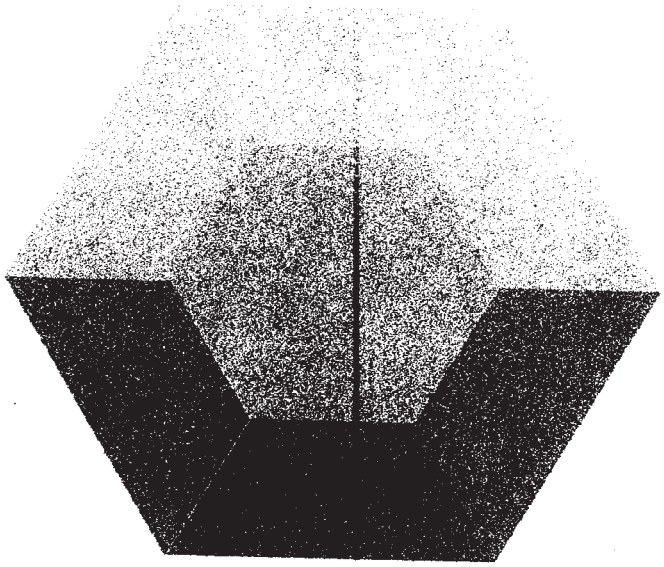

GEM Engineering, Inc.

GEOTECHNICAL EXPLORATION REPORT

Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky

Prepared For:

Three D's Development
8008 St. Andrews Church Road
Louisville, Kentucky 40258

GEM Engineering, Inc.

Geotechnical Environmental and Materials Services

July 17, 2003

Three D's Development
8008 St. Andrews Church Road
Louisville, Kentucky 40258

Attention: Mr. Don Jones

Subject: Geotechnical Exploration Report
Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky
GEM Project G-1517

Dear Mr. Jones:

We have completed the geotechnical exploration for the above referenced project. These services were authorized and conducted in general accordance with GEM Proposal No. GP-933, dated April 28, 2003.

Attached is our geotechnical exploration report for the referenced project. This report includes our design and construction recommendations for slopes, site preparation, and fill construction, as well as summaries of pertinent site observations, the subsurface conditions encountered, and other geotechnical issues identified. Included in the Appendix are a Site Location Plan, an Exploration Plan, an Exploration Legend, our Boring and Test Pits Records, the results of laboratory testing, and a summary of our field and laboratory procedures.

We appreciate the opportunity to serve as your geotechnical consultants for this project. We look forward to future association with you on this and other projects.

Sincerely,
GEM Engineering, Inc.

Samantha Schardein, P. E.
Project Engineer
Kentucky License No. 20438

G. T. Vandevelde, P. E.
Chief Engineer
Kentucky License No. 14708

cc: Chad Whitaker; BTM; 3001 Taylor Springs Drive; Louisville, Kentucky 40220

Attachments: Geotechnical Exploration Report

Common\Projects\2003\G-1517\Report

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1.0 EXECUTIVE SUMMARY

GEM Engineering, Inc. (GEM) has completed a geotechnical exploration for Sections 3, 4, and 5 of the Hardwood Forest subdivision in Louisville, Kentucky. The geotechnical exploration included evaluation of the existing and proposed slopes, as well as identification and evaluation of other potential geotechnical concerns.

A total of sixty-three (63) borings and test pits were drilled or excavated along the proposed road alignments or adjacent side slopes. Soil depths varied from approximately 4 to 22 feet and averaged between 10 to 12 feet in the three proposed sections. The soil generally consisted of various brown to mottled brown and gray, low plasticity, firm to stiff, clayey silt to silty clay. The clay was underlain by weathered clay shale. Evidence of groundwater (primarily saturated zones in the clay overburden) was observed in numerous borings.

Many of the existing soil slopes are covered by colluvium, loess, and eolian sand. Colluvium is soil that is slowly moving downhill due to weathering, seepage, and gravity effects. These types of soils are inherently unstable. The movement can be mobilized by minimal changes in moisture content, as well as other changes in conditions. Loess and eolian sand are wind-blown deposits that typically achieve much of their apparent strength through the partial cementation of particles. This cementation is very sensitive and is easily destroyed or reduced when these soils are disturbed by new construction. Given the weak and sensitive nature of these three deposits, construction and design methodologies for the proposed sections will be much more critical than typical subdivision construction. Therefore, all parties participating in the development, design, or construction of these new sections should be provided this report and should be aware of the concerns and limitations associated with construction in the proposed sections.

The factor of safety for the stability of existing native slopes in areas where groundwater or springs are present or where steep slopes exist (i.e., steeper than 2.5H:1V) likely is equal to or less than the factor of safety typically used for civil projects. The locations where the factor of safety is significantly below generally accepted standards (typically 1.2 to 1.4) are believed to be localized in nature and not considered to be representative of predominant conditions. Since it would be cost prohibitive to remediate existing slopes such that they achieve the typically desired factors of safety, the objective of our design analysis was to develop slope recommendations that would provide the desired site configuration while achieving a factor of safety equal to or greater than the native slopes. Based on our stability analyses, the proposed 3H:1V cut and fill soil slopes achieved adequate factors of safety as designed. The proposed development should be able to achieve acceptable factors of safety for the proposed construction provided the recommendations in this report are strictly followed.

Further details of our findings and recommendations are included in subsequent sections of this report. This report should be read in its entirety and understood prior to using any of the recommendations in the report.

2.0 PROJECT INFORMATION

The planned development includes approximately 89 acres of rolling to steeply sloped land. Much of the proposed construction area is heavily wooded. Single family residential lots, similar to those constructed in the existing development sections, are planned. Construction will include nearly 6,000 feet of roadway, utilities, storm water drainage facilities, and related improvements.

3.0 SCOPE OF SERVICES

Our scope of services included the tasks outlined in GEM Proposal No. GP-933, dated April 28, 2003. These tasks included: the exploration of existing soil conditions with test pits and soil test borings; the exploration of rock conditions with rock coring; laboratory testing; stability analysis of proposed slopes; and preparation of a report summarizing our findings and recommendations, pertinent on-site observations, the subsurface conditions encountered, site preparation and fill construction recommendations, and other geotechnical considerations identified.

4.0 PURPOSE OF EXPLORATION

The purpose of our exploration was: to obtain and evaluate subsurface information in order to assess slope stability; to identify geotechnical concerns that may affect the proposed construction and provide appropriate remediation recommendations; and to develop design and construction recommendations for site preparation and fill construction for the specific project described in this report.

5.0 SPECIAL CONSIDERATIONS

Slope stability (landslides) is a significant concern for this development due to the geology of the area. The site is underlain by the Borden Formation, which is a layered group of siltstone and readily degraded clay shales. The steep slopes in the area are erosional features created by a resistant cap rock near the top of the hills and rapidly eroded side slopes of the New Providence Shale. Failure scarps weather rapidly leaving a smoother stable appearance. Marginally stable deposits covering the slopes and thick deposits of poorly consolidated material near the base of the slopes combine with frequent, intermittent springs to trigger slope movements with minimal disturbance or due to prolonged periods of precipitation.

Construction in this geology requires consideration of the inherently low stability of the natural conditions and the impact of planned cuts and fills. Where cuts remove stabilizing material, or fills block drainage or create adverse loading conditions, landslides can result. Furthermore, landslides can occur due to purely natural causes, resulting in damage to property or structures. In general, it is economically unfeasible to improve the stability of the slopes to the factors of safety normally used for civil design projects. Therefore, special design and planning considerations must be used.

6.0 SITE INFORMATION

Several site visits were conducted between May and July 2003. Observations made during our visits were used to aid in interpreting the subsurface and geologic conditions and to detect conditions that may affect the proposed construction.

In general, the site was characterized by shallow to deep hollows eroded by stream activity. The remnant ridge tops generally were capped with more resistant rock, while the side slopes were comprised of readily erodible soil.

Section 3 (Secretariat Drive) was comprised of slopes and topography that generally were more gentle than the other sections. However, this section was marked by numerous intermittent streams and low areas. Also, the area near Road A had several complications associated with it, including very steep soil slopes (to the north of the road), very steep rock cuts (Lot 38), and a fill area (Lots 39 to 42). Section 4 (Sunny's Halo Drive) included a mixture of conditions, including relatively gentle slopes (generally southern portion) and very steep slopes (generally northern portion). Section 5 (Hardwood Forest Drive) included an intermittent stream that appeared to contain water flow much longer than the other streams in the project development. The northern portion of this section had some of the steepest slopes in the three sections.

7.0 SUBSURFACE INFORMATION

7.1 SITE GEOLOGY

The Louisville West Quadrangle, published by the United States Geologic Survey, and the results of this study indicate the site is overlain by loess and eolian sand, which is underlain by the Kenwood Siltstone and the New Providence Shale Members of the Borden Formation.

Loess and eolian sand are comprised of silt and minor sand that are light olive gray where fresh and yellowish brown to grayish brown and light brown to medium yellowish orange when weathered. The loess mantles most of the upland areas and is thickest near the base and east-facing slopes. The sand is very fine to fine-grained and subangular to subrounded. In some areas, erosion on steep slopes has exposed small patches of bedrock.

The Kenwood Siltstone Member is comprised of siltstone interbedded with shale. The siltstone is clayey, sandy, and light to medium light gray, but weathers to a yellowish gray. The sediments that the siltstone was derived from were deposited by southwestwardly flowing turbidity currents.

The New Providence Shale Member is comprised of clay shale interbedded with occasional limestone. The clay shale is silty, olive gray to grayish green, and weathers to yellowish gray to light greenish gray. The shale is micaceous, illitic, and plastic when wet. New Providence Shale is subject to landslides. Slope failures are common in the shale members of the Borden formation, especially in roadcuts after heavy rainfalls. Landslides in the shale members occur naturally as colluvium moves down the slope or as toe areas are undercut by erosion. Frequently, the slope

failures are precipitated by man-made changes, such as crest or slope fills, toe cuts, or altering groundwater seepage patterns.

7.2 EXPLORATORY METHODS

The exploration methods used were in general accordance with applicable ASTM methods and typical engineering practices in Kentucky. A description of the methods used is provided in the Appendix.

A total of sixty-three (63) borings and test pits were drilled or excavated in Sections 3, 4, and 5. The centerline of the roads along Sections 3 and 4 had been staked by Birch, Trautwein & Mims. Section 5 was not staked, but generally followed an existing ridgeline. The test pits and borings were located in the field by pacing or measuring distances from existing landmarks (such as surveyed locations or existing ridgelines). Test pit and boring elevations were interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. However, it should be noted that the elevation estimates are very approximate, since borings had to be shifted in the field, since the ground surface was cut or filled to create an access road (thereby changing the surface elevation), and since it was very difficult to accurately locate some test pits and borings due to the heavily wooded, steep nature of the site. Where sample locations were in proposed roadways, the elevation was estimated to be the existing elevation at the centerline of the proposed roadways.

Our engineers/geologists observed and directed the field activities and visually classified the soils encountered using ASTM D-2488 and the Unified Soil Classification System (USCS) as guides. Representative soil samples were placed in sealed containers. Rock cores were placed in boxes. Both soil and rock samples were transported to our office for further evaluation and laboratory testing.

The Boring and Test Pit Records in the Appendix summarize our interpretation of the conditions encountered during the exploration. Conditions may vary at other locations. The groundwater observations were made at the time of drilling and may vary with changes in the season or weather.

7.3 STRATIGRAPHY

The topsoil in most locations had been stripped from the area during construction of the access roads. Based on observation of the access road cuts, as well as the depth of topsoil encountered in test pits excavated in undisturbed areas, topsoil generally appeared to vary in depth from approximately 8 inches to 1 ½ feet.

Below the topsoil, or at the surface where topsoil was not encountered, brown, low plasticity, soft to stiff, moist to very moist, clayey silt to silty clay was encountered. The brown clay/silt transitioned into mottled brown and gray, low plasticity, stiff to very stiff, moist, very silty to silty clay. The mottled brown and gray clay was underlain by brown to gray, very weathered,

soft shale. Soil depths varied from approximately 4 to 22 feet, with averages varying from approximately 10 to 12 feet in each of the three sections. The weathered shale was penetrated to varying degrees depending on the level of weathering and the sampling technique used (soil test boring versus test pit).

Rock cores of the shale encountered were obtained from two locations. The rock recovered consisted of gray, soft to moderately hard, obscurely bedded shale. A few high angle fractures were observed in the cores. Recovery of the shale over the sample interval varied from 73 to 100 percent.

For a more detailed description of the specific conditions encountered in each test pit and boring, refer to the Boring and Test Pit Records in the Appendix.

7.4 LABORATORY TEST RESULTS

Consolidated-undrained triaxial testing was conducted on several samples of the soils encountered. In these samples, effective friction angles varied from approximately 27 to 34 degrees, with the effective cohesion varying from approximately 0 to 80 psf. Atterberg testing also was conducted, with the soils on-site being classified per the USCS soil system as low plasticity clays (CL), low plasticity silts (ML), or dual classification silts and clays (CL-ML). Moisture contents varied from 14 to 30 percent. The results of all laboratory testing are provided in the Appendix.

7.5 GROUNDWATER

Evidence of groundwater seepage (e.g., very moist to saturated soils) was observed in numerous borings. In these areas, the soil encountered was described as "very moist." Temporary groundwater wells were set in several borings. A summary of these locations and the groundwater levels measured are provided in the table below. Where encountered, the groundwater generally appeared to be either approximately 4 feet below the ground surface or just above the soil/rock interface.

Table 1: Depth to Groundwater

Boring	Depth of Well (ft)	Depth to Shale (ft)	Date of Measurement 06/18/03[1]	06/19/03[2]	06/24/03[2]	07/07/03[2]
SH-1	9.1 ft	13.0 ft	3.2 ft	4.0 ft	4.2 ft	5.3 ft
SH-7	8.9 ft	8.7 ft	1.9 ft	4.5 ft	A	A
SH-9	13.2 ft	11.1 ft	B	B	B	5.5 ft
SH-10	12.7 ft	9.7 ft	None	None	None	None
SH-19	12.7 ft	11.8 ft	11.8 ft	None	11.8 ft	11.6 ft
SH-22	10.7 ft	9.5 ft	10.7 ft	10.7 ft	10.6 ft	10.1 ft
HF-1	11.3 ft	11.9 ft	3.2 ft	C	3.6 ft	4.7 ft

Notes:
1 Measurement taken prior to the initial bailing of the well on June 18, 2003.
2 Measurement taken after the initial bailing of the well.
A Well destroyed by trackhoe or other equipment. Groundwater readings were not possible.
B The well was inaccessible.
C Groundwater measurement not taken this date.

With the exception of a groundwater table that may be present in low areas and along the large intermittent stream channels located at the base of slopes, groundwater within the proposed construction area typically occurs only intermittently and in small quantities, except after periods of prolonged precipitation. However, springs or seeps that introduce groundwater in localized areas likely are present in numerous locations. Our recommendations for the treatment of areas where groundwater is encountered are provided in subsequent sections.

8.0 3H:1V SLOPE STABILITY

8.1 PROCEDURES AND METHODS

Stability analysis involves calculation and summing of forces tending to cause movement and those tending to resist movement. The ratio of the sums is the factor of safety against sliding. To calculate the forces, the geometry of the slope, soil stratigraphy, soil strength, and groundwater conditions must be defined for each loading condition. For this study, the slope geometry was provided in drawings prepared by Birch, Trautwein & Mims; the groundwater conditions were interpolated and modeled from our past experience in this geologic formation, as well as from groundwater measurements obtained from our temporary wells; and the soil strengths were established by laboratory testing and our past experience in similar soil conditions and geologies. The types, layering, and properties of the soils underlying the project site were determined through use of the soil test borings and test pits, laboratory testing, and on-site observations, as well as our past experience within the geologic formation. Selected soil samples were obtained during the exploration to confirm the assumed typical soil strength characteristics. Three point consolidated-undrained triaxial tests with pore pressure measurements (to allow back calculation of effective stresses) were performed on selected specimens to better delineate the soil strength characteristics.

The subsurface information, slope dimensions, and indicated soil shear strength data were then combined to model the slope under specified design conditions. The factor of safety for each design condition was calculated by analyzing the stability of various failure surfaces and searching for the surface with the lowest factor of safety. The modified Bishop's method was used to analyze the slopes. This method divides the slope into a number of vertical sections, and sums the forces tending to cause sliding and the forces resisting sliding along the critical slip surface identified. The factor of safety is defined as the ratio of the forces resisting sliding divided by the forces tending to cause sliding.

8.2 STABILITY ANALYSIS

The following design cases were evaluated: end of construction; steady state conditions (at various groundwater levels); and earthquake conditions. An acceptable factor of safety for the end of construction conditions was defined as 1.2. Typically, the minimum required factor of safety for steady state conditions is 1.4. Since, for this project, the existing slopes likely have a factor of safety less than 1.4 during some design conditions (e.g., elevated groundwater levels), a lower factor of safety was considered acceptable when a lower factor of safety was calculated for comparable existing conditions. For example, if the existing conditions resulted in a factor of safety of 1.2 when the groundwater was assumed to be 4 feet below the existing ground surface, then a factor of safety of 1.2 was considered acceptable for new slopes when the groundwater was assumed to be 4 feet below the ground surface. Since the factor of safety for the existing native slopes likely is less than 1.4 in some areas, a factor of safety higher than 1.2 for proposed slopes would be prohibitively expensive to construct in these areas. A minimum factor of safety for steady state conditions was defined as 1.2. An acceptable factor of safety for earthquake conditions was defined as 1.0. For seismic loading conditions, a factored acceleration coefficient of 0.07 was assumed.

Slope stability was evaluated for movements occurring within the proposed fill layer and the underlying native materials. The most critical sections were identified based on the soil types present, proposed cut and fill depths, depth to rock, and groundwater fluctuations. Critical sections of the proposed and existing slopes were selected for analysis.

Since no evidence of a significant groundwater presence within the overburden soils was detected in the temporary wells installed, stability was evaluated assuming total saturation of the soil strata would not occur. Stability was checked for groundwater at various levels within the soil strata to assess the effect of such adverse conditions. It should be noted that groundwater has a significant affect on the stability of the slopes. For this reason, the control of surface and subsurface water will be critical for this project.

As mentioned previously, shear strengths were selected based on limited laboratory testing from this exploration and our experience with similar soils and loading conditions. For the soil types and conditions encountered on-site, the following soil parameters were used to model slope behavior:

Table 2: Assumed Soil Parameters

Soil Type	ϕ' (degrees)	c' (psf)	ϕ (degrees)	c (psf)	γ (pcf)
Existing Soils	31	0	0	600	125
New Fill	31	0	0	600	125
Weathered Shale	18	1000	0	10,000	140

The effective stress soil strength parameters (ϕ' and c') were used for steady state and earthquake conditions, while the total stress soil strength parameters (ϕ and c) were used for the end of construction conditions.

In general, slope stability was of greatest concern where one of the following situations was created: fills were constructed at the crest of a slope, a relatively thin layer of fill was placed along the face of the slope, or the toe of the slope was removed or steepened. Using the strength parameters given above and the methods, procedures and assumptions discussed previously, the minimum acceptable factors of safety were obtained for each design condition at the critical cut and fill sections evaluated. The results of our stability analyses indicated that the proposed 3H:1V slopes were stable for the assumed design groundwater gradients (groundwater at least 4 feet below the final ground surface), provided transient groundwater seepage was not allowed to be trapped and accumulated. Our recommendations to address the presence of groundwater and isolated seeps are provided in subsequent sections of this report.

Our analysis of existing slopes also indicates that they should be stable for the assumed groundwater gradients provided they are not disturbed, and provided groundwater is not allowed to saturate or permeate existing soils. The analysis of existing slopes for elevated groundwater levels indicated very low factors of safety, including some below 1.0. When the factor of safety is below 1.0, the driving forces are larger than the resisting forces, such that failure, theoretically, should occur. However, since soil and groundwater conditions vary within the areas analyzed, prediction of actual failure is imprecise and could require many years before the proper combination of conditions occurred such that a landslide actually was triggered. The low calculated factors of safety resulting from the presence of groundwater underscore the importance of using appropriate design methodologies and construction techniques for this project.

The stability analyses conducted were based on provided existing and proposed slope configurations, data from geotechnical studies on-site, laboratory testing, and our past experience with similar conditions and nearby projects. While **these analyses indicated stable conditions (i.e., calculated factor of safety greater than the minimum acceptable factor of safety) should predominate if the recommendations in this report are followed**, variations in soil conditions will undoubtedly occur, especially given the variable characteristics of the on-site soils. Therefore, it will be critical that all slope modifications be monitored by GEM to facilitate identifying subsurface conditions that may require modifications to the planned slopes. If conditions, other than those assumed are detected or expected, GEM should be notified.

9.0 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

The recommendations contained within this report are based on many factors, including, but not limited to, the subsurface conditions encountered in our test pits and borings, our interpretation of these conditions, our understanding of project information, and our past experience with similar projects and subsurface conditions. The limitations outlined in Section 10.0 of this report should be read and fully understood prior to using any of the recommendations contained within this report.

9.1 PROPOSED AND EXISTING SLOPES

The proposed 3H:1V slopes achieved an acceptable factor of safety as designed based on our stability analyses. The results of all stability analyses indicated that the slopes were stable for the design groundwater gradients, which requires that transient groundwater seepage not be allowed to be trapped and accumulated.

Some areas may require changes to the proposed design if actual elevations vary from the provided elevations (changes in elevations affect the amount of cut and fill, which in turn affects slope stability) or soil conditions vary from those assumed. For these reasons, we strongly recommend that GEM be involved during any cut or fill operations.

Existing slopes are steep, commonly in the range of 2.5H:1V to 3H:1V, with isolated areas achieving 2H:1V. The slopes generally are blanketed by a layer of colluvium, loess, and eolian sand underlain by weathered shale. The natural stability of the colluvium/loess/eolian sand-covered slopes is marginal, especially when climatic conditions result in long periods of soil saturation and elevated groundwater levels. Although visible signs of significant slope movements of existing slopes due solely to natural causes were limited, such failures can occur. Based on practical cost limitations, these types of failures create a limit to the degree of stability that can be achieved by engineered and constructed facilities at the site. The possibility of isolated slope failures is an inherent risk associated with construction in the project geology that must be accepted. This risk can be reduced by following the recommendations contained within this report.

9.2 CONTROL OF SURFACE AND SUBSURFACE WATER

Since water is typically the driving mechanism of most failures in the native soils, the removal of water from these slopes is critical. The results of stability analyses indicated that the slopes were stable for the design groundwater gradients, provided transient groundwater seepage was not allowed to be trapped and accumulated. Therefore, the control of surface and subsurface water is critical.

All streets should be equipped with curbs that direct surface water toward a collection system that will remove the water and keep it away from slopes. All road subgrades should be sloped to drain. Filtered ports, or weepholes, should be installed in catch basins to allow drainage for any water that accumulates in the road base material. Surface water should be directed away from houses to help reduce triggering slope problems near proposed homes. Ideally, as much surface water as possible should be collected and transported away from existing slopes. Water from downspouts should be collected and transported to the toe of slopes or as far away from houses as possible, either through extensions to appropriate discharge areas or to an approved collection system. Downspouts should not discharge within 50 feet of the crest of slope, and preferably, if near existing or proposed slopes, should be transported past the toe of the slopes (or as far down the slope as feasibly possible).

Any springs encountered during construction should be treated per the recommendations of the geotechnical engineer at the time of construction. This includes springs that are identified within

either existing slopes that will not receive fill or proposed fill slope areas. In general, we anticipate that treatment of springs, in most cases, will consist of the installation of a french drain system, which consists of an excavated trench backfilled with open-graded gravel (such as No. 2 stone) wrapped in filter fabric.

9.3 EXISTING FILL

Undocumented fill is defined as material that has no quality control records associated with it (such as density tests) to confirm that appropriate placement procedures were used. It may vary in character or consistency over short distances, or it may contain construction debris, organic matter, or other undesirable material. The presence of the undocumented fill creates several concerns that must be addressed. In general, these concerns are associated with the unknown quality and consistency of the fill. These unknowns can create potential problems with the proposed construction, including large total and differential settlements, collapse of unstable buried structures, slope stability problems, and bearing capacity problems. The manifestation of these problems can cause foundation settlement and poor slab performance.

Existing undocumented fill was present on Lots 39 to 42, which were located to the south of Road A, (located off Secretariat Drive in Section 3). The fill varied in depth from approximately 6 ½ to 10 ½ feet in the two borings drilled in this area and consisted of soft, poorly compacted clay intermixed with abundant organic matter and occasional debris. The fill was saturated, with water bubbling to the surface during drilling in one boring. The fill encountered in our borings was not suitable for support of the proposed construction.

If these lots are developed, all fill should be removed and replaced with controlled fill in areas to be overlain by proposed houses or pavement. It should be noted that significant difficulty should be anticipated during removal of the existing fill material, including unstable sidewalls and heavy groundwater inflow during excavation. The heavy groundwater inflow also will slow and complicate the placement of new fill and likely will limit the reuse of on-site clays as fill in this area.

9.4 INTERMITTENT CREEKS

Several intermittent creeks were observed throughout the proposed areas for Sections 3, 4, and 5. In general, the areas mostly likely to be affected by the initial roadway construction were Section 3 along the main road alignment (intermittent creeks located along both sides) and the low area at the beginning of Hardwood Forest Drive. The intermittent creeks along Secretariat Drive (Section 3) generally were dry during our site visits, but obviously carried large amounts of surface water during rain events. The intermittent creek along Hardwood Forest Drive (Section 5) was much smaller, but appeared to carry water on a more regular, longer-term basis. Intermittent creeks were present anywhere surface water was concentrated during rain events, including in valleys and at the toes of slopes.

The areas along the intermittent creeks likely will require extra stabilization during construction to achieve a suitable platform for the proposed construction, including fill placement. Soft, loose soil deposits, saturated soils, shallow groundwater, and organic soils commonly are encountered along intermittent creeks. Extra care should be taken to remove unsuitable soils, including soft deposits and organic soils. It may be feasible to bridge unsuitable soils in some locations, depending on the depth of new fill and the proposed final usage in the area. Actual recommendations (including the depth of undercut, if any, as well as the placement and type of bridging material) will depend on the actual conditions at the time of construction and the proposed final usage of the area. In general, we would anticipate that areas receiving large amounts of fill or that will be located in the right-of-way (between the edge of the road and the building limits) will require less extensive treatment, while those areas located within proposed building limits or within the proposed roadway will require undercutting and placement of bridging materials.

9.5 LOW AREAS

Low areas, like along intermittent creeks, are a concern due to the higher incidence of soft, loose soil deposits, saturated soils, trapped water, and organic soils. Low areas often extend beyond the limits of the intermittent creeks. The following low areas were identified: Stations 7+00 to 10+00, Road B, Stations 19+00 to 20+00 of Secretariat Drive; Stations 1+50 to 4+00 of Road E of Sunny's Halo Drive; and Stations 2+50 to 5+50 of Hardwood Forest Drive. These low areas most likely will require stabilization based on the conditions encountered during fieldwork. Other low areas also were present, but these areas may not need treatment (or will need less stabilization) depending on the conditions encountered during construction and the proposed final usage. Treatment of low areas likely will be similar to intermittent creeks.

9.6 DISTURBANCE OF EXISTING SLOPES

Many of the existing soil slopes are covered by colluvium, loess, and eolian sand, which are very sensitive and are easily weakened when these soils are disturbed by new construction. Therefore, it will be critical that disturbance of the existing slopes is kept to a minimum. Construction traffic should be kept to essential equipment only, especially in existing slope areas. In addition, the existing tree canopy should be disturbed or removed only where absolutely necessary, with the removal of the tree canopy on steep, existing slopes occurring as close to construction as possible, since the existing root systems of these trees likely contribute to the surface stability of the existing slopes. Because of the sensitive nature of the on-site soils, proper placement and compaction of proposed fills are critical. Blasting should be avoided as much as possible.

9.7 ROCK EXCAVATION

In general, only the upper 1 to 2 feet of the shale could be penetrated with the drilling and excavation equipment used (CME-55 drill and trackhoe, respectively). Consequently, we would anticipate that excavation of the weathered shale with conventional excavation equipment in

narrow trenches may require rock removal techniques. Based on our past experience, removal of the weathered shale in large, open areas generally can be accomplished with a large dozer fitted with a ripping tool or by a large trackhoe. Again, blasting should be avoided as much as possible.

9.8 STRIPPING

All topsoil and organic soil should be removed from the proposed roadway and fill slopes. Care should be taken during the removal process in order to minimize surface disturbance of existing slopes. For example, trees should not be ripped from the ground surface such that a large area of the surface is loosened. Instead, the rootball should be carefully excavated to minimize the area impacted. Also, an attempt should be made to keep equipment traffic on the disturbed areas to a minimum. The excavation resulting from the removal of rootballs should be properly backfilled so that a localized soft area, which can also trap water, does not result.

9.9 PROOFROLLING

After stripping, the site should be proofrolled in the presence of a representative of GEM. Proofrolling should be performed by repeated passes of a heavy rubber-tired vehicle, such as a fully loaded dump truck or scraper. Backhoes, compactors, and front-end loaders are not acceptable proofrolling equipment. Any areas judged to deflect excessively during proofrolling should be undercut and rerolled. This process should be repeated until all soft soils are removed, or the geotechnical engineer recommends an alternate stabilization method.

9.10 SOIL FILL CONSTRUCTION

Fill soils should be free of organics, deleterious debris, or rocks larger than 3 inches in diameter. The soil should have a plasticity index (PI) of less than 30 and a maximum dry density according to the standard Proctor compaction test of at least 100 pcf. The fill should be compacted to at least 98 percent of standard Proctor maximum dry density of the soil, as determined by ASTM D-698, at a moisture content within 3 percent of the optimum moisture content. The soil should be placed in lifts of 8 inches or less, compacted, and tested prior to placing additional lifts. Cut areas and fill pads should be constructed with a slight slope, and they should be rolled with a rubber-tired or smooth drum roller if placement stops and they may be exposed to rain. The geotechnical engineer or his/her representative should be consulted if subgrades become frozen or softened by rain.

New fill should be benched into the existing slope. Benching will be a critical step in achieving the stability of the proposed 3H:1V slopes. If the new fill is not properly benched into the existing soil, a preferential sliding surface may develop at the new fill/existing fill interface. Extra care should be taken to ensure any new fill placed against the existing slopes is properly compacted. A kneading-type roller (sheepsfoot or pad-foot) should traverse the area and contact the existing slope so that all fill is compacted to the required density.

In-place density testing should be performed on each layer of fill placed to check the compaction achieved. We recommend that test locations be evenly distributed throughout the fill area. Tests should be performed at a frequency of at least one test per layer per 10,000 square feet of fill placed.

9.11 SHALE FILL CONSTRUCTION

Based on the anticipated cut depths and the depth to weathered shale, we do not anticipate any significant amount of weathered shale will be produced for use as fill. However, if the shale will be used as fill, GEM should be contacted to provide appropriate guidelines for the reuse of this material. In general, due to the degradability of the shale, it must be disked, watered, and compacted in such a way as to breakdown the shale to particles less than ¾ of an inch in diameter. The shale essentially should behave like a soil fill when properly handled. This shale, if not artificially broken down prior to fill placement, will degrade over time resulting in settlement and possible slope problems.

9.12 UTILITY CONSTRUCTION

Granular material placed as bedding in utility trenches can act as a drain to remove groundwater seepage, but, if not well compacted, can weaken adjacent undisturbed soils. For example, poorly compacted backfill in a utility trench at the toe of a slope will reduce the resistance to slope movements (e.g., instead of the slope obtaining resistance from the backfill, the backfill is weak enough to allow the slope to slump into the utility excavation). Therefore, we recommend that all bedding and backfill materials placed in utility trenches be placed and compacted in accordance with the recommendations in this report. In addition, utility excavations should be backfilled as soon as possible, with prolonged periods of open excavations avoided. The length of the excavation should be limited to that length which can be completed and backfilled in a timely manner (less than 3 days), and preferably should not exceed 100 feet at a time. This is especially important where utility excavations will be located at the toe, in the middle, or at the crest of a slope.

9.13 TEMPORARY SLOPES/CUTS

The stability analyses and factors of safety described in this report were based on the shear strengths and loading conditions previously described. During construction, temporary cuts made at steeper angles than the 3H:1V permanent slopes may result in unstable conditions, particularly if precipitation has recently occurred or occurs after the cuts are made. While increased strength is available from undrained loading of the clay soils, the cohesion mobilized will dissipate with time, potentially creating failure conditions. Therefore, all temporary slopes steeper than the planned permanent slopes should be completed as quickly as possible. Cuts greater than 5 feet in height or steeper than 2H:1V should be reviewed by GEM to identify any unusual conditions that would increase the risk of slope failures. In general, temporary slopes should not exist for more than a few days.

9.14 PROPOSED STRUCTURES

Analysis of foundation conditions, stability of planned regrading of building sites, and evaluation of retaining structures were beyond the scope of this analysis. However, in many areas, excavation, fill construction, construction of retaining walls, loading related to new structures, blockage or rerouting of drainage paths, or other site changes could cause slope movements. Future planning must comply with appropriate guidelines to avoid creating instability. The following criteria should be used in planning:

- All fill must be placed and compacted in accordance with the recommendations contained in this report.
- Cut and fill slopes should be constructed in accordance with the recommendations in this report.
- Any retaining walls planned must be reviewed by GEM.
- Any structure set in a cut bench and any fill placed over a drainage feature or spring must include suitable permanent drainage provisions.
- Plans for structures proposed for lots with slopes equal to or greater than 3H:1V should be reviewed by GEM prior to the start of construction.

9.15 LOTS WITH STEEP SLOPES

There are numerous lots, generally located toward the ends of Sunny's Halo Drive (Section 4) and Hardwood Forest Drive (Section 5), that have steep slopes (i.e., 3H:1V or steeper) complicating construction on these lots. Included in the Appendix is a fax, dated June 14, 2003, that shows the approximate location of the lots in question. These lots are marked with a "D" on the site plan attached to the fax. Each lot was ranked as good, OK, or difficult based on the terrain of the lots. Some lots, including those noted as "good," have other issues beyond terrain/slope stability, such as the presence of creeks or existing fill, that be considered.

Construction on the lots with steep slopes within the proposed construction areas will be very difficult. If these lots are developed, each lot and the proposed construction and layout should be reviewed by the geotechnical engineer. In some cases, it may be possible to bench a house into the existing slope or construct engineered fill under a portion of the house to create a building lot. However, on some lots the fall is so drastic over the likely building locations that consideration of supporting the house on piers, or piles, may be required. In general, the long axis of structures planned should be aligned with the topographic contours (along the hill at the same elevation) to reduce the magnitude of elevation changes within the building footprint. There are a few lots where any construction may be difficult due to the fall of the lots combined with the presence of drainage swales. It also will be critical that any fill placed on these steep lots consists of engineered fill placed in strict accordance with the recommendations in this report.

9.16 PROPOSED RETAINING WALLS

Retaining walls likely will be utilized on numerous individual lots. While the use of the retaining walls generally is recommended, it will be important that the global stability of these walls is checked. In general, the global stability does not govern most retaining wall design. However, global stability likely will be more of a factor for this project (especially for walls exceeding 5 feet in height), since the retaining walls likely will create new loading at or near the crest of existing/proposed slopes or will remove the stabilizing toe of a slope.

10.0 LIMITATIONS

There are several limitations inherent to all geotechnical-type explorations and reports. These limitations are discussed in detail in this section of the report, and they should be fully understood prior to using any of the recommendations in this report.

Given the natural variable characteristics of soil and rock, conditions may vary over short distances, change with time, or be affected by natural events, such as floods or earthquakes. As such, the information generated during our exploration may not be representative of all conditions that may exist on the project site. Our report is based on the conditions encountered at the time the exploration was conducted.

It should be noted that our exploration identifies the subsurface conditions that exist only at the locations we explored with borings, test pits, or rock coring. We use our professional judgement to render an opinion about the subsurface conditions that may exist in the areas of the site not specifically tested during our exploration based on our review of available field and laboratory data and our past experience with similar subsurface conditions. However, the subsurface conditions encountered during construction may differ from assumed conditions. Thus, it is important to retain GEM to provide construction monitoring services based on our involvement in the project, our knowledge about the site, and our knowledge relating to the assumptions and recommendations contained within this report. The recommendations contained within this report are based in part on the assumption that GEM will observe the actual field conditions and confirm they are consistent with our assumptions.

By necessity and to reduce costs, subsurface explorations include a small number of borings and test pits, testing of only a few selected samples, and observation of the site over a relatively short period of time. These limitations reduce the level of knowledge of the subsurface conditions and the likelihood of detecting all important variations in the subsurface conditions. Therefore, design and analytical methods include a factor of safety based in part on the expected probability that the soil, rock, and groundwater conditions will not vary markedly from those detected in our exploration and used in our analyses.

This report is unique and was based on client needs and project requirements for the specific project described in this report. As such, no one other than who the report was intended and prepared for should rely on this report or the information contained within the report without first

consulting with GEM. This report is not valid for any purpose or project except as described in this report.

The recommendations contained within this report are dependent on many factors, including, but not limited to, the project information provided by others and the specific conditions encountered during our exploration. If any of the project information contained within this report is incorrect or changed at a later date or if the siting or nature of the facility components change, GEM should be notified and given the chance to assess the impact of the changes. We cannot and do not accept responsibility or liability for any problems that occur because we were not given the opportunity to properly assess changes to the project.

Our recommendations are dependent on several factors including, but not limited to, our review of project drawings and specifications prior to construction and observation of actual conditions during construction. We strongly recommend that GEM be retained to review pertinent portions of the project plans and specifications.

This report should be reproduced in its entirety only. Portions of this report should not be separated and used by others. For example, boring and test pit records should not be separated from the text of the report, since misinterpretation of the separated information is common. It should be noted that this report was prepared for use by the design team and may not contain sufficient information (such as depth to rock or the depth to specific rock types) for bidding purposes.

This report and our recommendations were prepared using the generally accepted standards of geotechnical engineers in the Commonwealth of Kentucky. No other warranty is expressed or implied.

APPENDIX

Site Location Plan

Exploration Plan

Exploration Legend

Boring and Test Pit Records

Laboratory Test Results

June 14, 2003 Fax

Field Procedures

Laboratory Procedures

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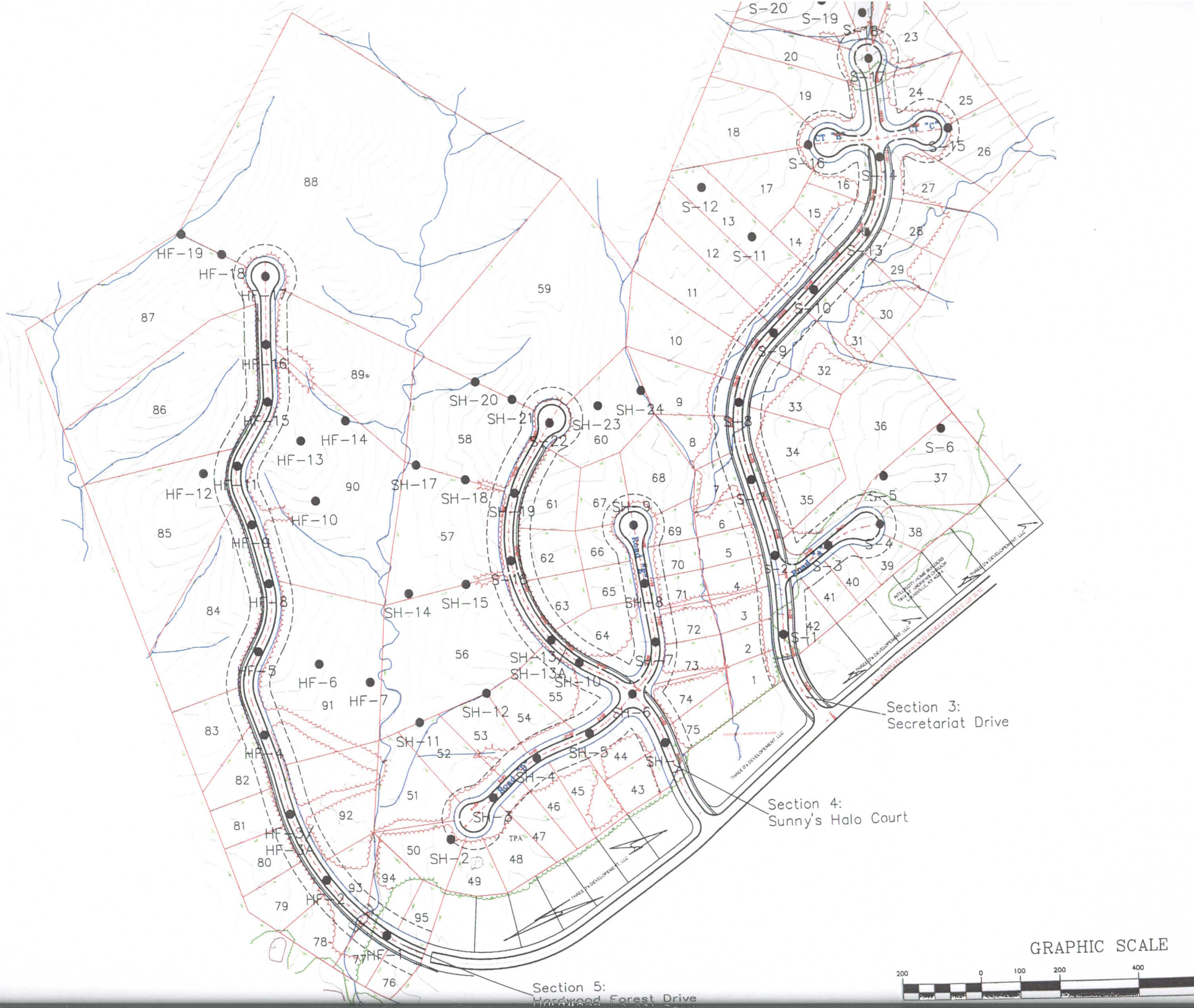
Site Location Plan
Hardwood Forest
Sections 3, 4 and 5
Louisville, Kentucky

GEM Engineering, Inc.
2219 Plantside Drive
Louisville, Kentucky 40299
Tel (502) 493-7100 Fax (502) 493-8190


Section 3:
Secretariat Drive
Section 4:
Sunny's Halo Court
Section 5:
Hardwood Forest Drive
GRAPHIC SCALE
200
0
100
200
400

GEM Engineering, Inc.
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Louisville, Kentucky 40299

EXPLORATION LEGEND

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
0.0	0.0	Fill		0.0-1.5	1.5'	3 4 5	9	Elev. - The difference between the ground surface elevation and the depth.
-1.0	1.0	Low plasticity clay, (CL)						Depth - The depth to the specified strata as measured in the field.
-2.0	2.0	Shale						Material Description - A detailed description of the material encountered in the field based on visual observations, the Unified Classification Soil System, and ASTM D-2488.
								Soil Symbol - A pattern that represents the material encountered.
								Sample Depth - The depth of the sample taken.
								Recovery - A measurement of the material recovered in the sample interval.
								Blows/6" - A count of the number of blows it takes to drive a splitspoon sampler 6 inches with a 140-lb hammer falling a height of 30 inches.
								N - The total of the last two 6-inch increments of the Blows/6."
								Qu - An indirect measurement (in tsf) of the unconfined compressive strength using a pocket penetrometer.
								Blows/1.75" - A count of the number of blows it takes to drive a dynamic cone penetrometer 1.75 inches with a 15-lb hammer falling a height of 20 inches.
								Nc - The average of the last two 1.75-inch increments of the Blows/1.75."
								Comments - Pertinent commments about the conditions encountered.

Abbreviations:
HSA = Hollow Stem Auger
SSA = Solid Stem Auger
SH = Safety Hammer
CORE – Rock Core
HA = Hand Auger
PP = Pocket Penetrometer
tsf = tons per square foot

Notes:
1. Dashed lines indicate estimated depths.
2. Solid lines indicate more precise depths.
3. N is typically referred to as the standard penetration value and is equal to the summation of last two increments of Blows/6".

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Louisville, Kentucky 40299

BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 566
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-1
Sheet 1 of 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		0.0-1.5 ft	0.8 ft	5 5 4	9	
	1.6	CLAY, silty, brown mottled gray, low plasticity, very stiff, moist, (CL)		1.5-3.0 ft	1.5 ft	6 9 9	18	
								UD tube pushed in an offset boring from 3.5 to 5.5 feet; recovery = 2.0 feet.
	4.0	SHALE, weathered		4.0-5.5 ft	1.5 ft	5 9 14	23	
	5.6	BORING TERMINATED AT AUGER REFUSAL AT 5.6 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 578
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Cloudy

Boring No. S-2
Sheet 1 **of** 1
Boring Started 05/28/03
Boring Completed 05/28/03
Logged By MTE/SLS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 2 3	5	
	2.0	CLAY, silty, mottled light brown and brown with some gray, low plasticity, stiff, moist, (CL)		1.5-3.0 ft	1.2 ft	4 6 7	13	
		(more grayish brown with depth)		4.0-5.5 ft	1.4 ft	4 4 5	9	
				6.5-8.0 ft	1.3 ft	5 6 7	13	
		(very stiff below 9.0 feet)		9.0-10.5 ft	1.2 ft	4 7 9	16	
	13.9	SHALE, weathered		14.0-14.0 ft	0.0 ft	15/0"	Ref.	
	14.0	BORING TERMINATED AT SPLITSPOON REFUSAL AT 14.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 572
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SII **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Partly Cloudy

Boring No. S-3
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	See "A" in Comments						A - CLAY, silty, brown mottled gray, low plasticity, soft to firm, moist, (CL), (FILL)
	0.8	CLAY, silty, mottled gray, low plasticity, soft to firm, moist, (CL), with wood particles and topsoil odor, (FILL)		0.0-1.5 ft	1.0 ft	2 3 3	6	
				1.5-3.0 ft	1.1 ft	2 2 3	5	
				4.0-5.5 ft	1.5 ft	2 2 3	5	
	6.3	SHALE, weathered						
				6.5-7.4 ft	0.9 ft	38 50/5"	Ref.	
	7.9	BORING TERMINATED AT AUGER REFUSAL AT 7.9 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 578
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SII **Hammer Type** Manual
Groundwater Depth Groundwater at surface at completion of drilling **Weather** 70's - Sunny

Boring No. S-4
Sheet 1 of 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	FILL, gray, silty clay matrix with asphalt particles and wood debris, moist, soft, (FILL)		0.0-1.5 ft	0.9 ft	1 1 1	2	Groundwater bubbling to surface during drilling.
				1.5-3.0 ft	1.0 ft	1 3 4	7	
				4.0-5.5 ft	1.5 ft	1 3 4	7	
				6.5-8.0 ft	0.0 ft	2 2 3	5	
				9.0-9.5 ft	0.5 ft	30 50/0"	Ref.	
	10.5	BORING TERMINATED AT AUGER REFUSAL AT 10.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 620
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-5
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		4 4 4	4	
	1.0	CLAY, very silty, light brown, low plasticity, firm, moist, (CL/ML)		1.0 ft		5 5 6	5	
	3.0	CLAY, very silty, brown, low plasticity, stiff, moist, (CL/ML)		3.0 ft		8 12 15	13	
				5.0 ft		8 14 16	15	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 646
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-6
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL		0.0 ft		1 2 2	2	
	0.8	CLAY, very silty, brown, low plasticity, very soft to soft, moist, (CL/ML)		1.0 ft		1 1 1	1	
	3.0	CLAY, very silty, light brown, low plasticity, soft to stiff, moist, (CL/ML)		3.0 ft		3 4 5	4	
				5.0 ft		8 9 25	17	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 577
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Cloudy

Boring No. S-7
Sheet 1 of 1
Boring Started 05/28/03
Boring Completed 05/28/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	TOPSOIL						
	0.3	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.0 ft	1 2 2	4	Approximately 6 to 8 inches of topsoil removed from location prior to drilling.
				1.5-3.0 ft	1.3 ft	3 3 5	8	
		(stiff below 2.5 feet)						
	4.0	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		4.0-5.5 ft	0.9 ft	4 5 7	12	
	7.1	CLAY, silty, mottled gray and brown, low plasticity, very stiff to hard, moist, (CL)		6.5-8.0 ft	1.5 ft	5 8 11	19	
				9.0-10.5 ft	1.5 ft	9 25 23	48	
	12.7	SHALE, very weathered, mottled light brown and gray		14.0-15.4 ft	1.3 ft	25 46 50/5"	Ref.	
	18.0	BORING TERMINATED AT AUGER REFUSAL AT 18.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. S-8
Project Hardwood Forest - Sections 3, 4, and 5 **Sheet** 1 of 1
Project Number G-1517 **Ground Surface Elevation** 575 **Boring Started** 05/28/03
Driller Geo-Drill **Rig Type** CME **Boring Completed** 05/28/03
Drilling Method SSA/SH **Hammer Type** Manual **Logged By** MTE
Groundwater Depth No groundwater encountered **Weather** 70's - Cloudy

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 3 3	6	Approximately 16 inches cut from location prior to drilling.
	1.7	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		1.5-3.0 ft	1.3 ft	4 6 6	12	
	4.0	See "A" in Comments						
	4.7	CLAY, silty, gray mottled brown, low plasticity, very stiff, moist, (CL)		4.0-5.5 ft	1.2 ft	12 13 9	22	A - CLAY, silty, brown, low plasticity, very stiff, moist, (CL), with rock fragments
	6.9	SHALE, weathered		6.5-7.7 ft	1.2 ft	14 40 50/2"	Ref.	
	8.8	BORING TERMINATED AT AUGER REFUSAL AT 8.8 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 587
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. S-9
Sheet 1 of 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.4 ft	2 3 3	6	
	1.3	CLAY, silty, brown mottled gray, low plasticity, firm, moist, (CL)		1.5-3.0 ft	1.3 ft	4 3 3	6	
	4.0	CLAY, silty, gray mottled brown, low plasticity, stiff, moist, (CL)		4.0-5.5 ft	1.4 ft	2 4 5	9	
				6.5-8.0 ft	1.3 ft	4 4 5	9	
				9.0-10.5 ft	1.3 ft	4 4 6	10	
	13.8	SHALE, weathered		14.0-14.7 ft	0.5 ft	8 50/2.5"	Ref.	
	14.9	BORING TERMINATED AT AUGER REFUSAL AT 14.9 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. S-10
Project Hardwood Forest - Sections 3, 4, and 5 **Sheet** 1 **of** 1
Project Number G-1517 **Ground Surface Elevation** 590 **Boring Started** 05/29/03
Driller Geo-Drill **Rig Type** CME **Boring Completed** 05/29/03
Drilling Method SSA/SH **Hammer Type** Manual **Logged By** MTE
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, silty, mottled gray and brown, low plasticity, stiff, moist, (CL)		0.0-1.5 ft	1.5 ft	3 5 4	9	
	1.4	CLAY, very silty, brown, low plasticity, stiff, moist, (CL/ML)		1.5-3.0 ft	1.3 ft	3 4 5	9	
	4.0	CLAY, silty, mottled gray, low plasticity, firm, moist, (CL)		4.0-5.5 ft	1.3 ft	2 3 3	6	
	6.5	CLAY, silty, gray mottled brown, low plasticity, firm, moist, (CL)		6.5-8.0 ft	1.3 ft	2 3 3	6	
				9.0-10.5 ft	1.5 ft	3 2 3	5	
	10.3	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)						
	14.5	SHALE, weathered		14.0-15.0 ft	1.3 ft	7 50/6"	Ref.	
	15.1	BORING TERMINATED AT AUGER REFUSAL AT 15.1 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Boring No. S-11
Project Hardwood Forest - Sections 3, 4, and 5 **Sheet** 1 **of** 1
Project Number G-1517 **Ground Surface Elevation** 612 **Boring Started** 06/05/03
Driller CPR/DCH **Rig Type** Not Applicable **Boring Completed** 06/05/03
Drilling Method HA **Hammer Type** E-rod **Logged By** CPR/DCH
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		2 3 3	3	
	1.0	CLAY, very silty, light brown, low plasticity, firm, moist, (CL/ML)		1.0 ft		3 6 5	5	
		(very stiff below 3.0 feet)		3.0 ft		8 20 20	20	
				5.0 ft		25/1"	Ref.	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 660
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-12
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		2 3 4	3	
	1.0	CLAY, very silty, light brown, low plasticity, firm, moist, (CL)		1.0 ft		6 5 5	5	
		(stiff below 3.0 feet)		3.0 ft		15 15 14	14	
				5.0 ft		9 12 14	13	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 600
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. S-13
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 2 3	5	Approximately 20 inches cut from location prior to drilling.
	1.6	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		1.5-3.0 ft	1.1 ft	4 6 7	13	
	4.0	CLAY, silty, mottled gray and brown, low plasticity, stiff, moist, (CL)		4.0-5.5 ft	1.3 ft	3 4 5	9	
	6.5	CLAY, silty, brown mottled gray, low plasticity, firm, very moist, (CL)		6.5-8.0 ft	1.1 ft	1 3 2	5	
	9.0	CLAY, silty, gray mottled brown, low plasticity, firm, wet, (CL)		9.0-10.5 ft	1.5 ft	3 3 4	7	
	14.0	CLAY, silty, brown mottled gray, low plasticity, very stiff, moist, (CL), with rock fragments		14.0-15.5 ft	1.5 ft	5 9 11	20	
	20.3	BORING TERMINATED AT SPLITSPOON REFUSAL AT 20.3 FEET		19.0-20.3 ft	1.4 ft	34 47 50/3"	Ref.	

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 605
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. S-14
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	1 1 2	3	Approximately 8 to 10 inches cut from location prior to drilling.
	1.5	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		1.5-3.0 ft	1.3 ft	2 4 5	9	
				4.0-5.5 ft	1.3 ft	2 4 6	10	
	6.5	CLAY, silty, gray mottled brown, low plasticity, stiff, moist, (CL)		6.5-8.0 ft	1.2 ft	2 5 7	12	
				9.0-10.5 ft	1.1 ft	4 5 9	14	
				14.0-15.5 ft	1.5 ft	7 13 22	35	
	15.0	CLAY, silty, brown mottled gray, low plasticity, hard, moist, (CL), with rock fragments						
		SHALE, weathered						
	19.0	BORING TERMINATED AT SPLITSPOON REFUSAL AT 20.0 FEET		19.0-20.0 ft	1.0 ft	26 50/6"	Ref.	
	20.0							

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 635
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-15
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, very moist, (CL/ML)						
				1.0-3.0 ft	2.0 ft			
				4.0-5.5 ft	1.0 ft	1 2 3	5	
	6.5	CLAY,silty, brown mottled gray, stiff, moist, (CL)		6.5-8.0 ft	1.4 ft	3 5 5	10	
	9.0	CLAY, silty, brown mottled gray, low plasticity, very stiff, moist, (CL), with rock fragments		9.0-10.5 ft	1.5 ft	5 8 11	19	
				10.5-11.5 ft	1.0 ft			
	13.4	BORING TERMINATED AT AUGER REFUSAL AT 13.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 606
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-16
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		1 2 1	1	
	1.0	CLAY, very silty, light brown, low plasticity, soft, moist, (CL/ML)		1.0 ft		3 3 2	2	
		(stiff to very stiff below 3.0 feet)		3.0 ft		6 12 12	12	
				5.0 ft		14 15 21	18	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 600
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. S-17
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, silty, mottled brown and gray, low plasticity, stiff to very stiff, moist, (CL)		0.0-1.5 ft	1.3 ft	3 5 10	15	Gravel drive, underlain by 10 inches of dark brown clay fill, encountered at the surface.
				1.5-3.5 ft	1.8 ft			
	4.0	CLAY, silty, gray mottled brown, low plasticity, stiff to very stiff, moist, (CL)		4.0-5.5 ft	1.3 ft	6 9 11	20	
				6.5-8.0 ft	1.5 ft	5 6 9	15	
		(with rock fragments below 9.0 feet)		9.0-10.5 ft	1.5 ft	7 9 13	22	
	11.0	BORING TERMINATED AT AUGER REFUSAL AT 11.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 594
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. S-18
Sheet 1 **of** 1
Boring Started 05/29/03
Boring Completed 05/29/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, silty, dark brown, (FILL)						
	0.8	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		0.0-1.5 ft	1.2 ft	4 7 7	14	Approximately 6 inches cut from location prior to drilling.
				1.5-3.0 ft	1.3 ft	4 4 5	9	
	4.0	CLAY, silty, mottled brown and gray, low to moderate plasticity, very stiff, moist, (CL)		4.0-5.5 ft	1.3 ft	4 7 10	17	
	7.0	SHALE, weathered		6.5-7.9 ft	1.5 ft	14 34 50/5"	Ref.	
	7.9	BORING TERMINATED AT AUGER REFUSAL AT 7.9 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 620
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-19
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		1 2 2	2	
	1.0	CLAY, very silty, light brown, low plasticity, stiff to very stiff, moist, (CL)		1.0 ft		5 8 8	8	
				3.0 ft		9 11 14	12	
				5.0 ft		25 25 25	25	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 640
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. S-20
Sheet 1 **of** 1
Boring Started 06/05/03
Boring Completed 06/05/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL		0.0 ft		1 2 2	2	
	1.0	CLAY, very silty, light brown, low plasticity, soft to firm, moist, (CL)		1.0 ft		3 4 5	4	
		(very stiff below 3.0 feet)		3.0 ft		12 22 24	23	
				5.0 ft		25/1"	Ref.	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 564
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-1
Sheet 1 **of** 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	2 2 2	4	
		(darker brown and very moist below 1.5 feet)		1.5-3.0 ft	1.3 ft	2 2 2	4	
	4.0	CLAY, silty, brown mottled gray, low plasticity, firm to stiff, moist, (CL)		4.0-5.5 ft	1.5 ft	2 3 6	9	
	6.5	CLAY, silty, mottled brown and gray, moderate plasticity, very stiff, moist, (CL), with rock fragments and black oxidation		6.5-8.0 ft	1.5 ft	10 10 12	22	
	9.0	CLAY, silty, brown mottled gray, moderate plasticity, very stiff, moist, (CL)		9.0-10.5 ft	1.3 ft	6 11 17	28	
	13.0	SHALE, weathered		14.0-15.5 ft	1.5 ft	15 28 49	77	
	15.5	BORING TERMINATED AT AUGER REFUSAL AT 15.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 567
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Partly Cloudy

Boring No. SH-2
Sheet 1 **of** 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	TOPSOIL						
	0.3	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 2 3	5	
				1.5-3.0 ft	1.2 ft	2 4 5	9	
				4.0-5.5 ft	1.2 ft	2 3 5	8	
	6.5	CLAY, silty, brown mottled gray and brownish red, moderate plasticity, stiff to very stiff, moist, (CL)		6.5-8.0 ft	1.3 ft	4 7 11	18	
	9.2	SHALE, weathered		9.0-10.5 ft	1.5 ft	7 15 29	44	
	10.5	BORING TERMINATED AT AUGER REFUSAL AT 10.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 584
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Cloudy

Boring No. SH-3
Sheet 1 of 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	TOPSOIL						
	0.6	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.1 ft	1 2 1	3	
				1.5-3.0 ft	1.2 ft	4 5 7	12	
				4.0-5.5 ft	1.5 ft	2 2 2	4	
		(very moist below 6.5 feet)		6.5-8.0 ft	1.5 ft	2 1 3	4	
	9.0	CLAY, silty, motttled brown, low plasticity, stiff, moist, (CL)		9.0-10.5 ft	1.1 ft	3 5 5	10	
	14.0	CLAY, silty, mottled brown and gray, moderate plasticity, very stiff, moist, (CL), with rock fragments		14.0-15.5 ft	1.5 ft	9 11 16	27	
	16.0	SHALE, weathered						
	18.7	BORING TERMINATED AT AUGER REFUSAL AT 18.7 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 593
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Partly Cloudy

Boring No. SH-4
Sheet 1 **of** 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 3 3	6	
				1.5-3.0 ft	1.3 ft	2 3 4	7	
		(very moist below 4.0 feet)		4.0-5.5 ft	1.2 ft	2 2 2	4	
				6.5-8.0 ft	1.2 ft	2 2 4	6	
	9.0	CLAY, silty, brown mottled gray, low plasticity, very stiff, moist, (CL), with rock fragments		9.0-10.5 ft	1.5 ft	6 10 13	23	
	12.1	SHALE, weathered						
	13.4	BORING TERMINATED AT AUGER REFUSAL AT 13.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 588
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Partly Cloudy

Boring No. SH-5
Sheet 1 **of** 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	TOPSOIL						
	0.7	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 3 3	6	
				1.5-3.0 ft	1.3 ft	3 3 4	7	
		(very moist below 4.0 feet)		4.0-5.5 ft	1.0 ft	2 2 3	5	
	6.5	CLAY, silty, mottled brown and gray, low plasticity, stiff, moist, (CL)		6.5-8.0 ft	1.0 ft	3 5 8	13	
	9.0	CLAY, silty, brown mottled gray, moderate plasticity, stiff, moist, (CL)		9.0-10.5 ft	1.3 ft	6 12 16	28	
	10.1	CLAY, silty, light brown mottled gray, low to moderate plasticity, very stiff, moist, (CL)						
	12.0	SHALE, weathered						
	12.6	BORING TERMINATED AT AUGER REFUSAL AT 12.6 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 582
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-6
Sheet 1 **of** 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	2 3 4	7	
				1.5-3.5 ft	2.0 ft			
		(very moist below 3.5 feet)		3.5-5.0 ft	1.3 ft	3 3 4	7	
	7.0	CLAY, silty, brown mottled gray, moderate plasticity, very stiff, moist, (CL), with rock fragments		6.5-8.0 ft	1.5 ft	4 7 9	16	
				8.0-10.0 ft	2.0 ft			
	10.2	CLAY, silty, brown mottled gray and red, moderate plasticity, hard, moist, (CL)		10.0-11.5 ft	1.5 ft	9 15 23	38	
	14.0	SHALE, weathered		14.0-15.4 ft	1.4 ft	19 33 50/5"	Ref.	
	15.4	BORING TERMINATED AT SPLITSPOON REFUSAL AT 15.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 570
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-7
Sheet 1 **of** 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	TOPSOIL						
	0.6	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.1 ft	1 1 2	3	
				1.5-3.0 ft	1.1 ft	2 3 6	9	
	4.0	CLAY, silty, brown mottled gray, moderate plasticity, very stiff, moist, (CL)		4.0-5.5 ft	0.3 ft	6 7 10	17	UD tube pushed in an offset boring from 4.0 to 6.0 feet; recovery = 2.0 feet.
	6.5	CLAY, silty, mottled brown and gray, moderate plasticity, stiff, moist, (CL)		6.5-8.0 ft	1.3 ft	3 5 7	12	UD tube pushed in an offset boring from 6.5 to 8.0 feet; recovery = 2.0 feet.
	8.7	SHALE, weathered		9.0-10.4 ft	1.4 ft	16 29 50/5"	Ref.	
	10.5	BORING TERMINATED AT AUGER REFUSAL AT 10.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 585
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-8
Sheet 1 of 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL)		0.0-1.5 ft	1.0 ft	2 2 3	5	
				1.5-3.0 ft	1.0 ft	3 3 3	6	
	4.3	CLAY, silty, mottled brown and gray, low plasticity, stiff to very stiff, moist, (CL)		4.0-5.5 ft	1.2 ft	4 5 7	12	
				5.5-7.5 ft	2.0 ft			
				7.5-9.0 ft	1.2 ft	4 11 16	27	
	8.5	SHALE, weathered		9.0-10.0 ft	1.0 ft	14 50/6"	Ref.	
	12.9	BORING TERMINATED AT AUGER REFUSAL AT 12.9 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 601
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-9
Sheet 1 **of** 1
Boring Started 06/02/03
Boring Completed 06/02/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 2 3	5	Approximately 8 inches cut from location prior to drilling.
		(stiff below 1.5 feet)		1.5-3.0 ft	1.5 ft	4 4 5	9	
	4.0	CLAY, silty, brown, low plasticity, soft, very moist, (CL)		4.0-5.5 ft	1.4 ft	1 2 2	4	
	6.0	CLAY, silty, brown mottled gray, low plasticity, stiff, very moist, (CL)		6.5-8.0 ft	1.3 ft	2 4 5	9	
	9.2	CLAY, silty, mottled brown and gray, low to moderate plasticity, very stiff, moist, (CL)		9.0-10.5 ft	1.3 ft	5 7 12	19	
	11.1	SHALE, weathered						
	13.7	BORING TERMINATED AT AUGER REFUSAL AT 13.7 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 565
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. SII-11
Sheet 1 **of** 1
Boring Started 06/06/03
Boring Completed 06/06/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		2 3 3	3	
	1.0	CLAY, very silty, light brown, low plasticity, firm to stiff, moist, (CL/ML)		1.0 ft		4 6 7	6	
				3.0 ft		4 6 9	7	
				5.0 ft		6 8 13	10	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 614
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Sunny

Boring No. SH-13
Sheet 1 **of** 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, stiff, moist, (CL/ML)		0.0-1.5 ft	1.5 ft	3 4 7	11	
				1.5-3.0 ft	1.0 ft	2 4 6	10	
		(firm and very moist below 4.0 feet)		4.0-5.5 ft	1.1 ft	2 2 3	5	
				6.5-8.0 ft	1.3 ft	2 3 5	8	
	7.8	CLAY, silty, mottled brown, low plasticity, firm to stiff, moist, (CL)						
	8.8	SHALE, weathered						
				9.0-10.4 ft	1.4 ft	14 32 50/4"	Ref.	
	10.4	BORING TERMINATED AT AUGER REFUSAL AT 10.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517
Driller Geo-Drill
Drilling Method SSA/SH/CORE
Groundwater Depth No groundwater encountered
Ground Surface Elevation 614
Rig Type CME
Hammer Type Manual
Weather 60's - Overcast

Boring No. SH-13A
Sheet 1 **of** 1
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown						
	11.5	SHALE, very weathered						
	12.5	Began Coring at 12.5 feet SHALE, very weathered, brownish gray, soft, obscurely bedded		12.5-22.5 ft	73%			
	19.7	SHALE, less weathered, gray, soft to moderately hard, obscurely bedded		22.5-27.5ft	100%			
		Ended Coring at 27.5 feet						
	27.5	BORING TERMINATED AT 27.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 564
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. SH-14
Sheet 1 **of** 1
Boring Started 06/06/03
Boring Completed 06/06/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL		0.0 ft		2 2 3	2	
	1.0	CLAY, very silty, light brown, low plasticity, stiff to very stiff, moist, (CL/ML)		1.0 ft		5 10 8	9	
				3.0 ft		15 17 21	19	
				5.0 ft		14 25 A	Ref.	A - 25/1"
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517
Driller CPR/DCH
Drilling Method HA
Groundwater Depth No groundwater encountered
Ground Surface Elevation 578
Rig Type Not Applicable
Hammer Type E-rod
Weather 70's - Sunny

Boring No. SH-15
Sheet 1 **of** 1
Boring Started 06/06/03
Boring Completed 06/06/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		1 1 1	1	
	1.0	CLAY, very silty, light brown, low plasticity, stiff to very stiff, moist, (CL/ML)		1.0 ft		5 8 15	11	
				3.0 ft		12 25 A	Ref.	A - 25/1"
				5.0 ft		25 25/1"	Ref.	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517
Driller Geo-Drill
Drilling Method SSA/SH
Groundwater Depth No groundwater encountered
Ground Surface Elevation 610
Rig Type CME
Hammer Type Manual
Weather 70's -Sunny

Boring No. SH-16
Sheet 1 of 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, olive gray, low plasticity, soft to firm, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	2 2 3	5	
				1.5-3.5 ft	2.0 ft			
	3.5	CLAY, very silty, brown, low plasticity, soft to firm, moist, (CL/ML)		3.5-5.0 ft	1.3 ft	3 2 3	5	
				6.5-8.0 ft	1.3 ft	2 2 3	5	
				9.0-11.0 ft	2.0 ft			
	10.8	CLAY, silty, mottled brown and gray, moderate plasticity, very stiff to hard, moist, (CL)		11.0-12.5 ft	1.2 ft	5 12 18	30	
	14.0	SHALE, weathered		14.0-14.7 ft	0.7 ft	40 50/3"	Ref.	
	14.7	BORING TERMINATED AT AUGER REFUSAL AT 14.7 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 570
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. SH-17
Sheet 1 **of** 1
Boring Started 06/06/03
Boring Completed 06/06/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		3 3 3	3	
	1.0	CLAY, very silty, light brown, low plasticity, firm to very stiff, moist, (CL/ML)		1.0 ft		4 7 9	8	
				3.0 ft		4 5 6	5	
				5.0 ft		12 15 15	15	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 590
Driller CPR/DCH **Rig Type** Not Applicable
Drilling Method HA **Hammer Type** E-rod
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. SH-18
Sheet 1 **of** 1
Boring Started 06/06/03
Boring Completed 06/06/03
Logged By CPR/DCH

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL		0.0 ft		2 3 3	3	
	1.0	CLAY, very silty, light brown, low plasticity, firm to very stiff, moist, (CL/ML)		1.0 ft		3 5 5	5	
				3.0 ft		10 20 A	Ref.	A - 25/1"
				5.0 ft		25/0"	Ref.	
	5.0	HAND AUGER BORING TERMINATED AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 624
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Boring No. SH-19
Sheet 1 **of** 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.3 ft	1 2 5	7	
				1.5-3.0 ft	1.2 ft	4 6 7	13	
	4.0	CLAY, very silty, brown, low plasticity, soft to firm, very moist, (CL/ML)		4.0-5.5 ft	1.3 ft	2 1 3	4	
				6.5-8.0 ft	1.0 ft	2 2 3	5	
				9.0-10.5 ft	1.5 ft	4 6 10	16	
	10.0	CLAY, silty, mottled brown and gray, low to moderate plasticity, very stiff, moist, (CL)						
	11.8	SHALE, weathered						
	13.5	BORING TERMINATED AT AUGER REFUSAL AT 13.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 586
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. SH-20
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.3	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		2.0 ft	1.0			
	5.0	CLAY, silty, mottled brown and gray, low plasticity, stiff, moist, (CL)		5.5 ft	2.5			
	6.7	SHALE, weathered						
	9.0	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 9.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 622
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. SH-21
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL						
	1.4	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		2.0 ft	1.0			
	3.0	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		5.0 ft	> 4.5			
	9.6	SHALE, weathered						
	12.0	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 12.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517
Driller Geo-Drill
Drilling Method SSA/SH
Groundwater Depth No groundwater encountered
Ground Surface Elevation 652
Rig Type CME
Hammer Type Manual
Weather 70's - Sunny

Boring No. SH-22
Sheet 1 **of** 1
Boring Started 05/30/03
Boring Completed 05/30/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, very soft to firm, moist, (CL/ML)		0.0-1.5 ft	0.7 ft	3 2 3	5	
				1.5-3.5 ft	2.0 ft			
				3.5-5.0 ft	1.3 ft	1 1 3	4	
				6.5-8.0 ft	1.3 ft	1 1 3	4	
								UD tube pushed in an offset boring from 8.0 to 10.0 feet; recovery = 2.0 feet.
	9.5	SHALE, weathered		9.0-10.5 ft	1.1 ft	4 6 15	21	
	11.4	BORING TERMINATED AT AUGER REFUSAL AT 11.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 616
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. SH-23
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL						
	0.8	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		3.0 ft	1.25			
	4.5	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		4.5 ft 5.5 ft	2.0 2.0			
	7.9	SHALE, weathered						
	9.0	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 9.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 580
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. SH-24
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.5	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)						
	5.3	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)						
	8.1	SHALE, weathered						
	11.6	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 11.6 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 540
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth Groundwater at 6.5 feet during drilling **Weather** 60's - Overcast

Boring No. HF-1
Sheet 1 of 1
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By SLS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brownish gray, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	0.4 ft	3 5 3	8	
				1.5-3.0 ft	1.0 ft	4 7 5	12	
	4.0	CLAY, silty, mottled brown and gray, low plasticity, soft, very moist, (CL)		4.0-5.5 ft	0.4 ft	1 2 1	3	
	6.5	CLAY, silty, mottled brown and gray, low plasticity, very stiff, moist, (CL), with rock fragments		6.5-8.0 ft	0.8 ft	6 10 9	19	
	9.5	CLAY, silty, mottled gray and brown, low plasticity, hard, moist, (CL)		9.0-10.5 ft	1.5 ft	9 15 23	38	
	11.9	SHALE, weathered						
	12.6	BORING TERMINATED AT AUGER REFUSAL AT 12.6 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 544
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring No. HF-2
Sheet 1 **of** 1
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By SLS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	2 2 3	5	
				1.5-3.0 ft	1.2 ft	3 5 4	9	
				4.0-5.5 ft	0.9 ft	3 3 3	6	
				6.5-8.0 ft	1.2 ft	3 3 6	9	
	9.0	CLAY, silty, mottled brown and reddish brown, moderate plasticity, very stiff, moist, (CL)		9.0-10.5 ft	1.2 ft	7 11 12	23	
	13.8	SHALE, weathered		14.0-15.0 ft	1.0 ft	30 50/6"	Ref.	
	17.3	BORING TERMINATED AT AUGER REFUSAL AT 17.3 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 578
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring No. HF-3
Sheet 1 **of** 1
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By SLS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	1.1 ft	2 2 5	7	
				1.5-3.0 ft	1.2 ft	5 6 7	13	
		(very moist below 4.0 feet)		4.0-5.5 ft	1.0 ft	2 2 3	5	
				6.5-8.0 ft	1.2 ft	2 2 2	4	
				8.0-10.0 ft	2.0 ft			
	10.0	CLAY, silty, brown mottled gray, low plasticity, very stiff, moist, (CL)		10.0-11.5 ft	1.2 ft	8 10 10	20	
	13.2	SHALE, weathered, yellowish to light gray		14.0-14.7 ft	0.7 ft	30 50/3"	Ref.	
	15.7	BORING TERMINATED AT AUGER REFUSAL AT 15.7 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-3A
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 578
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH/CORE **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown						
	13.5	SHALE, very weathered						
	14.5	Began Coring at 14.5 feet SHALE, very weathered, brownish gray, soft, obscurely bedded						
	18.8	SHALE, less weathered, gray, soft to moderately hard, obscurely bedded		14.5-24.5 ft	97%			45° fracture[1] at 21.3 feet 68° fracture[1] at 21.8 feet [1] As measured from the horizontal
		Ended Coring at 24.5 feet						
	24.5	BORING TERMINATED AT 24.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 592
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring No. HF-4
Sheet 1 **of** 1
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)						
				1.0-3.0 ft	2.0 ft			
				3.0-4.5 ft	0.0 ft	4 4 4	8	
				6.5-8.0 ft	1.2 ft	4 4 5	9	
	9.0	CLAY, silty, brown mottled gray and light brown, moderate plasticity, very stiff, moist, (CL)		9.0-10.5 ft	1.4 ft	7 9 14	23	
	11.4	SHALE, weathered, tan						
	13.4	BORING TERMINATED AT AUGER REFUSAL AT 13.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-5
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 611
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	2 2 3	5	
				1.5-3.0 ft	0.7 ft	4 6 5	11	
				4.0-5.5 ft	1.4 ft	2 1 1	2	UD tube pushed in an offset boring from 4.0 to 6.0 feet; recovery = 2.0 feet.
				6.5-8.0 ft	1.3 ft	2 1 2	3	
				8.0-10.0 ft	2.0 ft			
	10.0	CLAY, silty, light brown mottled light gray, low to moderate plasticity, very stiff, moist, (CL)		10.0-11.5 ft	1.5 ft	6 7 10	17	
	12.7	SHALE, weathered, tan						
	13.6	BORING TERMINATED AT AUGER REFUSAL AT 13.6 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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TEST PIT RECORD

Test Pit No. HF-6
Sheet 1 of 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 586
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.0	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)						
	6.5	CLAY, silty, brown mottled gray, stiff, moist, (CL)						
	9.0	CLAY, silty, yellow mottled brown, low plasticity, very stiff, moist, (CL)						
	12.5	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 12.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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Louisville, Kentucky 40299

TEST PIT RECORD

Test Pit No. HF-7
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE
Weather 70's - Sunny

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 554
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.5	CLAY, silty, brown mottled gray, low plasticity, stiff, moist, (CL)		3.0 ft	3.0			
				4.0 ft	> 4.5			
	6.9	SHALE, weathered						
	7.1	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 7.1 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-8
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 629
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	2 3 5	8	
				1.5-3.0 ft	0.7 ft	5 7 7	14	
				4.0-5.5 ft	1.5 ft	2 2 2	4	
				6.5-8.0 ft	1.2 ft	2 2 4	6	
	9.0	CLAY, silty, brown mottled light brown, low plasticity, stiff, moist, (CL)		9.0-10.5 ft	0.8 ft	7 7 7	14	
	11.1	SHALE, weathered						
	12.0	BORING TERMINATED AT AUGER REFUSAL AT 12.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-9
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 631
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, soft to stiff, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	3 4 10	14	
				1.5-3.0 ft	1.0 ft	7 8 9	17	
				4.0-5.5 ft	0.7 ft	3 2 2	4	
		(very moist below 6.5 feet)		6.5-8.0 ft	1.2 ft	2 3 5	8	
	9.0	CLAY, silty, light brown, low plasticity, hard, moist, (CL)		9.0-10.5 ft	1.2 ft	5 14 20	34	
	10.5	SHALE, weathered						
	11.4	BORING TERMINATED AT AUGER REFUSAL AT 11.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 600
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. HF-10
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	0.8	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		2.5 ft	2.0			
	6.5	CLAY, silty, mottled brown and gray, low plasticity, stiff, moist, (CL)		7.0 ft	3.0			
	8.7	SHALE, weathered						
	9.1	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 9.1 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-11
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 639
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	1.1 ft	3 5 7	12	
				1.5-3.0 ft	0.7 ft	5 7 7	14	
				4.0-5.5 ft	1.1 ft	3 3 4	7	
	6.5	CLAY, silty, light brown, low plasticity, stiff to very stiff, moist, (CL)		6.5-8.0 ft	1.0 ft	4 5 6	11	
				9.0-10.5 ft	1.4 ft	12 12 16	28	
	11.6	SHALE, weathered						
	12.3	BORING TERMINATED AT AUGER REFUSAL AT 12.3 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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TEST PIT RECORD

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 620
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Test Pit No. HF-12
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL						
	1.0	CLAY, silty, brown mottled gray, low plasticity, firm to stiff, moist, (CL)		1.0 ft	1.0			
				2.0 ft	1.75			
	3.8	SHALE, weathered		3.5 ft	2.75			
	5.0	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 5.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

TEST PIT RECORD

Test Pit No. HF-13
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 638
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.0	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)						
	4.5	CLAY, very silty, brown, low plasticity, soft, very moist, (CL/ML)		5.0 ft	1.0			
	7.0	CLAY, silty, mottled brown, low plasticity, firm, moist, (CL)		7.0 ft	0.75-1.0			
	10.2	SHALE, weathered						
	12.5	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 12.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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Louisville, Kentucky 40299

TEST PIT RECORD

Test Pit No. HF-14
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 594
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	CLAY, silty, dark brown, with organics, (TOPSOIL)						
	2.0	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)		4.0 ft	0.75-1.5			
	6.2	SHALE, weathered						
	9.0	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 9.0 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-15
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 651
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast

Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	1.2 ft	2 3 5	8	
				1.5-3.0 ft	0.8 ft	6 7 8	15	
		(soft to firm below 3.0 feet)						
				4.0-5.5 ft	1.2 ft	2 2 2	4	
		(very moist below 6.5 feet)		6.5-8.0 ft	1.2 ft	2 2 2	4	
				9.0-10.5 ft	1.5 ft	2 2 4	6	
	12.6	SHALE, weathered, tan						
	13.5	BORING TERMINATED AT AUGER REFUSAL AT 13.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

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BORING RECORD

Boring No. HF-16
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 657
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	1.0 ft	2 3 4	7	
				1.5-3.0 ft	1.3 ft	3 4 5	9	
				4.0-5.5 ft	1.2 ft	2 3 3	6	
				6.5-8.0 ft	1.0 ft	3 2 3	5	
	9.0	CLAY, silty, brown to light brown, low plasticity, stiff to very stiff, moist, (CL)		9.0-10.5 ft	1.1 ft	4 7 16	23	
	12.0	SHALE, weathered, tan						
	13.3	BORING TERMINATED AT AUGER REFUSAL AT 13.3 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
2219 Plantside Drive
Louisville, Kentucky 40299

BORING RECORD

Boring No. HF-17
Sheet 1 **of** 1

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 678
Driller Geo-Drill **Rig Type** CME
Drilling Method SSA/SH **Hammer Type** Manual
Groundwater Depth No groundwater encountered **Weather** 60's - Overcast
Boring Started 06/04/03
Boring Completed 06/04/03
Logged By EMS

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Recovery	Blows/6"	N	Comments
	0.0	CLAY, very silty, brown, low plasticity, firm to stiff, moist, (CL/ML)		0.0-1.5 ft	0.9 ft	3 4 7	11	
				1.5-3.0 ft	0.7 ft	3 5 6	11	
				4.0-5.5 ft	1.1 ft	3 3 4	7	
	6.5	CLAY, very silty, light brown, low plasticity, firm, moist, (CL)		6.5-8.0 ft	1.3 ft	3 3 3	6	
		(hard below 9.0 feet)		9.0-10.5 ft	1.2 ft	8 11 22	33	
	12.9	SHALE, weathered						
	13.4	BORING TERMINATED AT AUGER REFUSAL AT 13.4 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
2219 Plantside Drive
Louisville, Kentucky 40299

TEST PIT RECORD

Test Pit No. HF-18
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE
Weather 70's - Sunny

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 644
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_p, tsf (PP)	Blows / 1.75"	N_c	Comments
	0.0	TOPSOIL						
	1.5	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)						
	5.5	CLAY, silty, mottled brown and gray, stiff to very stiff, moist, (CL)						
	9.0	SHALE, weathered						
	9.5	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 9.5 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

GEM Engineering, Inc.
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Louisville, Kentucky 40299

TEST PIT RECORD

Test Pit No. HF-19
Sheet 1 **of** 1
Test Pit Started 06/05/03
Test Pit Completed 06/05/03
Logged By MTE

Project Hardwood Forest - Sections 3, 4, and 5
Project Number G-1517 **Ground Surface Elevation** 600
Excavator Culver & Associates
Excavation Method Trackhoe
Groundwater Depth No groundwater encountered **Weather** 70's - Sunny

Elev. (ft)	Depth (ft)	Material Description	Soil Symbol	Sample Depth	Q_u, tsf (PP)	Blows / 1.75"	N_e	Comments
	0.0	TOPSOIL						
	1.5	CLAY, very silty, brown, low plasticity, firm, moist, (CL/ML)						
	3.5	SHALE, weathered						
	4.1	TEST PIT TERMINATED AT TRACKHOE REFUSAL AT 4.1 FEET						

Remarks: The ground surface elevation was interpolated to the nearest 1 foot based on drawings provided by Birch, Trautwein & Mims. Refer to comments included in the text of the report concerning surface elevation estimates.

LABORATORY SUMMARY

Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky
GEM Project No. G-1517

Boring	Sample Depth (ft)	Sample Type	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Effective Friction Angle (degrees)	Effective Cohesion (psf)	Moist Unit Weight (pcf)
S-1	0.0-1.5	SS	16						
	1.5-3.0	SS	19						
	3.5-5.5 ft	UD	20[1]	36	18	18	33.9	0	129[2]
	4.0-5.5	SS	18						
S-7	0.0-1.5	SS	25						
	1.5-3.0	SS	26						
	4.0-5.5	SS	23						
	6.5-8.0	SS	18	41	18	23			
	9.0-10.5	SS	15						
S-9	0.0-1.5	SS	26						
	1.5-3.0	SS	27						
	4.0-5.5	SS	24						
	6.5-8.0	SS	21						
	9.0-10.5	SS	21						
S-13	0.0-1.5	SS	24						
	1.5-3.0	SS	25						
	4.0-5.5	SS	27						
	6.5-8.0	SS	30						
	9.0-10.5	SS	27						
	14.0-15.5	SS	19						
S-15	4.0-5.5	SS	26						
	6.5-8.0	SS	23						
	9.0-10.5	SS	18						
S-18	0.0-1.5	SS	18						
	1.5-3.0	SS	21						
	4.0-5.5	SS	19						

LABORATORY SUMMARY

Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky
GEM Project No. G-1517

Boring	Sample Depth (ft)	Sample Type	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Effective Friction Angle (degrees)	Effective Cohesion (psf)	Moist Unit Weight (pcf)
SH-1	0.0-1.5	SS	21						
	1.5-3.0	SS	28						
	4.0-5.5	SS	24						
	6.5-8.0	SS	17						
	9.0-10.5	SS	23						
SH-2	0.0-1.5	SS	25						
	1.5-3.0	SS	26						
	4.0-5.5	SS	25						
	6.5-8.0	SS	19						
	9.0-10.5	SS	14						
SH-4	0.0-1.5	SS	27						
	1.5-3.0	SS	27						
	4.0-5.5	SS	27						
	6.5-8.0	SS	27						
	9.0-10.5	SS	21						
SH-3	0.0-1.5	SS	23						
	1.5-3.0	SS	26						
	4.0-5.5	SS	27						
	6.5-8.0	SS	29						
	9.0-10.5	SS	24						
	14.0-15.5	SS	21						
SH-6	1.5-3.5	UD	24[1]	31	23	8	30.7	0	128[2]
SH-7	0.0-1.5	SS	27						
	1.5-3.0	SS	27						
	4.0-5.5	SS	24						
	6.5-8.0	SS	24						
	6.5-8.5	UD	19[1]	45	19	26	26.6	81	132[2]

LABORATORY SUMMARY

Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky
GEM Project No. G-1517

Boring	Sample Depth (ft)	Sample Type	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Effective Friction Angle (degrees)	Effective Cohesion (psf)	Moist Unit Weight (pcf)
SH-9	0.0-1.5	SS	23						
	1.5-3.0	SS	24						
	3.5-5.0	SS	26						
	6.5-8.0	SS	17						
	10.0-11.5	SS	23						
SH-13	0.0-1.5	SS	24						
	1.5-3.0	SS	21						
	4.0-5.5	SS	26						
	6.5-8.0	SS	19						
SH-22	0.0-1.5	SS	24						
	3.5-5.0	SS	24						
	6.5-8.0	SS	26						
	8.5-10.0	SS	17						
HF-1	0.0-1.5	SS	26						
	1.5-3.0	SS	20						
	4.0-5.5	SS	31						
	6.5-8.0	SS	14						
	9.0-10.5	SS	15						
HF-3	0.0-1.5	SS	22						
	1.5-3.0	SS	22						
	4.0-5.5	SS	27						
	6.5-8.0	SS	30						
	10.0-11.5	SS	18						

LABORATORY SUMMARY

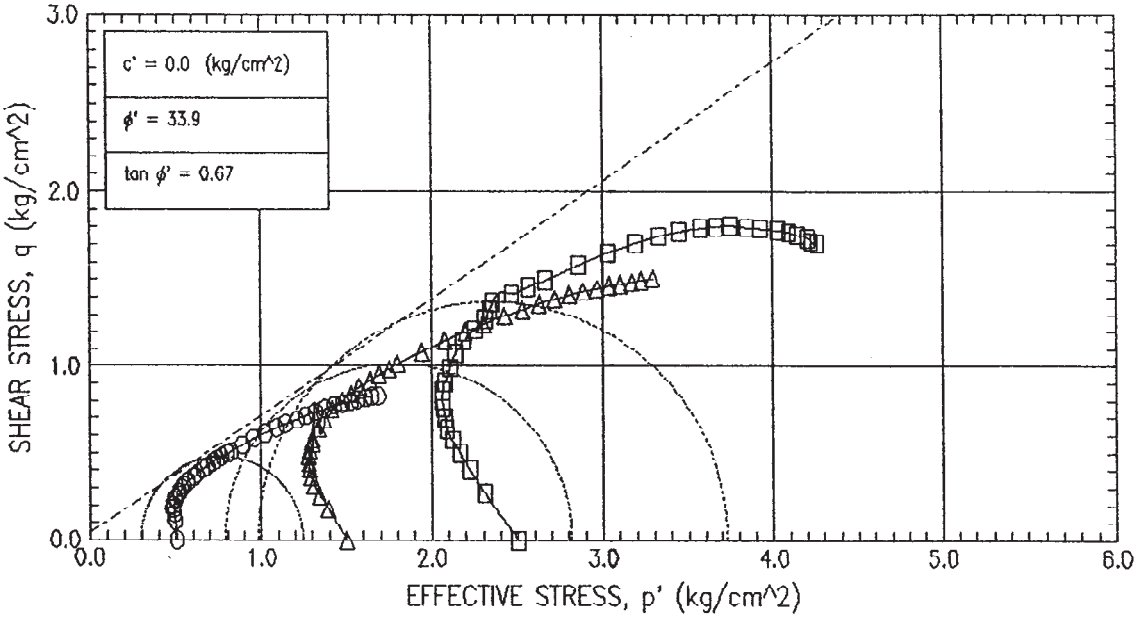
Hardwood Forest – Sections 3, 4, and 5
Louisville, Kentucky
GEM Project No. G-1517

Boring	Sample Depth (ft)	Sample Type	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Effective Friction Angle (degrees)	Effective Cohesion (psf)	Moist Unit Weight (pcf)
HF-5	0.0-1.5	SS	22						
	1.5-3.0	SS	23						
	4.0-5.5	SS	24	30	25	5			
	4.0-6.0	UD	25[1]	29	23	6	32.6	0	118[2]
	6.5-8.0	SS	27	30	25	5			
	10.0-11.5	SS	19						
HF-9	0.0-1.5	SS	19						
	1.5-3.0	SS	22						
	4.0-5.5	SS	20						
	6.5-8.0	SS	24						
	9.0-10.5	SS	12						
HF-15	0.0-1.5	SS	21						
	1.5-3.0	SS	19						
	4.0-5.5	SS	22						
	6.5-8.0	SS	26						
	9.0-10.5	SS	25						
HF-17	0.0-1.5	SS	23						
	1.5-3.0	SS	17						
	4.0-5.5	SS	15						

Notes:

1. The moisture content is the average of three consolidated-undrained test specimens.
2. The moist unit weight is the average of three consolidated-undrained test specimens.
3. SS = Splitspoon.
4. UD = Undisturbed Tube.

CU TRIAXIAL COMPRESSION TEST ASTM D 4767

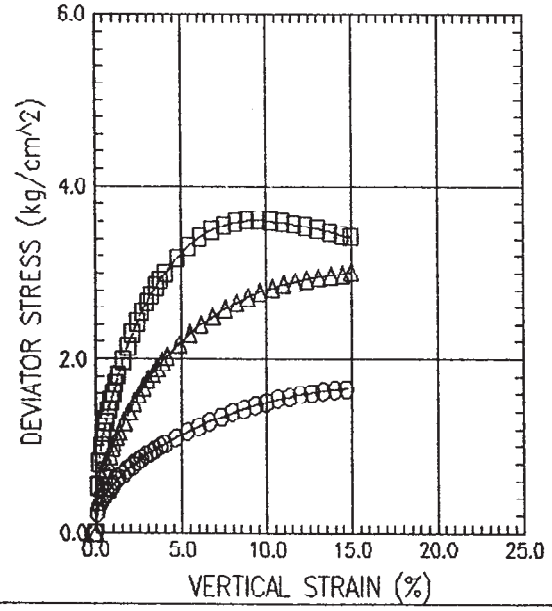


FAILURE SKETCHES


33487C04


33487C05


33487C06



SYMBOL		○	△	□	
TEST NO.		33487C04	33487C05	33487C06	
INITIAL	WATER CONTENT (%)	20.89	20.29	18.85	
	DRY DENSITY (gm/cm^3)	1.69	1.72	1.77	
	SATURATION (%)	93.79	95.12	96.21	
	VOID RATIO	0.606	0.580	0.533	
BEFORE SHEAR	WATER CONTENT (%)	22.98	21.28	18.46	
	DRY DENSITY (gm/cm^3)	1.70	1.75	1.83	
	SATURATION (%)	104.33	104.65	103.06	
	VOID RATIO	0.599	0.553	0.487	
	BACK PRESS. (kg/cm^2)	4.95	4.95	4.95	
MINOR PRIN. STRESS (kg/cm^2)		0.50	1.50	2.50	
MAX. DEV. STRESS (kg/cm^2)		1.66	3.06	3.73	
TIME TO FAILURE (min)		219.90	219.92	139.90	
RATE OF STRAIN INCR (%/min)		0.07	0.07	0.06	
INITIAL DIAMETER (cm)		7.24	7.23	7.26	
INITIAL HEIGHT (cm)		15.52	15.44	15.41	
B-VALUE		0.95	1.00	0.94	

STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

1) SILTY CLAY TRACE SAND - BROWN MOTTLED GRAY (CL) 2) SILTY CLAY TRACE SAND - BROWN MOTTLED GRAY (CL) 3) SILTY CLAY TRACE SAND - BROWN MOTTLED GRAY

LL 36.00	PL 18.00	PI 18.00	GS 2.72

TYPE OF SPECIMEN 3 IN ST

TYPE OF TEST CU (R)

REMARKS:

1) FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO

2)

3)

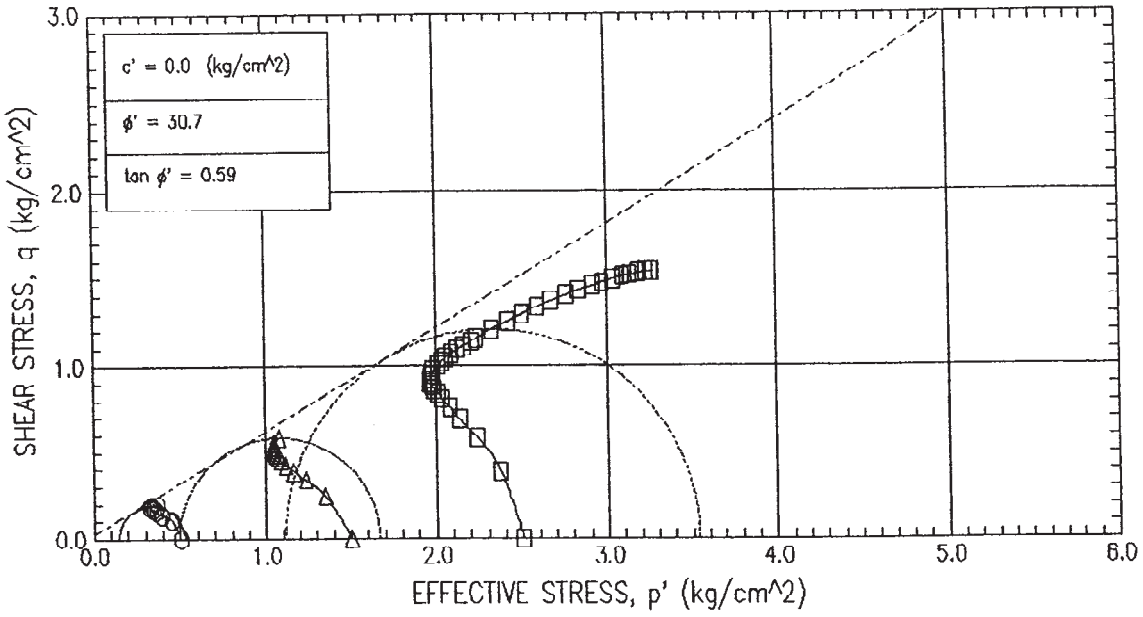
PROJECT GEM ENGINEERING G-1517, HARDWOOD FOREST

PROJECT NO.33487

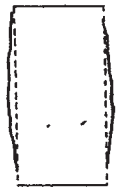
BORING NO. S-1	SAMPLE NO.	1	1	1	
TECH. LO	DEPTH/ELEV	3.5-5.5	3.5-5.5	3.5-5.5	
LABORATORY	DATE	06-18-03	06-20-03	06-20-03	

TRIAXIAL COMPRESSION TEST REPORT

CU TRIAXIAL COMPRESSION TEST ASTM D 4767

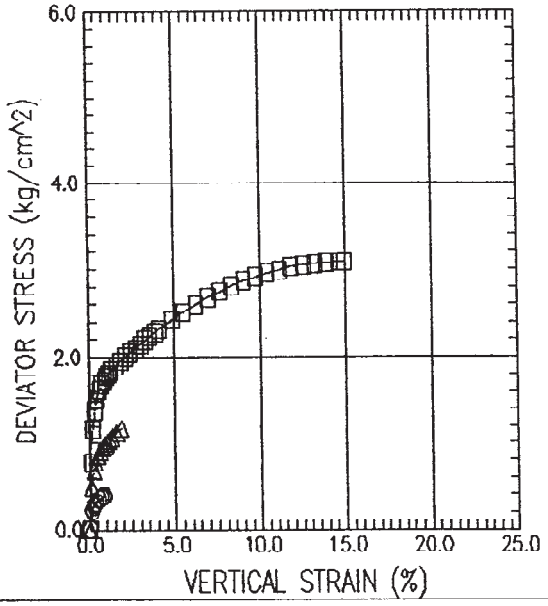


FAILURE SKETCHES


33487C10


33487C11


33487C12



SYMBOL		○	△	□	
TEST NO.		33487C10	33487C11	33487C12	
INITIAL	WATER CONTENT (%)	25.42	24.11	23.18	
	DRY DENSITY (gm/cm^3)	1.61	1.65	1.68	
	SATURATION (%)	99.84	101.27	101.98	
	VOID RATIO	0.692	0.648	0.618	
BEFORE SHEAR	WATER CONTENT (%)	25.76	23.78	22.68	
	DRY DENSITY (gm/cm^3)	1.61	1.66	1.69	
	SATURATION (%)	102.23	101.66	101.93	
	VOID RATIO	0.686	0.636	0.605	
	BACK PRESS. (kg/cm^2)	4.95	4.95	4.95	
MINOR PRIN. STRESS (kg/cm^2)		0.50	1.50	2.50	
MAX. DEV. STRESS (kg/cm^2)		0.39	1.19	3.13	
TIME TO FAILURE (min)		12.78	27.73	209.90	
RATE OF STRAIN INCR (%/min)		0.07	0.07	0.05	
INITIAL DIAMETER (cm)		7.06	7.06	7.06	
INITIAL HEIGHT (cm)		15.56	15.31	14.99	
B-VALUE		1.00	1.00	1.00	

STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

1) SILTY CLAY TRACE SAND ROOTS - BROWN (CL)

2) SILTY CLAY TRACE SAND ROOTS - BROWN (CL)

3) SILTY CLAY TRACE SAND ROOTS - BROWN (CL)

LL 31.00	PL 23.00	PI 8.00	GS 2.72

TYPE OF SPECIMEN 3 IN ST

TYPE OF TEST CU (R)

REMARKS:

1) FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO

2) PERFORMED AS STAGED TEST

3)

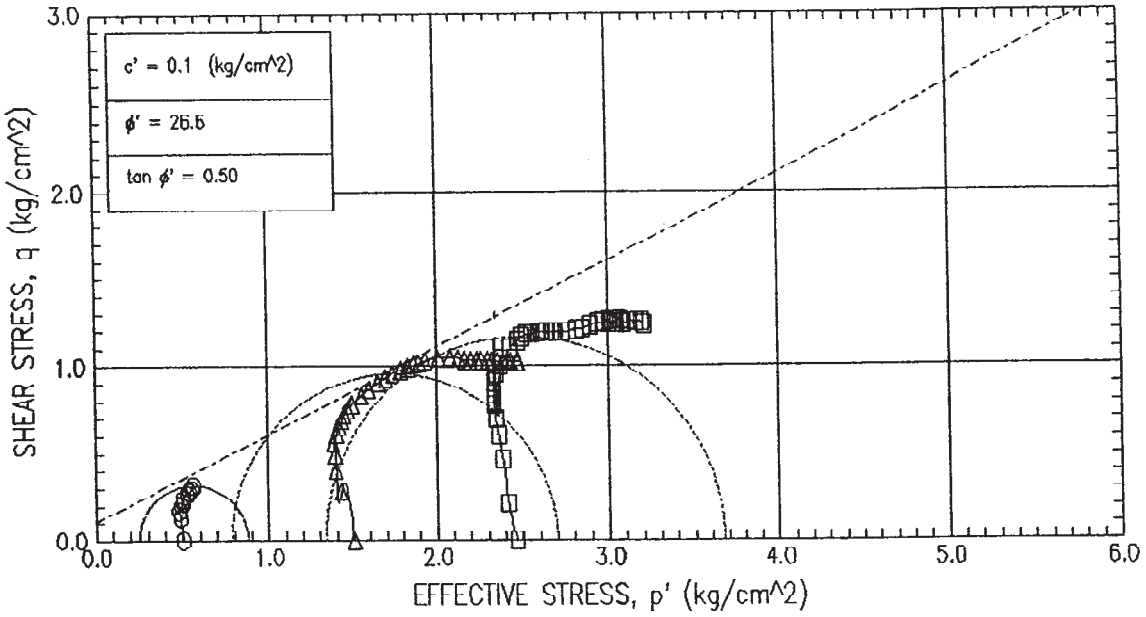
PROJECT GEM ENGINEERING G-1517, HARDWOOD FOREST

PROJECT NO.33487

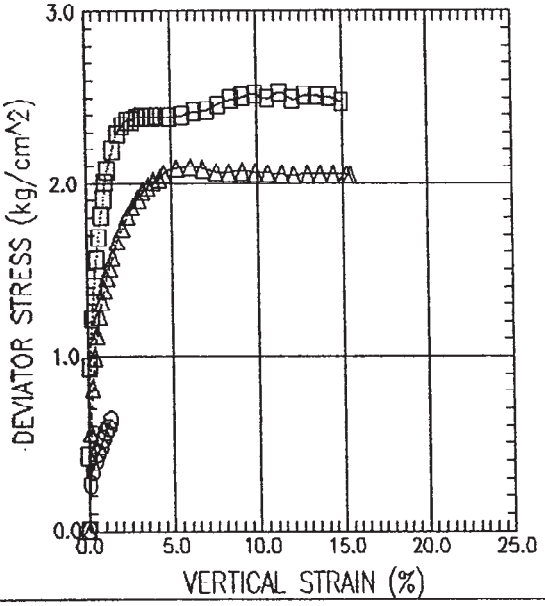
BORING NO SH-6	SAMPLE NO.	1	1	1
TECH. LO	DEPTH/ELEV	1.5-3.5	1.5-3.5	1.5-3.5
LABORATORY	DATE	06-23-03	06-23-03	06-24-03

TRIAXIAL COMPRESSION TEST REPORT

CU TRIAXIAL COMPRESSION TEST ASTM D 4767



FAILURE SKETCHES



SYMBOL		○	△	□	
TEST NO.		33487C07	33487C08	33487C09	
INITIAL	WATER CONTENT (%)	19.99	19.99	17.56	
	DRY DENSITY (gm/cm^3)	1.73	1.76	1.83	
	SATURATION (%)	94.94	99.79	98.86	
	VOID RATIO	0.573	0.545	0.483	
BEFORE SHEAR	WATER CONTENT (%)	21.21	20.59	16.48	
	DRY DENSITY (gm/cm^3)	1.72	1.76	1.89	
	SATURATION (%)	98.74	103.44	102.70	
	VOID RATIO	0.584	0.541	0.437	
	BACK PRESS. (kg/cm^2)	4.95	4.95	4.95	
MINOR PRIN. STRESS (kg/cm^2)		0.50	1.50	2.47	
MAX. DEV. STRESS (kg/cm^2)		0.64	2.12	2.60	
TIME TO FAILURE (min)		17.80	79.92	159.92	
RATE OF STRAIN INCR (%/min)		0.05	0.08	0.07	
INITIAL DIAMETER (cm)		7.23	7.23	7.24	
INITIAL HEIGHT (cm)		13.77	13.53	14.86	
B-VALUE		1.00	1.00	1.00	

STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

1) SILTY CLAY TRACE SAND SILTSTONES - BROWN (CL) 2) SILTY CLAY TRACE SAND SILTSTONES - BROWN (CL) 3) SILTY CLAY TRACE SAND - BROWN (CL)

LL 45.00	PL 19.00	PI 26.00	GS 2.72	TYPE OF SPECIMEN 3 IN ST	TYPE OF TEST CU (R)

REMARKS:

1) FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO

2) TESTS 33487C07 AND 33487C08 PERFORMED AS STAGED

3)

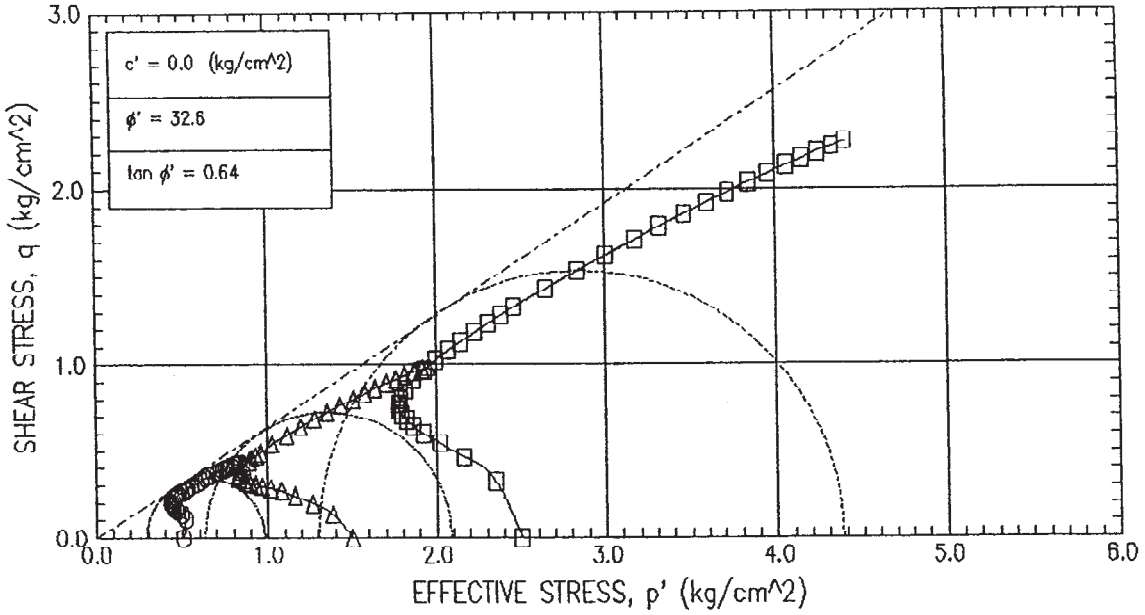
PROJECT GEM ENGINEERING G-1517, HARDWOOD FOREST

PROJECT NO.33487

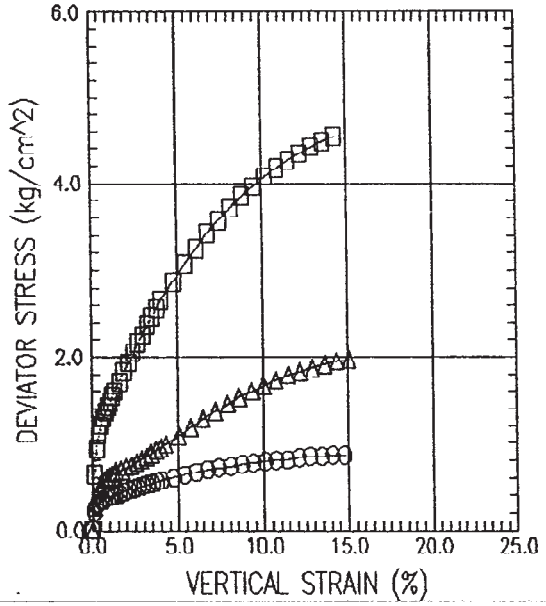
BORING NO. SH-7	SAMPLE NO.	2	2	2
TECH. LO	DEPTH/ELEV	6.5-8.5	6.5-8.5	6.5-8.5
LABORATORY	DATE	06-20-03	06-24-03	06-23-03

TRIAXIAL COMPRESSION TEST REPORT

CU TRIAXIAL COMPRESSION TEST ASTM D 4767



FAILURE SKETCHES



SYMBOL		○	△	□	
TEST NO.		33487C01	33487C02	33487C03	
INITIAL	WATER CONTENT (%)	25.88	24.37	24.68	
	DRY DENSITY (gm/cm^3)	1.46	1.51	1.58	
	SATURATION (%)	81.75	83.81	94.43	
	VOID RATIO	0.855	0.785	0.706	
BEFORE SHEAR	WATER CONTENT (%)	30.12	27.25	24.62	
	DRY DENSITY (gm/cm^3)	1.46	1.53	1.62	
	SATURATION (%)	95.89	96.34	99.12	
	VOID RATIO	0.848	0.764	0.671	
	BACK PRESS. (kg/cm^2)	4.95	4.95	4.95	
MINOR PRIN. STRESS (kg/cm^2)		0.50	1.50	2.50	
MAX. DEV. STRESS (kg/cm^2)		0.86	2.00	4.63	
TIME TO FAILURE (min)		219.30	209.90	209.90	
RATE OF STRAIN INCR (%/min)		0.07	0.07	0.07	
INITIAL DIAMETER (cm)		7.30	7.30	7.27	
INITIAL HEIGHT (cm)		15.49	14.86	15.51	
B-VALUE		0.92	0.92	0.95	

STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

1) SILTY CLAY TRACE SAND - BROWN (CL-ML)

2) SILTY CLAY TRACE SAND - BROWN (CL-ML)

3) SILTY CLAY TRACE SAND - BROWN (CL-ML)

LL 29.00	PL 23.00	PI 6.00	GS 2.70

TYPE OF SPECIMEN 3 IN ST

TYPE OF TEST CU (R)

REMARKS:

1) FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO

2)

3)

PROJECT GEM ENGINEERING G-1517, HARDWOOD FOREST

PROJECT NO.33487

BORING NO. HF-5	SAMPLE NO.	1	1	1
TECH. LO	DEPTH/ELEV	4.0-6.0	4.0-6.0	4.0-6.0
LABORATORY	DATE	06-18-03	06-18-03	06-18-03

TRIAXIAL COMPRESSION TEST REPORT

GEM Engineering, Inc.

2219 Plantside Drive Louisville, Kentucky 40299
Tel. (502) 493-7100 Fax (502) 493-8190

Fax

To: Don Jones	**From:** Samantha Schardein
Phone: 937-1983	**Pages :** 5 (including coversheet)
Fax: 937-9091	**Date:** 06/14/03
Re: Hardwood Forest Lots	**cc:**

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Comments:

As we discussed, we have completed the fieldwork portion of our study. We are now in the laboratory testing and analysis phase of the study and anticipate completion in approximately 3 to 4 weeks.

Attached is our assessment of the buildability of the individual lots for Sections 3, 4, and 5 based on a walk-thru of each section and visual estimates of distances and basic assumptions about the likely placement of a house on each lot. Please note that heavy woods in some areas did limit observations, requiring some assumptions about areas not specifically observed. Each lot was ranked as good, OK, or difficult. The ranking was developed primarily based on the terrain of the lots. Some lots, including those noted as "good," have other considerations beyond terrain/slope stability, such as the presence of creeks or existing fill, that must be taken into account.

We anticipate that a house on a "good" lot generally could be lot built with normal construction practices and considerations. A house on an "OK" lot could be built with some special considerations, including appropriate siting of the house and a few other additional considerations (such as retaining walls). A house on a "difficult" lot would require careful siting and likely would require some additional potentially costly considerations (such as a special foundation system for the house). In general, the existing slopes on the "difficult" lots are very steep and only marginally stable, with any future disturbance potentially triggering slope problems. We are in the process of analyzing these slopes to determine whether building on these lots is advisable. In general, it would be advisable to construct houses on the more difficult lots on the existing rock (clay shale) so that should future slope problems

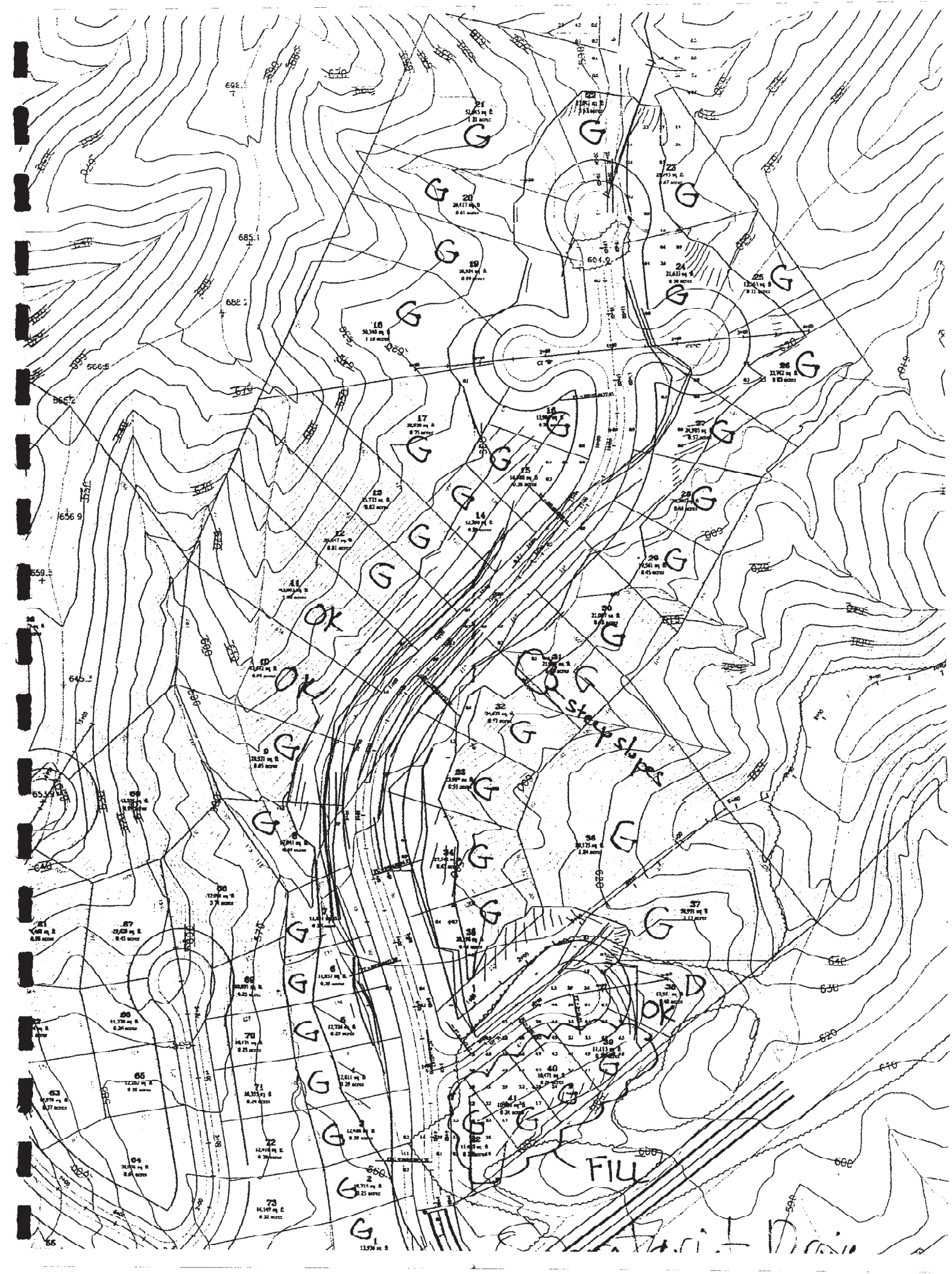
develop, the houses are less likely to be compromised. Included below are preliminary guidelines that will relate to construction on any of the lots in the new sections.

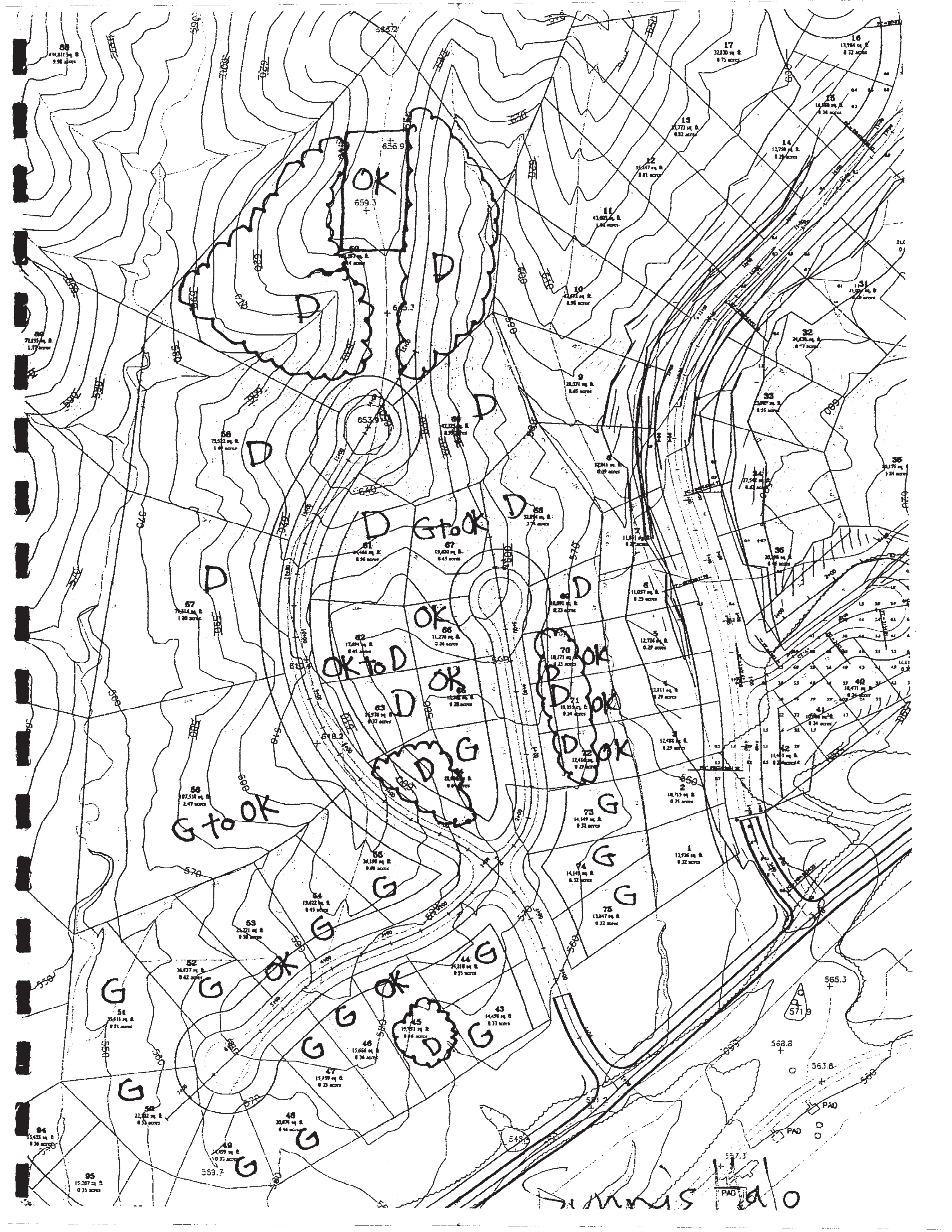
Special precautions should be taken to make sure all surface and subsurface water is controlled and disposed of properly. For example, surface water should be directed away from the houses as much as possible and, where possible, collected and disposed of so as to minimize the amount of water saturating existing slopes. Water from downspouts should be collected and transported away from houses (either through extensions to appropriate areas of the yard or direction to an off-site collection system). Downspouts or water collected from downspouts should not outlet at the crest of slopes, but preferably should be transported past the toe of slopes or, at a minimum, as far down the slope as feasibly possible. Since water triggers a large majority of slope failures, the control of water is critical for this project.

Care and caution must be exercised when any cuts or fills are made for this project, especially cuts at the toe or fills at the crest of existing slopes. Numerous past slope failures in the project vicinity and areas underlain by the same geology as the project site have been caused by minor cuts or fills. It is advisable for cuts and fills to be evaluated on a case-by-case basis that will include consideration of many factors, including, but not limited to, the following: the depth of cut or fill; the location of the cut or fill in relation to existing slopes; the purpose and nature of the cut and fill; and the potential damage to any construction in the area of the cut or fill. Cuts should not be left open for extended periods. For example, utility excavations should be backfilled as soon as possible. Basements also should be constructed and backfilled as soon as possible. All new fill should consist of engineered fill that is compacted to a minimum of 95 percent of the standard Proctor maximum dry density. Improperly placed fill tends to experience higher rates and longer periods of saturation, both of which could trigger slope problems.

Disturbance of existing slopes, especially those steeper than 3H:1V, should be kept to a minimum. Trees should be left in-place, where possible, and construction traffic/modification should be kept to a minimum.

Our report will address these and other considerations in more detail. Please call if you have any questions.


OK
OK
steep slopes
OK
FILL


OK
656.9
659.3
D
653.9
G to OK
OK to D
G
618.2
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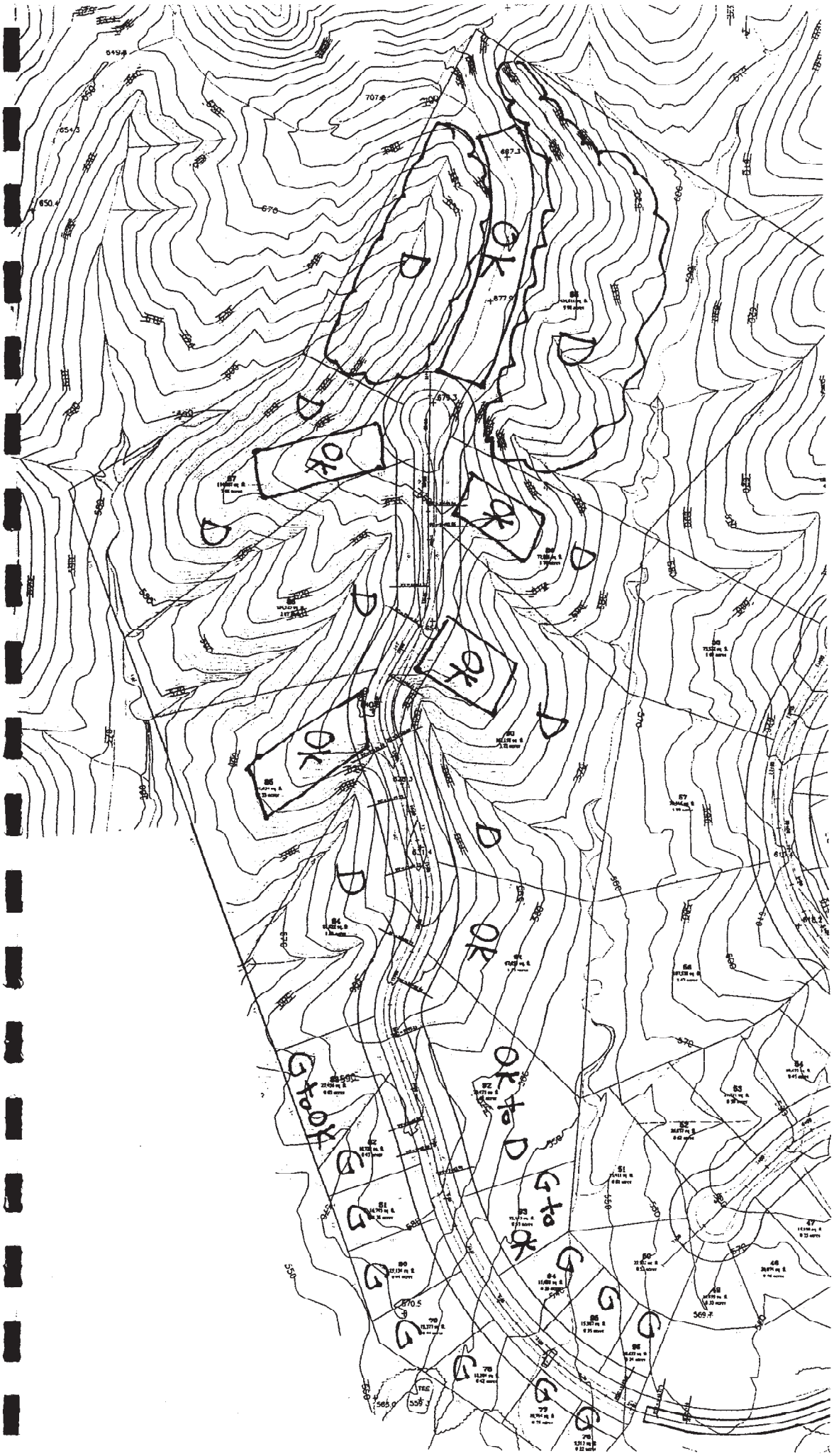
571.9
568.8
563.8
PAD
PAD
PAD


Hardwood
Forest
Drive

FIELD PROCEDURES

Test Pits

The test pits were excavated with a trackhoe to the depths listed on the Test Pit Records. The soils were observed and visually classified. At selected intervals, pocket penetrometer testing was conducted. Pocket penetrometer testing consists of using a hand-held, spring-loaded device that is pushed into the soil to obtain an indirect measurement of the unconfined compressive strength of the soil.

Soil Test Borings (ASTM D-1452)

The soil test borings were advanced with 3 ¼-inch diameter continuous solid stem augers attached to a truck-mounted drill. The soils were observed and visually classified. A representative sample was collected at selected intervals, placed in sealed containers, labeled, and returned to our office for further analysis and laboratory testing as necessary.

At selected intervals, a standard penetration test was conducted. A standard penetration test consists of driving a 1 ½-inch diameter hollow spilt-tube sampler (commonly referred to as a splitspoon) 18 inches with a 140-pound hammer falling a height of 30 inches. A sample of the soil is collected and stored in the hollow portion of the splitspoon. After sampling, the splitspoon is brought to the surface, where it is split open, and the sample is removed. The sample recovery length was measured and recorded. A representative portion of the soil sampled was placed in a sealed container and labeled.

Hand Auger Borings

Some borings were advanced with a hand auger. The soils were observed and visually classified. At selected intervals, dynamic cone penetrometer testing was conducted. This test consisted of driving a 1.5-inch diameter steel rod with a 1.75-inch diameter cone-shaped point (commonly referred to as an "E-rod") in three 1.75-inch increments with a 15-pound hammer falling a height of 20 inches. The number of blows required for each increment was recorded, with the N_c value equal to the average of the last two total blows per increment.

Refusal Materials

Refusal is the term applied to material that cannot be penetrated with the equipment used. Refusal may be encountered on continuous bedrock, discontinuous floaters, cemented soil, weathered rock, debris, buried structures, or other hard subsurface materials. Refusal materials can be evaluated only by obtaining a core of the material. This limitation must be considered when evaluating refusal depths where coring is not conducted.