GEOServices, LLC, Geotechnical and Materials Engineers

February 17, 2020

Partners Development
502 Union Avenue
Knoxville, Tennessee 37902-2134

Attention: Mr. Peter Osickey
posickey@partersinfo.com

Subject: **REPORT OF GEOTECHNICAL EXPLORATION, REVISED**
KCDC Austin Homes Redevelopment
East Summit Hill Avenue
Knoxville, Tennessee
GEOServices Project No. 21-191014R1

Dear Mr. Osickey:

We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed, in accordance with GEOServices Proposal No. 11-19622, dated September 20, 2019. The following report presents our findings and recommendations for the proposed project. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,
GEOServices, LLC

MATTHEW B. HASTON REGISTERED ENGINEER AGRICULTURE COMMERCE No. 109269 STATE OF TENNESSEE 2/17/2020

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REPORT OF

GEOTECHNICAL EXPLORATION

KCDC Austin Homes Redevelopment
Knoxville, Tennessee

GEOServices Project No. 21-191014

Submitted to:

Partners Development
502 Union Avenue
Knoxville, Tennessee 37902

Submitted by:

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GEOServices, LLC, Geotechnical and Materials Engineers

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of our geotechnical exploration was to explore the subsurface conditions for the proposed development and provide geotechnical recommendations for site preparation and grading and for design and construction of the foundation systems. Additionally, recommendations for light and heavy-duty pavements are included.

1.2 PROJECT INFORMATION AND SITE DESCRIPTION

Project information was provided via email correspondence with Mr. Peter Osickey of Partners Development on September 13, 2019 which included a *Request for Proposal* dated September 25, 2019 as prepared by Partners Development (Partners) and drawing titled *CEC Revised Concept Layout Plan:CP001* dated September 2019 as prepared by CEC, Inc. (CEC) which indicated the proposed boring locations.

Based on the provided information, we understand the project will initially consist of demolition of the existing structures at Austin Homes in Knoxville, Tennessee followed by the construction of new affordable housing structures across 23 acres. The project will be broken into phases with an overall of 420 units constructed which range from one to three bedrooms. The majority of the structures, approximately thirty-nine, will be two to three stories in height while four mid-rise building, four to six stories in height, will also be included in the project. The development will also include associated roadways and parking areas and a proposed open space in the western portion of the site. We have assumed the structures will likely be wood framed with brick veneer and slabs on grade. We understand some of the multi-story structures may be constructed with below grade or podium parking levels.

We have not been provided structural loading information at this time; however, based on our experience with similar development we anticipate the two to three story structure will have maximum column and continuous wall loads of less than 100 kips and 3 kips per linear foot, respectively. The mid-rise structures may have maximum column loads and wall loads on the order of 350 kips and 10 kips per linear foot.

Existing surface elevations range from approximately 950 feet Mean Sea Level (MSL) to 890 feet MSL, generally sloping downwards from south to north. However, we anticipate the existing development will be tiered with short retaining walls to facilitate proposed grades. While we have not been provided grading information at this time, we anticipate maximum cuts/fills of less than 10 feet will be necessary for each proposed building footprint. Locations, types, or geometry of any proposed retaining walls to facilitate the proposed grade changes was not provided as we understand the development is still in the early stages. Exploration of retaining walls and/or slopes has been excluded from our scope of services.

The overall development is bordered by East Summit Hill Drive to the south, Martin Luther King Jr. Avenue and Harriet Tubman Street to the east, commercial development and First Creek to the north and west. Based on our review of available aerial images (Google Earth), the majority of the eastern portion of the site previously consisted of multi-family structures (approximately 30) which appear to have been demolished and associated pavement removed sometime between 2002 and 2007 while the northeastern most structure demolished between 2009 and 2010. The remaining proposed site consists of approximately twenty-seven multi-family structures which will understand will demolished as part of the proposed development. This portion of the site appears to have remained relatively unchanged since 1992.

1.3 SCOPE OF STUDY

This geotechnical exploration involved a site reconnaissance, field drilling, laboratory testing and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, conclusions and recommendations. Following the text of this report, Appendix A presents figures and test boring records.

The scope of our geotechnical engineering services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on, or below, or around this site. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

2.1 FIELD EXPLORATION

The site subsurface conditions were explored by drilling the requested 35 soil test borings near the locations shown on the provided drawing. In some cases, the borings were offset a short distance from the requested location due to underground or overhead utilities. The borings were staked with elevations recorded in the field by CEC surveyors.

The soil test borings were drilled during the period from October 16 to 23, 2019 by our subcontractor. The borings were advanced using 3¼-inch hollow stem augers and a Geoprobe® track-mounted drill rig. The approximate locations of the soil test borings are shown on Figure 2 of Appendix A of this report. The elevations shown on the logs were obtained and provided by CEC. The depths in this report reference the ground surface that existed at the time of the exploration. Detailed logs for soil test borings can also be found in Appendix A.

Within each boring, Standard Penetration Testing (SPT) and split-spoon sampling were performed on 2½-foot intervals in the upper 10 feet and at 5-foot intervals thereafter. SPT and split-spoon sampling were performed in accordance with ASTM D 1586.

In split-spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration (or second and third 6-inch increments when sampling 24 inches) is recorded as the SPT resistance (N-value). These N-values are indicated on the boring logs at the test depth and provide an indication of the consistency or relative density of the soil.

2.2 LABORATORY TEST PROGRAM

After completion of the field drilling and sampling phase of this project, the soil samples were returned to our laboratory where they were visually-manually classified in general accordance with the Unified Soil

Classification System (USCS – ASTM D 2487) by a GEOServices geotechnical professional. Select samples were then tested for moisture content (ASTM D 2216) and Atterberg limits (ASTM D 4318). The laboratory testing is discussed in the following sections of this report and summarized in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site, as most of east Tennessee, lies in the Appalachian Valley and Ridge Physiographic Province. The Province is characterized by elongated, northeasterly-trending ridges formed on highly resistant sandstones and shales. Between ridges, broad valleys and rolling hills are formed primarily on less resistant limestones, dolomites and shales.

Published geologic maps we reviewed indicate the northernmost portions of the area to be developed are underlain by bedrock of the Ottosee Shale Formation while the remainder of the site is underlain by bedrock of the Copper Ridge Dolomite Formation. The Ottosee Shale is a mixture of fossiliferous shale and limestone with minor quantities of siltstone, sandstone and marble. Within a limited area, any one of these rock types may dominate. The various rock types grade into and interfinger with one another throughout the section. The shale portion of the formation typically weathers to produce a tan or yellowish brown silty clay residuum with weathered shale fragments. The limestone portions of the formation weather to a reddish or orangish-brown clay residuum.

The Copper Ridge Dolomite Formation is generally composed of gray, coarse to medium-grained, knotty dolomite in the upper zone and dark-gray crystalline dolomite in the lower zone. This formation typically weathers to produce a thick silty clay residual soil with dark iron stains. Silica in the form of chert is resistant to weathering and scattered in various quantities throughout the residuum.

Since the bedrock formations underlying the site consist of dolomite, they are susceptible to the typical carbonate hazards of irregular weathering, cave and cavern conditions, and overburden sinkholes. Carbonate rock, while appearing very hard and resistant, is soluble in slightly acidic water. This characteristic, plus differential weathering of the bedrock mass, is responsible for the hazards. Of these hazards, the occurrence of sinkholes is potentially the most damaging. In East Tennessee, sinkholes occur primarily due to differential weathering of the bedrock and "flushing" or "raveling" of overburden soils into the cavities in the bedrock. The loss of solids creates a cavity or "dome" in the overburden. Growth of the dome over time or excavation over the dome can create a condition in which rapid, local subsidence or collapse of the roof of the dome occurs. Such a feature is termed a sinkhole.

A certain degree of risk with respect to sinkhole formation and subsidence should be considered at any site located within carbonate geologic settings. A rigorous effort to assess the potential for sinkhole development at this site was beyond our scope of services for this project. However, we observed no closed contour depressions, which are indicative of past sinkhole activity, on the USGS (Knoxville, TN Quadrangle) topographic map within the immediate vicinity of the site.

It is our opinion that the risk of sinkhole development at this site is no greater than at other sites located within similar geologic settings which have been developed successfully. However, the owner must be willing to accept a low to moderate risk of future sinkhole development at this site. The risk of sinkhole development can be reduced by following the recommendations provided in the *Sinkhole Risk Reduction and Corrective Actions* section of this report.

3.2 SOIL STRATIGRAPHY

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

Surficial

Each of the borings, with the exception of P-7, were drilled in the grassed areas and initially encountered approximately 4 to 12 inches of topsoil at the ground surface. Boring P-7 was drilled in a paved area and encountered 6 inches of asphalt at the ground surface. We observed during our site reconnaissance that portions of the site are covered in asphalt and concrete pavements, the thickness of which are unknown.

Fill Materials

Beneath the surficial materials, the majority of the borings encountered apparent fill materials. The exceptions were borings B-2, B-9 and P-19 where apparent fill materials were not encountered. Fill is a material which has been transported and placed by man and machine. The fill was encountered to depths ranging from approximately 2 to 8.7 feet below the existing ground surface. Borings B-3 and B-10A refused on hard materials within the fill and the depth of fill at these locations may be greater. Several of the "P" borings drilled within the proposed pavement areas were terminated at the predetermined depth of 5 feet within the fill. Table 1 shows the approximate depths to which the fill was encountered in the borings.

The fill was manually classified as varying shades of brown, black, tan and gray lean (lower plasticity) clay, silty clay and fat (high plasticity) clay. The fill soils contained varying amounts of gravel, asphalt, mixed organics, metal fragments, glass, plastic and tile fragments. In addition, we note the sample of fill from a depth of approximately 3 of 5 feet in boring P-2 consisted of decomposed paper.

The SPT N-values within the fill soil ranged from W.O.H. (for Weight of Hammer, essentially 0 blows per foot) to 53 blows per foot (bpf). We note that some of the N-values of more than about 15 bpf were likely amplified by the presence of hard materials within the fill soils. The fill was most commonly soft to stiff consistency. The higher N-values of more than 50 blows per increment were recorded near the auger refusal depth which are not representative of the fill soils.

The natural moisture content of the fill samples subjected to testing ranged from 5.8 to 21.5 percent. The lower values correspond to samples which contained rock fragments or gravel. Atterberg limits testing of a selected sample of the fill indicated a Liquid Limit (LL) value of 36 percent and a Plasticity Index (PI) value of 20 percent. The soil may be classified as lean clay (USCS Group Symbol CL) based on the plasticity test results alone.

Residuum

Residual soils were underlying the surficial materials and fill where the boring penetrated the fill materials. Residual soils are formed from the in-place weathering of the underlying parent bedrock. The residual soils were classified as varying shades of tan, brown and gray lean clay, silty clay and fat clay soils. The residual soils contained some shale fragments and chert fragments.

The SPT N-values ranged from 3 to 26 bpf within the residual soils, indicating a soil consistency ranging from soft to very stiff. The soft soils were typically encountered in isolated zones in borings B-8, B-10B, B-11 and B-12 in the southeastern areas of the site.

The natural moisture contents of the residual soil samples tested ranged from 9.1 to 34.8 percent. The lower value of 9.1 percent contained weathered shale fragments.

Weathered Rock

Weathered rock was encountered at depths ranging from 3 to 27 feet below the existing ground surface (elevation 882.2 to 891.7 feet) in borings B-2, B-4 through B-7 and P-12 drilled in the northeastern portion of the site. The weathered rock was sampled as gray and tan weathered shale. The N-values within the weathered rock ranged from 31 bpf to 50 blows for 2 to 4 inches of penetration.

Auger Refusal

Refusal to the power auger used to advance the borings was encountered in borings B-1 through B-6, B-10A and P-23 at depths ranging from approximately 8.9 to 28.8 feet below the existing ground surface (elevation 880.4 to 947.1 feet). Table 1 shows the depth of auger refusal at each of the borings. Refusal is a designation applied to material that cannot be penetrated by the power auger used to drill the borings. Refusal at this site could indicate rock pinnacles, ledges or boulders, bedrock or debris within the fill. It is likely that borings B-3 and B-10A refused prior to penetrating the fill materials, possibly on buried concrete.

Ground Water

Groundwater was encountered in boring P-21 at a depth of 6 feet below the existing ground surface at the time of drilling. No water was encountered in the remaining borings and the borings were backfilled upon completion in consideration of safety. Subsurface water levels may fluctuate due to seasonal changes in precipitation amounts. Additionally, areas of perched water may exist in the overburden and/or near the contact with weathered rock and bedrock. Zones of perched water may also exist within fill soils.

Table 1 –Summary Information

Boring	Ground Surface Elevation	Fill Depth	Weathered Rock Depth	Weathered Rock Elevation	Refusal Depth	Refusal Elevation
B-1	890.9	8	NE	-	11.4	879.5
B-2	896.1	NE	12	884.1	14.2	881.9
B-3	892.9	8.7(1)	NE	-	8.7(1)	884.2(1)
B-4	896.2	8	12	884.2	14.8	881.4
B-5	898.7	3	7	891.7	8.9	889.8
B-6	909.2	6	27	882.2	28.8	880.4
B-7	902.4	3	17	885.4	BT @ 20	-
B-8	906.8	8	NE	-	BT @ 25	-
B-9	919.6	NE	NE	-	BT @ 20	-
B-10A	925.6	4.6(1)	NE	-	4.6(1)	921.0(1)
B-10B	925.6	3	NE	-	BT @ 25	-
B-11	932.7	3	NE	-	BT @ 30	-
B-12	937.6	6	NE	-	BT @ 30	-
P-1	888.4	5(2)	NE	-	BT @ 5	-
P-2	887.8	5(2)	NE	-	BT @ 5	-
P-3	890.0	5(2)	NE	-	BT @ 5	-
P-4	893.2	3	NE	-	BT @ 5	-
P-5	897.0	3	NE	-	BT @ 5	-
P-6	888.3	5(2)	NE	-	BT @ 5	-
P-7	891.4	5(2)	NE	-	BT @ 5	-
P-8	895.0	5(2)	NE	-	BT @ 5	-
P-9	892.0	5(2)	NE	-	BT @ 5	-
P-10	897.3	3	NE	-	BT @ 5	-
P-11	901.7	5(2)	NE	-	BT @ 5	-
P-12	904.2	3	NE	-	BT @ 5	-
P-13	910.1	2	NE	-	BT @ 5	-
P-14	913.9	5(2)	NE	-	BT @ 5	-
P-15	919.2	3	NE	-	BT @ 5	-
P-16	900.0	5(2)	NE	-	BT @ 5	-
P-17	920.4	5(2)	NE	-	BT @ 5	-
P-18	907.8	3	NE	-	BT @ 5	-
P-19	919.4	NE	NE	-	BT @ 5	-
P-20	925.0	3	NE	-	BT @ 5	-
P-21	926.1	8	NE	-	BT @ 10	-
P-22	930.1	3	NE	-	BT @ 5	-
P-23	960.9	8	NE	-	13.8	947.1

Note: Depths in feet below ground surface and elevations in Mean Sea Level.
BT – Boring Terminated, NE – Not Encountered
(1) – Boring refused within fill material and depth of fill at this location may be greater.
(2) – Boring terminated within fill and the depth of fill at this location may be greater.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 SITE ASSESSMENT

The borings of this exploration encountered fill soil which, where penetrated, were underlain by residual soils, weathered rock or refusal materials. The depth of fill ranged from about 2 to greater than 8 feet below the existing ground surface. The fill was of variable consistency and contained significant quantities of deleterious material. The residual soils were typically of firm to stiff consistency; although, soft zones were present. The depth to auger refusal ranged from about 8.9 to 28.8 feet below the existing ground surface; however, buried concrete likely caused refusal in some of the borings.

4.1.1 Foundation and Subgrade Support

Given the relatively heavily-loaded multi-story structures proposed for the site and considering the variable composition and consistency fill and residual soils encountered in the borings, we do not recommend the multi-story structures be supported by bearing on shallow spread foundations in the existing site soils. Recommendations are provided herein for rammed aggregate piers to improve the site soils and allow shallow foundation support. This recommendation generally applies for structures which support individual column loads of more than about 100 kips.

A program of undercutting and replacement may be considered to improve foundation support conditions for the more lightly loaded structures with maximum column loads of less than about 100 kips. A discussion of the recommended undercutting and replacement is presented later herein. We note that variable nature of the fill and presence of potentially impacted soils will present some challenges with this method, including difficulty in estimating the required undercut depths and associated costs. For these reasons, the owner may wish to consider rammed aggregate pier support of the more lightly loaded structures as well.

Several of the borings of this exploration encountered weathered shale and auger refusal materials. The potential exists for excessive differential foundation settlements where shallow foundations for a portion of a structure are underlain by soil and other portions of the structure are underlain by weathered rock or bedrock. The proposed finished grades for the project were not available at the time of this report;

therefore, an analysis of foundation settlements was not possible with respect to the weathered rock or bedrock. Once finished grades have been developed GEOServices should be retained to review the information and evaluate the estimated foundation settlements. The use of rammed aggregate piers or other alternative may be required to limit foundation settlements to an acceptable value where structures are underlain by differing materials.

Subgrade support correction measures will likely be required to form a stable subgrade in the floor slab and pavement areas. On previous projects, subgrade stabilization has been accomplished by undercutting and replacement, the use of a biaxial geogrid, by tracking surge stone into the exposed subgrade materials or combinations thereof. The owner may also wish to consider cement modification of the subgrade soils as an alternative to improve the subgrade. Recommendations for soil cement modification are provided in this report. Given the conditions encountered in the borings, we recommend the project budget include an allowance for subgrade stabilization across the site.

We strongly encourage the client to confer with the design team and a contractor with regard to the recommendations contained in this report, in an effort to assess potential costs and schedule. Due to onsite conditions and amount of undocumented fill materials, we recommend careful observation during construction activities, including mass grading. Additional onsite testing during construction can further classify the fill materials suitability for reuse as structural soil fill.

4.1.2 Excavation

Weathered rock was encountered at depths ranging from approximately 3 to 27 feet below the existing ground surface (elevation 882.2 to 891.7 feet) in borings B-2, B-4 through B-7 and P-12 drilled in the northeastern portion of the site. Refusal to the power auger used to advance the borings was encountered in borings B-1 through B-6, B-10A and P-23. The depth to auger refusal ranged from approximately 8.9 to 28.8 feet below the existing ground surface (elevation 880.4 to 947.1 feet).

Where excavations extend to the depths where weathered rock or auger refusal was encountered in the borings, excavation difficulty should be anticipated. The near surface or buried concrete encountered in borings B-3 and B-10A could also present difficulty during general earthwork, utility installation, rammed aggregate installation.

Excavations near existing structures or roadways should be evaluated with respect to the effect of the excavation on the materials supporting the structures or roads. Under no circumstances should foundation or slab support materials of existing structures or roads be disturbed or undermined by the excavation, without a plan previously approved by the structural engineer. Shoring to stabilize the adjacent structures, properties, sidewalks or streets may be required to allow deeper site excavations. We note the City of Knoxville does not typically allow anchors, nails, reinforcing, or other features of such stabilization systems to extend into public property, even temporarily.

4.2 SITE PREPARATION RECOMMENDATIONS

4.2.1 Subgrade

Demolition of the existing structures should include the complete removal of below grade items (including concrete foundations, slabs, and walls) and pavements (including basestone). Existing basements or pits, if present, should be excavated with a 2H:1V side slope and the excavation backfilled using structural soil fill or compacted dense graded aggregate. Additionally, utilities to be abandoned should be completely removed and their trenches backfilled using structural soil fill. If utilities are to remain in use, they should be rerouted outside of the proposed building areas.

After the completion of stripping operations and excavation to reach the planned subgrade elevation, we recommend that the subgrade be proofrolled with a fully-loaded, tandem-axle dump truck or other pneumatic-tired construction equipment of similar weight. Areas to receive structural soil fill should also be proofrolled prior to the placement of new fill. The geotechnical engineer or his representative should observe proofrolling.

Given the presence of uncontrolled fill and some lower consistency residual soil, it is likely measures will be required to correct subgrade support conditions for floor slabs and pavements. Alternatives to improve subgrades may consist of undercutting and replacement, the use of a biaxial geogrid, tracking surge stone into soft soil, or combinations thereof. Generally, subgrade improvement for light duty pavement areas consists of undercutting and replacing a minimum of 2 feet below the subgrade elevation with structural soil fill or compacted dense graded aggregate. The depth of undercutting should be determined based upon observations and tests performed at the time of construction.

Soil cement modification may also be considered to improve the subgrade areas. Given the conditions encountered in the borings, we recommend the project budget include an allowance for subgrade stabilization across the site.

4.2.2 Cement Modified Soil Subgrades

The use of soil cement modification may be considered to improve the site soils and provide a stable subgrade for the building floor slabs and pavements. Cement modification entails the placement and mixing of Portland cement into the clay subgrade soils and re-compacting the material to 98 percent of the standard Proctor maximum dry density. Cement modification serves to stabilize and strengthen the modified soil by way of a pozzolanic reaction which occurs between the calcium hydroxide released during hydration and alumina and silica in the clay soil.

The cement modification should result in a soil-cement modified zone of at least 12-inches in thickness extending below the floor slab or pavement subgrade elevation. Based on our experience with soils similar to those observed at the site, we recommend a minimum cement content of 5 percent to achieve a modified soil unconfined compressive strength of at least 200 pounds per square inch after 7 days. Depending on the natural moisture content of the on-site soils, the addition of water may be required to achieve compaction of the cement modified soil. Soil cement modification is best performed by specialty contractors familiar with this work.

The use of cement to modify the subgrade soils will allow construction to continue in a timely manner and provide an improved subgrade. Depending upon the season of construction and conditions encountered, cement modification may also be more economical than undercutting and replacement or other subgrade stabilization alternatives.

4.2.3 Structural Soil Fill

Material considered suitable for use as structural fill should be clean soil free of organics, trash, and other deleterious material, containing no rock fragments greater than 6 inches in dimension. Preferably, structural soil fill material should have a standard Proctor maximum dry density of 90 pounds per cubic foot (pcf), or greater, and a PI value of 35 percent, or less. The material to be used as structural fill should be tested by the geotechnical engineer to confirm that it meets the project requirements before being placed.

The existing fill materials which contained excessive deleterious materials are not suitable for use as new fill. The site residual soils generally appear suitable for reuse as new fill; however, moisture conditioning may be required to reach the range of moisture contents recommended for compaction.

Structural fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Each lift should be compacted to at least 98 percent of the soil's maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus (-) 2 percent to plus (+) 3 percent of the optimum moisture content. Each lift should be tested by geotechnical personnel to confirm that the contractors' method is capable of achieving the project requirements before placing subsequent lifts. Areas which have become soft or frozen should be removed before additional structural fill is placed.

4.2.4 Dense Graded Aggregate

Dense graded aggregate (DGA) fill may be required as backfill in undercut excavations and in utility trench excavations. The DGA used for this section should be Type A and Grading D or E in accordance with Section 903.05 of the Tennessee Department of Transportation (TDOT) specifications. The DGA fill should be placed in loose, horizontal lifts not exceeding 8 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698). Each lift should be compacted, tested by geotechnical personnel and approved before placing subsequent lifts.

4.3 FOUNDATION AND SLAB-ON-GRADE RECOMMENDATIONS

4.3.1 Shallow Foundations (Rammed Aggregate Pier Alternative)

Rammed aggregate piers may be considered to improve the existing fill and residual soils to allow shallow foundation support of the proposed multi-story buildings with column loads of more than 100 kips. Rammed aggregate piers may also be required where individual buildings are underlain by materials of differing compressibility (weathered shale/bedrock versus soil) to help maintain differential foundation settlements to an acceptable level.

Rammed aggregate piers are constructed by initially drilling a hole of predetermined diameter to a predetermined depth. These depths will be determined by the rammed aggregate pier designer. Once the required hole depth is achieved, the excavation is backfilled in lifts generally 18 to 24 inches thick with dense graded aggregate stone, or approved alternative. Upon completion of backfilling, dynamic cone penetrometer (DCP) testing is often performed to confirm adequate compaction of the backfill material. GEOServices should review the rammed aggregate pier design to confirm the appropriate design parameters are used. Additionally, at least one modulus test should be performed on a sacrificial pier to confirm the designed piers will perform satisfactorily. GEOServices should observe the modulus test.

The presence of buried concrete or other impenetrable materials at this site could present some difficulties during rammed aggregate pier installation. It will be required that the hard material which impedes rammed aggregate pier installation be removed by the project grading contractor and the excavation backfilled as recommended by the rammed aggregate pier designer.

The recommended allowable soil bearing capacity for design of the foundations is 5,000 psf where the rammed aggregate piers are used. Where rammed aggregate piers are installed, we recommend a friction coefficient of 0.45 be utilized. The values for allowable bearing pressure and frictional resistance should be confirmed and approved by the selected rammed aggregate pier designer.

We recommend the rammed aggregate piers be designed to control total settlements to less than 1 inch and differential settlements of less than ½ inch. GEOServices should be retained to observe and document the installation of the rammed aggregate piers so that the recommendations provided in this report are properly implemented in the field.

4.3.2 Shallow Foundations (Undercutting and Replacement)

Undercutting and replacement may be considered to improve foundation support conditions for the more lightly-loaded structures (maximum column loads of less than 100 kips) in areas where unsuitable existing fill is encountered at the foundation bearing elevation. It is generally recommended that the undercutting and replacement be performed to maintain a minimum thickness of structural soil fill or compacted dense graded aggregate equal to the width of the foundation below the foundation bearing elevation, or until stiff, suitable materials are encountered.

If the undercut excavations are backfilled using structural soil fill or compacted dense graded aggregate, the undercutting should extend laterally beyond the foundation perimeter for a distance equal to one-half the depth of undercut below the foundation bearing elevation. If the foundation undercutting is extended to expose an underlying stiff, suitable soil, then the excavation may be backfilled using lean concrete or flowable fil and the excavation be made the same width as the foundation.

The recommended allowable bearing pressure for design of the (lightly-loaded) foundations bearing on stiff residual soils or on undercut excavations backfilled as recommended is 2,500 pounds per square foot (psf). Even if design loads would allow smaller sizes, we recommend that continuous footings be a minimum of 18 inches wide and isolated spread footings be a minimum of 24 inches wide to reduce the possibility of a localized punching shear failure. Exterior footings should be designed to bear at least 18 inches below finished exterior grade to protect against frost heave.

The available lateral capacity of shallow foundations includes a soil lateral pressure and coefficient of friction as described in the IBC, Section 1806. Footings will be embedded in material similar to those described as Class 5 in Table 1806.2. Where footings are cast neat against the sides of excavations, an allowable lateral bearing pressure of 100 psf per foot depth below natural grade may be used in computations. Resistance to lateral sliding represented by a value of adhesion of 130 psf may be used for clays similar to those described as soil Class 5. An increase of one-third in the allowable lateral capacity may be considered for transient load combinations, including wind or earthquake, unless otherwise restricted by design code provisions.

Detailed foundation subgrade observations should be performed by a GEOServices geotechnical engineer, or his qualified representative so that the recommendations provided in this report are consistent with the site conditions encountered. A dynamic cone penetrometer (DCP) is commonly utilized to provide information that is compared to the data obtained in the geotechnical report. Where unacceptable materials are encountered, the material should be excavated to stiff, suitable soils or remediated at the geotechnical engineer's direction. Typical remedial measures consist of undercutting, overexcavation or combinations thereof.

4.3.3 Differential Bearing Conditions

A combination of differing bearing conditions (i.e., soil and rock) can cause differential foundation settlement and result in unsatisfactory long-term performance of the structure. In the event only a small area of bedrock is exposed, the remedial treatment may consist of removing the bedrock to a depth of at least 12 inches below the foundation bearing level. The excavation may then be backfilled using structural soil fill or compacted dense graded aggregate to the foundation bearing elevation to reduce the potential for differential stresses caused by point loading. The removal of rock from foundations will likely require the use of a pneumatic hammer (difficult excavation).

As mentioned previously, the potential exists for excessive differential foundation settlements where shallow foundations for a portion of a structure are underlain by soil and other portions of the structure are underlain by weathered rock or bedrock. The proposed finished grades for the project were not available at the time of this report; therefore, an analysis of foundation settlements was not possible with respect to the weathered rock or bedrock. Once finished grades have been developed GEOServices should be retained to review the information and evaluate the estimated foundation settlements.

4.3.3 Slabs-on-Grade

For slab-on-grade construction, the site should be prepared as previously described. This will likely require undercutting and replacement or cement modification of the existing fill if rammed aggregate piers are not installed to improve the soils for slab support.

We recommend concrete slabs be underlain by at least one foot of approved soil or aggregate. This may require the removal of bedrock pinnacles or boulders to prevent the point loading of slabs. The excavation to remove the rock should be backfilled using compacted dense graded aggregate.

We recommend that the subgrade be topped with a minimum 4-inch layer of crushed stone to act as a capillary moisture block. The subgrade should be proofrolled and approved prior to the placement of the crushed stone. Based on the conditions encountered on this site, we recommend that the floor slabs be designed using a subgrade modulus of 100 pounds per cubic inch (pci). This modulus is appropriate for small diameter loads (i.e. a 1ft x 1ft plate) and should be adjusted for wider loads.

4.4 SEISMIC DESIGN CRITERIA

4.4.1 Seismic Design Parameters

In accordance with the International Building Code (IBC), 2018, we are providing the following seismic design information. After evaluating the SPT N-value data from the soil test borings, it was determined that the subsurface conditions at the site most closely matched the description for “Seismic Site Class D” or “Stiff Soil Profile”. Table 2 provides the spectral response accelerations for both short and 1-second periods, which may be used for design.

Table 2 – Seismic Design Parameters

Structure	S_S g	S_1 g	S_{DS} g	S_{D1} g
KCDC Austin Homes Redevelopment	0.615	0.133	0.536	0.207

The short and 1-second period values indicate the structure should be assigned a Seismic Design Category “D” using the published information. The provided values are based on the results of our field exploration and the assumption that the structure will be designed utilizing a Risk Category I, II or III. If these assumptions are incorrect, we should be contacted to reevaluate the seismic design information.

We anticipate the seismic site class definition will be a contributing factor to the overall cost of the project. It has been our experience that the seismic reinforcement and corresponding construction costs may be significantly reduced if a less conservative value for the seismic site class definition can be used for design (such as Site Class C). The use of SPT N-values to evaluate the seismic site class is a conservative approach for evaluation of the seismic site class. A less conservative value can often be developed using geophysical methods to determine the average shear wave velocity of the subsurface materials. GEOServices would be pleased to discuss the recommended scope of geophysical testing for this project with the project team.

For structures assigned a Seismic Design Category D, Section 1803.5.12 of the 2018 IBC requires the determination of seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet of backfill height. Based on our understanding of the project information, foundation or retaining walls of more than 6 feet are not anticipated. If walls of more than 6 feet are included in the project design, GEOServices should be retained to develop the seismic lateral earth pressures.

4.4.2 Geologic Seismic Hazards

In accordance with IBC 2018 sections 1803.5.11 and 1803.5.12, we have provided a discussion on the following geologic and seismic hazards: slope instability, liquefaction, total/differential settlement, and surface displacement due to faulting or seismically induced lateral spread or lateral flow.

Liquefaction occurs when soil, primarily saturated cohesionless soils, undergo a loss in strength due to monotonic, transient, or repeated disturbance that commonly occurs during a seismic event (Kramer 1996). This loss of strength occurs due to increased pore water pressures caused by an undrained condition. The increase in pore water pressure decreases the effective stress in the soil, thus reducing the soils ability to support any applied loads. For liquefaction to occur, there must be an increase in pore pressure meaning the soil must be saturated and be able to behave in an undrained condition. According to the NHI 2011 Reference Manual on LRFD Seismic Analysis and Design of Transportation Geotechnical Features and Structural Foundations, if any of the following criteria are satisfied then a significant liquefaction hazard does not exist:

- The geologic materials underlying the site are either bedrock or have very low liquefaction susceptibility according to the relative susceptibility ratings shown in the Estimated Susceptibility of Sedimentary Deposits to Liquefaction During Strong Ground Motion table presented by Youd and Perkins in 1978.

- The soils below the groundwater table at the site are one of the following:
    - Clayey soils which have a clay content greater than 15%, liquid limit greater than 35%, or natural water content less than 90% of the liquid limit.
    - Sand with a minimum corrected SPT $(N_1)_{60}$ value of 30 blows/foot.
    - The water table is deeper than 50 feet below the ground surface or proposed finished grade at the site.

We note that the borings and observation pits encountered plastic soils having clay contents likely above 15 percent. Additionally, based on experience in this geologic region and immediate vicinity of the site, it is our opinion that a liquefaction hazard does not exist for the subject development. As such, we do not expect significant additional total and differential settlement, lateral soil movement, reduction in bearing capacity or lateral soil reaction, permanent increase in soil lateral pressure, or flotation of buried structures in accordance with Sections 1803.5.11 and 1803.5.12 of the 2018 IBC.

We also noted mapped faults on the geologic maps we reviewed for this project vicinity of the site. However, the known faults within the East Tennessee valley are generally ancient, with no known active faults reaching the surface. Therefore, it is our opinion that surface displacement due to faulting or seismically induced lateral spreading or lateral flow, is not a seismic hazard that will affect the subject development. In addition, seismically induced slope instability is also not expected to be a seismic hazard that will affect the subject development.

4.5 PAVEMENT DESIGN RECOMMENDATIONS

4.5.1 Flexible Pavement Design

AASHTO flexible pavement design methods have been utilized for pavement recommendations. Our recommendations are based on the assumptions that the subgrade has been properly prepared as described previously which will require subgrade stabilization to improve support conditions at this site. Based on our experience with similar developments, we recommend the following light and heavy-duty flexible pavement sections:

Table 3 - Flexible Pavement Recommendations

Pavement Materials	Light-Duty	Heavy-Duty
Bituminous Asphalt Surface Mix	1.5	1.5

Bituminous Asphalt Base Mix	2.0	3.0
Compacted Crushed Aggregate Base	6.0	8.0

We recommend a base stone equivalent to a Type A and Grading D in accordance with Section 903.05 of the TDOT specifications. The bituminous asphalt pavement should be Grading "E" as per Section 411 for the surface mix and Grading "BM" as per section 307 for the binder mix. Compaction requirements for the crushed aggregate base and the bituminous asphalt pavement should generally follow TDOT specifications.

4.5.2 Rigid Pavement Design

AASHTO rigid pavement design methods have been utilized for the rigid pavement recommendations. In areas of trash dumpster pads or areas where large trucks will traverse, we recommend the use of a concrete pavement section. Our recommendations are based on the assumptions that the subgrade has been properly prepared. Based on our experience with similar developments, we recommend the following rigid pavement section:

Table 4 - Rigid Pavement Recommendations

Pavement Materials	Light-Duty	Heavy-Duty
4,000 psi Type I Concrete	6.0	8.0
Compacted Crushed Aggregate Base	4.0	6.0

Concrete should be reinforced with welded wire fabric or reinforcing bars to assist in controlling cracking from drying shrinkage and thermal changes. Sawed or formed control joints should be included for each 225 square feet of area or less (15 feet by 15 feet). Saw cuts should not cut through the welded wire fabric or reinforcing steel and dowels should be utilized at formed and/or cold joints.

4.5.3 General

Our recommendations are based upon the assumption that the subgrade has been properly prepared as described in previous sections of this report. Additionally, if off-site borrow soil is to be used to backfill to the final subgrade, it meets the requirements of the structural fill section.

The paved areas should be constructed with positive drainage to direct water off-site and to minimize surface water seeping into the pavement subgrade. The subgrade should have a minimum slope of 1 percent. In down grade areas, the basestone should extend through the slope to allow water entering the basestone to exit. For rigid pavements, water-tight seals should also be provided at formed construction and expansion joints.

We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, owner, and project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life. If thinner pavement sections are warranted, alternate reinforced pavement sections can be considered, including the use of geogrid reinforcement.

4.6 LATERAL EARTH PRESSURES

For the design of below grade and site cast-in-place concrete retaining walls, we have provided equivalent fluid pressures for two backfill conditions for cantilever-type walls. These are 1) active earth pressure for granular backfill (clean sand or gravel) and 2) at-rest earth pressure for granular backfill. The equivalent fluid pressures provided have assumed a level backfill and a wall with a vertical face. The designer should confirm other aspects of retaining wall design, including an evaluation of local and global stability, with respect to the proposed walls and site design. As mentioned previously, walls of more than 6 feet in height must consider the seismic lateral earth pressures. If walls of more than 6 feet are proposed, GEOServices should be consulted with regards to the design lateral earth pressure values.

Condition 1 - The active earth pressure for granular backfill will result in an equivalent fluid pressure of 35 pounds per cubic foot (pcf). If the granular backfill is to develop active earth pressure conditions, walls must be flexible and/or free to rotate or translate at the top approximately one inch laterally for every 20 feet of wall height.

Condition 2 - The at-rest earth pressure for granular backfill will result in an equivalent fluid pressure of 55 pcf. For retaining walls that will not rotate or translate, such as building walls or other walls rigidly connected to structures, at-rest conditions will develop.

The wedge of clean aggregate backfill should have a minimum width of 1 foot at the base of the wall or the width of the footing heel, whichever is greater, and increase in width a minimum of 0.6 feet per foot of wall height. The aggregate should be fully encapsulated with a properly designed geotextile (filter fabric) to prevent migration of the adjacent soils into the aggregate. Aggregate placed behind the retaining wall should be placed in accordance with the compaction recommendations of this report. However, we caution that operating compaction equipment directly behind the wall can create lateral earth pressures far in excess of those recommended for design. Therefore, we recommend using hand operated, smaller compaction equipment in non-vibratory modes within 5 feet of the front of the wall.

For rigid, cast-in-place concrete walls, an ultimate friction factor of 0.35 between foundation concrete and the bearing soils may be used when evaluating friction. Also, an ultimate passive earth pressure resistance of well-compacted soil fill can be approximated by a uniformly acting resistance of 1,000 psf. However, to limit deformation when relying on passive strength, we recommend using a minimum safety factor of 3.0 applied to the ultimate passive resistance value.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 FOUNDATION CONSTRUCTION

Foundation excavations should be opened, the subgrade evaluated, remedial work performed (if required), and concrete placed in an expeditious manner. Exposure to weather often reduces foundation support capabilities, thus necessitating remedial measures prior to concrete placement. It is also important that proper surface drainage be maintained both during construction (especially in terms of maintaining dry footing trenches) and after construction. Soil backfill for footings should be placed in accordance with the recommendations for structural fill presented herein.

5.2 EXCAVATIONS

Weathered rock was encountered at depths ranging from approximately 3 to 27 feet below the existing ground surface (elevation 882.2 to 891.7 feet) in borings B-2, B-4 through B-7 and P-12 drilled in the northeastern portion of the site. Refusal to the power auger used to advance the borings was encountered in borings B-1 through B-6, B-10A and P-23. The depth to auger refusal ranged from approximately 8.9 to 28.8 feet below the existing ground surface (elevation 880.4 to 947.1 feet).

Refusal conditions generally correspond to materials which require difficult excavation techniques (pneumatic hammers or blasting) for removal. Typically, soils penetrated by the equipment used to advance the borings can be removed with conventional earthmoving equipment. We note the weathering process is erratic and variations in the rock profile can occur in small lateral distances, particularly in this type of geology. It is therefore possible that weathered rock or bedrock may be encountered at more shallow depths in areas between the borings of this exploration.

Where excavations extend to the depths where weathered rock or auger refusal was encountered in the borings, excavation difficulty should be anticipated. We note that the removal of weathered rock and rock in confined excavations, such as for foundations or utility trenches, can often be extremely difficult. The near surface or buried concrete encountered in some borings could also present difficulty during general earthwork, utility installation, rammed and aggregate pier installation.

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service, and under no circumstances should GEOServices be assumed responsible for construction site safety.

Excavations near existing structures or roadways should be evaluated with respect to the effect of the excavation on the materials supporting the structures or roads. Under no circumstances should foundation or slab support materials of existing structures be disturbed or undermined by the excavation, without a plan previously approved by the structural engineer. Shoring to stabilize the adjacent structures, properties, sidewalks or streets may be required to allow the proposed excavations. We note the City of Knoxville does not typically allow anchors, nails, reinforcing, or other features of such stabilization systems to extend into public property, even temporarily.

5.3 HIGH PLASTICITY SOIL CONSIDERATIONS

Based on our experience in the East Tennessee area, soils with plasticity indices (PI) less than 30 percent have a slight potential for volume changes with changes in moisture content, and soils with a PI greater than 50 percent are highly susceptible to volume changes. Between these values, we consider the soils to be moderately susceptible to volume changes.

Plastic soils have the potential to shrink or swell with significant changes in moisture content. Unlike other areas of the country where high plasticity soils cause considerable foundation problems, East Tennessee does not typically endure long periods of severe drought or wet weather. However, in recent years drought conditions have been sufficient to cause soil shrinkage and related structural distress of buildings, floor slabs and pavements at sites underlain by high plasticity soils.

At sites that have high plasticity soils, certain precautions should be considered to minimize or eliminate the potential for volume changes. The most effective way to eliminate the potential for volume changes is to remove highly plastic soils and replace them with compacted fill of non-expansive material. Testing and recommendations for the required depth of removal can be provided, if needed. If removal of the highly plastic soils is not desirable, then measures should be taken to protect the soils from excessive amounts of wetting or drying. In addition, modification of the soils by lime or cement treatment can be utilized to reduce the soil plasticity.

Several construction considerations may reduce the potential for volume changes in the subgrade soils. Foundations should be excavated, checked, and concreted in the same day to prevent excessive wetting or drying of the foundation soils. The floor subgrade should be protected from excessive drying and wetting by covering the subgrade prior to slab construction. The site should be graded in order to drain surface water away from the building both during and after construction. Installing moisture barriers around the perimeter of the slab will help limit the moisture variation of the soil and reduce the potential for shrinking or swelling. In addition, roof drains should discharge water away from the building area and foundations. Heat sources should be isolated from foundation soils to minimize drying of the foundation soils. Trees and large shrubs can draw large amounts of moisture from the soil during dry weather and should be kept well away from the building to prevent excessive drying of the foundation soils. Watering of lawns or landscaped areas should be performed to maintain moisture levels during dry weather.

Structural details to make the building flexible should be considered to accommodate potential volume changes in the subgrade. Floor slabs should be liberally jointed to control cracking, and the floor slab should not be structurally connected to the walls. Walls should incorporate sufficient expansion/contraction joints to allow for differential movement.

5.4 MOISTURE SENSITIVE SOILS

The plastic fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Construction traffic patterns should be varied to prevent the degradation of previously stable subgrade. In addition, the soils at this site which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. We caution if site grading is performed during the wet weather season; increases in the undercut volumes should be expected.

Further for site fills, methods such as discing and allowing the material to dry will be required to meet the required compaction recommendations. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather. However, November through March is typically the difficult grading period due to the limited drying conditions which exist.

5.5 DRAINAGE, SURFACE AND GROUNDWATER CONCERNS

To reduce the potential for additional undercut and construction induced sinkholes, water should not be allowed to collect in the foundation excavations, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, subsurface water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

Groundwater was encountered in boring P-21 at a depth of 6 feet below the existing ground surface at the time of drilling. Proposed finished grades were not available as of this report and the depths of excavation in the area of boring P-21 are unknown. Temporary construction dewatering has been performed on previous projects by pumping from gravel-lined cased sumps. Waters pumped from the sumps should be discharged at an approved outfall away from the construction area. Once finished grades have been developed, the requirement for construction or permanent dewatering can be evaluated.

5.6 SLOPES

We have not been provided within information regarding proposed finished grades or potential slope configurations. The following recommendations are provided for consideration during development of the site design and are generally applicable for dry slopes of up to 20 feet in maximum height. Once finished site grades have been determined, we recommend slope stability analyses be performed for slopes greater than 20 feet in height, for slopes with surcharge at the top, or for slopes which intersect the ground water level.

Our experience suggests that excavation side slopes through the residual soil overburden at the site may be laid back at a 2.0H:1V (Horizontal:Vertical) slope. Permanent fill slopes placed on a suitable foundation should be constructed at 2.5H:1V, or flatter. Before final grading of a fill slope, the edge of the compacted fill should extend at least 10 feet horizontally beyond the outside edge of the building foundations and at least 5 feet beyond paved areas. Fill slopes should be adequately compacted. Cut and fill slope surfaces should be protected from erosion by grassing or other means. Permanent slopes of 3H:1V or flatter may be desirable for mowing.

It has been our experience that improper control of surface drainage or inadequate slope maintenance can lead to problems with surficial stability. We recommend diversion berms along the top of the slope to divert surface runoff from the slope face. The toe of the slope should also be graded to provide positive drainage and prevent ponding of water.

5.7 SINKHOLE RISK REDUCTION AND CORRECTIVE ACTIONS

Based on our experience, corrective actions can also be performed to reduce the potential for sinkhole development at this site. These corrective actions would decrease but not eliminate the potential for sinkhole development. Much can be accomplished to decrease the potential of future sinkhole activity by proper grade selection and positive site drainage.

In general, the portions of a site that are excavated to achieve the desired grades will have a higher risk of sinkhole development than the areas that are filled, because of the exposure of relic fractures in the soil to rainfall and runoff. On the other hand, those portions of a site that receive a modest amount of fill (or that have been filled in the past) will have a decreased risk of sinkhole development caused by rainfall or runoff because the placement of a cohesive soil fill over these areas effectively caps the area with a relatively impervious "blanket" of remolded soil. Therefore, the recommendations that follow incorporate a modest remedial treatment program designed to make the surface of the soil in excavated areas less permeable.

Although it is our opinion that the risk of ground subsidence associated with sinkhole formation cannot be eliminated, we have found that several measures are useful in site design and development to reduce this potential risk. These measures include:

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

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

6.0 RECOMMENDED ADDITIONAL GEOTECHNICAL SERVICES

We understand the proposed Austin Homes Redevelopment includes an approximately 32-acre track which will house numerous buildings, including several multi-story structures. We note that many of the proposed building areas were not explored as part of the requested soil test borings drilled for this project. Many areas of the site were not accessible due to the presence of existing structures, utilities or other limiting factors. It should be anticipated that subsurface conditions will vary across the site and the recommendations provided in this report are therefore not applicable in areas of the site which have not been explored. Further, proposed grades were not available as part of this report and some additional exploration, laboratory testing and engineering analysis may be required to refine the recommendations herein for those areas of the site which were explored.

Additional field testing may include items such as more soil test borings, rock coring, the collection of relatively undisturbed and disturbed samples, and possibly in-situ testing. Additional laboratory testing may include triaxial shear tests, consolidation tests, grain size analysis, unit weight, plasticity, organic content, moisture content and compaction tests. The geotechnical engineer should be retained to consult with the designer during design development, design and construction phases.

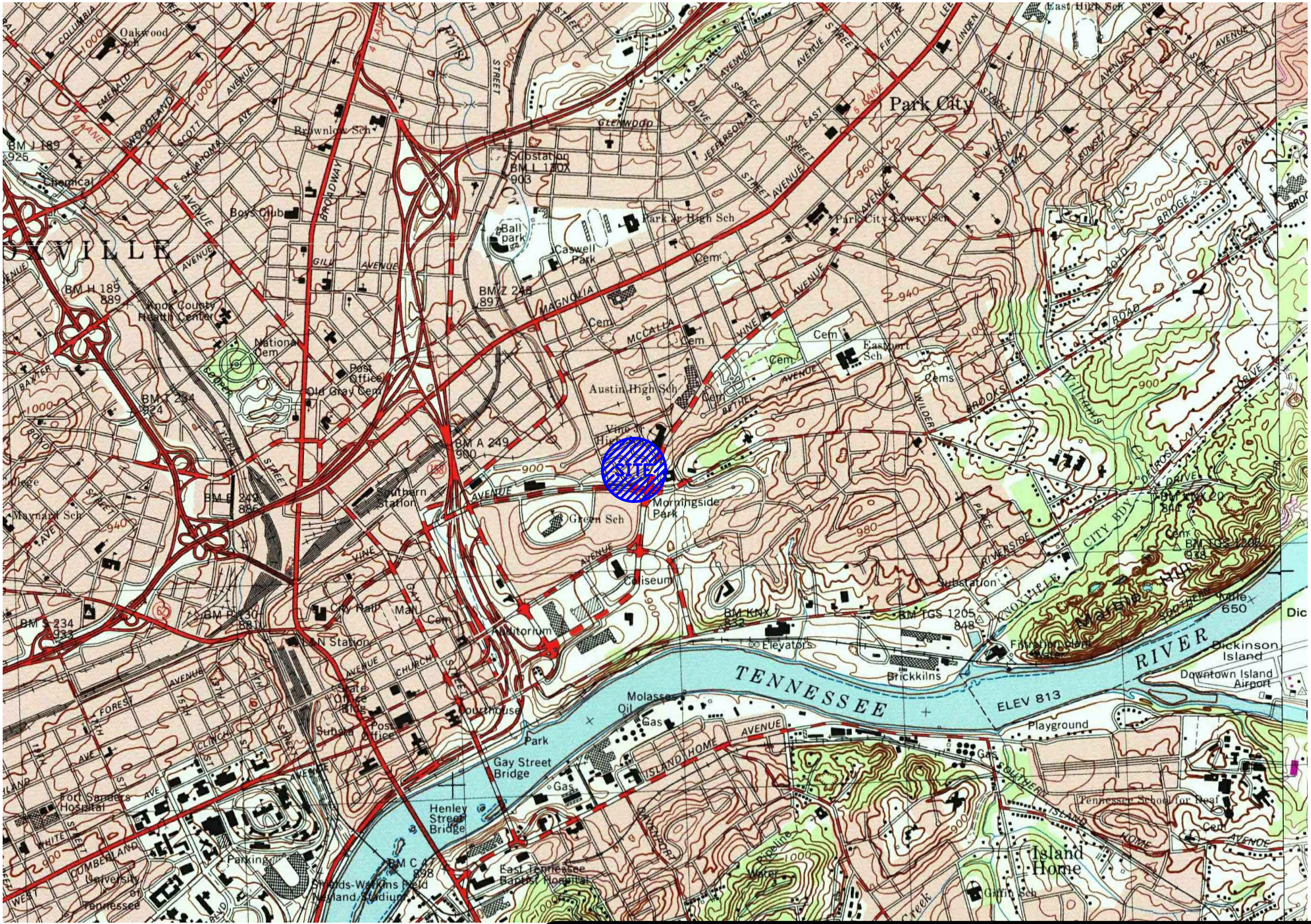
7.0 LIMITATIONS

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

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the borings will not become evident until construction. We recommend that GEOServices be retained to observe the project construction in the field. GEOServices cannot accept responsibility for conditions which deviate from those described in this report if not retained to perform construction observation and testing. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed, and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may need to be re-evaluated.

APPENDIX A

Figures and Test Boring Records



NOTES:

1.) BASE MAP: USGS QUADRANGLE (KNOXVILLE, TENNESSEE)

2.) BASE MAP: USGS QUADRANGLE (SHOOKS GAP, TENNESSEE)

GEOS
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2561 Willow Point Way
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Office: 865-539-8242
Fax: 865-539-8252

SITE VICINITY MAP

KCDC AUSTIN HOMES DEVELOPMENT

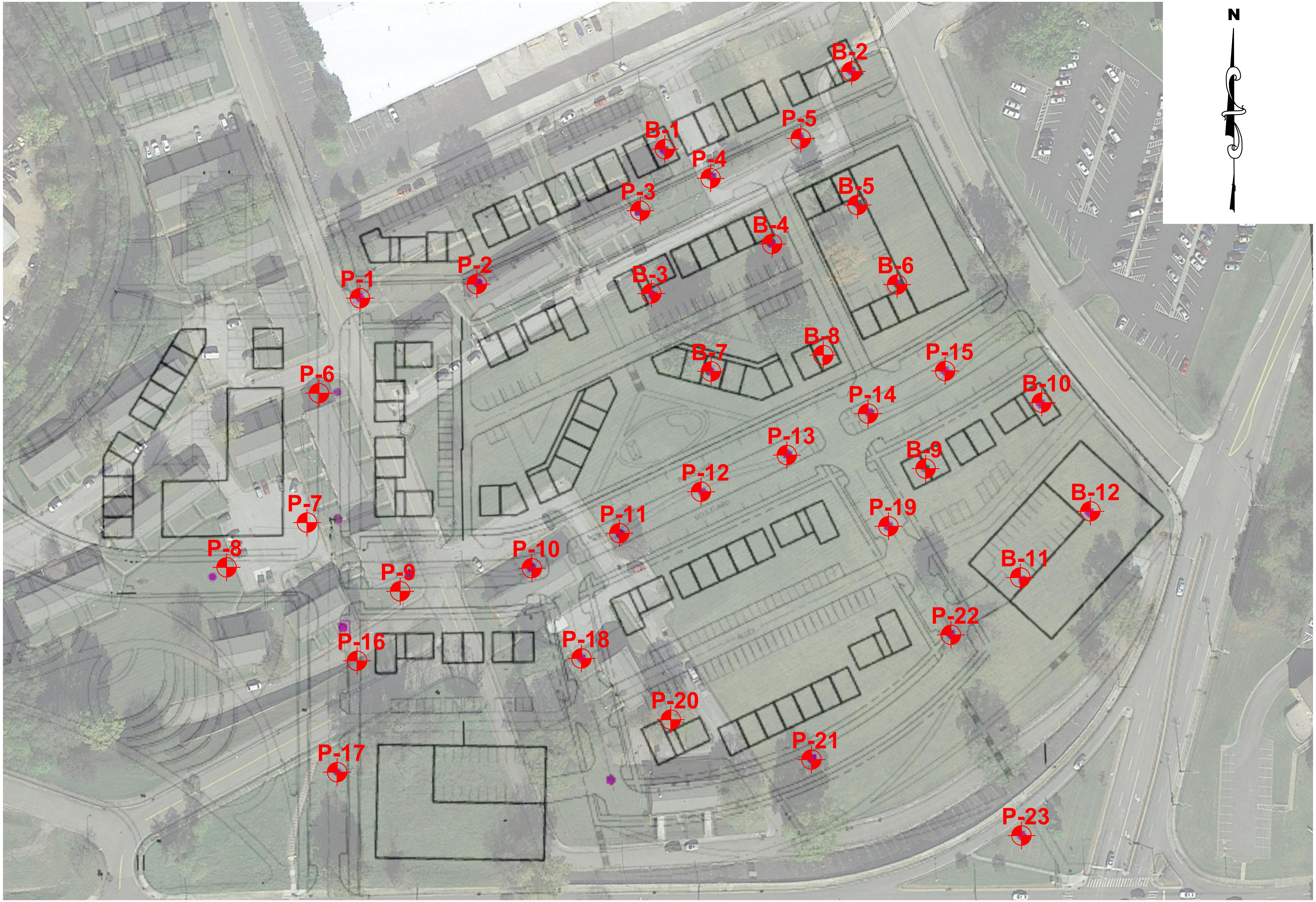
EAST SUMMIT HILL AVENUE

KNOXVILLE, TENNESSEE

DRAWN BY:	KSR
APPROVED BY:	MBH
SCALE:	N.T.S.
JOB NO.:	21-191014
DATE:	10/25/19

FIGURE

1



NOTES:
1.) BORING LOCATIONS ARE SHOWN IN GENERAL ARRANGEMENT ONLY.
2.) DO NOT USE BORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: Partners Development

⌖ LOCATION OF SOIL TEST BORINGS

SOIL TEST BORING LOCATION PLAN

KCDC AUSTIN HOMES DEVELOPMENT
EAST SUMMIT HILL AVENUE
KNOXVILLE, TENNESSEE

DRAWN BY:	KSR
APPROVED BY:	MBH
SCALE:	N.T.S.
JOB NO.:	21-191014
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Figure 2

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

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

COARSE GRAINED SOILS (SANDS & GRAVELS)

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

FINE GRAINED SOILS (SILTS & CLAYS)

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

STANDARD PENETRATION TEST (ASTM D1586)

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

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

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

SOIL PROPERTY SYMBOLS

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

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

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

ROCK HARDNESS

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

GEOServices, LLC-Geotechnical and Materials Engineers

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-1
SHEET 1 OF 1
DRILLER Neil Oildersleeve
ON-SITE REP.

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

DATE October 18, 2019
SURFACE ELEV. 890.9 FT.
REFUSAL: Yes DEPTH 11.4 FT. ELEV. 879.5 FT.
SAMPLED 11.4 FT. 3.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 11.4 FT. ELEV. 879.5 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION: DEPTH DRY FT. ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT. ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT. ELEV. FT.

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	5 - 4 - 7 N = 11				14.4	Silty CLAY (CL-ML) - with trace gravel, trace asphalt and trace organics at depth - dark brown, black and tan - dry (FILL)
2.5	888.4										
		3.5	5.0	2	SS	3 - 1 - 1 N = 2				12.9	
5.0	885.9										
		6.0	7.5	3	SS	WOH - WOH - 3 N = 3				14.4	
7.5	883.4										
		8.5	10.0	4	SS	2 - 3 - 3 N = 6				21.5	Lean CLAY (CL) - with trace shale fragments - tan, gray and brown - moist - firm (RESIDUUM)
10.0	880.9										
											Auger Refusal at 11.4 Feet
12.5	878.4										
15.0	875.9										
17.5	873.4										
20.0	870.9										

REMARKS: WOH - Weight of Hammer

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LOG OF BORING B-2
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

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

DATE: October 17, 2019
SURFACE ELEV. 896.1 FT.
REFUSAL: Yes DEPTH 14.2 FT. ELEV. 881.9 FT.
SAMPLED 14.2 FT. 4.3 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 14.2 FT. ELEV. 881.9 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	6 - 5 - 8 N = 13					Lean CLAY (CL) - with shale-like structure and weathered shale fragments - tan and orangish brown - dry - stiff to very stiff (RESIDUUM)
2.5	893.6										
		3.5	5.0	2	SS	9 - 11 - 14 N = 25					
5.0	891.1										
		6.0	7.5	3	SS	4 - 7- 13 N = 20					
7.5	888.6										
		8.5	10.0	4	SS	6 - 8 - 11 N = 19					
10.0	886.1										
12.5	883.6										Weathered ROCK (WR) - shale with shale-like structure - gray and tan - dry - very hard (RESIDUUM)
		13.5	14.2	5	SS	27 - 50/2 " N = 50/2 "					
											Auger Refusal at 14.2 Feet
15.0	881.1										
17.5	878.6										
20.0	876.1										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

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GEOServices Project # 21-191014

LOG OF BORING B-3
SHEET 1 OF 1
DRILLER Neil Oildersleeve
ON-SITE REP.

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

DATE October 17, 2019
SURFACE ELEV. 892.9 FT.
REFUSAL: Yes DEPTH 8.7 FT. ELEV. 884.2 FT.
SAMPLED 8.7 FT. 2.7 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 8.7 FT. ELEV. 884.2 FT.

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

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

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	6 - 6 - 5 N = 11					Fat CLAY (CH) - with gravel - gray, brown and orangish brown - moist to dry (FILL)
2.5	890.4										
		3.5	5.0	2	SS	1 - 2 - 3 N = 5					
5.0	887.9										
		6.0	7.5	3	SS	1 - 2 - 2 N = 4					Fat CLAY (CH) - with organics, organic odor, gravel, asphalt, metal fragments and trace sand - gray, brown and orangish brown - moist (FILL)
7.5	885.4	8.5	8.7	4	SS	50/2 " N = 50/2 "					- No Recovery
											Auger Refusal at 8.7 Feet
10.0	882.9										
12.5	880.4										
15.0	877.9										
17.5	875.4										
20.0	872.9										

REMARKS:

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LOG OF BORING B-4
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

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

DATE: October 16, 2019
SURFACE ELEV.: 896.2 FT.
REFUSAL: Yes DEPTH 14.8 FT. ELEV. 881.4 FT.
SAMPLED: 14.8 FT. 4.5 M
TOP OF ROCK: DEPTH FT. ELEV. FT.
BEGAN CORING: DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 14.8 FT. ELEV. 881.4 FT.

WATER LEVEL DATA (IF APPLICABLE)

	DEPTH	ELEV.
COMPLETION:	DRY FT.	FT.
AFTER 1 HRS:	TNP FT.	FT.
AFTER 24 HRS.	TNP FT.	FT.

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	6 - 6 - 7 N = 13					Lean CLAY (CL) - with gravel and trace root organics at depth - gray, brown and orangish brown - moist (FILL)
2.5	893.7										
		3.5	5.0	2	SS	2 - 2 - 4 N = 6					
5.0	891.2										
		6.0	7.5	3	SS	3 - 4 - 4 N = 8					
7.5	888.7										
		8.5	10.0	4	SS	6 - 7 - 11 N = 18					Silty CLAY (CL-ML) - with shale-like structure and weathered shale fragments - tan - dry - very stiff (RESIDUUM)
10.0	886.2										
12.5	883.7										Weathered ROCK (WR) - shale with shale-like structure - gray and tan - dry - very hard (RESIDUUM)
		13.5	14.8	5	SS	8 - 30 - 50/3" N = 50/3"					
15.0	881.2										Auger Refusal at 14.8 Feet
17.5	878.7										
20.0	876.2										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

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Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-5
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

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

DATE: October 16, 2019
SURFACE ELEV. 898.7 FT.
REFUSAL: Yes DEPTH 8.9 FT. ELEV. 889.8 FT.
SAMPLED 8.9 FT. 2.7 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 8.9 FT. ELEV. 889.8 FT.

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

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	7 - 12 - 7 N = 19				11.0	Lean CLAY (CL) - with gravel - tan and gray - dry (FILL)
2.5	896.2										
		3.5	5.0	2	SS	2 - 4 - 4 N = 8				19.4	Lean CLAY (CL) - orangish brown - moist - firm (RESIDUUM)
5.0	893.7										
		6.0	7.5	3	SS	3 - 6 - 27 N = 33				22.4	
7.5	891.2										Weathered ROCK (WR) - shale with shale-like structure - gray - dry - hard to very hard (RESIDUUM)
		8.5	8.8	4	SS	50/4 " N = 50/4 "				9.1	
											Auger Refusal at 8.9 Feet
10.0	888.7										
12.5	886.2										
15.0	883.7										
17.5	881.2										
20.0	878.7										

REMARKS: Offset 2.0 feet and refused at 8.8 feet.

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LOG OF BORING B-6
SHEET 1 OF 2

DRILLER	Neil Oildersleeve
ON-SITE REP.	

BORING NO. / LOCATION: B-6
DRY ON COMPLETION ? YES

DATE	October 16, 2019			SURFACE ELEV.	909.2 FT.
REFUSAL:	Yes	DEPTH	28.8 FT.	ELEV.	880.4 FT.
SAMPLED	28.8 FT.		8.8 M		
TOP OF ROCK		DEPTH	FT.	ELEV.	FT.
BEGAN CORING		DEPTH	FT.	ELEV.	FT.
FOOTAGE CORED (LF)			FT.		
BOTTOM OF HOLE DEPTH			28.8 FT.	ELEV.	880.4 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY FT.	ELEV.	FT.
AFTER 1 HRS:	DEPTH	TNP FT.	ELEV.	FT.
AFTER 24 HRS.	DEPTH	TNP FT.	ELEV.	FT.

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	3 - 5 - 6 N = 11					Lean CLAY (CL) - with gravel - brown and gray - dry (FILL)
2.5	906.7										
		3.5	5.0	2	SS	4 - 5 - 7 N = 12					- No Recovery
5.0	904.2										
		6.0	7.5	3	SS	4 - 5 - 8 N = 13					Lean CLAY (CL) - with shale-like structure - tan and orangish brown - moist to dry - stiff to firm (RESIDUUM)
7.5	901.7										
		8.5	10.0	4	SS	2 - 2 - 4 N = 6					
10.0	899.2										
12.5	896.7										Fat CLAY (CH) - orangish brown - moist - stiff to firm (RESIDUUM)
		13.5	15.0	5	SS	4 - 4 - 6 N = 10					
15.0	894.2										
17.5	891.7										
		18.5	20.0	6	SS	1 - 2 - 4 N = 6					
20.0	889.2										

Continued

REMARKS:

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LOG OF BORING B-6
SHEET 2 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-6
DRY ON COMPLETION ?: YES

DATE: October 16, 2019
SURFACE ELEV.: 909.2 FT.
REFUSAL: Yes DEPTH 28.8 FT. ELEV. 880.4 FT.
SAMPLED: 28.8 FT. 8.8 M
TOP OF ROCK: DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 28.8 FT. ELEV. 880.4 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											(Continued) Fat CLAY (CH) - orangish brown - moist - stiff to firm (RESIDUUM)
22.5	886.7										
		23.5	25.0	7	SS	4 - 8 - 16 N = 24					Silty CLAY (CL-ML) - with shale-like structure and weathered shale fragments - gray - dry - very stiff (RESIDUUM)
25.0	884.2										
27.5	881.7										
		28.5	28.8	8	SS	50/3 " N = 50/3 "					Weathered ROCK (WR) - shale with shale-like structure - tan and gray - dry - very hard (RESIDUUM)
											Auger Refusal at 28.8 Feet
30.0	879.2										
32.5	876.7										
35.0	874.2										
37.5	871.7										
40.0	869.2										

REMARKS:

GEOS
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GEOServices Project # 21-191014

LOG OF BORING B-7
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-7
DRY ON COMPLETION ?: YES

DATE: October 16, 2019
SURFACE ELEV.: 902.4 FT.
REFUSAL: No DEPTH: FT. ELEV.: FT.
SAMPLED: 20.0 FT. 6.1 M
TOP OF ROCK: DEPTH: FT. ELEV.: FT.
BEGAN CORING: DEPTH: FT. ELEV.: FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 20.0 FT. ELEV.: 882.4 FT.
BORING ADVANCED BY: POWER AUGERING: X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH: DRY FT.	ELEV.: FT.
AFTER 1 HRS:	DEPTH: TNP FT.	ELEV.: FT.
AFTER 24 HRS.	DEPTH: TNP FT.	ELEV.: FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	10 - 10 - 12 N = 22					Fat CLAY (CH) - with gravel and large root organics - dark brown, gray and orangish brown - dry (FILL)
2.5	899.9										
		3.5	5.0	2	SS	6 - 6 - 8 N = 14					Silty CLAY (CL-ML) - with shale-like structure and weathered shale fragments - tan and orangish brown - dry - very stiff to stiff (RESIDUUM)
5.0	897.4										
		6.0	7.5	3	SS	4 - 7 - 10 N = 17					
7.5	894.9										
		8.5	10.0	4	SS	4 - 8 - 9 N = 17					
10.0	892.4										
12.5	889.9										
		13.5	15.0	5	SS	5 - 5 - 7 N = 12					
15.0	887.4										
17.5	884.9										Weathered ROCK (WR) - shale with shale-like structure - gray - dry - hard (RESIDUUM)
		18.5	20.0	6	SS	3 - 4 - 27 N = 31					
20.0	882.4										Boring Terminated at 20.0 Feet

REMARKS:

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GEOServices Project # 21-191014

LOG OF BORING B-8
SHEET 1 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-8
DRY ON COMPLETION ?: YES

DATE: October 16, 2019 | SURFACE ELEV. 906.8 FT.
REFUSAL: No | DEPTH FT. | ELEV. FT.
SAMPLED: 25.0 FT. 7.6 M
TOP OF ROCK: DEPTH FT. | ELEV. FT.
BEGAN CORING: DEPTH FT. | ELEV. FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH 25.0 FT. | ELEV. 881.8 FT.

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

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

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	7 - 10 - 10 N = 20				12.4	Lean CLAY (CL) - with asphalt and trace gravel - brown, gray and reddish brown - dry to moist (FILL)
2.5	904.3										
		3.5	5.0	2	SS	1 - 2 - 3 N = 5		36	20	17.9	
5.0	901.8										
		6.0	7.5	3	SS	1 - 1 - 1 N = 2				21.5	
7.5	899.3										
		8.5	10.0	4	SS	1 - 1 - 3 N = 4				31.3	Fat CLAY (CH) - with black manganese and chert fragments - orangish brown - moist - soft to firm (RESIDUUM)
10.0	896.8										
12.5	894.3										
		13.5	15.0	5	SS	3 - 2 - 4 N = 6					
15.0	891.8										
17.5	889.3										Lean CLAY (CL) - with shale-like structure - tan and orangish brown - moist - soft to very stiff (RESIDUUM)
		18.5	20.0	6	SS	1 - 1 - 2 N = 3					
20.0	886.8										

Continued

REMARKS:

GEOS — GEOServices, LLC, Geotechnical and Materials Engineers

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LOG OF BORING B-8
SHEET 2 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-8
DRY ON COMPLETION ? YES

DATE: October 16, 2019
SURFACE ELEV. 906.8 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 25.0 FT. 7.6 M
TOP OF ROCK DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF) ___ FT.
BOTTOM OF HOLE DEPTH 25.0 FT. ELEV. 881.8 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: ___ FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. ___ FT.
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. ___ FT.
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											(Continued)
22.5	884.3										Lean CLAY (CL) - with shale-like structure - tan and orangish brown - moist - soft to very stiff (RESIDUUM)
		23.5	25.0	7	SS	6 - 9 - 10 N = 19					
25.0	881.8										Boring Terminated at 25.0 Feet
27.5	879.3										
30.0	876.8										
32.5	874.3										
35.0	871.8										
37.5	869.3										
40.0	866.8										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

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LOG OF BORING B-9
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-9
DRY ON COMPLETION ?: YES

DATE: October 17, 2019
SURFACE ELEV. 919.6 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED: 20.0 FT. 6.1 M
TOP OF ROCK: DEPTH FT. ELEV. FT.
BEGAN CORING: DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 20.0 FT. ELEV. 899.6 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION: DEPTH DRY FT. ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT. ELEV. FT.
AFTER 24 HRS.: DEPTH TNP FT. ELEV. FT.

STRATUM DEPTH FT.	STRATUM ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	12 - 6 - 8 N = 14					Fat CLAY (CH) - with chert fragments - reddish brown and orangish brown - moist - stiff to very stiff (RESIDUUM)
2.5	917.1										
		3.5	5.0	2	SS	4 - 6 - 10 N = 16					
5.0	914.6										
		6.0	7.5	3	SS	6 - 9 - 17 N = 26					
7.5	912.1										
		8.5	10.0	4	SS	5 - 6 - 8 N = 14					Fat CLAY (CH) - with black manganese - orangish brown - moist - stiff to firm (RESIDUUM)
10.0	909.6										
12.5	907.1										
		13.5	15.0	5	SS	4 - 4 - 6 N = 10					
15.0	904.6										
17.5	902.1										
		18.5	20.0	6	SS	2 - 3 - 4 N = 7					
20.0	899.6										Boring Terminated at 20.0 Feet

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

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LOG OF BORING B-10A
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-10A
DRY ON COMPLETION ?: YES

DATE: October 17, 2019
SURFACE ELEV.: 925.6 FT.
REFUSAL: Yes DEPTH 4.6 FT. ELEV. 921.0 FT.
SAMPLED: 4.6 FT. 1.4 M
TOP OF ROCK: DEPTH FT. ELEV. FT.
BEGAN CORING: DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 4.6 FT. ELEV. 921.0 FT.

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

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.2	1	SS	7 - 9 - 50/2" N = 50/2 "					
2.5	923.1										Lean CLAY (CL) - with gravel - gray, brown and orangish brown - dry (FILL)
5.0	920.6										Auger Refusal at 4.6 Feet
7.5	918.1										
10.0	915.6										
12.5	913.1										
15.0	910.6										
17.5	908.1										
20.0	905.6										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-10B
SHEET 1 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-10B
DRY ON COMPLETION ? YES

DATE: October 17, 2019
SURFACE ELEV. 925.6 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED: 25.0 FT. 7.6 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 25.0 FT. ELEV. 900.6 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. FT.
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. FT.
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LAB LL	LAB PI	%M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
2.5	923.1	1.0	2.5	1	SS	9 - 11 - 10 N = 31				5.8	Lean CLAY (CL) - with gravel and trace root organics - gray, brown and reddish brown - dry (FILL)
5.0	920.6	3.5	5.0	2	SS	6 - 4 - 8 N = 12				31.8	Fat CLAY (CH) - with trace chert fragments - orangish brown - moist - stiff (RESIDUUM)
7.5	918.1	6.0	7.5	3	SS	5 - 6 - 10 N = 16				27.7	Fat CLAY (CH) - with chert gravel - orangish brown - moist - very stiff (RESIDUUM)
10.0	915.6	8.5	10.0	4	SS	6 - 9 - 7 N = 16				31.4	
12.5	913.1										Lean CLAY (CL) - with chert fragments and weathered shale fragments - orangish brown - moist - stiff to soft (RESIDUUM)
15.0	910.6	13.5	15.0	5	SS	1 - 3 - 7 N = 10					
17.5	908.1										
20.0	905.6	18.5	20.0	6	SS	1 - 2 - 2 N = 4					

Continued

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-10B
SHEET 2 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-10B
DRY ON COMPLETION ? YES

DATE: October 17, 2019
SURFACE ELEV. 925.6 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 25.0 FT. 7.6 M
TOP OF ROCK: DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 25.0 FT. ELEV. 900.6 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: ___ FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. ___ FT.	
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. ___ FT.	
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. ___ FT.	

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											(Continued) Lean CLAY (CL) - with chert fragments and weathered shale fragments - orangish brown - moist - stiff to soft (RESIDUUM)
22.5	903.1										
											Fat CLAY (CH) - with chert fragments - orangish brown - moist - firm (RESIDUUM)
		23.5	25.0	7	SS	3 - 4 - 4 N = 8					
25.0	900.6										Boring Terminated at 25.0 Feet
27.5	898.1										
30.0	895.6										
32.5	893.1										
35.0	890.6										
37.5	888.1										
40.0	885.6										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-11
SHEET 1 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-11
DRY ON COMPLETION ?: YES

DATE: October 17, 2019
SURFACE ELEV. 932.7 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED: 30.0 FT. 9.1 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 30.0 FT. ELEV. 902.7 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	6 - 15 - 9 N = 24				10.9	Lean CLAY (CL) - with gravel and trace root organics - reddish brown, brown and gray - dry (FILL)
2.5	930.2										
		3.5	5.0	2	SS	4 - 4 - 8 N = 12				34.8	Fat CLAY (CH) - with chert fragments - orangish brown - moist - stiff to firm (RESDIUUM)
5.0	927.7										
		6.0	7.5	3	SS	4 - 4 - 6 N = 10				33.1	
7.5	925.2										
		8.5	10.0	4	SS	4 - 5 - 7 N = 12				33.2	
10.0	922.7										
12.5	920.2										
		13.5	15.0	5	SS	2 - 3 - 4 N = 7					
15.0	917.7										
17.5	915.2										Lean CLAY (CL) - with weathered shale fragments and trace sand - tan, orangish brown and black - moist - soft (RESIDUUM)
		18.5	20.0	6	SS	1 - 2 - 2 N = 4					
20.0	912.7										

Continued

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-11
SHEET 2 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-11
DRY ON COMPLETION ?: YES

DATE: October 17, 2019
SURFACE ELEV.: 932.7 FT.
REFUSAL: No — DEPTH: FT. — ELEV.: FT.
SAMPLED: 30.0 FT. — 9.1 M
TOP OF ROCK: DEPTH: FT. — ELEV.: FT.
BEGAN CORING: DEPTH: FT. — ELEV.: FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 30.0 FT. — ELEV.: 902.7 FT.

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

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

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											(Continued) Lean CLAY (CL) - with weathered shale fragments and trace sand - tan, orangish brown and black - moist - soft (RESIDUUM)
22.5	910.2										
		23.5	25.0	7	SS	3 - 4 - 5 N = 9					Fat CLAY (CH) - with black manganese - orangish brown - moist - stiff to firm (RESIDUUM)
25.0	907.7										
27.5	905.2										
		28.5	30.0	8	SS	2 - 3 - 4 N = 7					
30.0	902.7										Boring Terminated at 30.0 Feet
32.5	900.2										
35.0	897.7										
37.5	895.2										
40.0	892.7										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-12
SHEET 1 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-12
DRY ON COMPLETION ? YES

DATE: October 17, 2019
SURFACE ELEV. 937.6 FT.
REFUSAL: No — DEPTH ___ FT. — ELEV. ___ FT.
SAMPLED: 30.0 FT. — 9.1 M
TOP OF ROCK — DEPTH ___ FT. — ELEV. ___ FT.
BEGAN CORING — DEPTH ___ FT. — ELEV. ___ FT.
FOOTAGE CORED (LF) ___ FT.
BOTTOM OF HOLE DEPTH 30.0 FT. — ELEV. 907.6 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

	DEPTH	ELEV.
COMPLETION:	DRY FT.	FT.
AFTER 1 HRS:	TNP FT.	FT.
AFTER 24 HRS.	TNP FT.	FT.

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LAB LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	5 - 5 - 7 N = 12					Lean CLAY (CL) - with gravel and trace sand - tan and orangish brown - dry (FILL)
2.5	935.1										
		3.5	5.0	2	SS	15 - 7 - 7 N = 14					Fat CLAY (CH) - with gravel and asphalt - black, white and orangish brown - dry (FILL)
5.0	932.6										
		6.0	7.5	3	SS	5 - 6 - 8 N = 14					Fat CLAY (CH) - orangish brown - moist - stiff (RESIDUUM)
7.5	930.1										
		8.5	10.0	4	SS	3 - 4 - 5 N = 9					Lean CLAY (CL) - with weathered shale fragments - tan, black and orangish brown - moist - stiff (RESIDUUM)
10.0	927.6										
12.5	925.1										
		13.5	15.0	5	SS	3 - 3 - 4 N = 7					Fat CLAY (CH) - orangish brown - moist - firm to stiff (RESIDUUM)
15.0	922.6										
17.5	920.1										
		18.5	20.0	6	SS	3 - 4 - 5 N = 9					
20.0	917.6										

Continued

REMARKS:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING B-12
SHEET 2 OF 2

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: B-12
DRY ON COMPLETION ?: YES

DATE: October 17, 2019 | SURFACE ELEV. 937.6 FT.
REFUSAL: No | DEPTH FT. | ELEV. FT.
SAMPLED: 30.0 FT. | 9.1 M
TOP OF ROCK | DEPTH FT. | ELEV. FT.
BEGAN CORING | DEPTH FT. | ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 30.0 FT. | ELEV. 907.6 FT.

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

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											(Continued) Fat CLAY (CH) - with shale-like structure - orangish brown - moist - firm to stiff (RESIDUUM)
22.5	915.1										
		23.5	25.0	7	SS	1 - 2 - 2 N = 4					
25.0	912.6										Lean CLAY (CL) - with chert fragments - orangish brown and tan - wet - soft to firm (RESIDUUM)
27.5	910.1										
		28.5	30.0	8	SS	1 - 3 - 3 N = 6					
30.0	907.6										Boring Terminated at 30.0 Feet
32.5	905.1										
35.0	902.6										
37.5	900.1										
40.0	897.6										

REMARKS:

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

GEOServices, LLC, Geotechnical and Materials Engineers

LOG OF BORING P-1
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-1
DRY ON COMPLETION ?: YES

DATE: October 18, 2019
SURFACE ELEV.: 888.4 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK: DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. ELEV. 883.4 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

	DEPTH	ELEV.
COMPLETION:	DRY FT.	FT.
AFTER 1 HRS:	TNP FT.	FT.
AFTER 24 HRS.	TNP FT.	FT.

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LAB LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	6 - 8 - 7 N = 15					Fat CLAY (CH) - with gravel - gray, brown and orangish brown - dry (FILL)
2.5	885.9										
		3.5	5.0	2	SS	1 - 2 - 4 N = 6					Fat CLAY (CH) - with trace glass fragments - gray and orangish brown - moist (FILL)
5.0	883.4										Boring Terminated at 5.0 Feet
7.5	880.9										
10.0	878.4										
12.5	875.9										
15.0	873.4										
17.5	870.9										
20.0	868.4										

REMARKS: Boring location was moved away from the road and into the sidewalk intersection due to utilities and tree cover.

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-2
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-2
DRY ON COMPLETION ?: YES

DATE: October 18, 2019
SURFACE ELEV.: 887.8 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK: DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. ELEV. 882.8 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	6 - 4 - 3 N = 7					Fat CLAY (CH) - brown, orangish brown and tan - moist (FILL)
2.5	885.3										
		3.5	5.0	2	SS	1 - 1 - 1 N = 2					Decomposed PAPER - black - moist (FILL)
5.0	882.8										Boring Terminated at 5.0 Feet
7.5	880.3										
10.0	877.8										
12.5	875.3										
15.0	872.8										
17.5	870.3										
20.0	867.8										

REMARKS:

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

GEOServices, LLC, Geotechnical and Materials Engineers

LOG OF BORING P-3
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-3
DRY ON COMPLETION ? YES

DATE: October 18, 2019
SURFACE ELEV. 890.0 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED 5.0 FT. 1.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 885.0 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	8 - 9 - 10 N = 19					Silty CLAY (CL-ML) - with trace gravel and trace asphalt at depth - dark brown - dry (FILL)
2.5	887.5										
		3.5	5.0	2	SS	9 - 29 - 24 N = 53					
5.0	885.0										Boring Terminated at 5.0 Feet
7.5	882.5										
10.0	880.0										
12.5	877.5										
15.0	875.0										
17.5	872.5										
20.0	870.0										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-4
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-4
DRY ON COMPLETION ?: YES

DATE: October 18, 2019
SURFACE ELEV.: 893.2 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK: DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. ELEV. 888.2 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION: DEPTH DRY FT. ELEV. ___ FT.
AFTER 1 HRS: DEPTH TNP FT. ELEV. ___ FT.
AFTER 24 HRS.: DEPTH TNP FT. ELEV. ___ FT.

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	4 - 5 - 4 N = 9					Gravelly Lean CLAY (CL) - gray and dark brown - dry (FILL)
2.5	890.7										
		3.5	5.0	2	SS	3 - 3 - 3 N = 6					Lean CLAY (CL) - tan - dry - firm (RESIDUUM)
5.0	888.2										Boring Terminated at 5.0 Feet
7.5	885.7										
10.0	883.2										
12.5	880.7										
15.0	878.2										
17.5	875.7										
20.0	873.2										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-5
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-5
DRY ON COMPLETION ?: YES

DATE: October 18, 2019
SURFACE ELEV. 897.0 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF) ___ FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 892.0 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	6 - 7 - 7 N = 14					Lean CLAY (CL) - with gravel and brick fragments - tan and brown - dry (FILL)
2.5	894.5										
		3.5	5.0	2	SS	4 - 4 - 7 N = 11					Silty CLAY (CL-ML) - with shale-like structure and weathered shale fragments - tan - dry - stiff (RESIDUUM)
5.0	892.0										Boring Terminated at 5.0 Feet
7.5	889.5										
10.0	887.0										
12.5	884.5										
15.0	882.0										
17.5	879.5										
20.0	877.0										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-6
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-6
DRY ON COMPLETION ? YES

DATE	October 23, 2019		SURFACE ELEV.	888.3	FT.
REFUSAL:	No	DEPTH FT.	ELEV.		FT.
SAMPLED	5.0 FT.	1.5 M			
TOP OF ROCK		DEPTH FT.	ELEV.		FT.
BEGAN CORING		DEPTH FT.	ELEV.		FT.
FOOTAGE CORED (LF)		FT.			
BOTTOM OF HOLE DEPTH		5.0 FT.	ELEV.	883.3	FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

BORING ADVANCED BY: POWER AUGERING X

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	3 - 8 - 6 N = 14					Lean CLAY (CL) - with gravel and asphalt at depth - brown, black and reddish brown - dry (FILL)
2.5	885.8										
		3.5	5.0	2	SS	2 - 4 - 3 N = 7					
5.0	883.3										Boring Terminated at 5.0 Feet
7.5	880.8										
10.0	878.3										
12.5	875.8										
15.0	873.3										
17.5	870.8										
20.0	868.3										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-7
SHEET 1 OF 1

DRILLER	Rick Brock
ON-SITE REP.	
BORING NO. / LOCATION	P-7
DRY ON COMPLETION ?	YES

DATE	October 23, 2019			SURFACE ELEV.	891.4	FT.
REFUSAL:	No	DEPTH	FT.	ELEV.		FT.
SAMPLED	5.0 FT.	1.5	M			
TOP OF ROCK		DEPTH	FT.	ELEV.		FT.
BEGAN CORING		DEPTH	FT.	ELEV.		FT.
FOOTAGE CORED (LF)			FT.			
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	886.4	FT.
BORING ADVANCED BY:				POWER AUGERING	X	

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: ______ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Asphalt (6 Inches)
		1.0	2.5	1	SS	3 - 2 - 4 N = 6					Fat CLAY (CH) - with asphalt, wood organics, large glass fragments and trace gravel - dark brown - moist (FILL)
2.5	888.9										
		3.5	5.0	2	SS	7 - 4 - 3 N = 7					
5.0	886.4										Boring Terminated at 5.0 Feet
7.5	883.9										
10.0	881.4										
12.5	878.9										
15.0	876.4										
17.5	873.9										
20.0	871.4										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-8
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-8
DRY ON COMPLETION ?: YES

DATE: October 23, 2019
SURFACE ELEV.: 895.0 FT.
REFUSAL: No DEPTH: FT. ELEV.: FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK DEPTH: FT. ELEV.: FT.
BEGAN CORING DEPTH: FT. ELEV.: FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. ELEV.: 890.0 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	3 - 9 - 12 N = 21					Lean CLAY (CL) - with gravel, glass fragments and asphalt - dark brown - dry (FILL)
2.5	892.5										
		3.5	5.0	2	SS	31 - 13 - 10 N = 23					Lean CLAY (CL) - with gravel and glass fragments and trace sand - gray, tan and white - moist (FILL)
5.0	890.0										Boring Terminated at 5.0 Feet
7.5	887.5										
10.0	885.0										
12.5	882.5										
15.0	880.0										
17.5	877.5										
20.0	875.0										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

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Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-9
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-9
DRY ON COMPLETION ?: YES

DATE	October 23, 2019			SURFACE ELEV.	892.0 FT.		
REFUSAL:	No	DEPTH	FT.	ELEV.	FT.		
SAMPLED	5.0 FT.	1.5	M				
TOP OF ROCK		DEPTH	FT.	ELEV.	FT.		
BEGAN CORING		DEPTH	FT.	ELEV.	FT.		
FOOTAGE CORED (LF)			FT.				
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	887.0 FT.		
BORING ADVANCED BY:				POWER AUGERING	X		

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	4 - 6 - 8 N = 14					Lean CLAY (CL) - with gravel, asphalt and brick fragments - brown and reddish brown - dry (FILL)
2.5	889.5										
		3.5	5.0	2	SS	3 - 4 - 5 N = 9					Fat CLAY (CH) - with asphalt, wood organics, trace gravel and trace glass fragments - dark gray - moist (FILL)
5.0	887.0										Boring Terminated at 5.0 Feet
7.5	884.5										
10.0	882.0										
12.5	879.5										
15.0	877.0										
17.5	874.5										
20.0	872.0										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-10
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-10
DRY ON COMPLETION ? YES

DATE: October 23, 2019
SURFACE ELEV. 897.3 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 892.3 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	2 - 2 - 3 N = 5					Fat CLAY (CH) - with trace gravel and trace asphalt - dark brown and orangish brown - moist (FILL)
2.5	894.8										
		3.5	5.0	2	SS	5 - 3 - 6 N = 9					Fat CLAY (CH) - orangish brown - moist - stiff (RESIDUUM)
5.0	892.3										Boring Terminated at 5.0 Feet
7.5	889.8										
10.0	887.3										
12.5	884.8										
15.0	882.3										
17.5	879.8										
20.0	877.3										

REMARKS:

GEOS
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Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-11
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-11
DRY ON COMPLETION ?: YES

DATE: October 16, 2019
SURFACE ELEV.: 901.7 FT.
REFUSAL: No — DEPTH ___ FT. — ELEV. ___ FT.
SAMPLED: 5.0 FT. — 1.5 M
TOP OF ROCK: DEPTH ___ FT. — ELEV. ___ FT.
BEGAN CORING: DEPTH ___ FT. — ELEV. ___ FT.
FOOTAGE CORED (LF): ___ FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. — ELEV. 896.7 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. ___ FT.
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. ___ FT.
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. ___ FT.

PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	4 - 4 - 4 N = 8					Fat CLAY (CH) - with gravel - dark brown, black and orangish brown - dry (FILL)
2.5	899.2										
		3.5	5.0	2	SS	3 - 4 - 6 N = 10					
5.0	896.7										Boring Terminated at 5.0 Feet
7.5	894.2										
10.0	891.7										
12.5	889.2										
15.0	886.7										
17.5	884.2										
20.0	881.7										

REMARKS:

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

GEOServices, LLC, Geotechnical and Materials Engineers

LOG OF BORING P-12
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-12
DRY ON COMPLETION ?: YES

DATE	October 16, 2019			SURFACE ELEV.	904.2 FT.
REFUSAL:	No	DEPTH	FT.	ELEV.	FT.
SAMPLED	5.0 FT.	1.5	M		
TOP OF ROCK		DEPTH	FT.	ELEV.	FT.
BEGAN CORING		DEPTH	FT.	ELEV.	FT.
FOOTAGE CORED (LF)			FT.		
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	899.2 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

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

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	4 - 5 - 8 N = 13					Fat CLAY (CH) - with trace root organics - orangish brown - moist - stiff (FILL)
2.5	901.7										
		3.5	5.0	2	SS	4 - 10 - 26 N = 36					Weathered ROCK (WR) - shale with shale-like structure - gray and reddish brown - moist - hard (RESIDUUM)
5.0	899.2										Boring Terminated at 5.0 Feet
7.5	896.7										
10.0	894.2										
12.5	891.7										
15.0	889.2										
17.5	886.7										
20.0	884.2										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-13
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-13
DRY ON COMPLETION ? YES

DATE	October 16, 2019	SURFACE ELEV.	910.1 FT.
REFUSAL:	No	DEPTH FT.	ELEV. FT.
SAMPLED	5.0 FT.	1.5 M	
TOP OF ROCK		DEPTH FT.	ELEV. FT.
BEGAN CORING		DEPTH FT.	ELEV. FT.
FOOTAGE CORED (LF)		FT.	
BOTTOM OF HOLE DEPTH		5.0 FT.	ELEV. 905.1 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. FT.
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. FT.
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. FT.

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

STRATUM DEPTH FT.	STRATUM ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LAB LL	LAB PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	5 - 7 - 7 N = 14					Lean CLAY (CL) - with gravel - dark brown - dry (FILL)
2.5	907.6										
		3.5	5.0	2	SS	4 - 5 - 6 N = 11					Fat CLAY (CH) - with chert fragments - orangish brown - moist - stiff (RESIDUUM)
5.0	905.1										Boring Terminated at 5.0 Feet
7.5	902.6										
10.0	900.1										
12.5	897.6										
15.0	895.1										
17.5	892.6										
20.0	890.1										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-14
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-14
DRY ON COMPLETION ?: YES

DATE	October 16, 2019			SURFACE ELEV.	913.9 FT.
REFUSAL:	No	DEPTH	FT.	ELEV.	FT.
SAMPLED	5.0 FT.	1.5	M		
TOP OF ROCK		DEPTH	FT.	ELEV.	FT.
BEGAN CORING		DEPTH	FT.	ELEV.	FT.
FOOTAGE CORED (LF)			FT.		
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	908.9 FT.

BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (12 Inches)
		1.0	2.5	1	SS	5 - 9 - 9 N = 18					Lean CLAY (CL) - with gravel, plastic fragments and trace root organics - brown - moist to dry (FILL)
2.5	911.4										
		3.5	5.0	2	SS	2 - 3 - 4 N = 7					
5.0	908.9										Boring Terminated at 5.0 Feet
7.5	906.4										
10.0	903.9										
12.5	901.4										
15.0	898.9										
17.5	896.4										
20.0	893.9										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-15
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-15
DRY ON COMPLETION ?: YES

DATE: October 17, 2019
SURFACE ELEV.: 919.2 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 914.2 FT.

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

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M
		1.0	2.5	1	SS	9 - 5 - 6 N = 11				
2.5	916.7									
		3.5	5.0	2	SS	3 - 3 - 3 N = 6				
5.0	914.2									
7.5	911.7									
10.0	909.2									
12.5	906.7									
15.0	904.2									
17.5	901.7									
20.0	899.2									

STRATUM DESCRIPTION

Topsoil (6 Inches)

Fat CLAY (CH) - with gravel and brick fragments - reddish brown, brown and gray - dry (FILL)

Silty CLAY (CL-ML) - with shale-like structure and weathered shale fragments - tan - dry - firm (RESIDUUM)

Boring Terminated at 5.0 Feet

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-16
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-16
DRY ON COMPLETION ?: YES

DATE: October 23, 2019
SURFACE ELEV.: 900.0 FT.
REFUSAL: No
DEPTH: FT.
ELEV.: FT.
SAMPLED: 5.0 FT. 1.5 M
TOP OF ROCK DEPTH: FT. ELEV.: FT.
BEGAN CORING DEPTH: FT. ELEV.: FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 5.0 FT. ELEV.: 895.0 FT.

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

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

STRATUM DEPTH FT.	STRATUM ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	4 - 5 - 3 N = 8					Fat CLAY (CH) - with gravel and asphalt - brown - moist (FILL)
2.5	897.5										
		3.5	5.0	2	SS	2 - 3 - 4 N = 7					Fat CLAY (CH) - with tile fragments and trace asphalt - dark brown and orangish brown - moist (FILL)
5.0	895.0										Boring Terminated at 5.0 Feet
7.5	892.5										
10.0	890.0										
12.5	887.5										
15.0	885.0										
17.5	882.5										
20.0	880.0										

REMARKS:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

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Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-17
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-17
DRY ON COMPLETION ? YES

DATE	October 23, 2019			SURFACE ELEV.	920.4	FT.
REFUSAL:	No	DEPTH	FT.	ELEV.		FT.
SAMPLED	5.0 FT.		1.5 M			
TOP OF ROCK		DEPTH	FT.	ELEV.		FT.
BEGAN CORING		DEPTH	FT.	ELEV.		FT.
FOOTAGE CORED (LF)			FT.			
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	915.4	FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

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

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	3 - 6 - 9 N = 15					Lean CLAY (CL) - with glass fragments, trace root organics, trace gravel and trace sand - dark brown and reddish brown - dry (FILL)
2.5	917.9										
		3.5	5.0	2	SS	7 - 7 - 10 N = 17					Fat CLAY (CH) - with brick fragments, sand, trace root organics, trace gravel and trace asphalt - dark brown and reddish brown - dry (FILL)
5.0	915.4										Boring Terminated at 5.0 Feet
7.5	912.9										
10.0	910.4										
12.5	907.9										
15.0	905.4										
17.5	902.9										
20.0	900.4										

REMARKS:

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-18
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-18
DRY ON COMPLETION ?: YES

DATE	October 23, 2019			SURFACE ELEV.	907.8	FT.
REFUSAL:	No	DEPTH	FT.	ELEV.		FT.
SAMPLED	5.0 FT.	1.5	M			
TOP OF ROCK		DEPTH	FT.	ELEV.		FT.
BEGAN CORING		DEPTH	FT.	ELEV.		FT.
FOOTAGE CORED (LF)			FT.			
BOTTOM OF HOLE DEPTH		5.0	FT.	ELEV.	902.8	FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

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

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	2 - 4 - 4 N = 8					Lean CLAY (CL) - with asphalt and trace gravel - dark brown - dry (FILL)
2.5	905.3										
		3.5	5.0	2	SS	6 - 8 - 5 N = 13					Fat CLAY (CH) - with chert fragments - orangish brown - moist - stiff (RESIDUUM)
5.0	902.8										Boring Terminated at 5.0 Feet
7.5	900.3										
10.0	897.8										
12.5	895.3										
15.0	892.8										
17.5	890.3										
20.0	887.8										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-19
SHEET 1 OF 1

DRILLER: Neil Oildersleeve
ON-SITE REP.:

BORING NO. / LOCATION: P-19
DRY ON COMPLETION ? YES

DATE: October 17, 2019
SURFACE ELEV. 919.4 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED 5.0 FT. 1.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 914.4 FT.
BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH	DRY	FT.
	ELEV.		FT.
AFTER 1 HRS:	DEPTH	TNP	FT.
	ELEV.		FT.
AFTER 24 HRS.	DEPTH	TNP	FT.
	ELEV.		FT.

PROPOSED FFE: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	2.5	1	SS	9 - 9 - 10 N = 19					Lean CLAY (CL) - with chert fragments - reddish brown and orangish brown - moist to dry - very stiff to stiff (RESIDUUM)
2.5	916.9										
		3.5	5.0	2	SS	3 - 5 - 8 N = 13					
5.0	914.4										Boring Terminated at 5.0 Feet
7.5	911.9										
10.0	909.4										
12.5	906.9										
15.0	904.4										
17.5	901.9										
20.0	899.4										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-20
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-20
DRY ON COMPLETION ? YES

DATE: October 23, 2019
SURFACE ELEV. 925.0 FT.
REFUSAL: No DEPTH ___ FT. ELEV. ___ FT.
SAMPLED 5.0 FT. 1.5 M
TOP OF ROCK DEPTH ___ FT. ELEV. ___ FT.
BEGAN CORING DEPTH ___ FT. ELEV. ___ FT.
FOOTAGE CORED (LF) ___ FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 920.0 FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION: DEPTH DRY FT. ELEV. ___ FT.
AFTER 1 HRS: DEPTH TNP FT. ELEV. ___ FT.
AFTER 24 HRS. DEPTH TNP FT. ELEV. ___ FT.

BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: ___ FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (4 Inches)
		1.0	2.5	1	SS	2 - 4 - 7 N = 11					Lean CLAY (CL) - with trace root organics - brown - moist (FILL)
2.5	922.5										
		3.5	5.0	2	SS	5 - 6 - 10 N = 16					Fat CLAY (CH) - with trace chert fragments - reddish brown - moist - very stiff (RESIDUUM)
5.0	920.0										Boring Terminated at 5.0 Feet
7.5	917.5										
10.0	915.0										
12.5	912.5										
15.0	910.0										
17.5	907.5										
20.0	905.0										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-21
SHEET 1 OF 1

DRILLER	Neil Oildersleeve
ON-SITE REP.	
BORING NO. / LOCATION	P-21
DRY ON COMPLETION ?	NO
DATE	October 17, 2019
SURFACE ELEV.	926.1 FT.
REFUSAL:	No
REFUSAL DEPTH	FT.
REFUSAL ELEV.	FT.
SAMPLED	10.0 FT. 3.0 M
TOP OF ROCK	DEPTH FT. ELEV. FT.
BEGAN CORING	DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF)	FT.
BOTTOM OF HOLE DEPTH	10.0 FT.
BOTTOM OF HOLE ELEV.	916.1 FT.
BORING ADVANCED BY:	POWER AUGERING X
PROPOSED FFE:	FT.

WATER LEVEL DATA (IF APPLICABLE)

	DEPTH	ELEV.
COMPLETION:	6.0 FT.	920.1 FT.
AFTER 1 HRS:	TNP FT.	FT.
AFTER 24 HRS.	TNP FT.	FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
2.5	923.6	1.0	2.5	1	SS	7 - 6 - 3 N = 9					Gravelly Lean CLAY (CL) - gray and orangish brown - dry (FILL)
5.0	921.1	3.5	5.0	2	SS	3 - 2 - 1 N = 3					Lean CLAY (CL) - with organic odor and trace asphalt - brown - moist (FILL)
7.5	918.6	6.0	7.5	3	SS	WOH - WOH - WOH N = 0					- No Recovery
10.0	916.1	8.5	10.0	4	SS	5 - 7 - 9 N = 16					Fat CLAY (CH) - with chert fragments - orangish brown - moist - very stiff (RESIDUUM)
											Boring Terminated at 10.0 Feet
12.5	913.6										
15.0	911.1										
17.5	908.6										
20.0	906.1										

REMARKS: WOH = Weight of Hammer

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-22
SHEET 1 OF 1

DRILLER Neil Oildersleeve
ON-SITE REP.

BORING NO. / LOCATION P-22
DRY ON COMPLETION ? YES

DATE October 17, 2019
SURFACE ELEV. 930.1 FT.
REFUSAL: No DEPTH FT. ELEV. FT.
SAMPLED 5.0 FT. 1.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.0 FT. ELEV. 925.1 FT.
BORING ADVANCED BY: POWER AUGERING X

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

PROPOSED FFE: FT.

STRATUM DEPTH FT.	ELEV.	SAMPLE DEPTH FROM FT.	TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	Qu	LABORATORY RESULTS LL	PI	%M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
2.5	927.6	1.0	2.5	1	SS	7 - 10 - 13 N = 23					Lean CLAY (CL) - with gravel and asphalt - tan - dry (FILL)
5.0	925.1	3.5	5.0	2	SS	1 - 2 - 4 N = 6					Fat CLAY (CH) - with chert fragments - reddish brown - moist - firm (RESIDUUM)
											Boring Terminated at 5.0 Feet
7.5	922.6										
10.0	920.1										
12.5	917.6										
15.0	915.1										
17.5	912.6										
20.0	910.1										

REMARKS:

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
Knoxville, Tennessee
GEOServices Project # 21-191014

LOG OF BORING P-23
SHEET 1 OF 1

DRILLER: Rick Brock
ON-SITE REP.:

BORING NO. / LOCATION: P-23
DRY ON COMPLETION ?: YES

DATE: October 23, 2019
SURFACE ELEV.: 960.9 FT.
REFUSAL: Yes DEPTH 13.8 FT. ELEV. 947.1 FT.
SAMPLED: 13.8 FT. 4.2 M
TOP OF ROCK: DEPTH FT. ELEV. FT.
BEGAN CORING: DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF): FT.
BOTTOM OF HOLE DEPTH: 13.8 FT. ELEV. 947.1 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FFE: FT.

WATER LEVEL DATA (IF APPLICABLE)

COMPLETION:	DEPTH DRY FT.	ELEV. FT.
AFTER 1 HRS:	DEPTH TNP FT.	ELEV. FT.
AFTER 24 HRS.	DEPTH TNP FT.	ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LAB RESULTS LL	LAB RESULTS PI	%M
		1.0	2.5	1	SS	4 - 7 - 9 N = 16				
2.5	958.4									
		3.5	5.0	2	SS	9 - 11 - 7 N = 18				
5.0	955.9									
		6.0	7.5	3	SS	10 - 13 - 9 N = 22				
7.5	953.4									
		8.5	10.0	4	SS	10 - 6 - 3 N = 9				
10.0	950.9									
12.5	948.4									
		13.5	13.8	5	SS	50/4 " N = 50/4 "				
15.0	945.9									
17.5	943.4									
20.0	940.9									

STRATUM DESCRIPTION

Topsoil (4 Inches)

Lean CLAY (CL) - with gravel and asphalt - dark brown and reddish brown - dry (FILL)

Fat CLAY (CH) - with gravel - dark reddish brown, brown and tan - moist (FILL)

Fat CLAY (CH) - with trace chert fragments - orangish brown - moist - stiff to very hard (RESIDUUM)

Auger Refusal at 13.8 Feet

REMARKS:

APPENDIX B

Laboratory Test Results

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes

GEOServices Project No. 21-191014

November 11, 2019

SOIL DATA SUMMARY

Boring Number	Sample Number	Depth (feet)	Natural Moisture Content	Atterberg Limits			Soil Type	Percent Organic Content
				LL	PL	PI		
B-1	1	1.0-2.5'	14.4%					
	2	3.5-5.0'	12.9%					
	3	6.0-7.5'	14.4%					
	4	8.5-10.0'	21.5%					
B-5	1	1.0-2.5'	11.0%					
	2	3.5-5.0'	19.4%					
	3	6.0-7.5'	22.4%					
	4	8.5-10.0'	9.1%					
B-8	1	1.0-2.5'	12.4%					
	2	3.5-5.0'	17.9%	36	16	20	CL	
	3	6.0-7.5'	21.5%					
	4	8.5-10.0'	31.3%					
B-10	1	1.0-2.5'	5.8%					
	2	3.5-5.0'	31.8%					
	3	6.0-7.5'	27.7%					
	4	8.5-10.0'	31.4%					
B-11	1	1.0-2.5'	10.9%					
	2	3.5-5.0'	34.8%					
	3	6.0-7.5'	33.1%					
	4	8.5-10.0'	33.2%					

APPENDIX C

Addendum to Geotechnical Report

GEOServices, LLC, Geotechnical and Materials Engineers

January 28, 2020

Partners Development
502 Union Avenue
Knoxville, Tennessee 37902-2134

Attention: Mr. Peter Osickey
posickey@partersinfo.com

Subject: **ADDENDUM TO GEOTECHNICAL EXPLORATION**
KCDC Austin Homes Redevelopment
East Summit Hill Avenue
Knoxville, Tennessee
GEOServices Project No. 21-191014

Dear Mr. Osickey,

GEOServices previously prepared a geotechnical report for the proposed KCDC Austin Homes Redevelopment located along East Summit Hill Avenue titled "*Report of Geotechnical Exploration",* dated November 26, 2019 (please reference GEOServices Report No. 21-191014). The exploration consisted of thirty-five (35) soil test borings; spread throughout the area proposed for construction. The results of the soil test borings indicated that portions of the site were overlain by unsuitable existing fill soils that contained deleterious materials. In efforts to better define the depths of unsuitable fill material in the areas of deeper cuts, we were requested to performed additional geotechnical services.

Field Exploration

The subsurface conditions were explored with fourteen (14) observation pits excavated at the approximate locations as shown on the Observation Pit Location Plan attached to this report. The observation pit locations were selected and located by Partners Development and GEOServices personnel. Excavations were performed by your subcontractor on January 21, 2020. Observations were performed during excavation by our Brian Williamson. All depths in this report reference the ground surface that existed at the time of this exploration. Each observation pit location was backfilled and compacted before departing the site. Detailed information pertaining to each observation pit can be found in the Observation Pit Logs included as an attachment to this letter.

Subsurface Conditions

The additional information obtained from observation pits generally corresponds to the data obtained in our initial report. Furthermore, the observation pits revealed what was suspected by the previously performed soil test borings. The existing fill, which contains, varying amounts of deleterious materials will not be suitable for structural fill. Below is a table that provides additional information for each observation pit and depths at which unsuitable materials extended to.

Location	Notes
OP-1	Unsuitable fill (clay with brick and plastic) to 4 feet
OP-2	Unsuitable fill (clay with concrete foundation) to 5.5 feet
OP-3	Unsuitable fill (clay with clay pipe, pvc pipe and black sand layer) to 5 feet
OP-4	Unsuitable fill (clay with mortared brick foundation, metal and concrete fragments) to 10 feet
OP-5	Unsuitable fill (clay with concrete fragments) to 10 feet
OP-6	Unsuitable fill (clay with brick) to 4 feet.
OP-7	Unsuitable fill (clay black and brown) to 3 feet
OP-8	Unsuitable fill (clay with brick fragments and metal strap) to 2 feet
OP-9	Thin veneer of fill (likely reusable fill, but moist)
OP-10	Thin veneer of fill (likely reusable fill, but moist)
OP-11	Unsuitable fill (wet clay with high organics) to 5 feet overlying soft alluvium
OP-12	Unsuitable fill (wet clay with concrete) to 7 feet overlying soft alluvium
OP-13	Soft brown fill overlying a concrete slab at 18 inches
OP-14	Soft brown fill overlying residual soils at 4 feet

Recommendations

Based on the results of the additional exploration, our recommendations remain unchanged. The existing fill materials which contained excessive deleterious materials are not suitable for use as new fill. The depths at which these unsuitable materials were encountered varying in depth between 1 foot and over 10 feet. The site residual soils generally appear suitable for reuse as new fill; however, moisture conditioning may be required to reach the range of moisture contents recommended for compaction.

GEOServices looks forward to continuing to work with you on this project. If you have any questions or require additional information, please feel free to call us.

Sincerely,
GEOServices, LLC

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

THOMAS BRIAN WILLIAMSON
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 118861
STATE OF TENNESSEE
1/28/2020

T. Brian Williamson, P.E.
Geotechnical Department Manager
TN 118,861

Attachments: Figures
Observation Pit Summary

NOTES:

1.) OBSERVATION PIT LOCATIONS ARE SHOWN IN GENERAL ARRANGEMENT ONLY.
2.) DO NOT USE OBSERVATION PIT LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: Partners Development.

OP-# LOCATION OF SOIL OBSERVATION PIT

OBSERVATION PIT LOCATION PLAN

KCDC AUSTIN HOMES DEVELOPMENT
EAST SUMMIT HILL AVENUE
KNOXVILLE, TENNESSEE

DRAWN BY:	KSR
APPROVED BY:	MBH
SCALE:	N.T.S.
JOB NO.:	21-191014
DATE:	1/24/20

GEOServices, LLC Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

Figure 1

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-1	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	4.0	Fill	Lean Clay (CL) - with brick fragments and plastic fragments - brown - moist	Unsuitable Deleterious Materials
	4.0	7.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
		7.0		Observation Pit Terminated at 7.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-2	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	5.5	Fill	Fat Clay (CH) - with concrete foundation from 0.5 to 5 feet and chert fragments at depth - brown - moist	Unsuitable Deleterious Materials
	5.5	6.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
				Observation Pit Terminated at 6 Feet	

GEOServices, LLC, Geotechnical and Materials Engineers

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-3	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	5.0	Fill	Sandy Lean Clay (CL) - with clay pipe fragments and PVC pipe fragments at 3' - dark brown and black - moist	Unsuitable Deleterious Materials
	5.0	8.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
		8.0		Observation Pit Terminated at 8.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-4	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	10.0	Fill	Fat Clay (CH) - with mortered brick foundation at 2', metal pipe fragments at 8' and concrete fragments at 10' - dark brown and reddish brown - moist to wet	Unsuitable Deleterious Materials
		10.0		Observation Pit Terminated at 10.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-5	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	10.0	Fill	Fat Clay (CH) with concrete chunks - dark brown and reddish brown - moist to wet	Soft to Firm
		10.0		Observation Pit Terminated at 10.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-6	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	4.0	Fill	Fat Clay (CH) - with brick fragments - dark brown - moist to wet	Unsuitable Deleterious Materials
	4.0	6.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-7	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	3.0	Fill	Fat Clay (CH) - with black and brown - black - moist	Unsuitable Deleterious Materials
	3.0	6.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet	

Observation Pit Logs

GEOServices, LLC, Geotechnical and Materials Engineers

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-8	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	2.0	Fill	Fat Clay (CH) - with brick fragments and metal strap - brown - moist	Unsuitable Deleterious Materials
	2.0	6.0	Residuum	Lean CLAY (CL) - with shale fragments - tan - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet	

GEOServices, LLC, Geotechnical and Materials Engineers

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-9	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	1.0	Fill	Lean Clay (CL) - tan - moist	Firm
	1.0	6.0	Residuum	Lean CLAY (CL) - with shale fragments - tan - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-10	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	1.0	Fill	Lean Clay (CL) - tan - moist	firm
	1.0	6.0	Residuum	Lean CLAY (CL) - with shale fragments - tan - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet	

Duplicate bottom picture from OP-9

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-11	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	5.0	Fill	Lean Clay (CL) - brown - wet - tree branches at 5 feet	Soft to Firm
	5.0	7.0	Alluvium	Lean CLAY (CL) - with wood fragments - gray - wet	Firm
				Observation Pit Terminated at 7 Feet	

GEOServices, LLC, Geotechnical and Materials Engineers

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-12	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	5.0	Fill	Lean Clay (CL) - with sand - brown - moist - concrete chunck at 4 feet	Soft
	5.0	7.0	Fill	Lean CLAY (CL) - light brown - moist	Firm
	7.0	9.0	Alluvium	Lean CLAY (CL) - with plastic, rubber, metal and glass fragments - gray - wet	soft
		9.0		Observation Pit Terminated at 9.0 Feet	

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.)		Material Type	Description	Comments
	from	to			
OP-13	0.0	0.3	Topsoil	Topsoil (4 Inches)	
	0.3	1.5	Fill	Fat Clay (CH) - brown - moist	Soft to Firm
		1.5		Observation Pit Refusal at 1.5 Feet on concrete slab	

GEOServices, LLC, Geotechnical and Materials Engineers

Observation Pit Logs

KCDC Austin Homes Development
GEOS Project No. 21-191014
Personnel: T. Brian Williamson, P.E.

Date: January 21, 2020

Location	Depth (ft.) from	Depth (ft.) to	Material Type	Description	Comments
OP-14	0.0	0.5	Topsoil	Topsoil (4 Inches)	
	0.5	4.0	Fill	Fat Clay (CH) - black - moist	Soft
	4.0	6.0	Residuum	Fat CLAY (CH) - with chert fragments - reddish brown - moist	Stiff
		6.0		Observation Pit Terminated at 6.0 Feet