhibit high shear strengths and low compressibility under low to moderate foundation loads. This material was encountered in several of the borings.

4.4 PENNSYLVANIAN DEPOSITS

Pennsylvanian rock composed of mainly shale with some sandstone, coal, and minor amounts of interbedded limestone occurs erratically in the Columbia area. These deposits are thickest where they unconformably overlie depressions and valleys in the underlying Mississippian surface. This material was encountered in twenty-two of the twenty-seven borings.

4.5 MISSISSIPPIAN LIMESTONE AND DOLOMITE

Underlying the Pennsylvanian deposits is Mississippian aged bedrock. The principal bedrock formation is the Burlington limestone. The limestone generally has a fine crystalline structure and is medium to massively bedded in the region. The inclusion of chert is quite common. This formation typically exhibits high shear strength and low compressibility characteristics. The Burlington formation can be heavily characterized by karst features, including pinnacles, caves, sinkholes, and filled sinks. A review of available data indicates that three know sinkholes exist on the project site. One boring was confirmed to have been extended to this material.

Future sinkhole activity is difficult to predict. Sinkholes and caves in this area are in various stages of development and can appear at any time. Activities of man, both on the site and off, can alter surface drainage and other site conditions. These activities could accelerate the development of caves and sinkholes in areas with no evidence of this activity. See section 8.2 for more information about sinkhole activity.

5 FIELD INVESTIGATION

Field investigations consisting of a site reconnaissance, a review of subsurface records for the area, and the drilling of twenty-seven (27) soil and rock borings performed between November 28th and December 1st, 2022. The field investigation and the site reconnaissance were performed in accordance with procedures outlined in ASTM D420.

5.1 DRILLING

The 27 borings were advanced to depths ranging from 12.5 to 42.5 feet. All drilling was powered with a track mounted CME® drill rig using a carbide tipped finger bit and a two-inch diameter core barrel in the rock stratum. Rock core samples were taken at borings B2, B5, B7, B15, B16, B21, and B26. Boring locations are shown on the boring plan included in the Appendix of this report. Disturbed samples were obtained from auger cuttings or using a split-barrel sampler in accordance with ASTM D1586. Undisturbed samples were obtained using 3-inch O.D. thin-walled sampling procedures in accordance with ASTM D1587.

Drilling was monitored by an engineer from this firm. The engineer provided technical direction, logged the borings, performed field tests, and prepared and transported the samples to the laboratory for testing.

5.2 FIELD TESTS AND MEASUREMENTS

Boring locations were selected based on preliminary discussions with the owner. Locations were laid out by means of a handheld GPS and later collected, along with ground surface elevations, by a survey crew from this firm. Boring locations are assumed correct to within ± 1.0 feet and elevations are assumed correct to ± 0.5 feet. Field observations are detailed in the boring logs included in the Appendix of this report.

6 LABORATORY INVESTIGATION

In conjunction with the field investigation, a laboratory investigation was conducted on the sampled materials to determine the engineering properties needed to analyze and predict foundation and subgrade performance. The laboratory investigation included supplementary visual classification, water content tests, unconfined compressive strength tests, dry unit weight measurements and Atterberg limit tests. All tests were performed by this firm in accordance with appropriate ASTM procedures in an ACOE accredited lab. Results may be found in the Appendix of this report.

Laboratory tests performed on soil samples retrieved during the field investigation provided a range of results. The natural moisture contents of the soils were found to range from 17 to 25 percent. The dry density of the undisturbed samples ranged from 93 to 109 pounds per cubic foot (pcf). The cohesion, as measured in the unconfined compression test, was found to range from a low of 0.7 tons per square foot (tsf) to a high of 1.9 tsf. The Atterberg liquid limits ranged from 35 to 64 percent while the plastic limits ranged from 17 to 19 percent, giving plasticity indices from 16 to 45. This indicates the tested soils have a moderate to high plasticity.

7 SUBSURFACE CONDITIONS

7.1 GENERAL

The materials encountered during the subsurface investigation were visually classified according to ASTM D2488. The materials encountered during the field investigation are described in detail in Boring Logs included in the Appendix of this report. The stratification lines represent approximate boundaries, and the transition may be gradual.

7.2 DESCRIPTION OF SUBSURFACE MATERIALS

Subsurface soils were fairly consistent throughout the site. The borings revealed clay-rich soils underlying a thin layer of topsoil at all boring locations. The soils encountered consisted of silty clay with varying amounts of sand and gravel, described as tan, brown, gray and reddish brown in color, damp to moist, and firm to hard in consistency. Sand, gravel, and cobble content increased with depth. Borings B3, B10, B12, B13, and B24 were terminated in the clay-rich soils. Limestone bedrock was encountered at a depth as shallow as 11.2 and as deep as 33.5 feet below existing grade in borings B2 and B25, respectively. All borings, other than those five borings terminated in clay-rich soils, were terminated in bedrock.

The seven rock core sample locations revealed Pennsylvanian aged limestone underlain by Mississippian aged limestone. In general, the Pennsylvanian limestone was described as beige in color and contained varying quantities of chert inclusions, clay seams, and was often interbedded with shale. The Mississippian limestone was described as beige and light gray in color with medium to course crystalline structure, healed fractures, and thin beds of shale and sandstone. Borings B7, B16, B21, and B6 were terminated in this stratum. Shale and clay rich soils were found at depths between 25.5 and 39.8 feet in borings B2, B5, and B15 underlying the Mississippian limestone. It is believed that this material has filled the subsurface voids that are the cause of the sinkholes on this site.

7.3 UTILITIES

No underground utilities were marked within the potential building locations at the time of the field investigation. Existing utilities primarily ran along the right-of-way of Smith and Louisville Drives. The utility backfill may contain material that is unsuitable for use under the proposed structures and would need to be replaced with engineered fill, per the recommendations of this report.

7.4 GROUNDWATER

Groundwater was not encountered in any of the borings and is not expected to affect construction. The exact location of the groundwater surface should be expected to fluctuate depending on normal seasonal variations in precipitation and other climatic conditions, surface runoff, permeability of onsite soils, continuity of pervious material, and other factors.

8 ENGINEERING ANALYSIS AND RECOMMENDATIONS

8.1 GENERAL

The engineering analysis and recommendations which follow are based upon the results of a geotechnical investigation, analysis, and the preliminary design information for the proposed buildings. If the project scope is altered appreciably or differing geotechnical conditions are encountered than those noted in the Boring Logs, a review of the changes or conditions is recommended to determine their impact upon design.

Shallow spread footings may be used to support the proposed structures. It is recommended that a qualified geotechnical engineer observe all bearing surfaces immediately after excavation and prior to concrete placement to verify the suitability of the bearing surface and bearing material.

8.2 SINKHOLE EVALUATION

8.2.1 General Sinkhole Information

Boone County is located in the Ozark Highlands physiographic region. The bedrock in this region consists of Mississippian aged limestone, which is highly susceptible to solution weathering. This type of geography is commonly referred to as “Karst” and is characterized by features including pinnacles, caves, sinkholes, losing streams, springs, and filled sinks. These features are caused by erosion along bedding planes and fractures within the bedrock where water dissolves the limestone and creates voids and channels. In time, these voids can collapse, and the overburden material may fall in and fill the holes. Future sinkhole activity is difficult to predict. Sinkholes and caves in this area are in various stages of development and can appear at any time. Activities of man, both on the site and off, can alter surface drainage and other site conditions. These activities could accelerate the development of caves and sinkholes in areas with Karst geology. Any construction activity in Karst topography is accompanied by some degree of risk for future soil erosion and ground subsidence that may affect the stability of structures built on this site.

8.2.2 Existing Sinkholes

A review of available information at the All Things Missouri website indicates that three know sinkholes exist on the project site. Observations of the site by our engineers have confirmed the existence of the sinkholes along with several others. See the Sinkhole Map attached in the appendix of this report for sinkhole locations on the site. It is believed that the sinkholes along the norther boundary of the site, along Smith Dr. and the northern end of Louisville Dr., are connected to one another. It is our opinion that future sinkhole activity or changes to the existing sinkholes in this area is highly likely to occur.

8.2.3 Risk Mitigation

As previously noted, any construction activity in Karst topography is accompanied by some degree of risk for that may affect the stability of structures built on this site. In order to reduce the likelihood of future sinkhole activity, changes to the existing topography of the site that may alter the flow of water into the existing sinks should be minimized. Site grading plans should account for the increase in stormwater runoff that is caused by the increase in impervious surfaces associated with site development. Surfaces such as driveway pavement, sidewalks, patios, and roofing will all increase the amount of surface runoff that may run into sink areas. Increased water flow can contribute to movement within a sink. Every effort

should be made to capture all surface runoff and divert it away from the sinks. All work should comply with the Boone County Stormwater Ordinance and the Boone County Stormwater Design Manual.

In addition to limiting surface runoff into sink areas, site grading should also limit the amount of fill material to be placed within the sinks. Adding soils to the surface of a sink will increase the pressure being exerted on any subsurface voids. These addition pressure can cause the voids to collapse and ultimately changes to surface conditions.

Building should be located as for from sinkholes as possible. The risk of damage to a structure due to movement within a sink is reduced as distance from the sink is increased. In consideration of the numerous sink locations on this site, we recommend that structures be constructed within the "Possible Build Areas" shown on the Sinkhole Exhibit attached to this report. While these areas are not immune to future ground surface subsidence, it is our professional opinion that structures built in these areas will carry the least amount of risk for this site.

8.2.3 Utility Considerations

Structures such as homes and outbuildings, along with drives, walkways, and patios are not the only elements of development that are susceptible to damage from future ground movement caused by sinkholes. Utilities are also vulnerable to damage and should have special consideration during design and construction. Damage may include broken or separated pipes, water/sewer leaks, severed power lines, or gas leaks. Constructed of utilities within the sink areas should be minimized.

Along with surface drainage changes, utility construction is a major man-made contributor to sinkhole activity. Severed waterlines or separated storm and sewer pipes can lead to piping within the subsurface soils. Piping is a hydraulic process that leads to the development of sub-surface voids. With time, these voids can connect to existing sinks and contribute to there future development. A reputable contractor should be used to install utilities and all work should be inspected prior to trench backfill.

8.3 Bedrock Quality

Rock Quality Designation (RQD) is a standard index that is used to help classify rock (see table 2). RQD is a ratio of individual rock core lengths to the total length of the sample. This ratio accounts for the fractures and voids, including non-rock material such as clay and sand, within the bedrock to provide a qualitative and quantitative assessment of rock quality. A core sample that consists of solid rock with little fracturing and no voids will have a higher RQD than a core sample that contains highly fractured rock with beds of sand, silt, or clay-rich soils.

Along with bedrock and core sample elevations, Table 1 shows the RQD and percent recovery for each of the seven sampled locations. Bedrock consisting of Pennsylvanian aged shale and limestone was encountered within the upper reached of all seven of the rock core locations. The RQD and recovery values have a wide range for *Core Run 1* of each location, indicating the amount of soil, sand, and shale varied from location to location. This variation or inconsistency is very common in central Missouri and is further described in the boring logs. Mississippian aged limestone was encountered within the cores at borings B2, B5, B7, B16, B21, and B26. This mass formation of limestone typically has less voids and is not as prone to interbedding as the overlying Pennsylvanian bedrock. Recovery and RQD values are higher as a result and is reflected in the table as core depth increases. Of these 6 borings, B7, B16, B21, and B26 were terminated in Mississippian aged massive limestone.

The remaining core locations (B2, B5, and B15) were terminated in shale and clay rich soil material. The RQD values for Boring B2 Core Run(s) 3 and 4, and Boring B15 Core Run(s) 3 and 4 are noticeable lower

than the others. The rock quality designation for these samples is *Poor* to *Very Poor.* It is our belief that these samples, along with the shale at Boring B5 Core Run 4, contained material that filled the voids in the bedrock caused by erosion and resulted in the sinkholes that are on the site. This table was used to help determine the "Possible Build Areas" on the attached Sinkhole Exhibit.

Table 1 – Rock Core Information

Boring	*Core Run*	*Top of Rock Elevation*	*Start Core Elevation*	*Stop Core Elevation*	*Recovery (%)*	*RQD*
B2	1	690.8	690.8	985.8	21.7	7.5
	2		685.8	680.8	83.3	60.0
	3		680.8	675.8	91.7	34.2
	4		675.8	671.8	62.5	22.9
B5	1	677.5	677.5	672.7	93.0	81.6
	2		672.7	667.7	100.0	80.8
	3		667.7	662.7	93.3	93.3
	4		662.7	658.2	70.4	59.3
B7	1	684.6	681.9	676.3	93.3	86.7
	2		676.3	671.3	80.0	59.2
	3		671.3	666.3	93.3	68.3
B15	1	673.5	673.5	669.0	48.1	42.6
	2		669.0	664.0	95.0	95.0
	3		664.0	659.0	5.0	0.0
	4		659.0	654.0	51.7	23.3
B16	1	676.3	676.3	672.1	92.0	65.0
	2		672.1	667.1	85.0	80.0
	3		667.1	662.3	88.3	78.3
B21	1	660.5	660.5	655.5	100.0	93.3
	2		655.5	650.5	93.3	85.0
	3		650.5	645.6	91.5	87.2
B26	1	669.7	669.7	664.9	73.7	54.4
	2		664.9	659.9	98.3	90.0
	3		659.9	654.9	100.0	100.0

Table 2 – Rock Quality Designation

RQD	*Rock Quality*
1.0-0.9	Excellent
0.9-0.75	Good
0.75-0.5	Fair
0.5-0.25	Poor
0.25-0	Very Poor

8.4 Seismic Loading

In the design of the proposed structures the following seismic parameters may be used. These parameters are based on the *2018 International Building Codes* and are site specific.

1.	Site Class	C
2.	Mapped Spectral Response, Short Periods (Ss)	0.158
3.	Mapped Spectral Response, Short Periods (S1)	0.093
4.	Site Coefficient as a Function of Ss (Fa)	1.3
5.	Site Coefficient as a Function of S1 (Fv)	1.5

8.5 Site Grading

Grade work for this project is anticipated to be minimal. Although no grading plans were available at the time of this investigation, we anticipate final grades at building locations will be very close to existing grades.

The boring logs and laboratory tests indicate the presence high plasticity soils at depths of 10 to 13 feet below existing grade. In light of this, we recommend that within the basement building pad, the upper two (2) feet of subgrade consist of a low volume change (LVC) material. Low volume change material may consist of imported soils with a liquid limit less than 50 and plasticity index less than 30 or a granular fill containing sufficient fines to exhibit a definite moisture/density relationship. Some of the on-site soils encountered during this investigation do not meet the requirements of LVC. Imported materials should be analyzed by a qualified geotechnical engineer prior to placement.

Imported fill should be analyzed by the geotechnical engineer as soon as borrow sources are identified to determine suitability and conformance with the qualifications of LVC material. All LVC material should be placed as engineered fill as defined in section 9.5 of this report.

Construction should not begin until all cuts have been completed and fill placed within the plan area of the proposed structures. Prior to the start of construction, it is recommended that all vegetation, debris, topsoil, and other unsuitable materials be removed from the site. Following completion of excavation and stripping, and prior to fill placement, it is recommended that the subgrade be proof-rolled with a rubber-tired piece of heavy construction equipment such as a fully loaded, tandem-axle dump truck to help identify any soft or unsuitable areas. Areas identified as unsuitable should be overexcavated and reconstructed with engineered fill.

8.6 Foundation Recommendations

Preliminary concepts indicate that the property will be sub-divided into four residential lots. Finished floor elevations are expected to be near existing grade. Column and wall loads are not anticipated to exceed 50 kips and 3,000 plf, respectively.

A perimeter foundation drainage system is recommended to discharge accumulated moisture away from the structures. The perimeter drainage system should consist of a perforated pipe bedded and backfilled with free draining aggregate. The free draining aggregate zone should be wrapped in geotextile filter fabric with an apparent opening size (ASTM D 4751) of 70 to 100 and minimum trapezoid tear strength (ASTM D 4533) of 50 pounds. The free draining aggregate should be covered with at least 2 feet of compacted low permeability clay soil. Downspouts and gutters should not be designed to flow into the foundation drain system.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structures.

8.6.1 Shallow Foundations with Slab-on-Grade

The structure may be supported by a shallow foundation system with net allowable bearing pressures of 3,000 psf for isolated and continuous footings. Continuous footings should be a minimum of 18 inches wide and designed to act as grade beams, with isolated footings being at least 36 inches wide. For frost protection, the perimeter foundations should bear at an approximate elevation of 36 inches below adjacent finished grade. Total settlement is estimated to be on the order of one inch or less with approximately one-half inch of differential settlement. Most of the settlement should occur during construction. No rock excavation is anticipated in the construction of a shallow foundation system.

8.7 Radon

The US Environmental Protection Agency lists Boone County as a Radon Zone 2 area, having average indoor radon screening levels between 2 and 4 pCi/L. The average indoor level has recently been determined to be 4.0 pCi/L with 51% of the tests above the 2.0 pCi/L level and 28 % above the 4.0 pCi/L level. This rating is based on indoor radon measurements; geology; aerial radioactivity; soil permeability; and foundation type. Geology, soil permeability and anticipated foundation type are addressed here.

Radon is produced by the radioactive decay of uranium. Significant uranium deposits are not known to exist in Boone County. Radon is often associated with clastic shale and coal formations, which are not found in the project area.

The soils encountered during our site investigation, are considered moderately permeable soils. With reduced permeability, the soils are less likely to form deep cracks due to loss of moisture. Deep cracks and high permeability can contribute to the presence of radon in a structure.

Radon is most commonly encountered in basements. It is heavier than air and can accumulate in higher concentrations in basement construction. It is unknown at the time of this reports if the planned project will include any basement construction.

It is our professional opinion that the geological conditions of the project site are such that radon is not likely to exceed acceptable levels in completed buildings

8.8 Retaining Walls

Any walls subject to unbalanced earth pressure should be designed for earth pressures equal to or greater than those provided on the following table. For the granular or cohesionless backfill values to be valid the "Structural Backfill" zone must extend 45° from vertical from the heel of the retaining structure's foundation. These load distributions do not include a factor of safety or include the influence of hydrostatic pressures on the wall. Surcharge loads above the top of the wall due to vehicles, equipment, structures, or sloped backfill should be considered in the design as well.

EARTH PRESSURE COEFFICIENTS

The below chart is based on these conditions.

- Equivalent Fluid Pressures are based on a unit soil weight of 125 pcf and granular weight of 140 pcf.
- No groundwater is acting on the wall.
- For active earth pressure, wall must rotate at base, top lateral movement should be between 0.002 and 0.004 times the height of the wall (H).
- Surcharge pressure (S) acts at H/2 above the base.
- Backfill is compacted to a minimum of 95% of Maximum Dry Density (ASTM D698).
- Ignore passive pressure in the frost zone.

	Coefficient for Backfill Type	Equivalent Fluid Pressure (psf)	Surcharge Pressure P_1 (psf)	Earth Pressure P_2 (psf)
Active (K_a)	Cohesionless or Granular – 0.30	42	(0.30)S	(42)H
	Low Plasticity Clays (LL<50) – 0.42	53	(0.42)S	(53)H
	High Plasticity Clays (LL≥50) – 0.52	65	(0.52)S	(65)H
At-Rest (K_o)	Cohesionless or Granular – 0.46	65	(0.46)S	(65)H
	Low Plasticity Clays (LL<50) – 0.59	74	(0.59)S	(74)H
	High Plasticity Clays (LL≥50) – 0.69	86	(0.69)S	(86)H
Passive (K_p)	Cohesionless or Granular – 3.4	476	---	---
	Low Plasticity Clays (LL<50) – 2.4	300	---	---
	High Plasticity Clays (LL≥50) – 1.9	240	---	---

A maximum toe pressure of 2,000 psf may be used for design on native and properly placed engineered fill soils. A coefficient of friction 0.4 may be used to calculate sliding resistance. Shallow temporary below grade excavations should be stable long enough to allow for construction of the foundation and walls of the proposed structure. All excavations should be benched, sloped, or shored in accordance with OSHA guidelines. Some sloughing may occur due to weathering and freeze/thaw cycles. Long term excavation slopes and deep excavations should be analyzed prior to construction to ensure that adequate stability is achieved.

9 CONSTRUCTION CONSIDERATIONS

9.1 SITE PREPARATION

Site preparation will primarily consist of stripping topsoil and grubbing. All debris from grubbing activities should be removed from the site. All utility trenches should be backfilled in accordance with appropriate controlled engineered fill specifications. All trench excavations should be made with sufficient working space to permit the placing, inspection, and completion of all work including backfill construction. It is recommended that a representative of the geotechnical engineer be present during fill placement and compaction to assure that adequate compaction is achieved and that proper methods are employed.

9.2 SITE EXCAVATION

General site excavation may be accomplished using earthwork equipment such as dozers, excavators, and scrapers. Depending on final design elevations, rock excavation may be anticipated and encountering large boulders is possible. It is recommended that a unit price for rock and debris removal be established in the contract documents, to address their presence.

In areas where the excavation side wall cannot be sloped to meet OSHA requirements, some form of shoring system will be required. Shoring systems may consist of trench boxes, soldier piles and lagging and sheet piles. The same design parameters presented in the retaining wall section may be used for design of the shoring system.

9.3 SLAB SUBGRADE PREPARATION

The subgrade soils should not be permitted to dry excessively or become inundated prior to or during construction of the floor slab. If subgrade soils are found to be unsuitable or become disturbed by nature or construction activities, these areas should be excavated to a solid base and then regraded with controlled engineered fill.

9.4 FOUNDATION EXCAVATION AND CONSTRUCTION

Foundation bearing surfaces should be free of loose soil and standing water and should be level. Foundation concrete should be placed the same day the foundation is excavated. Deleterious materials or isolated soft spots within the foundation should be overexcavated to suitable base and filled to design bearing elevation with lean concrete.

9.5 CONSTRUCTION FILL AND BACKFILL

Engineered fill is defined as soil or granular fill containing sufficient fines to establish a moisture/density relationship. Engineered fill should be free of frozen soil, organics, rubbish, large rocks, wood, or other deleterious material. Cohesive soils should be uniformly compacted to at least 95 percent of the “Standard” maximum dry density and be within -2 to +4 percent of optimum moisture content as described by ASTM D698. Granular fill, such as MoDOT 1007 Type 1/5, should be compacted to at least 95% of the maximum dry density as determined by the Standard Proctor, ASTM D698. The moisture content should be low enough to prevent undue pumping but no less than 3% below optimum moisture content. Should the results of the in-place density tests indicate that the specified compaction limits have not been achieved, the area represented by the test should be reworked and retested as required until

the specified limits are reached. Proposed fill should be analyzed by the geotechnical engineer as soon as borrow sources are identified to determine suitability and conformance with the following recommendations.

Soil classified as MH, OH, OL, or PT (high plasticity soils and organic soils) by the Unified Soil Classification System (ASTM D 2487) should not be imported for use as engineered fill. Soils that classify as CH should be analyzed and approved by a qualified geotechnical engineer prior to use on site. Limestone screenings or "wastelime" may be used as the low volume change material for slabs-on-grade only when confined within a foundation system and should not be used under paved areas.

The fill material should be placed in layers, not to exceed eight inches in loose thickness, and should be wetted or dried as required to secure specified compaction. Effective spreading equipment should be used on each lift to obtain a uniform lift thickness prior to compaction. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Material that is too wet to permit proper compaction may be stockpiled or spread and permitted to dry assisted by disking, harrowing, or pulverizing until the moisture content is reduced to a satisfactory value. The fill layers should be placed in horizontal lifts. Fill placed on slopes greater than 5H:1V should be benched into the slope to limit the potential of creating a slip plane between the existing soil and the freshly placed fill. The benches should be wide enough to accommodate the construction equipment, horizontal, and should be no more than three feet in height. Rocks and stones that exceed the thickness of the 8-inch loose lift layer should be removed and disposed of off the immediate construction site.

Fill and subgrade construction should not be started on foundation soil, partially completed fill, or subgrades that contain frost or ice. Fill should not be constructed of frozen soil. Frozen soil should be removed prior to placing fill material.

9.6 Climatic Considerations

The on-site soils are relatively sensitive to changes in atmospheric conditions and precipitation. These soils are predominantly clay, sand, and silt, and are subject to high rates of erosion, rapid loss of shear strength upon wetting, and shrink-swell behavior with changes in moisture content. The greatest impact of climatic conditions will occur within the first few inches of exposed soil surface. The contractor should take positive measures to limit erosion of the site following stripping and up to establishment of ground cover or turf. Earthwork operations may be delayed by heavy precipitation at the site

10 Warranties and Limitations

This report has been prepared for the exclusive use of Kathy Reuter, and any consultants for the specific project discussed, in accordance with generally accepted soils engineering practices common to the central Missouri area. No other warranties, expressed or implied, are made.

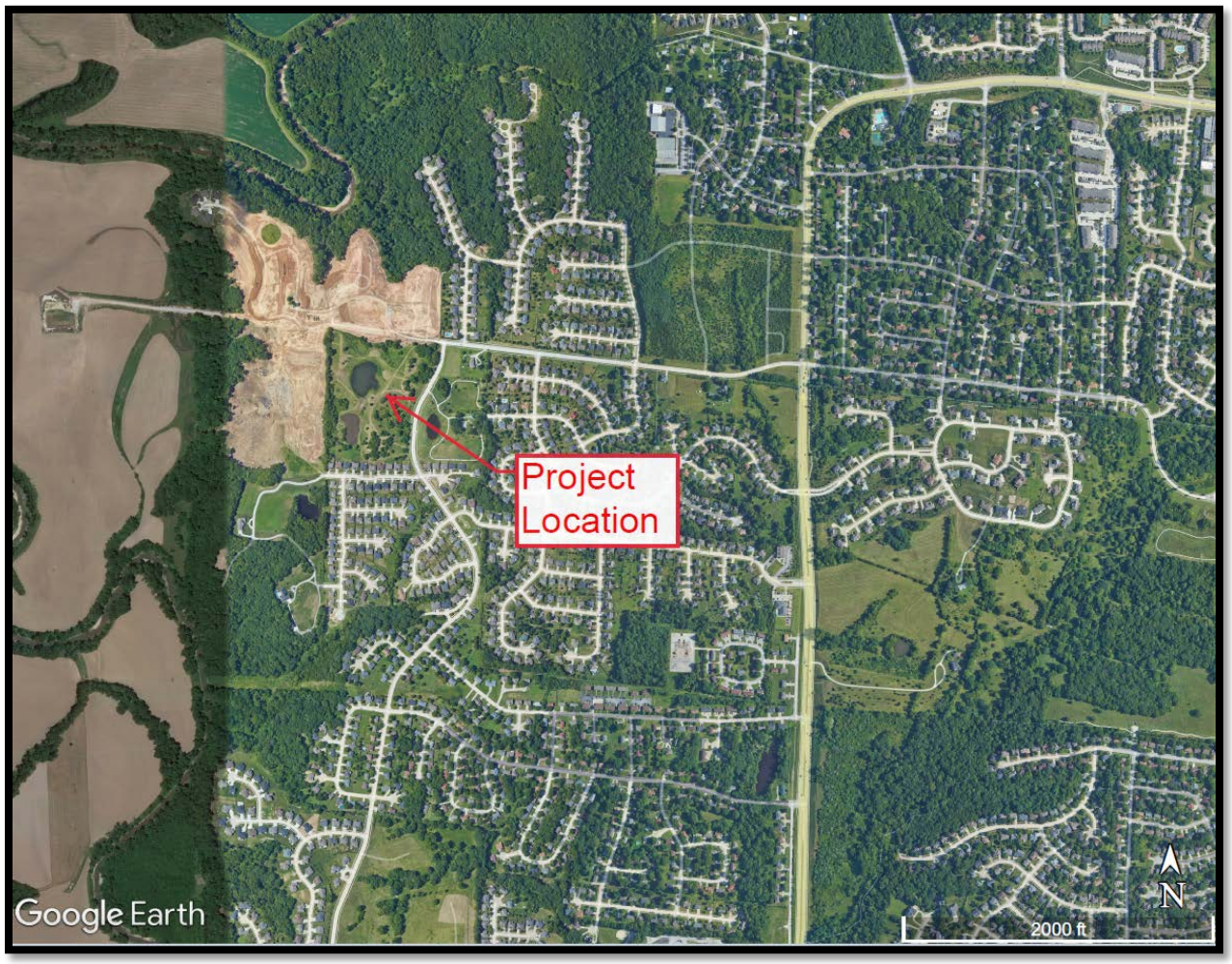
This investigation and report do not constitute a guarantee of subsurface conditions, groundwater conditions, excavation characteristics or construction conditions. We recommend that excavation conditions across the site be evaluated during construction relative to this interpretation of subsurface conditions. Variations in subsurface conditions may occur that require evaluation or revision of geotechnical design parameters or recommendations. If the scope of the project is altered or differing geotechnical conditions are encountered, it would be advisable to review and update our recommendations in consideration of those findings or variations.

Recommendations contained in this report are based on subsurface conditions and proposed designs provided as of this date. The above study and recommendations are applicable only for the conditions and locations described, and for the specific project mentioned. Use of the data contained herein by others may require interpretation or analysis that was not contemplated by our investigation and analysis. The use of this data and any interpretations or conclusions developed by others are the sole responsibility of those firms or individuals.

Factors affecting design and construction often become apparent during detailed design or actual construction that were not anticipated in the pre-design or early design phases. Engineering Surveys and Services is available during design and construction to assist in evaluating these factors and their impact on these geotechnical recommendations.

11 APPENDIX

11.1 VICINITY MAP



11.2 SYMBOLS AND TERMS

LAB NO. *L14846*

PROJECT: *Quail Creek Plat 8*
Columbia, Missouri

SYMBOLS AND TERMS

SAMPLE TYPES

Auger	Shelby Tube	Split Spoon	Giddings Tube	No Recovery	NX Core Boring	Roller Bit (Tri–Cone)	Concrete Corer	Down Hole Hammer

ABBREVIATIONS

⊗	Unconfined Compression (1)
●	Water Content (2)
+	Plastic (PL) & Liquid (LL) Limit (2)
USCS	Unified Soil Classification System
PI	Plasticity Index
ATD	At Time of Drilling
RQD	Rock Quality Designation
SS	Split Spoon – 1 3/8" I.D., 2" O.D.
ST	Shelby Tube – 3" O.D.
PA	Power Auger
HA	Hand Auger
AS	Auger Sample
S	Cuttings Sample
TV	Hand–Held Torvane

DEFINITIONS

Blows per ft.– Indicates blows per 12 inches of sampler penetration when driven by a 140–pound hammer falling freely 30 inches. The Standard Penetration Resistance is the number of blows for the last 12 inches of penetration of the split–spoon sampler.

NOTES

(1) Shear Strength Data plotted on cohesion scale of Boring Logs.

(2) Classification and Index Properties plotted on Water Content Scale of Boring Logs.

LL14846 BORE PLAN.DWG 1/3/2023

11.3 SUMMARY OF LABORATORY TEST RESULTS

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	SAMPLE NO.	DEPTH (FEET)	USCS CLASS	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	ATTERBERG LIMITS LL	PL	PI	UNCONFINED COMPRESSION COHESION (TSF)	STRAIN %	REMARKS
B3	ST1	3.0-5.0	CL	19	93	46	17	29	1.1	1.3	PP = 4.5+; TV = 1.8
	ST2	8.0-10.0		19	103						PP = 3.8; TV = 1.5
	ST3	13.0-15.0	CH	25	99	64	19	45	0.7	1.3	PP = 4.5+; TV = 2.3
B8	ST1	3.0-5.0		17	109				1.5	1.9	
B10	ST1	3.0-5.0	CL	21	101	35	19	16	0.9	1.1	PP = 4.5; TV = 1.3
	ST2	8.0-10.0		20	107						PP = 4.5+; TV = 1.6
	ST3	13.0-15.0	CH	20	109	54	19	35	1.9	4.8	PP = 4.5+; TV = 2.3
B24	ST1	3.0-5.0		20	94				1.8	1.9	PP = 4.5+; TV = 1.6

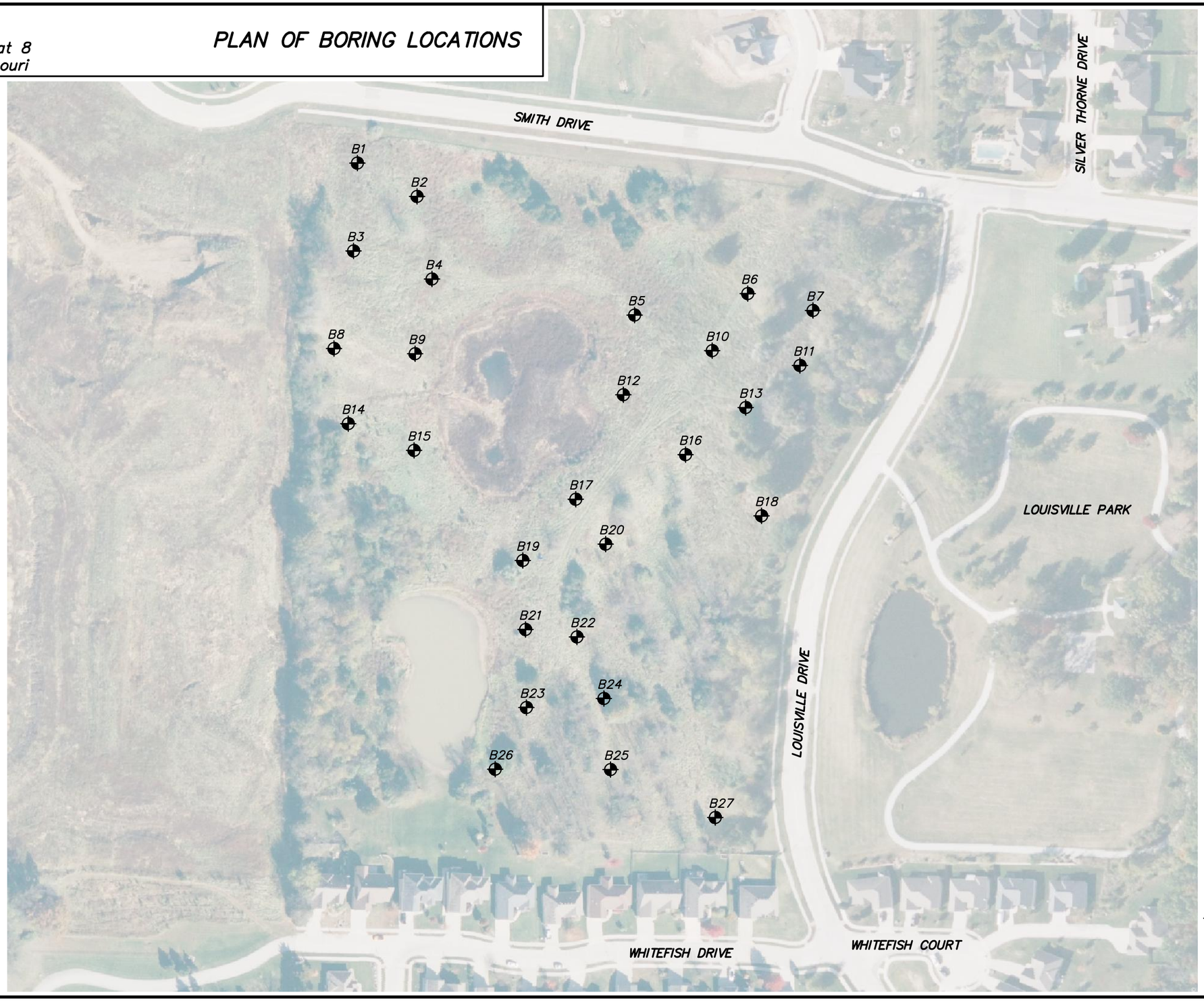
PP=Pocket Penetrometer, TV=Hand Held Torvane

11.4 PLAN OF BORING LOCATIONS

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

PLAN OF BORING LOCATIONS



N

0 150 300

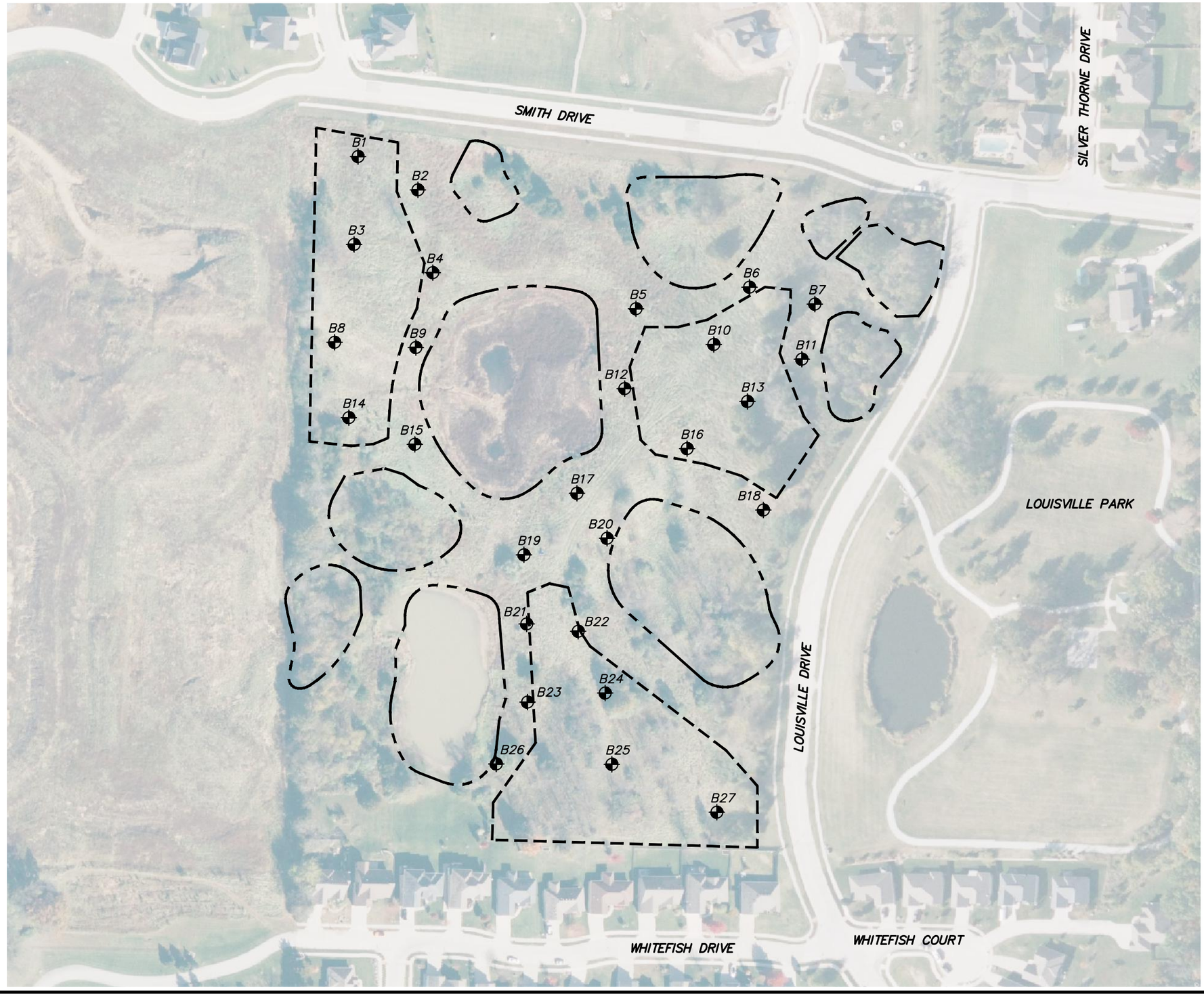
SCALE: 1" = 150'

LEGEND

B1 BORING

Engineering Surveys
& Services

11.5 SINKHOLE EXHIBIT



N

0 150 300

SCALE: 1" = 150'

LEGEND

B1 BORING

SINK AREA

POSSIBLE BUILD AREA

SINKHOLE EXHIBIT

QUAIL CREEK PLAT 8

COLUMBIA, BOONE COUNTY, MISSOURI

MARCH 25, 2023

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11.6 BORING LOGS

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B1

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 709.4'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
2		SILTY CLAY: Tan, moist, firm			
4		-; hard	15		
6					
8		CLAYEY SILT: Brown, moist, firm, w/ chert gravel	12		
10					
12					
14			50/3"		
		LIMESTONE			
		AUGER REFUSAL ON LIMESTONE			
16					
18					
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 14.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

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LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B2

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 702.0'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
		TOPSOIL				
2		SILTY CLAY: Tan, moist, firm				
4		-; stiff	12			
6		-; w/ cobble				
8		SHALEY CLAY: Reddish brown, moist, stiff, trace of sand and lignite	7			
10		-; w/ cobble				
12		AUGER REFUSAL ON LIMESTONE				
14		LIMESTONE: Beige, medium crystalline interbedded w/ clay rich soils				Core 1 (11.2' - 16.2') Recovery = 21.7% RQD = 7.5%
16						
18		LIMESTONE: Beige, medium crystalline w/ some chert inclusions and thin clay seams				Core 2 (16.2' - 21.2') Recovery = 83.3% RQD = 60.0%
20						
22		LIMESTONE: Light gray, medium crystalline				
24		SHALE: Multicolored, limestone stringer				Core 3 (21.2' - 26.2') Recovery = 91.7% RQD = 34.2%
26		CLAY RICH SOIL: Brown w/ sand and limestone stringers and chert inclusions				
28						Core 4 (26.2' - 30.2') Recovery = 62.5% RQD = 22.9%
30						
32						

Completion Depth: 30.2'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B3

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 710.5'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Brown, moist, firm			
2					
		-; hard			
4				CL	93
6					
8		-; stiff			
					103
10					
12					
		-; hard w/ trace of lignite			
14				CH	99
16					
18		SILTY SANDY CLAY: Orangish brown, moist, firm, trace of lignite	7		
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 19.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B4

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 703.7'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2		-; damp, stiff			
4					
6					
8		-; w/ gravel			
10		-; w/ cobble			
12		AUGER REFUSAL ON LIMESTONE			
14					
16					
18					
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 12.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B5

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 700.0'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
0		TOPSOIL				
2		SILTY CLAY: Brown, moist, firm				
4	X	-; tan, stiff	8			
6						
8	X	-; firm	8			
10						
12						
14	X	SILTY SANDY CLAY: Tan and gray, moist, stiff, trace of lignite	13			
16						
18	X	-; reddish brown w/ trace of gravel	5			
20		-; w/ cobble				
22						
24		AUGER REFUSAL ON LIMESTONE				Core 1 (22.5' - 27.3') Recovery = 93.0% RQD = 81.6%
26		LIMESTONE: Beige and light gray, medium crystalline				
28						
30		LIMESTONE: Beige and light gray, medium crystalline, healed fractures, w/ some chert nodules				Core 2 (27.3' - 32.3') Recovery = 100.0% RQD = 80.8%
32						
34						Core 3 (32.3' - 37.3') Recovery = 93.3% RQD = 93.3%
36		-; w/ shale stringers				
38						
40		SHALE: Tan				Core 4 (37.3' - 41.8') Recovery = 70.4% RQD = 59.3%
42						
44						

Completion Depth: 41.8
Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B6

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 697.5'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Brown, moist, firm			
2					
		-; stiff			
4					
6					
8		SILTY SANDY CLAY: Reddish brown, moist, hard	20		
10					
12		-; w/ chert gravel			
14			7		
		-; cobble			
16					
18					
20					
22		AUGER REFUSAL ON LIMESTONE			

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 21.5'
Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B7

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations

SURF. ELEV.: 697.6'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
0		TOPSOIL				
2		SILTY CLAY: Brown, moist, firm				
4		-; tan and gray, damp, stiff, blockey				
6						
8		SILTY SANDY CLAY: Reddish brown, moist, hard, trace of gravel	18			
10						
12		-; w/ limestone stringers				
14			16			
16		AUGER REFUSAL ON LIMESTONE				
18		LIMESTONE: Beige, medium crystalline, healed fractures				Core 1 (15.7' - 21.3') Recovery = 93.3% RQD = 86.7%
20						
22		LIMESTONE: Beige and light gray, medium to course crystalline, healed fractures, chert nodules				
24						Core 2 (21.3' - 26.3') Recovery = 80.0% RQD = 59.2%
26						
28						Core 3 (26.3' - 31.3') Recovery = 93.3% RQD = 68.3%
30						
32						

Completion Depth: 31.3

Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B8

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 701.7'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
		-; hard, blockey			
4					109
6					
8		SILTY SANDY CLAY: Reddish brown, moist, hard, trace of lignite and gravel	16		
10		-; chert gravel			
12		AUGER REFUSAL ON LIMESTONE			
14					
16					
18					
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 12.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B9

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 700.3'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
4		SILTY CLAY: Tan and gray, damp, hard, trace of lignite			
6					
8					
		SILTY CLAY: Reddish brown, moist, hard, trace of gravel and manganese stains	16		
10					
12					
			50/3"		
14		AUGER REFUSAL ON LIMESTONE			
16					
18					
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 14.0'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B10

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 705.9'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
		TOPSOIL				
2		SILTY CLAY: Brown, moist, firm				
4		CLAYEY SILT: Tan and gray, moist, stiff		CL	101	
6						
8					107	
10						
12						
14		SHALEY CLAY: Gray, moist, hard, trace of lignite		CH	109	1.9
16						
18			16			
20						
22						

Completion Depth: 19.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B11

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 700.9'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Brown, moist, firm			
2					
4					
		-; tan			
6					
8					
10					
12					
14					
		-; reddish brown			
16					
18					
		-; w/ cobble			
20					
		AUGER REFUSAL ON LIMESTONE			
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 20.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B12

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 699.8'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY SANDY CLAY: Tan, moist, firm			
2					
		-; reddish brown			
4					
6					
8		SHALEY CLAY: Tan and gray, moist, stiff, trace of lignite			
10					
12					
		SILTY SANDY CLAY: Gray and tan, damp, hard, trace of lignite	27		
14					
16					
18		SILTY SANDY CLAY: Reddish brown, moist, stiff	10		
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 19.5'
Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B13

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 709.8'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
		SILTY CLAY: Tan and gray, damp, hard	12		
4					
6					
8		-; w/ trace of sand	12		
10					
12					
		-; gray	14		
14					
16					
18		-; w/ trace of lignite	17		
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 19.5'
Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B14

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 698.6'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
4		-; reddish brown, stiff			
6		-; w/ gravel			
8		-; w/ cobble			
10					
12					
14		SILTY SANDY CLAY: Reddish brown, moist, stiff, w/ cobble and gravel			
16		AUGER REFUSAL ON LIMESTONE			
18					
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 15.5'
Date: 28 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B15

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 696.5'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
2		FILL; SILTY SANDY CLAY: Tan and gray, moist, firm				
4	X	-; hard	8			
6						
8	X	-; firm	6			
10						
12						
14	X	SILTY SANDY CLAY: Reddish brown and gray, moist, stiff, trace of lignite	11			
16						
18	X	-; w/ gravel	12			
20						
22						
24		AUGER REFUSAL ON LIMESTONE				
		LIMESTONE: Beige, medium crystalline				Core 1 (23.0' - 27.5') Recovery = 48.1% RQD = 42.6%
26		NO RECOVERY: Clay rich soil				
28		LIMESTONE: Beige, medium crystalline				
30						Core 2 (27.5' - 32.5') Recovery = 95.0% RQD = 95.0%
32						
34		SHALE/CLAY RICH SOILS: multicolored, w/ chert nodules and thin limestone stringers				Core 3 (32.5' - 37.5') Recovery = 5.0% RQD = 0.0%
36						
38						
40						Core 4 (37.5' - 42.5') Recovery = 51.7% RQD = 23.3%
42						
44						

Completion Depth: 42.5'
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B16

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 700.8'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
0		TOPSOIL				
2		SILTY SANDY CLAY: Brown, moist, firm				
4		-; tan and gray, hard	19			
6						
8			28			
10						
12						
14		SILTY SANDY CLAY: Gray, damp, hard, w/ trace of gravel and lignite, rust stains	25			
16						
18		-; reddish brown	26			
20						
22		-; w/ cobble				
24		AUGER REFUSAL ON LIMESTONE				
26		LIMESTONE: Beige, firm to medium crystalline, interbedded w/ thing stringers of clay rich soil				Core 1 (24.5' - 28.7') Recovery = 92.0% RQD = 65.0%
28						
30		LIMESTONE: Beige and light tan, medium crystalline, healed fractures, w/ thin shale stringers				Core 2 (28.7' - 33.7') Recovery = 85.0% RQD = 80.0%
32						
34						
36						Core 3 (33.7' - 38.5') Recovery = 88.3% RQD = 78.3%
38						
40						
42						
44						

Completion Depth: 38.5'
Date: 29 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B17

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations

SURF. ELEV.: 699.1'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
		TOPSOIL				
		SILTY CLAY: Brown, moist, firm				
2						
		SILTY CLAY: Gray and tan, moist, hard, friable				
4						
6						
8		SILTY SANDY CLAY: Gray, moist, stiff to hard				
10						
12						
		SILTY SANDY CLAY: Reddish brown and gray, stiff to hard, w/ gravel				
14						
		AUGER REFUSAL ON LIMESTONE				
16						
18						
20						
22						

Completion Depth: 14.5'
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B18

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations

SURF. ELEV.: 696.9'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
2		SILTY CLAY: Tan, moist, firm			
4					
6		SILTY SANDY CLAY: Tan and gray, moist, stiff			
8					
10					
12					
14		SILTY CLAY: Gray, moist, stiff			
16					
18					
20		SILTY SANDY CLAY: Reddish brown, moist, stiff -; w/ cobble			
22					
24					
26					
28		AUGER REFUSAL ON LIMESTONE			
30					
32					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 26.5'
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B19

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 699.6'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
		-; gray and tan, stiff to hard			
4					
6					
8	X		13		
10					
12					
	X	SILTY SANDY CLAY: Reddish brown, moist, hard, w/ trace of gravel and lignite	25		
14					
16					
18	X		34		
20		AUGER REFUSAL ON LIMESTONE			
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 20.0'
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B20

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 691.6'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Brown, moist, firm			
2					
4		-; gray and tan			
6					
8					
10					
12		SILTY SANDY CLAY: Reddish brown, moist, firm, w/ cobble			
14					
16					
18					
20					
22		AUGER REFUSAL ON LIMESTONE			

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 21.0'
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B21

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 697.0'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
2		TOPSOIL				
		SILTY CLAY: Brown, moist, firm				
4		SILTY CLAY: Gray and tan, moist, stiff				
6						
8			9			
10						
12						
14		SILTY SANDY CLAY: Reddish brown and gray, moist, stiff, trace of gravel and lignite	12			
16		-; w/ cobble				
18						
20		AUGER REFUSAL ON LIMESTONE				
		LIMESTONE: Beige, medium crystalline, w/ some chert nodules				Core 1 (18.5' - 23.5') Recovery = 100.0% RQD = 93.3%
22						
24						
26		LIMESTONE: Beige and light gray, medium crystalline, healed fractures, thin sandstone beds				Core 2 (23.5' - 28.5') Recovery = 93.3% RQD = 85.0%
28						
30						Core 3 (28.5' - 33.4') Recovery = 91.5% RQD = 87.2%
32						
34						
36						
38						
40						
42						
44						

Completion Depth: 33.4'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B22

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 699.6'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
2		SILTY CLAY: Tan, moist, firm			
		-; gray and tan, stiff			
4					
6					
8					
10					
12					
		-; w/ trace of gravel			
14					
16					
18					
20		SILTY SANDY CLAY: Reddish brown, moist, stiff, w/ cobble			
22					
		AUGER REFUSAL ON LIMESTONE			
24					
26					
28					
30					
32					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 23.0
Date: 30 November 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B23

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 695.7'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
2					
4		SILTY SANDY CLAY: Reddish brown, moist, stiff	9		
6					
8		-; w/ lignite	21		
10					
12					
14		-; w/ trace of gravel	27		
16		-; w/ cobble			
18					
		AUGER REFUSAL ON LIMESTONE			
20					
22					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 19.0'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B24

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 702.1'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
		TOPSOIL				
2		SILTY CLAY: Tan, moist, firm				
4		SILTY SANDY CLAY: Tan and gray, damp, hard, trace of lignite			94	1.8
6						
8						
10		SILTY CLAY: Gray and reddish brown, damp, hard	18			
12						
14		-; w/ trace of lignite	17			
16						
18		SHALEY SANDY CLAY: Gray and tan, moist, hard, trace of lignite	18			
20						
22						

Completion Depth: 19.5'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B25

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 705.2'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
2		TOPSOIL			
		SILTY CLAY: Tan, moist, firm			
4		SILTY SANDY CLAY: Tan and gray, moist, stiff to hard, trace of lignite			
6					
8		SILTY CLAY: Gray and reddish brown, moist, stiff to hard, blocky			
10					
12		-; w/ lignite			
14					
16					
18					
20		SILTY SANDY CLAY: Tan and gray, moist, stiff to hard, w/ trace of lignite	16		
22					
24					
26					
28					
30		-; w/ cobble			
32					
34		AUGER REFUSAL ON LIMESTONE			
36					
38					
40					
42					
44					

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 33.5'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B26

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 690.7'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION (TYPE, COLOR, MOISTURE & OTHER)	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.	COHESION, TON/SQ.FT. (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT (10 20 30 40 50 60 70)
0		TOPSOIL				
2		SILTY CLAY: Brown and gray, moist, stiff				
4	X	-; w/ trace of lignite, stiff to hard	12			
6						
8	X	SILTY SANDY CLAY: Reddish brown, moist, stiff, w/ trace of gravel and lignite	14			
10						
12						
14	X		15			
16		-; w/ cobble				
18						
20						
22		AUGER REFUSAL ON LIMESTONE				
24		LIMESTONE: Beige, medium crystalline, some chert nodules and clay rich soil beds				Core 1 (21.0' - 25.8') Recovery = 73.7% RQD = 54.4%
26		LIMESTONE: Light gray, medium crystalline w/ healed fractures				
28						Core 2 (25.8' - 30.8') Recovery = 98.3% RQD = 90.0%
30						
32						
34		LIMESTONE: Beige and light gray, fine to medium crystalline w/ healed fractures				Core 3 (30.8' - 35.8') Recovery = 100.0% RQD = 100.0%
36						
38						
40						
42						
44						

Completion Depth: 35.8'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

Engineering Surveys & Services

LAB NO. L14846

PROJECT: Quail Creek Plat 8
Columbia, Missouri

LOG OF BORING NO. B27

TYPE: 4" Solid Stem Auger

LOCATION: See Plan of Boring Locations
SURF. ELEV.: 688.1'

DEPTH, FT.	SAMPLE TYPE	SOIL DESCRIPTION TYPE, COLOR, MOISTURE & OTHER	BLOWS PER FT.	UNIFIED CLASSIFICATION	UNIT DRY WT. LB./CU.FT.
		TOPSOIL			
		SILTY CLAY: Brown, moist, firm			
2					
4		-; gray, stiff			
6					
8					
10		SILTY SANDY CLAY: Gray and tan, moist, stiff			
12					
14					
16					
18		-; w/ cobble			
20					
22		AUGER REFUSAL ON LIMESTONE			

COHESION, TON/SQ.FT. ⊗
0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT — WATER CONTENT,% — LIQUID LIMIT
10 20 30 40 50 60 70

Completion Depth: 21.5'
Date: 1 December 2022

Depth to Water ATD: Not Encountered

LL14846 BORE PLAN.DWG 1/3/2023

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