ENVIRONMENTAL • GEOTECHNICAL
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REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

DOBSON LANE SUBDIVISION
DOBSON LANE
LOUISVILLE, JEFFERSON COUNTY, KENTUCKY

ATC PROJECT NO. LOUGE21012

MARCH 8, 2021

PREPARED FOR:

MR. BRIAN STEPHENS
BALL HOMES
3609 WALDEN DRIVE
LEXINGTON, KY 40517

ATC
ENVIRONMENTAL • GEOTECHNICAL
BUILDING SCIENCES • MATERIALS TESTING

2724 River Green Circle
Louisville, KY 40206
Tel: 502-722-1401
www.atcgroupservices.com

March 8, 2021

Ball Homes
3609 Walden Drive
Lexington, KY 40517
Phone: 859-268-1191

Attention: Brian Stephens

Subject: Report of Geotechnical Engineering Investigation
Dobson Lane Subdivision
Dobson Lane
Louisville, Jefferson County, Kentucky
ATC Project No. LOUGE21012

Dear Mr. Stephens:

ATC has completed subsurface exploration at the Dobson Lane Subdivision site in Louisville, Jefferson County, Kentucky. These services were provided in accordance with ATC Proposal Number LOUGE21012 dated January 26, 2021.

The attached report presents a review of the project information provided to us, a description of the site and geologic conditions, a summary of the karst features found on the site, and a brief discussion of the impact of the observed solution features on the proposed site development.

ATC appreciates the opportunity to provide these services and we look forward to serving as your geotechnical consultant throughout this project. If there are any questions, or if additional information is required, please call.

Sincerely,

STATE OF KENTUCKY
RYAN CHRISTOPHER ORTIZ
33219
LICENSED PROFESSIONAL ENGINEER

Zane Nichols
Staff Geotechnical Engineer

Ryan C. Ortiz, P.E.
Project Geotechnical Engineer
Licensed Kentucky 33219

Travis J. Andres, P.E.
Senior Geotechnical Engineer
Licensed Kentucky 29429

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1. PROJECT INFORMATION

The site property consists of approximately 56-acre tract of undeveloped and partially residential developed property located at the end of Dobson Lane in southeast Jefferson County, Louisville, Kentucky. Of the undeveloped property, about 29 acres total is being considered for proposed residential development. The majority of the site is undeveloped, with exception of several houses and roadways. The site is covered with a combination of grassland with sparse trees, with some woodland across the site. Glenmary East Subdivision is located to the west of the site. Residential areas are located at the northern portion of the site. The eastern portion of the site is comprised of woodlands and some fields. We understand a residential development is planned for the site and potential karstic features and steep slopes along with management/remediation of such may influence future site development.

2. SURFACE CONDITIONS

Our field reconnaissance activities were performed by Ryan C. Ortiz, P.E. and Zane Nichols, E.I.T. with ATC Group Services on February 24, 2021. The purpose of the reconnaissance was to observe and document surface conditions at the site. The information gathered was used to help us interpret the geologic data and to detect conditions which could affect our recommendations.

In general the site slopes downhill from the northwest to south and east. The site topography is characterized as flat in the majority of the site with some slight to moderate slopes. A maximum site elevation of 674 is located near the northwest portion of the site, and gradually slopes downhill to the south to an elevation of about 638 at the southwest portion of the site. However, due to a very steep slope, the minimum site elevation of 610 is located near the northeastern portion of the site. While the grade of the slope varies, the average inclination is about 2H:1V.

The majority of the site included vegetation and sparse trees. Portions of the site contained heavily vegetated brush and wooded areas. A residence and barn is located in the northeast portion of the site. Several residences are located in the southern portion of the site. Our reconnaissance was based in part on visual observations of karst features. We anticipate additional features may have been obscured by vegetation during our site walkover and may be discovered during site clearing and earthwork.

3. DATA REVIEW

3.1 Soil Survey

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report for Jefferson County, Kentucky was assembled and referenced. The following near-surface soil types are mapped at the site:

Soil Survey Soil Types

Map Symbol	Soil Type	Percent Slopes	Percent of Site, Approximate
CrB	Crider Silt Loam	2-6	70
FsF	Faywood-Shrouts-Beasley Complex	25-50	17
ShD3	Shrout Silt Loam	12-25	5
UjC	Urban Land-Alfic Udarents Complex	0-12	5
CrC	Crider Silt Loam	6-12	3

The Crider Series consists of well drained soils formed in fine-silty noncalcareous loess over clay residuum weathered from limestone, typically in ridges, shoulders, summits, and side slopes. The Faywood-Shrouts-Beasley Series consists of well drained soils formed in clayey residuum weathered from limestone and shale, typically in hills, back slopes, and side slopes. The Shrouts Series consists of clayey residuum weathered from calcareous shale and/or siltstone, typically in hills, back slopes, and side slopes. Alfic Udarents consist of well drained soils formed in thin fine silty loess over clayey residuum weathered from limestone and dolomite, typically in ridges, summits, and interfluves.

3.2 Site Geology

A review of Kentucky Geological Survey (KGS) publicly available mapping service indicates the site is primarily underlain by the Laurel Dolomite formation. The Laurel Dolomite formation is primarily comprised of dolomite and shale. There are two types of dolomite in this formation, the upper 1/3 to ½ of the unit is very fine grained, compact, and in even beds generally from just under 1 foot to nearly 2 feet in thickness, largely unfossiliferous, the lower part of the unit is fine grained, thick to very thick bedded, porous, massive weathering dolomite which is slightly limy and sparsely fossiliferous. The Waldron Shale formation is mapped northern portion of the site. The shale in this formation is greenish gray, silty, dolomitic, and fissile Based on review of publicly available KGS Karst Potential Maps, the potential for the development of sinkholes or other solution weathering features in the sites area is medium. There are several KGS mapped sinkholes within a mile of the site to the north and southeast.

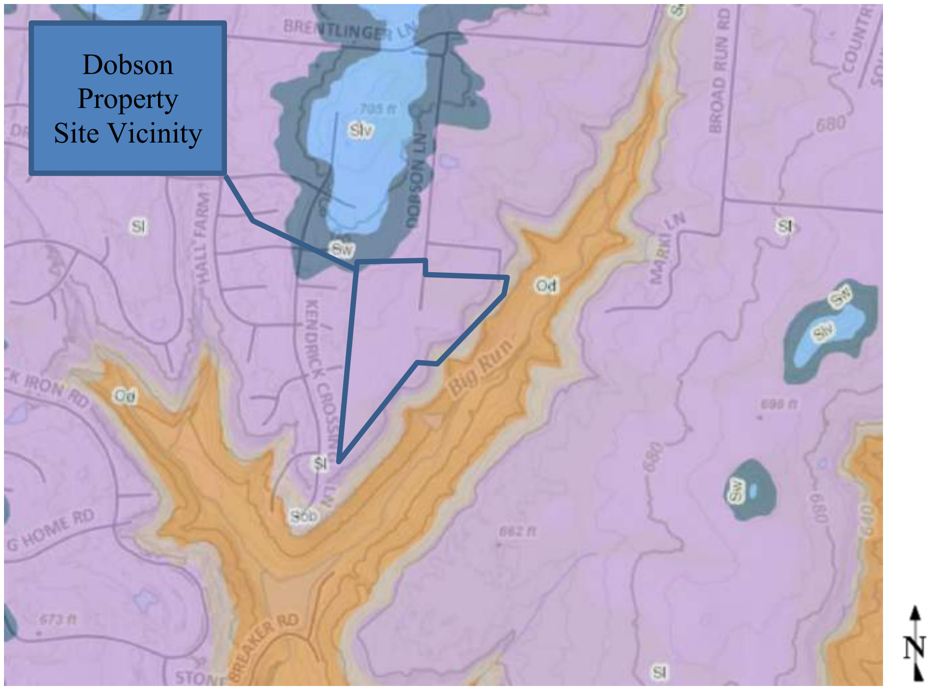


Figure 1: Geologic Map of the Jeffersontown Quadrangle

4. KARST POTENTIAL

The proposed development site is underlain by dolomite sedimentary bedrock (described above) which are locally known for the potential to develop Karstic features such as sinkholes. Figure 2 shows a map of southeastern Jefferson County prepared by the Kentucky Geologic Survey. The map displays the areas of known karstic activity near the proposed development site and indicates the project area as having a medium potential for karstic activity. LIDAR mapped sinkholes are present in the north and southeast directions of the site; however, it is not uncommon for karstic features to exist and not be displayed by this map. Based on our experience and the presence of the rock formations underlying the site there is a potential for Karstic activity to be present at this site.

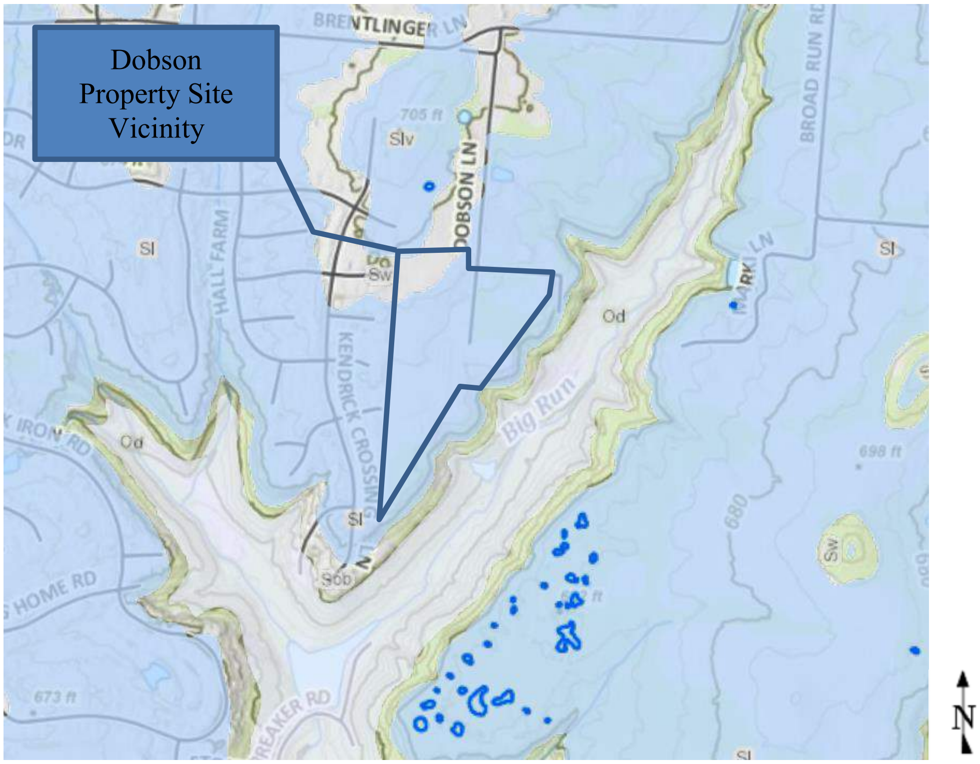


Figure 2: Karst Potential Map (blue indicates LIDAR-mapped Karst activity)

4.1 Sinkhole Development

Solution activity in areas underlain by dolomite generally results from a gradual process of dissolving underlying bedrock units by slightly acidic rain water. This process may take hundreds to thousands of years to develop but may result in the formation of caves in the subsurface and sinkholes at the ground surface. Sinkholes are defined by the Jefferson County Land Development Code (LDC) as follows: *Any closed depression in soil or bedrock formed by the erosion and transport of earth material from below the land surface, which is circumscribed by a closed topographic contour and drains to the sub-surface*.

Sinkholes at the ground surface are caused from either a general raveling of the overlying soil into voids in the underlying rock or by a cover collapse, both of which are described below in further detail. Either phenomena typically results in depressions at the ground surface, which if large enough, can be identified on topographic maps. In addition to the natural causes of sinkhole development, sinkholes may also form as a result from fluids leaking from subsurface piping and drainage systems such as buried water and sewer pipes, septic lateral fields, and roof drains beneath the building and floor slabs. The attached *Karst Diagram of the Inner Bluegrass* illustrates features which are common to Karstic areas.

4.2 Dissolution Feature

Dissolution features are the most common ground subsidence phenomena associated with areas underlain by karstic formations. A typical scenario for dissolution feature development begins with the gradual dissolution of the bedrock usually along joints and fractures in the bedrock units. Dissolved rock and insoluble residuum are then transported via the *sinkhole throat* and *karst aquifer* conduits in the subsurface, away from the sinkhole location. Variants of dissolution sinkholes may be expressed as totally buried, soil filled, or bedrock may be totally exposed. The features may be linear in nature following weathered joints in the rock but also can have the classic bowl-shaped closed contour, with a variable thickness of soil or other unconsolidated residuum covering the bedrock. The movement or raveling of soil particles over time results in the formation of open voids in the overburden soil just above the rock surface. Surface erosion, generally over a long period of time, then continues to enlarge the dropout to a rounded depression. The diameter of the depression is related to the depth and type of soil cover, the age of the feature, the size of the opening in the subsurface, its ability to receive water and soil as well as the size of the watershed surrounding and feeding water into the feature. Over long periods of time, the migration of water may result in additional solution weathering of the rock. However, this dissolutioning process generally requires hundreds or thousands of years to occur. The natural acidity in water migrating through the rock reacts with the calcium-based rock. This chemical reaction dissolves the rock, resulting in the formation of voids and cavities in the rock unit. The open voids and cavities in the rock act as a conduit for movement of water and suspended solids.

4.3 Cover Collapse

The second type of subsidence is due to rock or soil cover collapse. The development of caves within rock is the result of prolonged, concentrated solution activity. Voids are created through the introduction of surface water into the subsurface, as described above. The voids thus created are then enlarged by continued flow of water through the area. As the voids become larger and eventually interconnect, the quantity of water flowing through the area increases and results in more rapid solution weathering. When the strength of the underlying rock/soil support is compromised and cannot support the weight of the overburden, the rock roof can collapse, resulting in a surface depression (i.e., a cover collapse sinkhole).

5. SITE CONDITIONS

5.1 Ground Water Conditions

Karst areas are often characterized by the lack of well-defined streams or creeks since surface water runoff is directed to closed topographic depressions and sinkholes connecting to subsurface drainage features. These features collect and direct the water into cracks, crevices, joints, porous zones, and caves in the underlying dolomite rock.

5.2 Site Reconnaissance

Our site reconnaissance activities were conducted on February 24, 2021. As part of our reconnaissance, the site terrain was traversed in an effort to identify, locate and document the topographical features that may be related to solution activity (closed topographic depressions and sinkholes) in the underlying bedrock. Topographical features observed during our reconnaissance were located in the field using a handheld Global Positioning System (GPS) unit. The approximate location of the twenty-three features noted, are shown on the Geologic Feature Reconnaissance Table and Feature Location Plan in the Appendix to this report. The field locations shown are approximate.

The features observed were photographed. Representative photographs of the features are attached to this report. All features observed were given a qualitative significance rating shown on the table. The significance rating is subjective but was based on the following criteria:

- Drainage area
- Topographic Location
- Depth of bottom (if feasible)
- Area of feature (if feasible)
- Presence of adjacent features
- Material observed in bottom
- Rock outcrops observed
- Connection to subsurface
- Difficulty of engineered remedation of feature

A **low** significance rating indicates the feature was generally small in horizontal dimension, appeared to accept a limited amount of storm water runoff, and was thought to represent a condition that if the feature were filled to facilitate the development (using the methods described in Section 7 of this report), the filling would have minimal impacts and low cost. A **moderate** significance rating indicates a more significant impact from filling and likely a higher construction cost to fill the feature. A **high** rating indicates a likely impact from filling and a significant construction cost to fill the feature.

A few common indicators of karst activity such as springs, sinking streams, closed depressions, and sinkholes were observed during our site reconnaissance. Several of these features appeared scattered throughout the site. These features are designated as Feature Location Number 1 to 20 in the Geologic Feature Reconnaissance Table and Karst Feature Location Map provided in the Appendix.

Subsurface conditions in the area of observed karst features likely have a ground water table influenced by an internal "plumbing" system in the rock. Surface water collected by closed depressions and sinkholes is often routed internally through discontinuities in the underlying formation toward seeps and springs. Springs and seeps are common and typically flow when perched water sources daylight in drainage swales, creek corridors, and tributaries. Flow may be intermittent depending on the weather.

In our opinion the observed features noted during our study likely represent both dissolution features and cover collapse as described in Section 4.1. Over long periods of time, the migration of water may result in additional solution weathering of the rock. This dissolution process generally requires hundreds or thousands of years to occur. Based on the characteristics of the observed features it is likely the formation of these features has progressed for many years.

Numerous features appear located within the proposed development area. Conditions at the site appear to agree closely with our experience as the karst activity appears to be attributed to this rock layer. The characteristics of these features are expected to require additional consideration during planning and development.

5.3 Subsurface Exploration and Conditions

A Geoprobe drill rig was used to advance a total of thirteen (13) test borings and thirty eight (38) rock soundings to a depth of macrocore or direct push tool refusal. Boring and Sounding locations and depths appear in the attached Test Boring Logs provided in the Appendix.

Standard Penetration Testing was performed at the test boring locations and materials were sampled for classification and testing. Results of the classification and compaction characteristic tests are provided in the appendix.

In general, encountered soil conditions included topsoil underlain by brown to reddish brown lean clay typically transitioning to fat clay with depth. Apparent rock depths indicated by direct push refusal ranged from 0.1 foot to 18.5 feet.

6. DEVELOPMENT SCHEME EVALUATION

We understand this report will be utilized in preparation of the development scheme for the property. The significance of each feature we observed during our reconnaissance was subjectively assessed from a development cost and environmental standpoint using the criteria in Section 5.2. The site is underlain by rock formations which are susceptible to karstic activity. We observed site features which appear to require special consideration during planning and development. The proximity of the underlying rock surface has likely limited the depth and areal extent of surface features; however, the features and areas identified within the proposed development area by this study are in our opinion large enough or possess attributes which warrant planning, treatment, and/or preservation.

The thick site vegetative ground cover observed at a portion of the site made the observation of karstic features in some areas difficult. We recommend once the site is cleared of surface vegetation a reevaluation of the site be made to determine whether additional features (previously obscured by vegetation) are present. There is the possibility that some features were not evident during our field reconnaissance. During grading and construction activities all identified and any newly exposed solution features should be observed by ATC so that specific recommendations can be made dependent on the characteristics of the feature and the area usage. If springs are encountered in construction areas, ATC will make recommendations for the installation of spring boxes and underdrains (French drains), if necessary. All feature remediation and filling should be performed according to the procedures described in Section 7 of this report. These treatment schemes have been used successfully on many similar developments in karst terrain.

Note that development as that contemplated for this site inherently alters surface grades and the resulting permeability of surface materials. This has a direct impact on surface drainage rates and patterns, and direct or indirect effects on subsurface drainage systems. Adequate planning consideration of these alterations must be provided to avoid conditions which would increase subsurface drainage and thereby potentiate additional and/or more rapid karst development.

7. FEATURE TREATMENT RECOMMENDATIONS

We recommend all solution features noted on the property in this report or discovered during site earthwork operations be located by surveying methods and flagged in the field. Features with a defined throat should be repaired individually as described below. The features with no discernible throat should be stripped of topsoil and vegetation. The exposed subgrade in the closed depression should then be proof-rolled in the presence of the geotechnical engineer to locate areas of soft, wet soil or incipient dropouts. Proof-rolling should be performed using a loaded dump truck, or similar equipment judged acceptable by the geotechnical engineer, after a suitable period of dry weather to avoid degrading the subgrade. Normally, two to four passes over each section with the proof-rolling equipment is required.

After stripping and proof-rolling the exposed subgrade material should be observed for evidence of sinkhole throats. The throats are typically indicated by zones of wet soil, of darker soil containing a higher percentage of organic material, or by cherty more granular material. When sinkhole throats are well defined, they should be cleaned of all soil and extraneous material to expose competent rock on all sides and in the bottom. The filling of the excavated feature should then proceed according to one of the following procedures.

7.1 Sinkhole Treatment Method A

When the bedrock depression is less than 2 feet in diameter and no evidence of flowing water is present a concrete plug may be utilized. The plug should be constructed of low slump concrete and be 1½ to 2 times as tall or long as it is wide to facilitate the filling of voids and crevices. It is essential that a good concrete to rock bond be created by the plug, and the plug increase in diameter with elevation. After the concrete plug has set up, we recommend the resulting excavation be lined with a geotextile filter fabric and backfilled with engineered fill material compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D698).

7.2 Sinkhole Treatment Method B

When the throat is greater than 2 feet in diameter or evidence of flowing water is observed, an inverted filter should be constructed; however smaller features may also be filled in this manner. To plug the throat, a zone of shot-rock, rip-rap or durable limestone boulders such as KYTC Class IV

Channel Lining should be placed and wedged into the throat up to the surrounding existing rock surface. Using the large stone pieces and surrounding rock surface as a base, place a geotextile filter fabric over the entire throat area a minimum of 5 feet extending radially from the throat and drape excess on the excavation side slopes. Next place an 18-inch-thick layer of Kentucky Transportation Cabinet (KYTC) gradation No. 3 or similar gradation crushed limestone over the fabric and tamp into place by excavator bucket or hand tamper. Next, construct an 18-inch-thick layer of KYTC gradation No. 57 or No. 9 or similar gradation crushed limestone over the placed No. 3 stone and tamped into place by excavator bucket or hand tamper. The entire installed stone section should be surrounded and covered with the geotextile fabric with minimum 2 feet overlap. The remaining excavation may then be properly backfilled with engineered fill material compacted to at least 95 percent of the material standard Proctor maximum dry density (ASTM D698).

7.3 Sinkhole Treatment Method C

If well-defined sinkhole throats are not identifiable after stripping the surficial soils from the sinkholes to expose the residual soils, shallow test pits should be excavated to check for voids present below the ground surface as a result of solution activity. The pits should be excavated at the lowest elevations of the depression. If no throat is found, then the excavation and depression should be properly backfilled using engineered fill material from the borrow areas on site. The fill material should be compacted the same as in Methods A and B.

8. GENERAL SITE AND FOUNDATION DESIGN AND CONSTRUCTION RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions. If there is any change in these project criteria, including project location on the site, a review should be made by this office.

Based on geologic mapping and the results of the test borings and rock soundings, it is our opinion that the subsurface conditions at this site meet the criteria for Site Class C based on Section 1613.3.2 of the 2018 International Building Code. The seismic site class may be improved to Site Class B upon reevaluation of final site grading plans.

Karst Conditions and Existing Fill

General karst conditions and treatment recommendations have been provided in previous sections. A number of karst features were observed and identified in the appendix. Further, karst indicators were observed in Boring B-5 that was drilled in an area that was apparent at the ground surface. In particular, Boring B-5 encountered fill transitioning to wood fragments at about 5.5 feet BEG. At this location, the boring transitioned to native soil and refusal at 8 and 9.3 feet, respectively.

The existing fill is comprised of medium stiff lean clay followed by wood fragments to 8 feet. Existing fill encountered onsite should be completely removed and replaced with new engineered fill. These conditions will likely have negative effects on any overlying structures. The poor existing fill warrants remediation, and will also allow for inspection of existing fill at this karst feature.

Soft to Medium Stiff Soils

Soft to medium stiff soils were encountered across the site. These soils will likely result in poor performance of foundations, slabs, and pavements. The site should be proofrolled and inspected by a geotechnical engineer's representative. Any soft to medium stiff soils should be undercut to stiff soils and replaced with new engineered fill.

Wet Soils

Based on laboratory testing, site soils at the time of testing are wet of the standard proctor optimum moisture content. These soils will require moisture conditioning prior to placement as new engineered fill. However, the geotechnical investigation was performed during wet winter months. Site soils may be drier during summer months.

8.1 General Foundation Concepts

Based upon the results of the limited subsurface investigation performed at this site, the most feasible and economical foundation system for support of the proposed structure appears to be conventional shallow spread footings bearing on stiff natural clay soils or on well-compacted engineered fill materials that are placed over these natural materials. It should be expected that soft soil zones may be encountered during foundation excavation. Pockets of these soft soils could present some consolidation potential. Consolidation potential can be reduced by excavating these soft zones and backfilling with engineered structural fill or crushed stone. We recommend backfilling with compacted crushed stone in order to reduce the consolidation and building settlement potential.

The clay soils expected to be encountered in excavations may lose strength if they become wet during construction. Therefore, we recommend the foundation subgrades be protected from exposure to water.

Any miscellaneous uncontrolled fill materials from previous development on-site (which were not apparent in any borings), which are not suitable for support of spread footings, will need to be removed and replaced with well-compacted engineered fill, cementitious flowable fill of a design mix judged suitable by the geotechnical engineer, or lean concrete where such materials are encountered. In addition to the miscellaneous uncontrolled fill that may be encountered, it is likely that remnants from prior construction (including slabs, footings, foundation walls, utilities, etc.), may exist in the area of the barn development based on previous site use; these elements will also need to be removed and replaced with engineered fill where encountered.

Careful evaluation of the footing bearing materials will be required at the time of construction in order to identify uncontrolled fill materials that must be removed from beneath the foundations and replaced with engineered fill. It is important that the observation and evaluation methods be implemented and that any soft natural soils, old fill materials and remnants from previous construction revealed by such observations and evaluations be removed and replaced.

8.2 Spread Footings

Our findings show that the proposed structures can be supported on conventional shallow spread footings bearing on stiff natural soils provided that any unsuitable materials (such as soft natural soil or old fill) are removed, where encountered, and replaced with engineered fill. Spread footings that bear on stiff natural soils, or on engineered fill that is placed over stiff natural soils, can be preliminarily designed for a net allowable bearing pressure of 3,000 lbs/sq.ft provided all old fill, remnants from previous construction and any pockets of soft natural soils below the spread footings are identified, removed and replaced with well-compacted engineered fill or lean concrete.

Wall footings should be at least 2.0 ft wide and column footings should be at least 3.0 ft wide for bearing capacity considerations. All exterior footings and footings in unheated areas should be located at a depth of at least 24 inches below the final exterior grade for frost protection.

Uplift forces on the spread footings can be resisted by the weight of the footings and the soil material that is placed over the footings. It is recommended that the soil weight considered to resist uplift loads be limited to that immediately above and within the perimeter of the footings (unless a much higher factor of safety is used). A total soil unit weight of 115 lbs/cu.ft. can be used for the backfill material placed above the footings, provided it is compacted as recommended. It is also recommended that a factor of safety of at least 1.3 be used for calculating uplift resistance from the footings (provided only the weight of the footing and the soil immediately above it are used to resist uplift forces).

Lateral forces on a spread footing can be resisted by the passive lateral earth pressure against the side of the footing and by friction between the soil and the base of the footing. A uniform allowable passive pressure of 350 lbs/sq.ft. can be used for that portion of the footing that is below a depth of 2 ft below the final exterior grade (no portion of the footing above this depth should use for lateral resistance). An allowable coefficient of friction between the base of the footing and the underlying soil of 0.2 (based on a factor of safety of 1.5) can be used in conjunction with the minimum downward load on the base of the footing.

Care must be exercised when excavating near any existing streets, utilities, etc. to protect the integrity of the existing foundations, and other features. Bracing or underpinning will be required where it is necessary to excavate below the bottom elevation of the existing streets, utilities, etc.

8.3 Floor Slabs

Floor slabs can be supported on stiff, low-plasticity natural soils or on new compacted structural fill. In areas of grade-raise fill, the combination of undercut and fill should ensure that a minimum of 2 ft of low-plasticity clay soil and/or granular fill is maintained underneath the floor slab. Any fat clay encountered at floor slab bearing elevations should be undercut and replaced with new engineered fill.

It is recommended that the slab-on-grade floors be supported on a minimum 4 in. thick layer of relatively clean granular material such crushed stone. This is to help equalize moisture conditions beneath the floor slab and provide uniform support of the slab. Provided that a minimum of 4 inches of crushed stone is placed beneath the floor slabs, a modulus of subgrade reaction of 100 lbs/cu.in. can be used for design of the floor slabs.

8.4 Pavement

Based on the soil conditions encountered at this site and in conjunction with our experience on similar projects in the near vicinity of this project site; it appears likely that the pavement subgrade in some areas of the project will be soft or yielding at the time of construction. These conditions can be particularly problematic if the construction will be done during seasons when more precipitation and cooler temperatures typically occur, such as in the late fall, winter and spring (typically November through April). The extent to which yielding subgrades may be a problem is difficult to predict beforehand since it is dependent upon several factors, some of which are controllable and others that are not; including seasonal conditions, precipitation, cut depths, occurrence of saturated sand or silt seams, sequencing and scheduling of the earthwork, surface and subsurface drainage measures, the weight and traffic patterns of construction equipment, etc. In general, yielding subgrade problems are more prominent in cut areas (where saturated or nearly saturated silty and clayey soils are exposed by the excavation or where such soils are underlain by a saturated sand layer) or where little or no fill is to be placed.

The subgrade soils in the areas that are found to be excessively wet, soft or yielding at the time of construction, can likely be moisture conditioned and stabilized by discing, aerating, and recompacting. However, this will require a combination of time to allow for working the soils, favorable weather conditions for drying and stiffer soils at shallow depth below the yielding soils in order to be successful. If it is not possible to improve the subgrade soils in this manner because of weather conditions, scheduling or other constraints or site conditions (which is most often the case); it is recommended that the subgrade soils be improved or modified using either chemical stabilization (i.e., quicklime or a suitable lime by-product such as lime-kiln-dust or cement), mechanical stabilization (i.e., a geogrid with additional crushed limestone placed over the subgrade), or removal of the unsuitable soils and replacement with crushed limestone. The best method for stabilizing the pavement subgrade should be determined in the field at the time of construction based upon the actual field conditions in conjunction with the specific soil type encountered at the locations requiring stabilization, the size of the areas requiring stabilization and the construction schedule. For soil conditions such as those at this site, all mentioned stabilization methods are suitable. The choice of which will typically depend on cost effectiveness.

Controlling subsurface water in pavement areas is important to enhancing the long-term performance of the pavements. The pavement subgrade surface should be uniformly sloped to facilitate drainage through the granular base and to avoid ponding of water beneath the pavement. Subsurface perforated drainage pipes should at a minimum be included beneath the lowest lines of the pavement and between catch basins. Since the storm water catch basins in pavement areas are at the lowest points in pavement areas where water is often trapped beneath the pavements, they should be designed to allow water to drain from the aggregate base into the catch basins. At a minimum, subsurface perforated drainage pipes should be included that extend out beneath the pavement at least 25 ft from the catch basins in at least four directions in addition to the other subsurface perforated drainage pipes included for the project.

Based on the results of classification tests and our experience with similar soils, a resilient modulus value of approximately 4,500 lbs/sq.in. has been estimated for use in pavement design for the clayey subgrade soils encountered at this site. The subgrade soils should be prepared and inspected as described in this report.

Since this investigation identified actual subsurface conditions only at the rock sounding locations, it was necessary for our geotechnical engineers to extrapolate these conditions in order to characterize the entire project site. Even under the best of circumstances, the conditions encountered during construction should be expected to vary somewhat from the test boring results and may, in the extreme case, differ to the extent that modifications to the foundation recommendations become necessary. Additionally, only limited material sampling and testing was performed. Therefore, we recommend that ATC be retained as geotechnical consultant and soils testing technician throughout the earth-related phases of this project to correlate actual soil and rock conditions with test boring data, identify variations, conduct additional tests that may be needed and recommend solutions to earth-related problems that may develop.

8.5 Site Preparation

All areas that will support slabs and pavements should be properly prepared. After rough grade has been established and prior to placement of fill, the exposed subgrade should be carefully observed by the geotechnical engineer, or a qualified soils technician working under the direction of the geotechnical engineer, by probing and testing as needed. Any organic material still in place, frozen, wet, soft or loose soil, uncontrolled fill, existing pavements, utilities and other undesirable materials should be removed. The exposed subgrade should furthermore be evaluated by proof-rolling with suitable equipment to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed should be removed and replaced with well-compacted, engineered fill as outlined in Section 8.6. All existing underground utilities and associated backfill should be completely removed from beneath the building areas and replaced with well-compacted engineered fill.

Care should be exercised during the grading operations at the site. Due to the nature of the near surface soils, the traffic of construction equipment may create pumping and general deterioration of the shallower soils, especially if excess surface water is present. The grading, therefore, should be performed during a dry season, if at all possible. Based on our experience on other nearby sites, it is likely that the subgrade soils in some areas will be wet and soft when exposed, which often is the case beneath existing pavements. The extent to which yielding subgrade may be a problem is difficult to predict beforehand since it is dependent upon several factors including seasonal conditions, precipitation, cut depths, sequencing and scheduling of the earthwork, surface and subsurface drainage measures, the weight and traffic patterns of construction equipment, etc. In general, yielding subgrade problems are more prominent in cut areas (where saturated or nearly saturated silty and clayey soils are exposed by the excavation) or where little or no fill is placed. Therefore, it is suggested that provisions be made in the contract documents for subgrade improvements to be used where determined to be necessary in the field at the time of construction. It appears that the best method for subgrade improvements will be scarification and drying to near optimum moisture condition or removal and replacement with crushed limestone. However, lime stabilization may be appropriate in some cases, depending upon the locations, areas and specific conditions.

It is important that positive surface drainage be established at the beginning of the earthwork operations and be maintained throughout the project. Surface water must not be allowed to pond. Furthermore, compaction and sealing of the subgrade surface is important when precipitation is expected. The site storm drainage elements (i.e., catch basins, pipes, manholes, etc.) should be installed as early as possible, which will aid in control of surface and ground water.

8.6 Fill Construction

All engineered fill beneath footings, floor slabs and pavements should be compacted to a dry density of at least 98 percent of the standard Proctor maximum dry density (ASTM D-698). The compaction should be accomplished by placing the fill in about 8 in. (or less) loose lifts and mechanically compacting each lift to at least the specified minimum dry density. Soil fill materials should be compacted using a non-vibratory sheeps-foot roller, and aggregate fill materials should be compacted using a vibratory smooth-drum roller or as judged acceptable by the geotechnical engineer. Field density tests should be performed on each lift as necessary to insure that adequate moisture conditioning and compaction is being achieved.

The low plasticity silty clays encountered at this site are considered suitable as general fill material. The need for some aeration or lime modification of the clayey soils should be expected before they can be placed and compacted to the specified density. Well-graded granular material, such as pit-run sand and gravel or dense grade aggregate (DGA) crushed limestone, or cementitious flowable fill or lean concrete should be used to fill undercut excavations beneath footings and other excavations of limited lateral dimensions where proper compaction of cohesive materials is difficult.

Cut and fill depths are unknown at this time; therefore, it is not possible to estimate expected post-construction settlements.

8.7 Footing Excavation Observations

The soil at the base of each spread footing excavation should be observed and evaluated by a geotechnical engineer or a qualified soils technician working under the direction of the geotechnical engineer to insure that any remnants from previous construction, old fill material, soft natural soil and any otherwise undesirable material is identified and removed at footing locations and that the footing will bear on satisfactory material. At the time of such inspection, it will be necessary to make hand auger borings or use a hand penetration device in the base of the foundation excavation to determine whether the soils below the base are satisfactory for foundation support. The necessary depth of penetration will be established during inspection.

Where undercutting is required to remove unsuitable materials beneath footings, the proposed footing bearing elevation may be re-established by backfilling after all undesirable materials have been removed. The undercut excavation beneath each footing should extend to suitable bearing soils. The dimensions of the excavation base should be determined by the engineer. The entire excavation should then be refilled with engineered fill. The engineered fill should be limited to well-graded crushed stone such as DGA compacted to at least 98% of the material maximum dry density; cementitious flowable fill or lean concrete. Special care should be exercised to remove any sloughed, loose or soft materials near the base of the excavation slopes. In addition, special care should be taken to "tie-in" the compacted fill with the excavation slopes with benches as necessary. This is to insure that no pockets of loose or soft materials will be left in place along the excavation slopes below the foundation bearing level.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from disturbance, rain and freezing. Surface run-off water should be drained away from the excavation and not allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not practical, the footing excavations should be adequately protected. It is recommended that a concrete "mud mat" be placed at the base of the footing excavations to protect the subgrade soils from deterioration due to seepage of ground water, surface water, etc., and to aid in the proper placement of reinforcing steel.

9. QUALIFICATIONS TO REPORT

It is not possible to remove all of the risk associated with construction in steeply sloped areas or over known sinkholes or in sinkhole-prone, karst areas. Our experience in other portions of Jefferson County indicates the limestone formations mapped underlying the site are prone to solution activity and sinkhole formation. The natural rising and lowering of the ground water table and surface water migration downward through the subsurface soils can create the risk of continued soil migration into solution voids in the underlying limestone. In addition, current or future anthropogenic sources of subsurface water such as drains, septic leach fields, leaking water utilities, etc. may contribute to development of karst features. However we believe the risks of construction at this site are no greater than similar sites located in this portion of Jefferson County.

Proper observations during sinkhole repair and during construction by a qualified geotechnical engineer can reduce but not eliminate the level of risk. To further reduce the risk of unidentified sinkholes at the site would require the implementation of more sophisticated geotechnical exploration methods including borings on a tightly spaced grid or geophysical methods. In our opinion these exploration methods are not warranted at this time.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

LEGEND TO CLASSIFICATION AND SYMBOLS

SOIL TYPES
(Shown in Graphic Log)

- Fill
- Asphalt
- Topsoil
- Gravel
- Sand
- Silt
- Lean Clay
- Fat Clay
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Limestone
- Sandstone
- Siltstone
- Shale

SAMPLER TYPES
(Shown in Sampler Column)

- Shelby Tube
- Split Spoon
- Rock Core
- Grab Sample
- No Recovery

ATC
ENVIRONMENTAL • GEOTECHNICAL
BUILDING SCIENCES • MATERIALS TESTING

CONSISTENCY OF COHESIVE SOILS
(Automatic Hammer)

SPT "N" VALUE	CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (PSF)
<2	Very Soft	<500
2-3	Soft	500-1,000
4-6	Medium Stiff	1,000-2,000
7-12	Stiff	2,000-4,000
13-26	Very Stiff	4,000-8,000
>26	Hard	>8,000

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	SPT "N" VALUE
<5	Very Loose
5 to 10	Loose
11 to 30	Medium Dense
31 to 50	Dense
>50	Very Dense

ESTIMATES RELATIVE MOISTURE CONDITION
(Visual classification relative to assumed optimum moisture content (OMC) of standard proctor)

Dry	-Air dry to dusty
Slightly Moist	-Dusty to approximate -2% OMC
Moist	-Approximate ±2% OMC
Very Moist	-Approximate +2% OMC to saturated
Wet	-Contains free water and/or saturated

RELATIVE HARDNESS OF ROCK
(Automatic Hammer)

Very Soft	-Pieces 1 inch or more in thickness can be broken by finger pressure.
Soft	-May be broken with fingers
Medium	-Corners and edges may be broken with fingers
Moderately Hard	-Moderate blow of hammer required to break sample
Hard	-Hard blow of hammer required to break sample
Very Hard	-Several hard blows of hammer required to break sample

RELATIVE WEATHERING OF ROCK

Fresh	-No visible sign of weathering, slight discoloration
Slightly	-Discoloration and discontinuity surfaces
Moderately	-Less than half disintegrated, significant discoloration
Highly	-More than half disintegrated
Completely	-All rock disintegrated into soil. Rock matrix intact.
Residual Soil	-All rock converted to soil. Rock matrix destroyed.

PARTICLE SIZE IDENTIFICATION
(ASTM D2488)

Boulders	> 12 inches
Cobbles	12 to 3 inches
Gravel	
Coarse	3 to ¾ inches
Fine	¾ to 4.75 mm
Sand [1]	
Coarse	4.75 to 2 mm
Medium	2 to 0.425
Fine	0.425 to 0.075 mm
Silt or Clay [2]	<0.075 mm

1. *No. 4 Sieve to No. 200 Sieve*
2. *Finer than No. 200 Sieve*

PROPORTION OF SAND AND GRAVEL
(By Dry Weight)

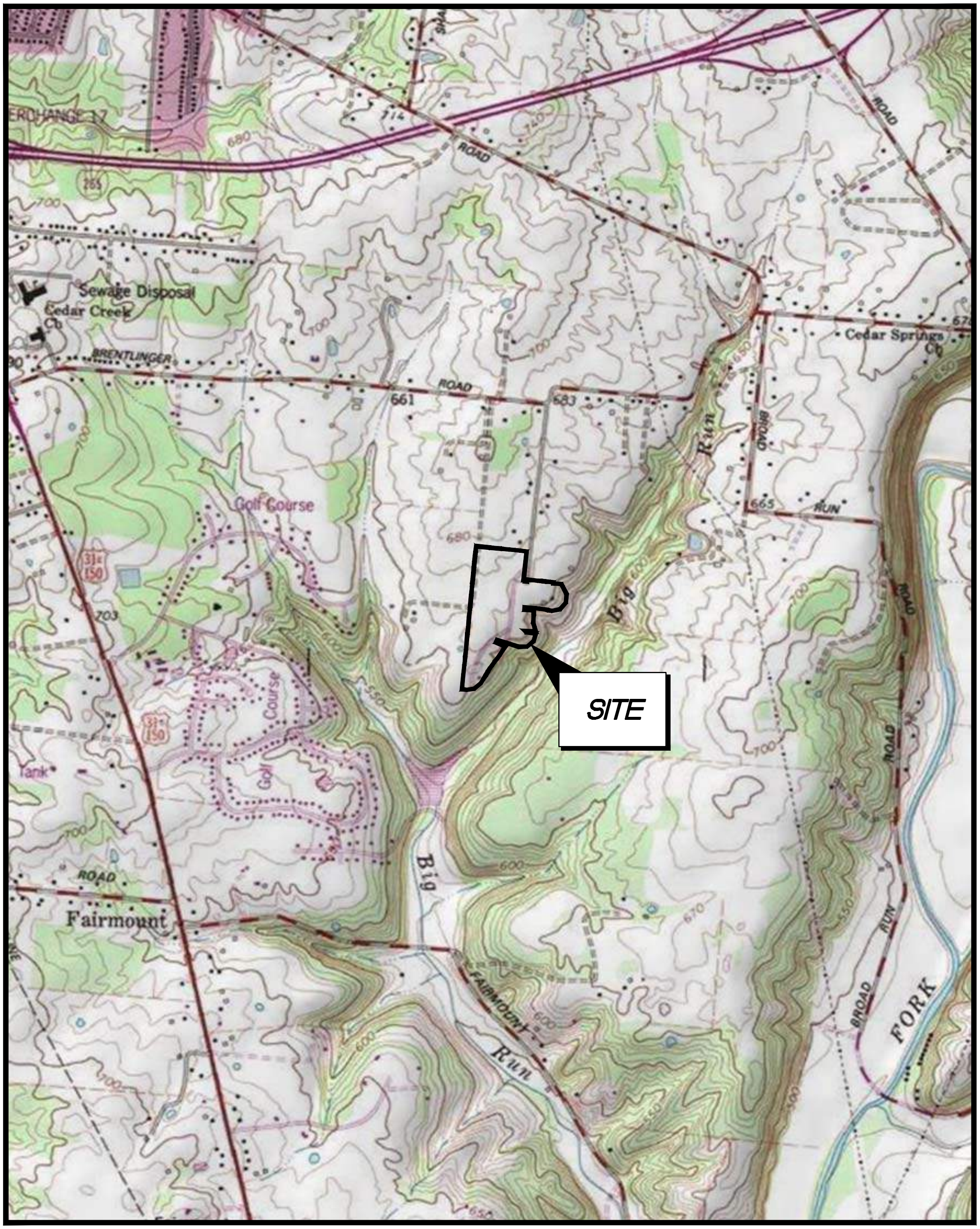
Trace	<15%
With	15 to 29%
Modifier	>29%

PROPORTION OF FINES
(By Dry Weight)

Trace	<5%
With	5 to 12%
Modifier	>12%

TERMS

Standard Penetration Test "N" Value (SPT "N" Value)	Number of blows required to drive a 1.4 inch (inside diameter) split spoon sampler 1 foot by a 140 pound hammer falling 30 inches
Recovery (REC)	Total length of rock recovered in the core barrel divided by the total length of the core run
Rock Quality Designation (RQD)	Total length of sound rock segments recovered longer or equal to 4 inches divided by the total length of core run



N

VICINITY MAP

PROPOSED DOBSON LANE SUBDIVISION
800 DOBSON LANE
LOUSIVILLE, KENTUCKY

Project Number: LOUGE21012		Drn. By: BH
Drawing File: SEE LOWER LEFT		Ckd. By: ZN
Date: 02/11/2021	Scale: 1"= 2,000'	App'd By: TA
ATC		Figure: 1

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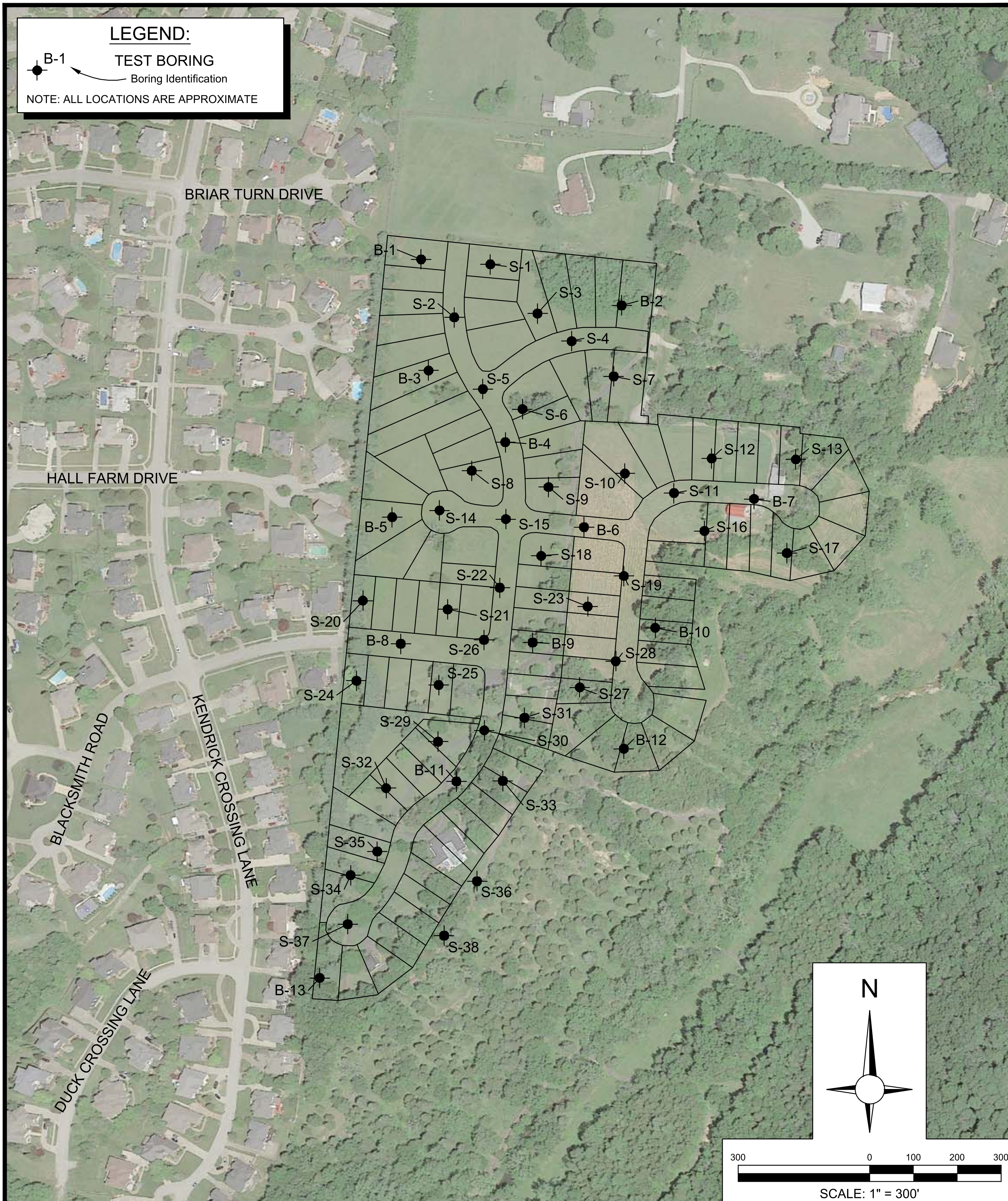

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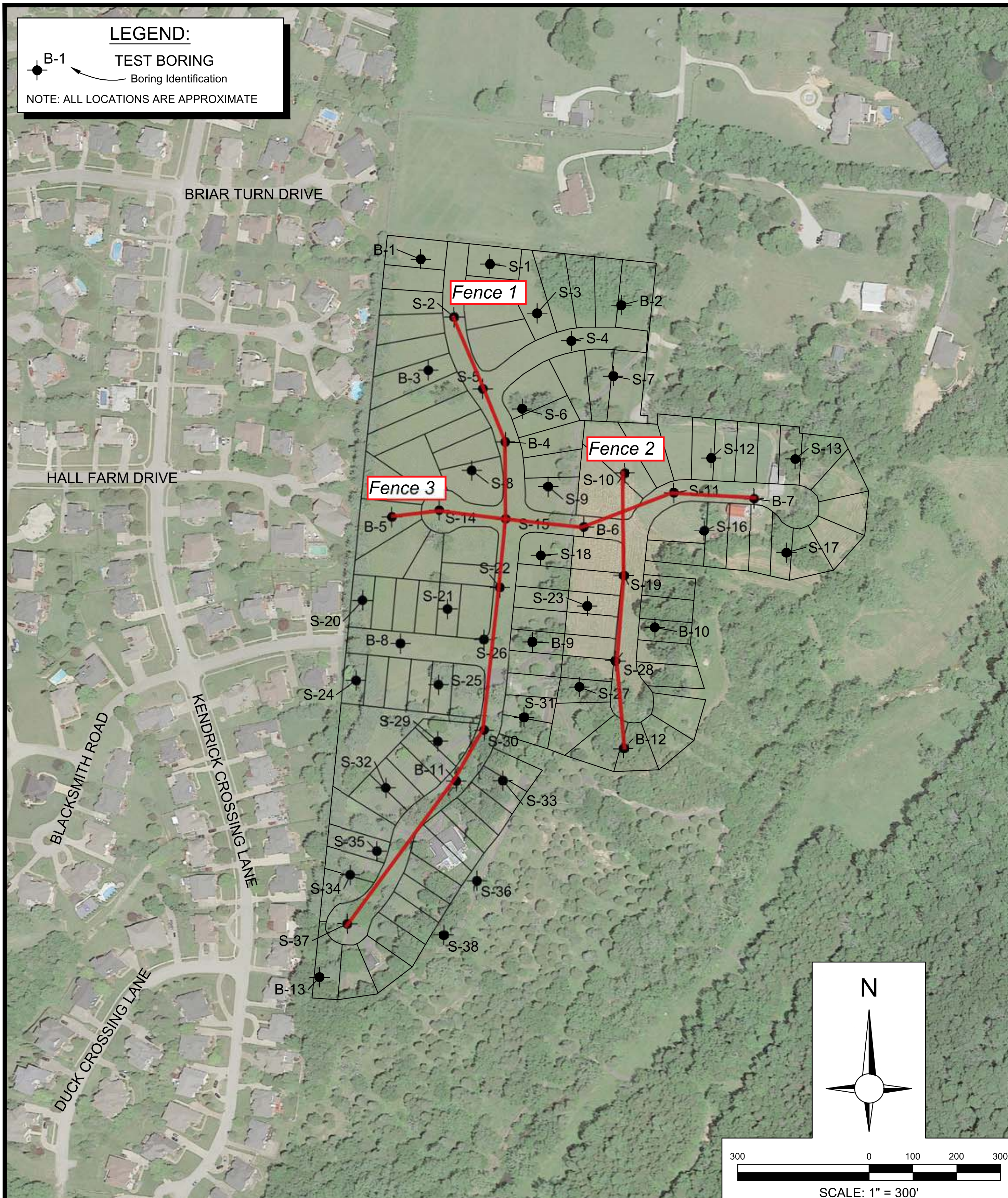
BORING PLAN

PROPOSED DOBSON LANE SUBDIVISION
800 DOBSON LANE
LOUSIVILLE, KENTUCKY

Project Number: LOUGE21012		Drn. By: BH
Drawing File: SEE LOWER LEFT		Ckd. By: ZN
Date: 02/11/2021	Scale: AS SHOWN	App'd By: TA
ATC		Figure: 2



Project Number: LOUGE21012	Drn. By: ZN
Drawing File: SEE LOWER LEFT	Ckd. By: RCO
Date: 03/3/2021 — Scale: AS SHOWN	App'd By: TA
ATC	Figure: 3

Fence Diagram

PROPOSED DOBSON LANE SUBDIVISION
800 DOBSON LANE
LOUSIVILLE, KENTUCKY

H:\2021\OTHER OFFICES\KENTUCKY\BALL HOMES, LLC\BALL HOMES - DOBSON LANE SUBDIVISION\LOUGE21012-BPLAN.DWG, BPLAN

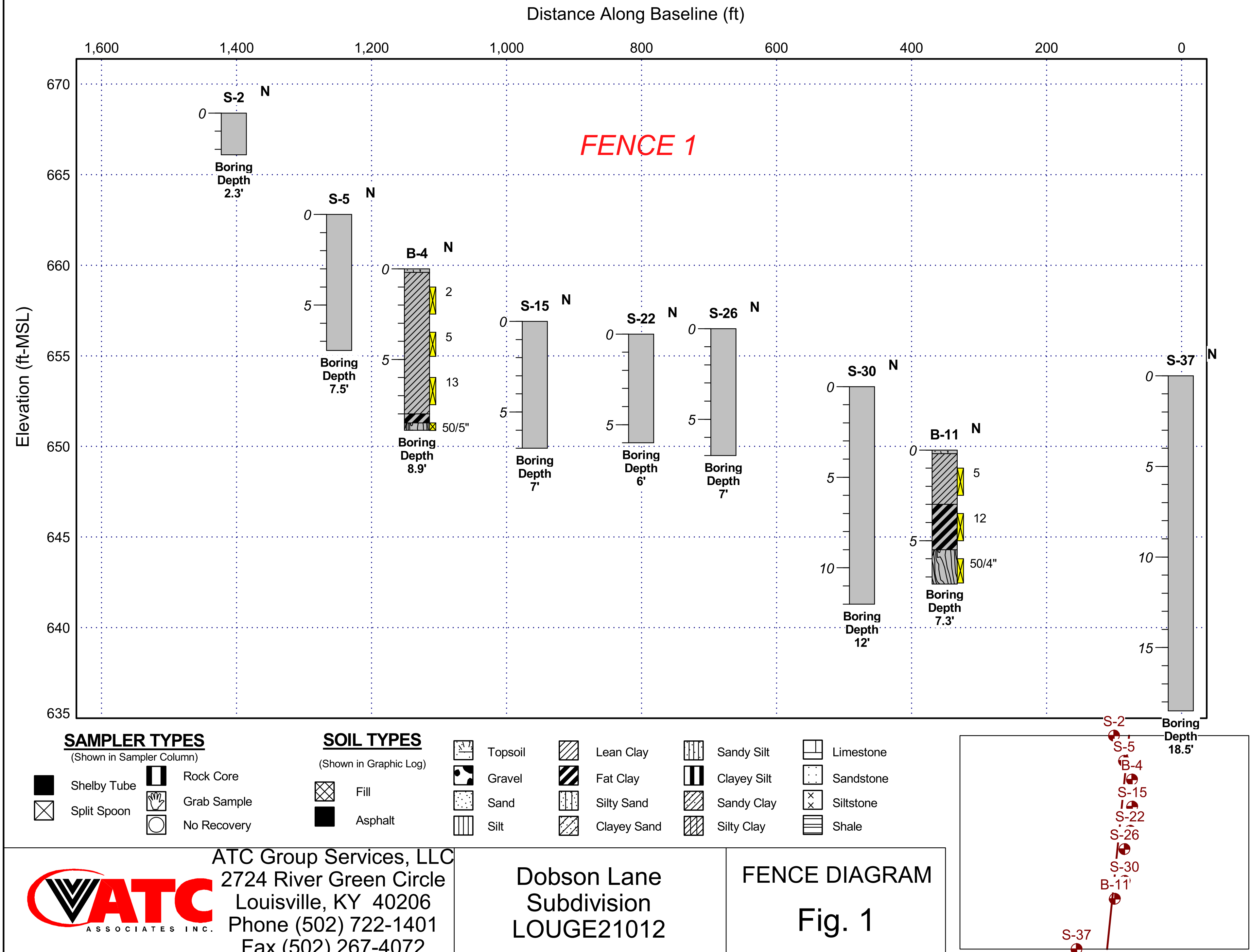
Exploration Data Sheet
Dobson Lane Subdivision- Ball Homes

ID	Latitude (deg)	Longitude (deg)	Surface Elev. (ft)	Refusal Depth (ft)	Refusal Elev. (ft)
B-1	38.128839	-85.557704	671.3	6.3	665.0
B-2	38.128490	-85.557688	657.7	8.8	648.9
B-3	38.128144	-85.559213	665.5	4.7	660.8
B-4	38.127701	-85.558595	659.8	8.9	650.9
B-5	38.127221	-85.559485	657.6	9.3	648.3
B-6	38.127176	-85.557962	654.3	4.9	649.4
B-7	38.127368	-85.556617	651.3	1.7	649.6
B-8	38.126429	-85.559402	656.3	6.7	649.6
B-9	38.126449	-85.558356	655.9	9.8	646.1
B-10	38.126551	-85.557386	644.2	6.0	638.2
B-11	38.125571	-85.558945	649.8	7.3	642.5
B-12	38.125791	-85.557621	625.2	1.3	623.9
B-13	38.124327	-85.560007	649.3	7.4	641.9
S-1	38.128814	-85.558734	670.3	7.0	663.3
S-2	38.128479	-85.559015	668.4	2.3	666.1
S-3	38.128510	-85.558355	663.5	1.5	662.0
S-4	38.128340	-85.558081	660.6	6.5	654.1
S-5	38.128032	-85.558780	662.8	7.5	655.3
S-6	38.127910	-85.558463	658.6	5.2	653.4
S-7	38.128123	-85.557743	657.4	8.5	648.9
S-8	38.127519	-85.558858	660.9	7.5	653.4
S-9	38.127424	-85.558248	657.2	6.0	651.2
S-10	38.127516	-85.557644	653.2	6.5	646.7
S-11	38.127398	-85.557252	650.1	3.5	646.6
S-12	38.127618	-85.556958	653.1	7.0	646.1
S-13	38.127619	-85.556290	647.6	1.0	646.6
S-14	38.127268	-85.559110	658.2	4.0	654.2
S-15	38.127219	-85.558583	656.9	7.0	649.9
S-16	38.127163	-85.557006	644.2	3.2	641.0
S-17	38.127152	-85.556548	624.3	0.0	624.3
S-18	38.126992	-85.558299	655.9	6.0	649.9
S-19	38.126873	-85.557640	651.6	8.2	643.4
S-20	38.126695	-85.559708	656.9	12.0	644.9
S-21	38.126649	-85.559034	658.3	11.5	646.8
S-22	38.126788	-85.558623	656.2	6.0	650.2
S-23	38.126679	-85.557924	653.9	9.9	644.0
S-24	38.126193	-85.559749	652.0	4.0	648.0
S-25	38.126173	-85.559097	655.1	5.3	649.8
S-26	38.126460	-85.558742	656.5	7.0	649.5
S-27	38.126171	-85.557978	648.9	5.5	643.4
S-28	38.126339	-85.557695	653.1	11.5	641.6
S-29	38.125818	-85.559095	654.1	4.8	649.3
S-30	38.125893	-85.558730	653.3	12.0	641.3
S-31	38.125976	-85.558413	650.6	6.8	643.8
S-32	38.125523	-85.559502	653.5	6.5	647.0

Exploration Data Sheet

Dobson Lane Subdivision- Ball Homes

ID	Latitude (deg)	Longitude (deg)	Surface Elev. (ft)	Refusal Depth (ft)	Refusal Elev. (ft)
S-33	38.125578	-85.558577	641.3	1.5	639.8
S-34	38.124974	-85.559773	654.9	9.0	645.9
S-35	38.125175	-85.559655	655.3	8.0	647.3
S-36	38.124947	-85.558770	643.5	2.3	641.2
S-37	38.124666	-85.559791	653.9	18.5	635.4
S-38	38.124604	-85.559026	638.7	2.5	636.2



SAMPLER TYPES
(Shown in Sampler Column)

- Shelby Tube
- Split Spoon
- Rock Core
- Grab Sample
- No Recovery

SOIL TYPES
(Shown in Graphic Log)

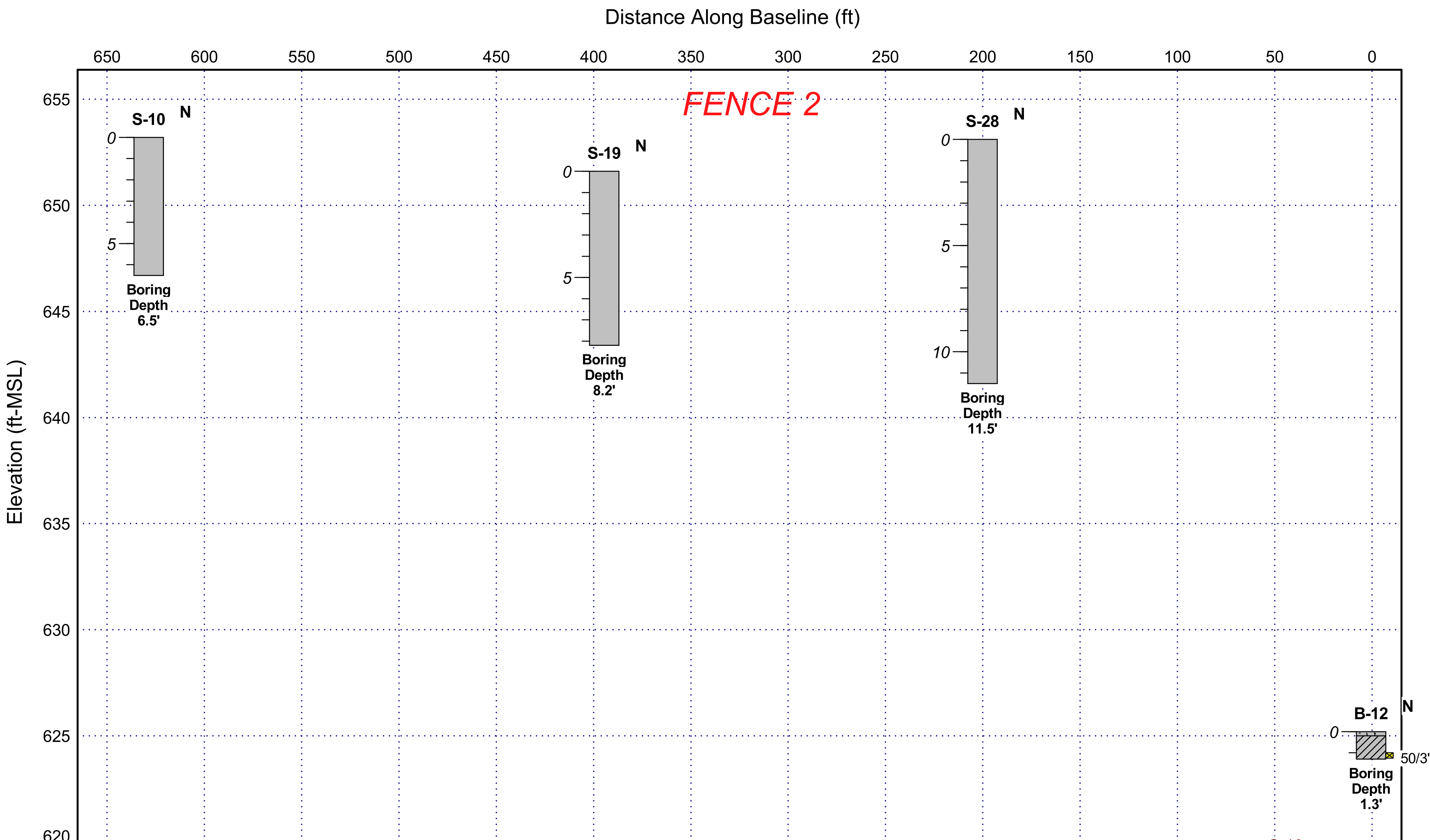
- Fill
- Asphalt
- Topsoil
- Gravel
- Sand
- Silt
- Lean Clay
- Fat Clay
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Limestone
- Sandstone
- Siltstone
- Shale

ATC ASSOCIATES INC.
ATC Group Services, LLC
2724 River Green Circle
Louisville, KY 40206
Phone (502) 722-1401
Fax (502) 267-4072

Dobson Lane Subdivision
LOUGE21012

FENCE DIAGRAM

Fig. 1



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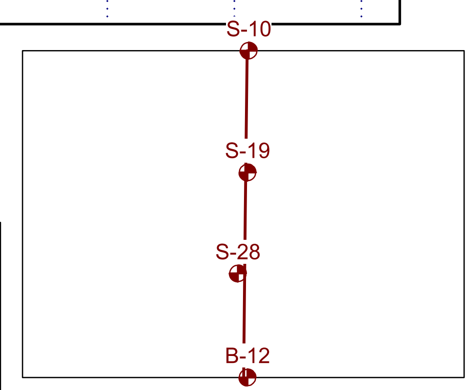
- Sandy Clay
- Silty Clay
- Limestone
- Sandstone
- Siltstone
- Shale



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Dobson Lane Subdivision
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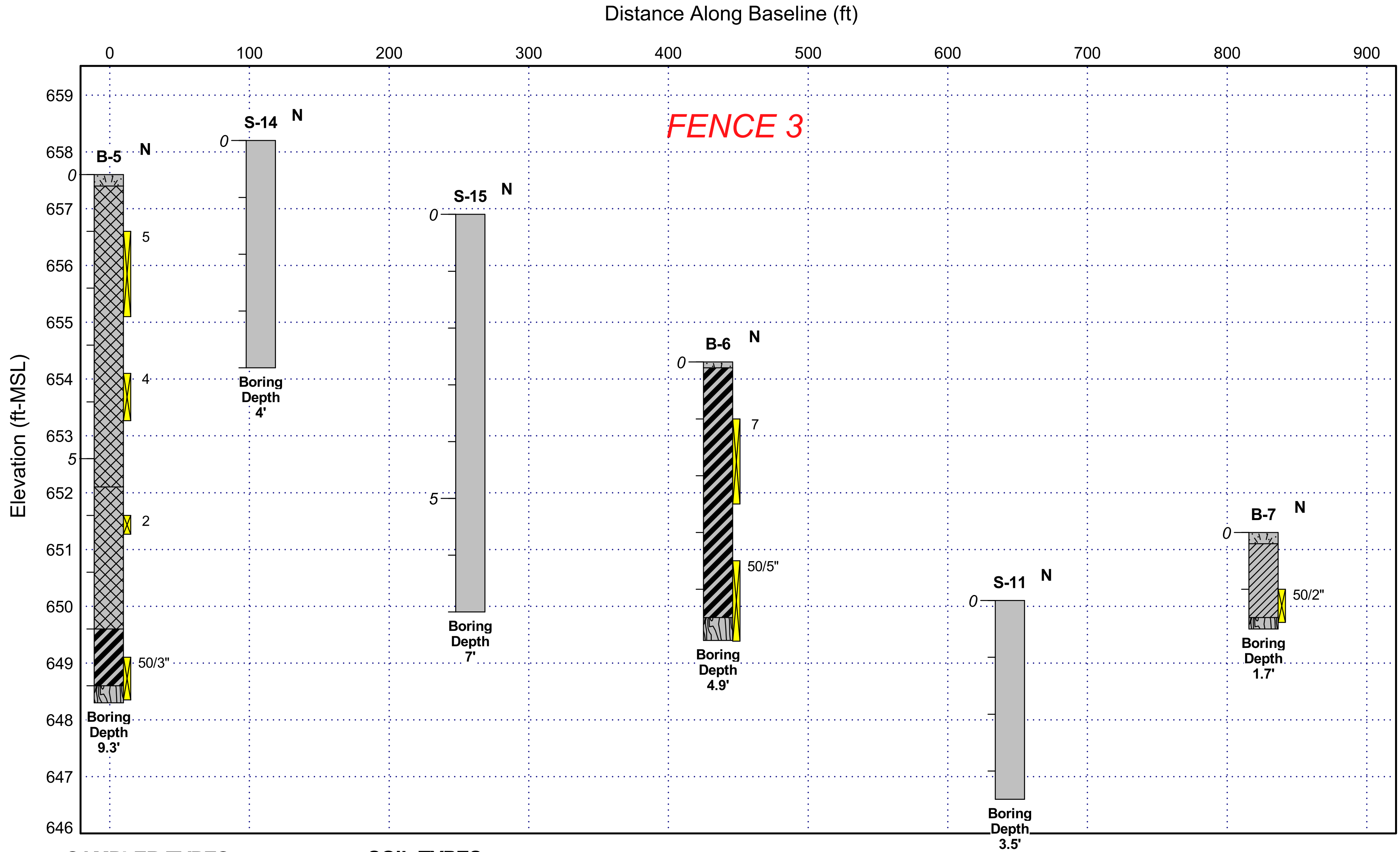
FENCE DIAGRAM

Fig. 1

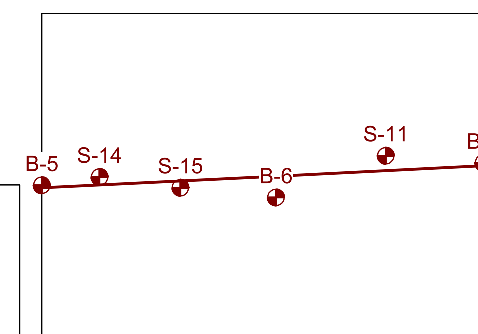


SAMPLER TYPES
(Shown in Sampler Column)

- Shelby Tube
- Split Spoon
- Rock Core
- Grab Sample
- No Recovery

SOIL TYPES
(Shown in Graphic Log)

- Fill
- Asphalt
- Topsoil
- Gravel
- Sand
- Silt
- Lean Clay
- Fat Clay
- Silty Sand
- Clayey Sand
- Sandy Silt
- Clayey Silt
- Sandy Clay
- Silty Clay
- Limestone
- Sandstone
- Siltstone
- Shale



ATC Group Services, LLC
2724 River Green Circle
Louisville, KY 40206
Phone (502) 722-1401
Fax (502) 267-4072

Dobson Lane Subdivision
LOUGE21012

FENCE DIAGRAM

Fig. 1

ATC Group Services, LLC
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(502) 722-1401
Fax (502) 267-4072

TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-1**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 671.3

Latitude (deg): 38.128839, Longitude (deg): -85.557704

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.1												
LEAN CLAY (CL), Brown, MEDIUM STIFF			1	SS			2-2-2- [*4*]						
FAT CLAY (CH), Brown, VERY STIFF	3.0		2	SS			6-7-10- [*17*]						
		5											
WEATHERED LIMESTONE	5.5		3	SS			50/3"--- [*50/3"*]						
Macrocore Refusal at 6.3 feet	6.3												

Sample Type
- SPT - Standard Penetration Test
- SS - Driven Split Spoon
- SH - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater
- Noted on Drilling Tools **N/A** ft.
- At Completion (in augers) ____ ft.
- At Completion (open hole) ____ ft.
- After ____ hours ____ ft.
- After ____ hours ____ ft.
- Cave Depth ____ ft.

Boring Method
- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling
- MH - Manual Hammer
- AH - Automatic Hammer

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(502) 722-1401
Fax (502) 267-4072

TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-2**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 657.7

Latitude (deg): 38.12849, Longitude (deg): -85.557688

TEST DATA

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), with silt, Brown, SOFT to MEDIUM STIFF			1	SS			1-1-2- [3]						
			2	SS			2-2-3- [5]						
		5											
FAT CLAY (CH), Brown, STIFF	5.5		3	SS			3-3-4- [7]						
WEATHERED LIMESTONE	8.0		4	SS			50/3"--- [*50/3"*]						
Macrocore Refusal at 8.8 feet	8.8												

Sample Type

SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

Noted on Drilling Tools	**N/A** ft.
At Completion (in augers)	ft.
At Completion (open hole)	ft.
After ____ hours	ft.
After ____ hours	ft.
Cave Depth	ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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Louisville, KY 40206
(502) 722-1401
Fax (502) 267-4072

TEST BORING LOG

CLIENT: **Ball Homes**
PROJECT NAME: **Dobson Lane Subdivision**
PROJECT LOCATION: **Dobson Lane**
Louisville, KY

BORING #: **B-3**
JOB #: **LOUGE21012**
DRAWN BY: **R. Ortiz**
APPROVED BY: **T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION (ft): 665.5
Latitude (deg): 38.128144, Longitude (deg): -85.559213

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown, MEDIUM STIFF			1	SS			3-2-3- [5]						
FAT CLAY (CH), Brown	3.0		2	SS			8-8-50/3"- [50/3"]						
WEATHERED LIMESTONE	4.5												
Macrocore Refusal at 4.7 feet	4.8												

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools **N/A** ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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Louisville, KY 40206
(502) 722-1401
Fax (502) 267-4072

TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-4**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 659.8

Latitude (deg): 38.127701, Longitude (deg): -85.558595

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), with silt, Brown, SOFT to VERY STIFF			1	SS			1-1-1- [2]						
			2	SS			2-2-3- [5]						
		5											
			3	SS			6-7-6- [13]						
FAT CLAY (CH), Brown	8.0												
WEATHERED LIMESTONE	8.5		4	SS			50/5"--- [50/5"]						
Macrocore Refusal at 8.9 feet	8.9												

Sample Type

SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

Noted on Drilling Tools **N/A** ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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TEST BORING LOG

CLIENT: **Ball Homes**
PROJECT NAME: **Dobson Lane Subdivision**
PROJECT LOCATION: **Dobson Lane, Louisville, KY**

BORING #: **B-5**
JOB #: **LOUGE21012**
DRAWN BY: **R. Ortiz**
APPROVED BY: **T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION (ft): 657.6
Latitude (deg): 38.127221, Longitude (deg): -85.559485

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
FILL - LEAN CLAY, Brown, with glass fragments to about 3 ft			1	SS			3-2-3- [*5*]						
- transition to brown to dark brown			2	SS			1-2-2- [*4*]						
		5											
WOOD FRAGMENTS, Only wood was recovered at this location. The sampler may have been blocked by wood fragments at this location. Other materials may be encountered.	5.5		3	SS			11-1-1- [*2*]						
FAT CLAY (CH), Brown, wet	8.0		4	SS			12-50/3"-- [*50/3"*]						
WEATHERED LIMESTONE	9.0												
Macrocore Refusal at 9.3 feet	9.3												

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools **N/A** ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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TEST BORING LOG

CLIENT	Ball Homes	BORING #	B-6
PROJECT NAME	Dobson Lane Subdivision	JOB #	LOUGE21012
PROJECT LOCATION	Dobson Lane Louisville, KY	DRAWN BY	R. Ortiz
		APPROVED BY	T. Andres

DRILLING and SAMPLING INFORMATION

Date Started	2/1/21	Hammer Wt.	140 lbs.
Date Completed	2/1/21	Hammer Drop	30 in.
Drill Foreman	M. Reynolds	Spoon Sampler OD	2 in.
Inspector	R. Ortiz	Rock Core Dia.	- in.
Boring Method	Macrocore, AH	Shelby Tube OD	- in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 654.3

Latitude (deg): 38.127176, Longitude (deg): -85.557962

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.1												
FAT CLAY (CH), Reddish brown, STIFF			1	SS			3-3-4- [7]						
			2	SS			4-4-50/5"- [*50/5"*]						
WEATHERED LIMESTONE	4.5												
Macrocore Refusal at 4.9 feet	4.9												

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools N/A ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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Fax (502) 267-4072

TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-7**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 651.3

Latitude (deg): 38.127368, Longitude (deg): -85.556617

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown to light brown	1.5		1	SS			3-50/2"-- [*50/2"*]						
WEATHERED LIMESTONE	1.7												
Macrocore Refusal at 1.7 feet													

Sample Type
- SPT - Standard Penetration Test
- SS - Driven Split Spoon
- SH - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater
- Noted on Drilling Tools **N/A** ft.
- At Completion (in augers) ____ ft.
- At Completion (open hole) ____ ft.
- After ____ hours ____ ft.
- After ____ hours ____ ft.
- Cave Depth ____ ft.

Boring Method
- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling
- MH - Manual Hammer
- AH - Automatic Hammer

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Louisville, KY 40206
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Fax (502) 267-4072

TEST BORING LOG

CLIENT	Ball Homes	BORING #	B-8
PROJECT NAME	Dobson Lane Subdivision	JOB #	LOUGE21012
PROJECT LOCATION	Dobson Lane, Louisville, KY	DRAWN BY	R. Ortiz
		APPROVED BY	T. Andres

DRILLING and SAMPLING INFORMATION

Date Started	2/1/21	Hammer Wt.	140 lbs.
Date Completed	2/1/21	Hammer Drop	30 in.
Drill Foreman	M. Reynolds	Spoon Sampler OD	2 in.
Inspector	R. Ortiz	Rock Core Dia.	- in.
Boring Method	Macrocore, AH	Shelby Tube OD	- in.

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 656.3

Latitude (deg): 38.126429, Longitude (deg): -85.559402

TEST DATA

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Reddish brown, MEDIUM STIFF			1	SS			2-2-2- [4]						
FAT CLAY (CH), Reddish brown, MEDIUM STIFF	3.0		2	SS			2-3-3- [6]						
		5											
			3	SS			15-50/2"-- [50/2"]						
WEATHERED LIMESTONE	6.5												
Macrocore Refusal at 6.7 feet	6.7												

Sample Type
- SPT - Standard Penetration Test
- SS - Driven Split Spoon
- SH - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Depth to Groundwater
- Noted on Drilling Tools N/A ft.
- At Completion (in augers) ____ ft.
- At Completion (open hole) ____ ft.
- After ____ hours ____ ft.
- After ____ hours ____ ft.
- Cave Depth ____ ft.

Boring Method
- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling
- MH - Manual Hammer
- AH - Automatic Hammer

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TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-9**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 655.9

Latitude (deg): 38.126449, Longitude (deg): -85.558356

TEST DATA

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown, MEDIUM STIFF to STIFF			1	SS			3-6-4- [*10*]						
- with a 3-inch layer of limestone fragments at 2 ft													
			2	SS			3-3-3- [*6*]						
		5											
FAT CLAY (CH), Reddish brown, VERY STIFF	5.5		3	SS			8-9-10- [*19*]						
			4	SS			10-12-50/3"- [*50/3"*]						
Macrocore Refusal at 9.8 feet	9.8												

Sample Type

SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater

Noted on Drilling Tools **N/A** ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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TEST BORING LOG

CLIENT	Ball Homes	BORING #	B-10
PROJECT NAME	Dobson Lane Subdivision	JOB #	LOUGE21012
PROJECT LOCATION	Dobson Lane Louisville, KY	DRAWN BY	R. Ortiz
		APPROVED BY	T. Andres

DRILLING and SAMPLING INFORMATION

Date Started	2/1/21	Hammer Wt.	140 lbs.
Date Completed	2/1/21	Hammer Drop	30 in.
Drill Foreman	M. Reynolds	Spoon Sampler OD	2 in.
Inspector	R. Ortiz	Rock Core Dia.	- in.
Boring Method	Macrocore, AH	Shelby Tube OD	- in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION (ft): 644.2
Latitude (deg): 38.126551, Longitude (deg): -85.557386

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown, MEDIUM STIFF			1	SS			3-2-3- [5]						
FAT CLAY (CH), Tan, VERY STIFF	3.0		2	SS			5-6-13- [19]						
		5											
Macrocore Refusal at 6 feet	6.0		3	SS			50/0"--- [50/0"]						

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools N/A ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

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TEST BORING LOG

CLIENT	**Ball Homes**	BORING #	**B-11**
PROJECT NAME	**Dobson Lane Subdivision**	JOB #	**LOUGE21012**
PROJECT LOCATION	**Dobson Lane**	DRAWN BY	**R. Ortiz**
	Louisville, KY	APPROVED BY	**T. Andres**

DRILLING and SAMPLING INFORMATION

Date Started	**2/1/21**	Hammer Wt.	**140** lbs.
Date Completed	**2/1/21**	Hammer Drop	**30** in.
Drill Foreman	**M. Reynolds**	Spoon Sampler OD	**2** in.
Inspector	**R. Ortiz**	Rock Core Dia.	**-** in.
Boring Method	**Macrocore, AH**	Shelby Tube OD	**-** in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION (ft): 649.8
Latitude (deg): 38.125571, Longitude (deg): -85.558945

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown, MEDIUM STIFF			1	SS			2-2-3- [*5*]						
FAT CLAY (CH), Reddish brown, STIFF	3.0		2	SS			5-5-7- [*12*]						
		5											
WEATHERED SHALE, Light brown	5.5		3	SS			13-16-50/4"- [*50/4"*]						
Macrocore Refusal at 7.3 feet	7.4												

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools **N/A** ft.
At Completion (in augers) ______ ft.
At Completion (open hole) ______ ft.
After ______ hours ______ ft.
After ______ hours ______ ft.
Cave Depth ______ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

ATC Group Services, LLC
2724 River Green Circle
Louisville, KY 40206
(502) 722-1401
Fax (502) 267-4072

TEST BORING LOG

CLIENT	Ball Homes	BORING #	B-12
PROJECT NAME	Dobson Lane Subdivision	JOB #	LOUGE21012
PROJECT LOCATION	Dobson Lane Louisville, KY	DRAWN BY	R. Ortiz
		APPROVED BY	T. Andres

DRILLING and SAMPLING INFORMATION

Date Started	2/1/21	Hammer Wt.	140 lbs.
Date Completed	2/1/21	Hammer Drop	30 in.
Drill Foreman	M. Reynolds	Spoon Sampler OD	2 in.
Inspector	R. Ortiz	Rock Core Dia.	- in.
Boring Method	Macrocore, AH	Shelby Tube OD	- in.

TEST DATA

SOIL CLASSIFICATION

SURFACE ELEVATION (ft): 625.2
Latitude (deg): 38.125791, Longitude (deg): -85.557621

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [N-Value] blows/foot	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Light brown	1.3		1	SS			50/3"--- [50/3"]						
Macrocore Refusal at 1.3 feet													

Sample Type	Depth to Groundwater		Boring Method
SPT - Standard Penetration Test	Noted on Drilling Tools	N/A ft.	HSA - Hollow Stem Augers
SS - Driven Split Spoon	At Completion (in augers)	ft.	CFA - Continuous Flight Augers
SH - Pressed Shelby Tube	At Completion (open hole)	ft.	DC - Driving Casing
CA - Continuous Flight Auger	After ____ hours	ft.	MD - Mud Drilling
RC - Rock Core	After ____ hours	ft.	MH - Manual Hammer
CU - Cuttings	Cave Depth	ft.	AH - Automatic Hammer
CT - Continuous Tube			

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Fax (502) 267-4072

TEST BORING LOG

CLIENT	Ball Homes	BORING #	B-13
PROJECT NAME	Dobson Lane Subdivision	JOB #	LOUGE21012
PROJECT LOCATION	Dobson Lane	DRAWN BY	R. Ortiz
	Louisville, KY	APPROVED BY	T. Andres

DRILLING and SAMPLING INFORMATION

Date Started	2/1/21	Hammer Wt.	140 lbs.
Date Completed	2/1/21	Hammer Drop	30 in.
Drill Foreman	M. Reynolds	Spoon Sampler OD	2 in.
Inspector	R. Ortiz	Rock Core Dia.	- in.
Boring Method	Macrocore, AH	Shelby Tube OD	- in.

TEST DATA

SOIL CLASSIFICATION
SURFACE ELEVATION (ft): 649.3
Latitude (deg): 38.124327, Longitude (deg): -85.560007

Soil Classification	Stratum Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Groundwater	Standard Penetration Test Blows per 6" [*N-Value*] *blows/foot*	Qu-tsf Unconfined Compressive Strength	Moisture Content %	Liquid Limit (LL)	Plastic Limit (PL)	Percent Passing #200 Sieve	Remarks
TOPSOIL	0.2												
LEAN CLAY (CL), Brown, MEDIUM STIFF, trace roots			1	SS			3-3-3- [*6*]						
FAT CLAY (CH), Brown, VERY STIFF	3.0		2	SS			24-8-6- [*14*]						
WEATHERED SHALE, Light brown	4.5	5	3	SS			27-33-50/5"- [*50/5"*]						
Macrocore Refusal at 7.4 feet	7.5												

Sample Type
SPT - Standard Penetration Test
SS - Driven Split Spoon
SH - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Depth to Groundwater
Noted on Drilling Tools N/A ft.
At Completion (in augers) ____ ft.
At Completion (open hole) ____ ft.
After ____ hours ____ ft.
After ____ hours ____ ft.
Cave Depth ____ ft.

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling
MH - Manual Hammer
AH - Automatic Hammer

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (tsf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	CBR	Swell (%)	RQD	Percent Recovery	Cc	Cr	pH
B-3	3.0	GRAB	37	20	17	CL	24.3				107.7	17.3							
B-3	0.0	GRAB	37	22	15	CL	28.3				104.3	17.6							
B-4	0.0	GRAB	35	23	12	CL	28.2				104.8	17.1							

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Louisville, KY 40206
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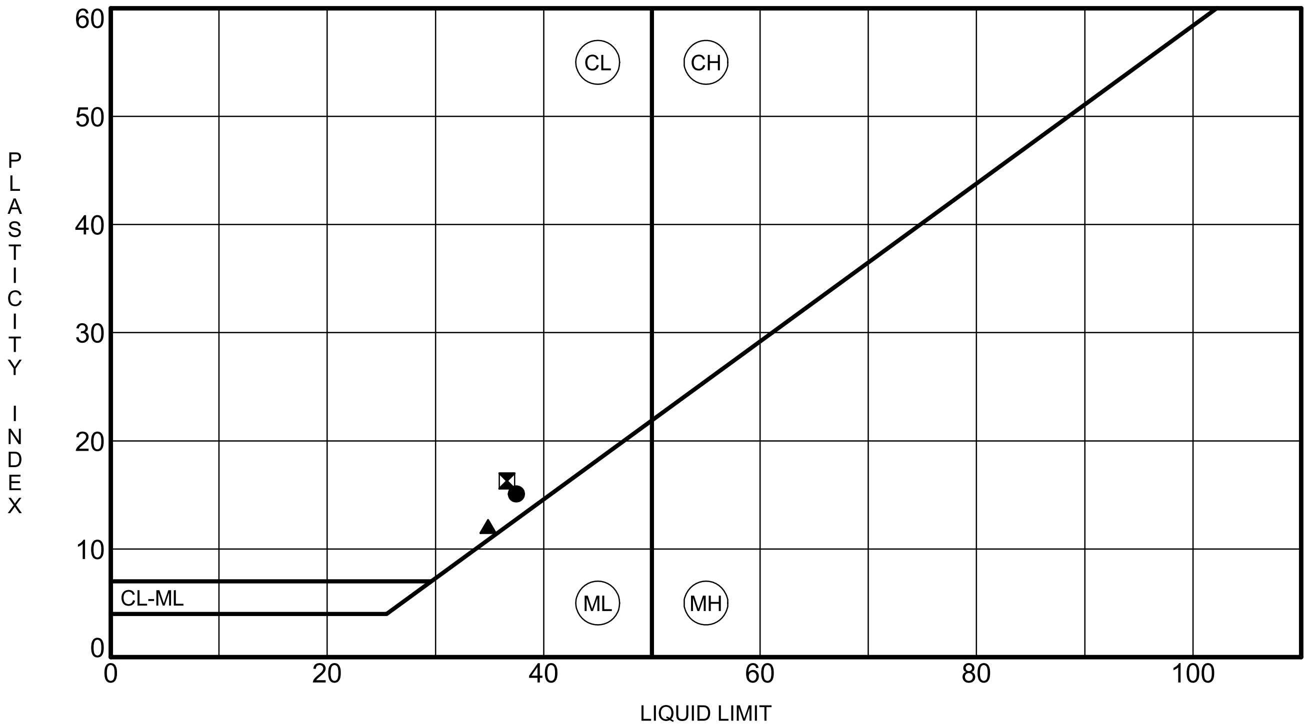
Fax (502) 267-4072

Summary of Laboratory Results

Client: Ball Homes
Project: Dobson Lane Subdivision
Location: Dobson Lane
City, State: Louisville, KY
Number: LOUGE21012 Date: 2/8/2021



	Specimen Identification		LL	PL	PI	Water Content	Description
●	**B-3**	**0.0**	**37**	**22**	**15**	**28.3**	**LEAN CLAY (CL), Brown**
⧗	**B-3**	**3.0**	**37**	**20**	**17**	**24.3**	**LEAN CLAY (CL), Brown**
▲	**B-4**	**0.0**	**35**	**23**	**12**	**28.2**	**LEAN CLAY (CL), Brown**

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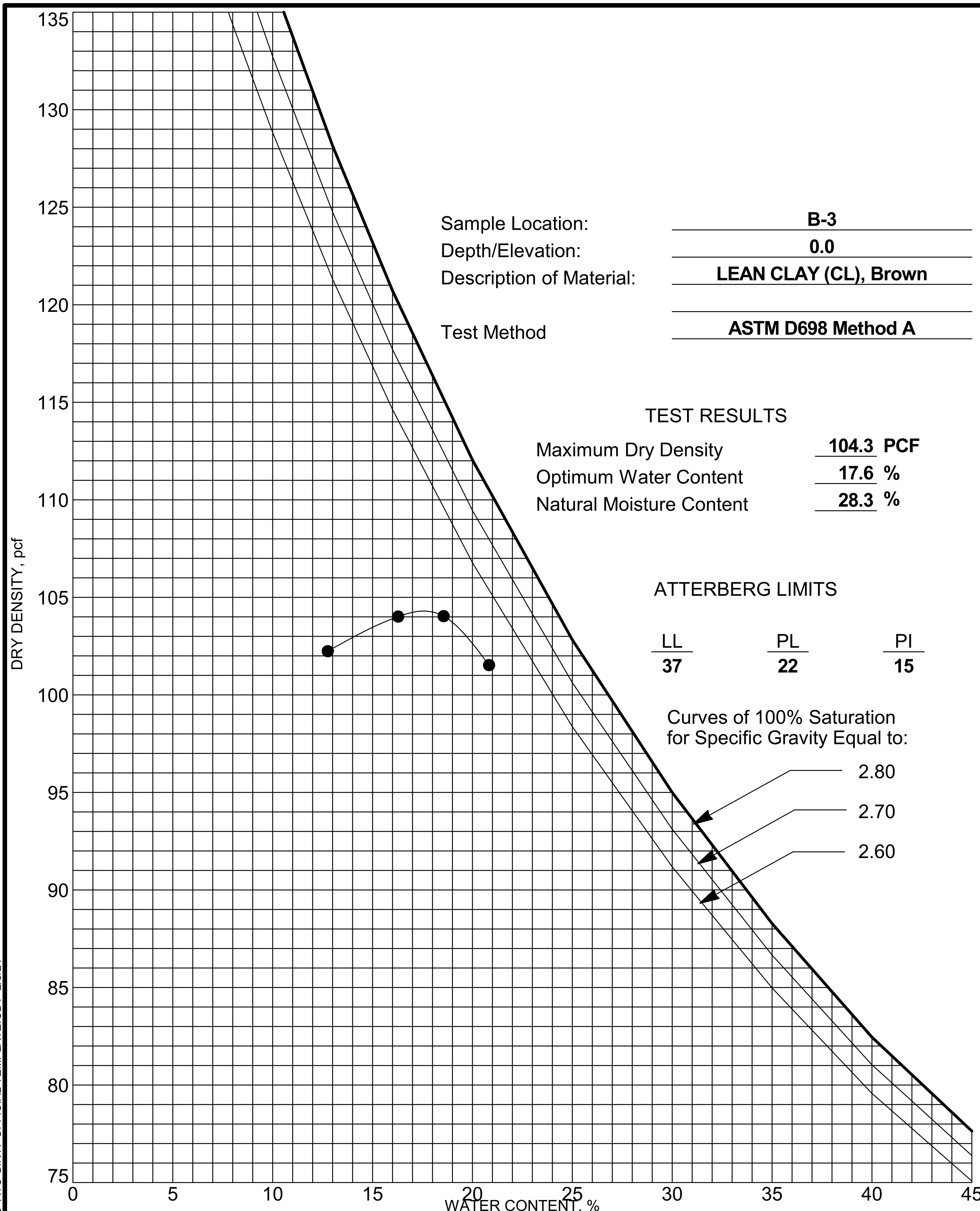
ATTERBERG LIMITS RESULTS

Client: Ball Homes
Project: Dobson Lane Subdivision
Location: Dobson Lane
City, State: Louisville, KY
Number: LOUGE21012
Date: 2/8/2021



Sample Location:	**B-3**
Depth/Elevation:	**0.0**
Description of Material:	**LEAN CLAY (CL), Brown**
Test Method	**ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**104.3 PCF**
Optimum Water Content	**17.6 %**
Natural Moisture Content	**28.3 %**

ATTERBERG LIMITS

LL	PL	PI
37	**22**	**15**

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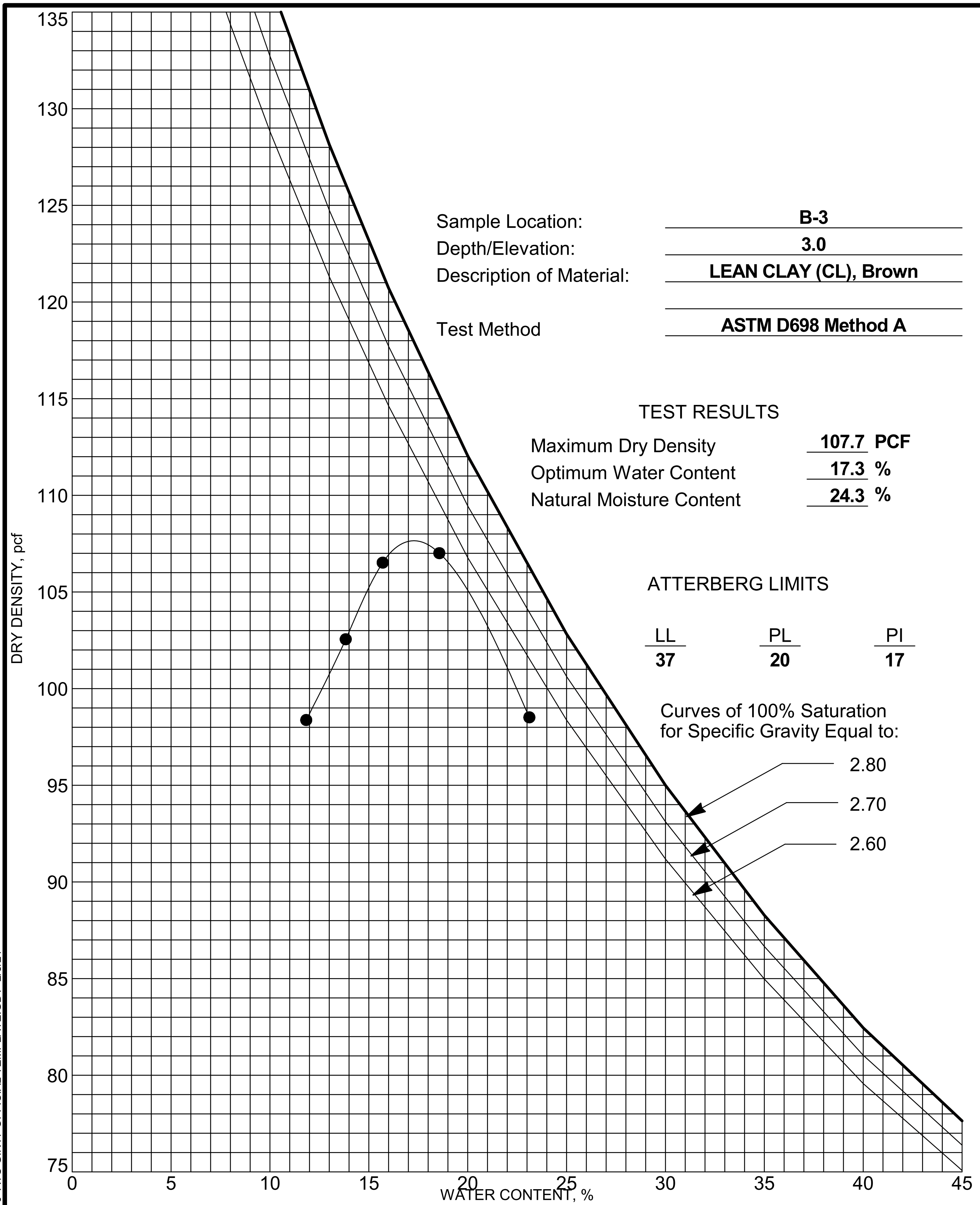
MOISTURE-DENSITY RELATIONSHIP

Client: Ball Homes
Project: Dobson Lane Subdivision
Location: Dobson Lane
City, State: Louisville, KY
Number: LOUGE21012

Date: 2/8/2021



Sample Location:	**B-3**
Depth/Elevation:	**3.0**
Description of Material:	**LEAN CLAY (CL), Brown**
Test Method	**ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**107.7**	**PCF**
Optimum Water Content	**17.3**	**%**
Natural Moisture Content	**24.3**	**%**

ATTERBERG LIMITS

LL	PL	PI
37	**20**	**17**

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Phone (502) 722-1401
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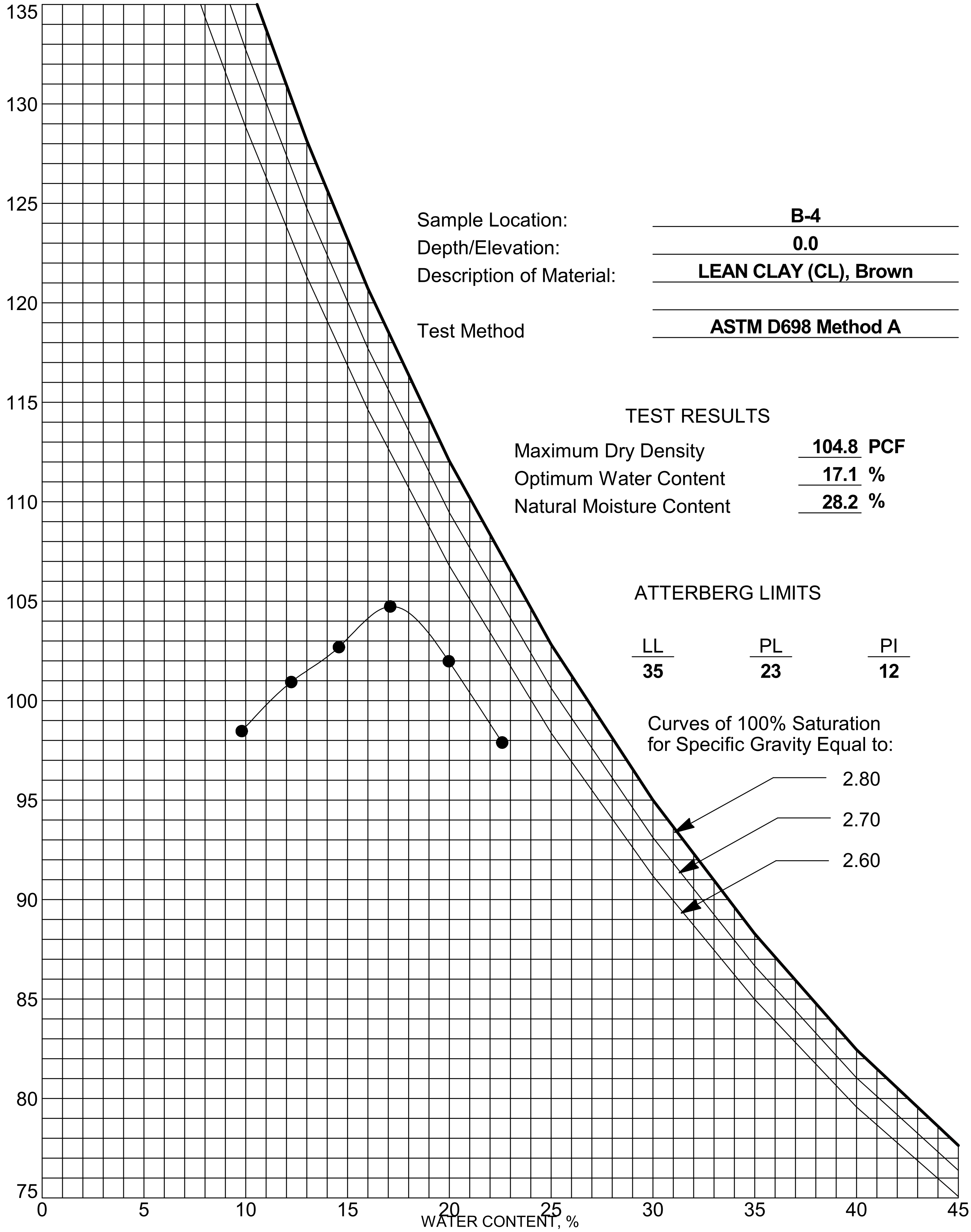
MOISTURE-DENSITY RELATIONSHIP

Client: Ball Homes
Project: Dobson Lane Subdivision
Location: Dobson Lane
City, State: Louisville, KY
Number: LOUGE21012
Date: 2/8/2021



Sample Location:	**B-4**
Depth/Elevation:	**0.0**
Description of Material:	**LEAN CLAY (CL), Brown**
Test Method	**ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density	**104.8 PCF**
Optimum Water Content	**17.1 %**
Natural Moisture Content	**28.2 %**

ATTERBERG LIMITS

LL	PL	PI
35	**23**	**12**

US COMPACTION DOBSON.GPJ ATC GINT7 OFFICIAL TEMPLATE.GDT 2/8/21

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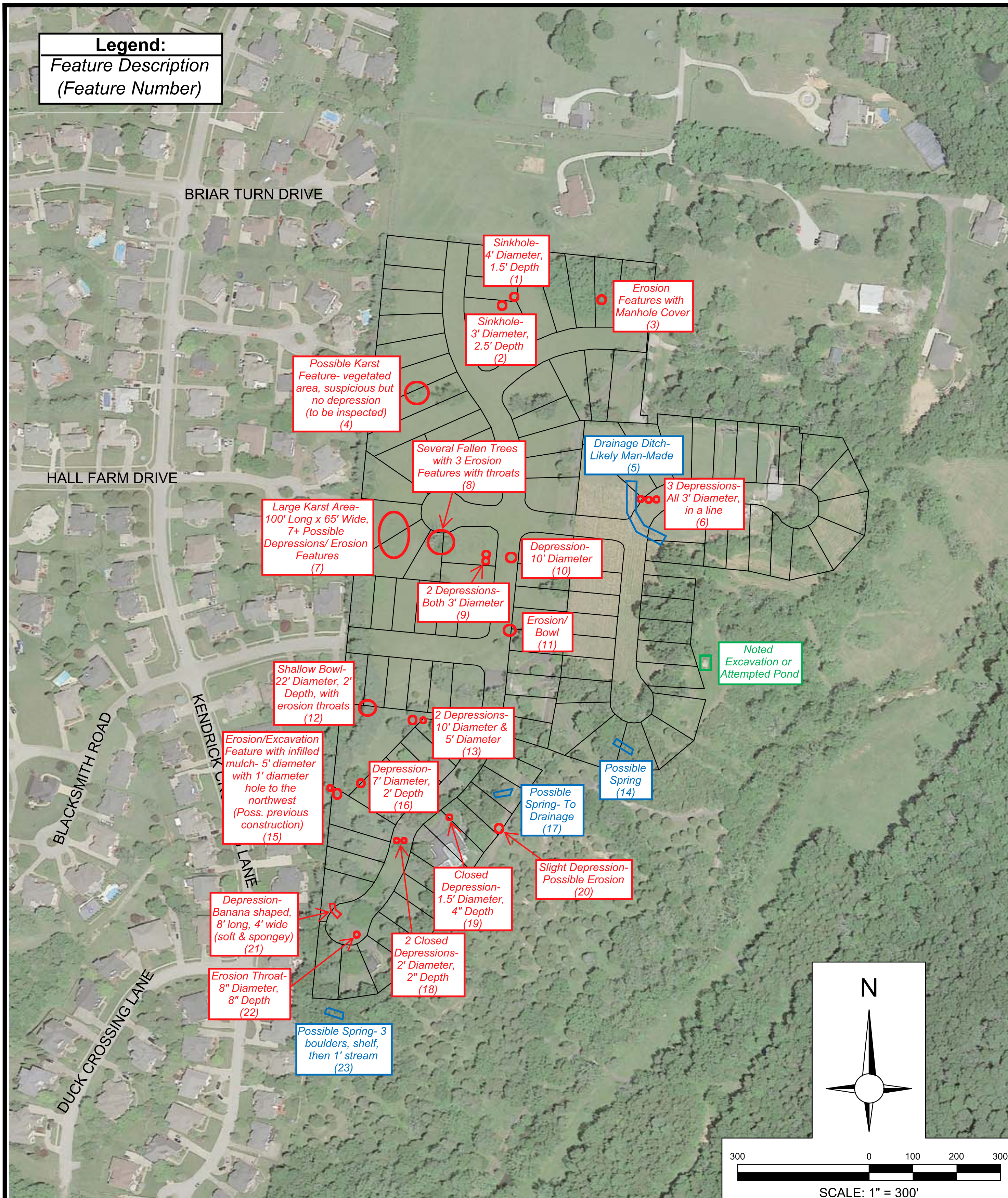
Louisville, KY 40206
Phone (502) 722-1401
Fax (502) 267-4072

MOISTURE-DENSITY RELATIONSHIP

Client: Ball Homes
Project: Dobson Lane Subdivision
Location: Dobson Lane
City, State: Louisville, KY
Number: LOUGE21012
Date: 2/8/2021



KARST FEATURE LOCATION PLAN

PROPOSED DOBSON LANE SUBDIVISION
800 DOBSON LANE
LOUSIVILLE, KENTUCKY

Project Number: LOUGE21012		Drn. By: ZN
Drawing File: SEE LOWER LEFT		Ckd. By: RCO
Date: 02/11/2021	Scale: AS SHOWN	App'd By: TA
ATC		Figure: N/A

Karst Feature Reconnaissance Table

Project Name: Dobson Lane Subdivision
ATC Project Number: LOUGE21012
Field Reconaissance Dates: 2/24/2021

Item ID		Physical Setting											Feature Characteristics														Assessment							Additional Comments	
Feature Des.		Location		Estimated Drainage Area				Topography					Est Dimensions				Surrounding Features			Bottom Material				Features			Connection to Subsurface			Significance ****					
Feature Location No.	Feature Type **	Geologic Formation ***	GPS Point	Less than 1 acre	Less than 10 acres	Less than 50 acres	More than 50 acres	Top of Hill	Hillside	Valley Floor	Drainage Swale	In 100-Year Flood Plain	Depth (feet)	Diameter (feet)	Estimated Length (ft.)	Estimated Width (ft.)	Low, less than 1 per acre	Moderate, 1 to 10 per acre	High, more than 10 per Ac.	None, Open Throat	Sand, Gravel, or Cobbles	Silt or Clay	Organic Debris/Topsoil	Throat	Rim	Adjacent Areas	Open Throat	Water Inflow	Water Outflow	None, Easily Plugged	L: Cleanout and Plug	M: Irregular, Mult. Throats	H: Leave Intact, Other	Yes	No
1	SH	Sl	38.128578, 85.558527	x									1.5	4	na	na		x				x		x		x		x				x		5, 9	
2	SH	Sl	38.128515, 85.558620	x									2.5	3	na	na		x				x		x		x		x				x		5, 9	
3	SH	Sl	38.128615, 85.557852	x									na	7	na	na		x				x		x				x				x		10	
4	na	Sl	38.128064, 85.559324	x									na				x						x										x	6	
5	SS	Sl	38.127473, 85.557586		x			x			x		na	na	200	20	x									x		x	x				x	10	
6	CD	Sl	38.127371, 85.557450	x									na					x				x				x		x			x	x		5	
7	CD	Sl	38.127008, 85.559387		x								na	na	100	65		x				x	x	x		x						x		5, 9	
8	CD	Sl	38.127031, 85.559114		x								na					x				x	x	x		x	x	x				x		5, 6, 9	
9	CD	Sl	38.126906, 85.558677	x									na	3	na	na		x				x				x		x			x	x		5, 9	
10	CD	Sl	38.126898, 85.558540	x									na	10	na	na		x				x				x		x			x	x			x
11	CD	Sl	38.126533, 85.558576	x									na				x					x						x			x	x	x		x
12	CD	Sl	38.126055, 85.559745	x									2	22	na	na		x				x	x	x		x		x			x	x		5, 9	
13	CD	Sl	38.125961, 85.559245	x									na	10	na	na		x				x				x		x			x	x		5, 9	
14	GS	Sl	38.125795, 85.557589		x				x		x		na				x					x						x	x			x	x	10	
15	CD	Sl	38.125529, 85.559947	x									na	5	na	na		x				x		x		x		x		x				2, 5	
16	CD	Sl	38.125571, 85.559728	x									2	7	na	na		x				x				x		x			x	x			x
17	GS	Sl	38.125488, 85.558713		x						x		na				x					x						x	x				x	10	
18	CD	Sl	38.125201, 85.559408	x									2	2	na	na		x				x				x		x			x	x		5, 9	
19	CD	Sl	38.125367, 85.559006	x									0.3	1.5	na	na	x					x				x		x			x				x
20	CD	Sl	38.125254, 85.558625	x									na					x				x				x		x		x					x
21	CD	Sl	38.124747, 85.559915	x									na	na	8	4		x				x				x		x			x	x		4	
22	SH	Sl	38.124604, 85.559729	x									0.7	0.7	na	na		x				x		x		x	x	x			x	x			x
23	GS	Sl	38.124015, 85.559795		x						x		na				x					x						x	x					1,10	

* Multiple Features, see additional comments and photo

** **Feature Type:** **CD** = Closed Depression; **RS** = Enlarged Slot in Rock; **SH** = Sinkhole; **C** = Cave; **KW** = Karst Window; **GS** = Groundwater Spring; **SS** = Sinking Stream; **VR** = Vuggy Rock Outcrop

*** **Geologic Formation:** **Sl** = Laurel Dolomite

**** **Significance Rating:** **L - Low,** featue easily plugged or filled; **M - Moderate,** irregular shape, multiple throats, preservation candidate; **H - High,** large or deep feature, difficult to plug or treat, preservation recommended

Abbreviations: na - not applicable; no - not observed; unk - unknown; SH - sinkhole; CD - closed depression

Notes:

1 Off Site
2 On property line
3 Likely from road construction
4 irregular shaped
5 Connected to another Feature
6 Heavily Vegetated, View Obscured
7 Animal Burrow
8 Outside of Planned Development Area
9 Multiple Features including CD, SH, GS, SS, along swale
10 Drainage Feature

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log


Feature 1- Sinkhole


Feature 2- Sinkhole

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 3- Erosion Features with Manhole Cover


Feature 5- Drainage Ditch


Feature 6- 3 Depressions in a Line

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 7- Large Karst Area with Erosion Features

Feature 8- Several Fallen Trees with Erosion Features

Feature 9- 2 Depressions

Feature 10- Depression

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 11- Erosion

Feature 12- Erosion Throats in Shallow Bowl

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 12- Shallow Bowl

Feature 13- 2 Depressions

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 14- Possible Spring

Feature 15- Possible Erosion

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 16- Depression at Base of Tree

Feature 17- Possible Spring to Drainage

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 18- Closed Depression #1

Feature 18- Closed Depression #2

Feature 19- Sinkhole

Feature 20- Possible Erosion

Dobson Lane Subdivision
Louisville, Kentucky

Karst Feature Observation Services
Project Number: LOUGE21012
Karst Feature Photo Log

Feature 21- Depression

Feature 22- Erosion Throat

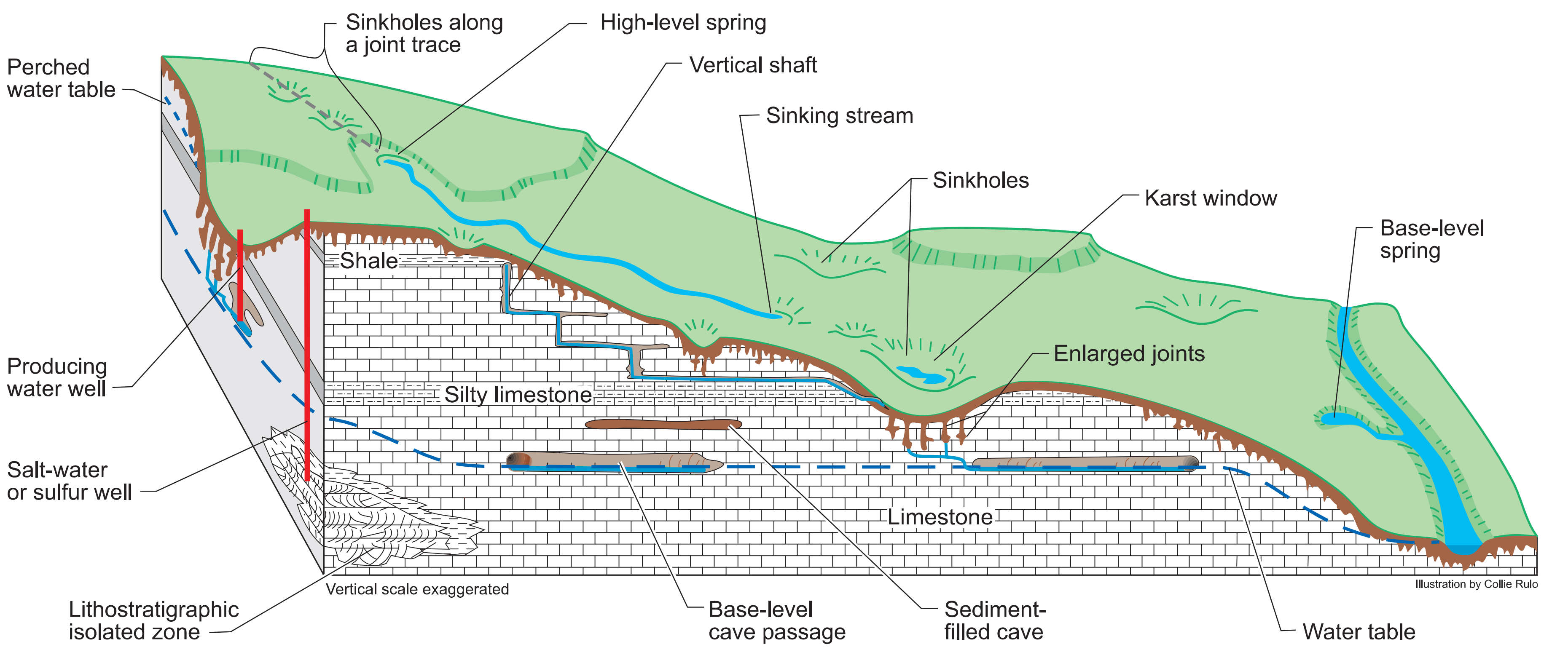
Feature 23- Possible Spring with boulders

Kentucky Geological Survey
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

MAP AND CHART 15
Series XII, 2001

Generalized Block Diagram of the Inner Bluegrass Karst

James C. Currens

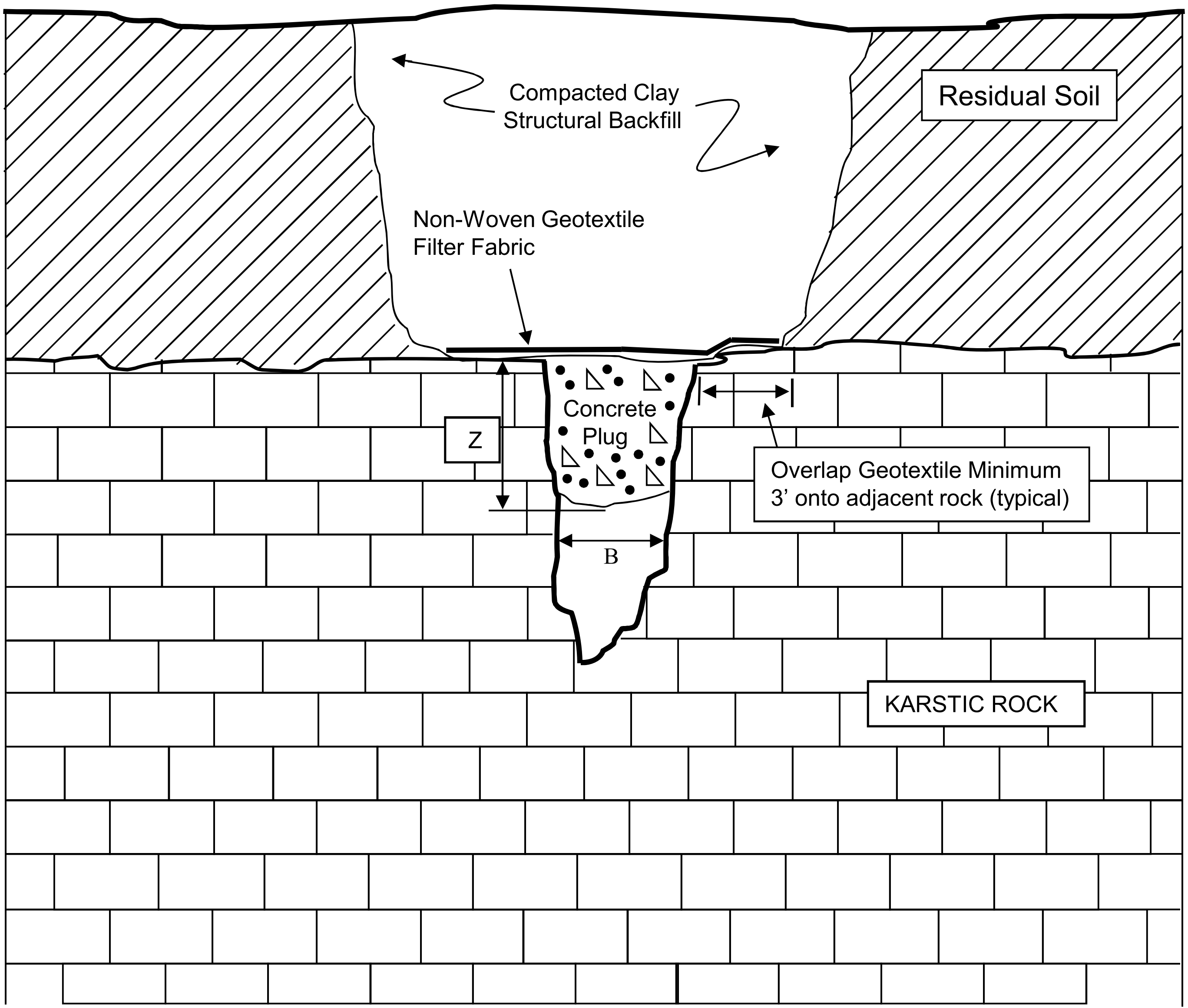


Inner Bluegrass karst:

Karst occurs where limestone or other soluble bedrock is near the earth's surface, and fractures in the rock become enlarged when the rock dissolves. Sinkholes and sinking streams are two surface features that indicate karst development. In karst areas most rainfall sinks underground, resulting in fewer streams flowing on the surface than in non-karst settings. Instead of flowing on the surface, the water flows underground through caves, sometimes reemerging at karst windows, then sinks again to eventually discharge at a base-level spring along a major stream or at the top of an impermeable strata. The development of karst features is influenced by the type of soluble rock and how it has been broken or folded by geologic forces. There are four major karst regions in Kentucky: the Inner Bluegrass, Western Pennyroyal, Eastern Pennyroyal, and Pine Mountain. This diagram depicts the Inner Bluegrass karst.

In the Inner Bluegrass, insoluble impurities within the limestone, such as shale, result in a perched or isolated water table that discharges ground water at high-level springs or may locally isolate pockets of saltwater or sulfur water. In some locations, vertical fractures in the rock, called joints, may increase the rate of water flowing toward base level. The joints and impurities also influence the location and development of vertical shafts and caves. As erosion on the surface continues over geologic time, the major stream draining a karst terrane cuts its channel deeper. In response, deeper conduits increase their flow to the major stream, and new springs develop at lower elevations along the stream's banks. Older, higher flow routes are left as dry cave passages, some of which become sediment filled. To produce significant amounts of water, wells drilled into karst aquifers must intersect a set of enlarged fractures, a dissolution conduit, or a cave passage with an underground stream.

For information on obtaining copies of this chart and other Kentucky Geological Survey maps and publications call:
Publication Sales
(859) 257-3896
View the KGS World Wide Web site at:
www.uky.edu/kgs



*NOTE: Good concrete to rock bond is essential (Z = 1.5 to 2 times B)

CLIENT:

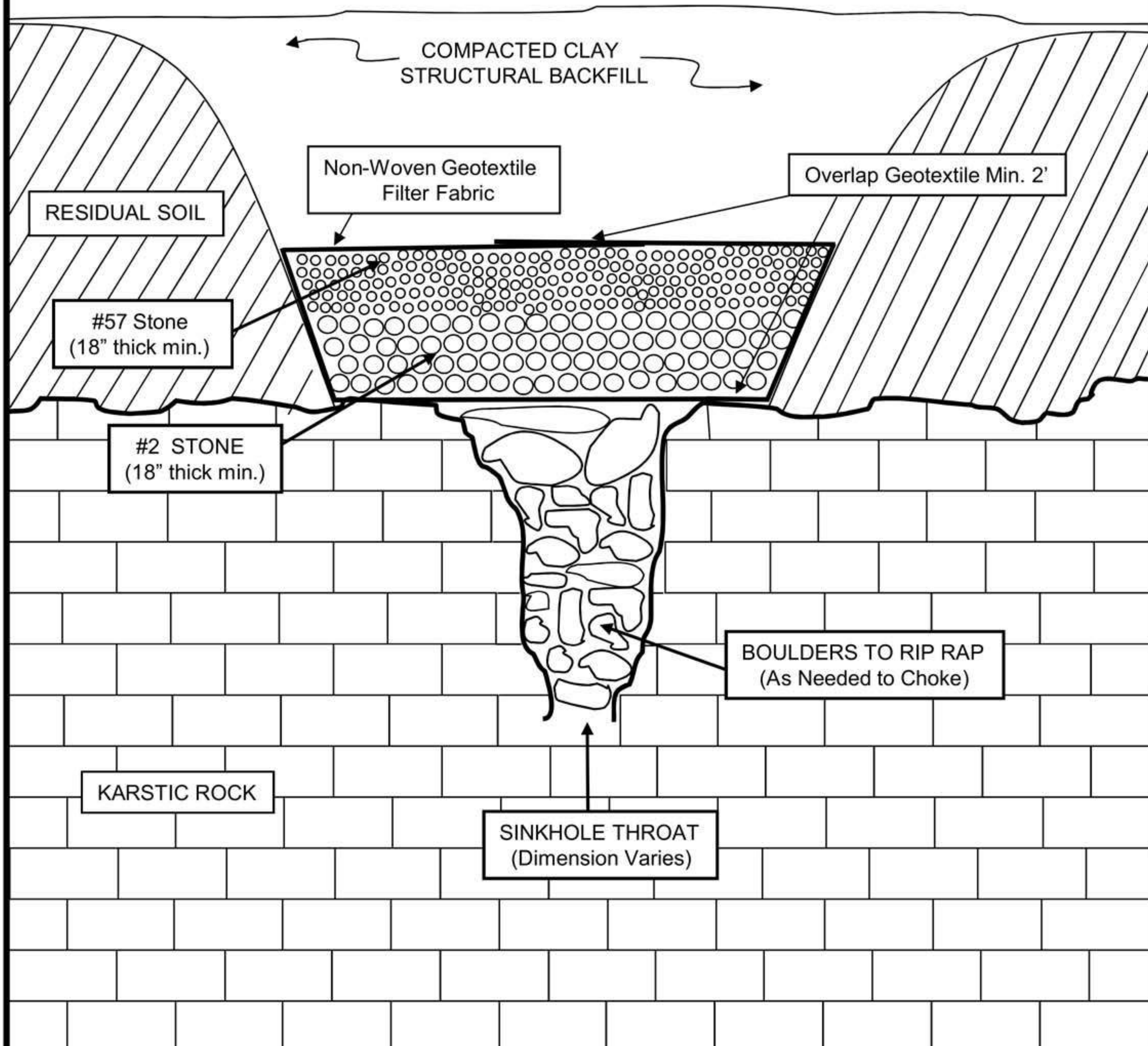
Ball Homes

2724 River Green Circle
Louisville, KY 40206
Phone: (502) 722-1401
Fax: (502) 267-4072

DENTAL FILLING OF SMALL SOLUTION CAVITY

Dobson Lane Subdivision
Louisville, Jefferson County, Kentucky

PROJECT NO: LOUGE21012



CLIENT:

Ball Homes

ATC
2724 River Green Circle
Louisville, KY 40206
Phone: (502) 722-1401
Fax: (502) 267-4072

GRADED FILTER FOR SOLUTION CAVITY

Dobson Lane Subdivision
Louisville, Jefferson County, Kentucky

PROJECT NO: LOUGE21012