February 1, 2024

Bob Mishler
Ashton Woods
900 Ridgefield Drive, Suite 335
Raleigh, NC 27609

Subject: Report of Subsurface Exploration and Geotechnical Engineering Evaluation
Harding Drive
Goldsboro, North Carolina
TME Project No.: #232138E

Mr. Mishler:

The purpose of this report is to present the results of the subsurface exploration and geotechnical engineering analyses undertaken by TM Engineering, Inc. in connection with the above referenced project. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our evaluations and recommendations.

We have enjoyed working with you on this project, and we are prepared to assist you with the recommended quality assurance monitoring and testing services during construction. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,

TM Engineering, Inc. (C3201)

Toby Mallik, P.E.
NC Registration No. 026472

Bryant Mueller, P.E.
NC Registration No. 050303

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INTRODUCTION

Project Information

Our understanding of the project is based on information provided by Ashton Woods and the attached preliminary concept layout titled “South Harding Drive Assemblage” drafted by John R. McAdams Company dated 1/12/24. The proposed site consists of four adjoining land parcels (Wayne County PINs: 3519881157, 3519883223, 3519885239, 3519873233) and is located at 500 South Harding Drive in Goldsboro, North Carolina. It is our understanding that the site is being evaluated for a residential single-family development with associated infrastructure including utilities, paved roadways, and storm-water management facilities.

Scope of Services

The purposes of our involvement on this project were as follows: 1) provide general descriptions of the subsurface soil conditions at the site, 2) provide foundation design recommendations, and 3) comment on geotechnical aspects of the proposed development. In order to accomplish the above objectives, we undertook the following scope of services:

1) Visited the site to observe existing surface conditions and features; and to mark boring locations.
2) Reviewed readily available geologic and subsurface information relative to the project site.
3) Executed a subsurface exploration consisting of eight (8) soil test borings advanced to a depth of fifteen (15) feet below the existing ground surface.
4) Evaluated the findings of the subsurface exploration and data relative to proposed construction.
5) Prepared this written report summarizing our geotechnical engineering work on the project, providing descriptions of the subsurface conditions encountered, providing foundation design criteria, and discussing geotechnical related aspects of the proposed construction.

Our geotechnical scope of services did not include a survey of boring locations and elevations, quantity estimates, preparation of plans or specifications, detention pond infiltration testing, environmental analysis or the identification and evaluation of environmental aspects of the project site.

SUBSURFACE EXPLORATION PROCEDURES

The subsurface exploration program was comprised of eight (8) subsurface soil test borings designated B-01 through B-08 advanced to predetermined depths of fifteen (15) feet below the existing ground surface. The boring locations shown were located by estimating distances from known points within the area studied and the locations should be considered approximate. A boring location map is attached.

The soil test borings were performed in accordance with generally accepted practice using an ATV mounted rotary drill rig. Hollow-stem augers were advanced to pre-selected depths, and representative soil samples were recovered with a standard split-spoon sampler in general accordance with ASTM Standards. The number of blows required to drive the split-spoon sampler three consecutive 6-inch increments is recorded, and the blows of the last two increments are summed to obtain the Standard Penetration Test (SPT) Resistance (N-value). The N-value provides a general indication of in-situ soil conditions and has been correlated with certain engineering properties of soils.

Subsurface water level readings were taken in each of the borings immediately upon completion of the soil drilling process. Periodic observation of the boreholes should be performed to monitor subsidence at the ground surface, as the borehole backfill could settle over time.

Representative portions of the split-spoon soil samples obtained throughout the exploration program were evaluated by a member of our professional staff. The soil descriptions and classifications discussed in this report and shown on the attached boring logs and subsurface diagram are based on visual observation and should be considered approximate. Copies of the boring logs are provided. Split-spoon soil samples recovered on this project will be stored for a period of sixty days. After sixty days, the samples will be discarded unless prior notification is provided to us.

SITE AND SUBSURFACE CONDITIONS

Site Description

The proposed site spans approximately 32 acres and mainly consists of recreational grass fields and agricultural fields surrounded by undeveloped woodlands and a wetland area near the southwestern boundary. A power line easement bisects the southern portion of the site in the northwest/southeast direction. The site is bound by S Harding Drive to the north, residential development and Fieldcrest Drive to the west, residential properties and woodlands to the east, and residential properties and an existing pond to the south. The site is very gently sloped with elevations spanning across the open fields of approximately 110 to 116 feet. The land slopes down toward the wetland area near the southwest boundary of the site with low elevations of approximately 104 feet. See attached soil boring map for reference.

Subsurface Conditions

The subsurface conditions discussed in the following paragraphs and those shown on the attached boring logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Subsurface conditions intermediate of the soil borings may vary from the conditions found at the specific boring locations. Should soil conditions adverse to those described in this report be encountered during site development, those conditions should be reported to the geotechnical engineer for additional review and comment.

The soil test borings encountered 2 to 4 inches prior to transitioning into residual soils. Due to the site consisting of agricultural fields and woodlands, the depths of topsoil may vary. Underlying the topsoil, soil test borings B-01, B-02, B-03, B-05, and B-07 encountered a near surface layer of very loose silty sands (SM) or soft sandy silty clays (CL) with SPT N-values ranging from 2 to 3 blows per foot (bpf) to depths of 3.0 to 5.0 feet beneath existing surface. The rest of the material encountered within the soil test borings consisted of loose to medium dense silty sands (SM), firm to very stiff sandy silty clays (CL), and/or loose to medium dense clayey sands (SC) with SPT N-values ranging from 5 to 28 bpf which extended to depths of boring termination at 15.0 feet below the existing ground surface. Soil test borings B-05 encountered a layer of dense silty sands (SM) with SPT N-values ranging from 42 to 57 bpf at depths of 5.0 to 15.0 feet below the existing ground surface. Partially weathered rock (PWR), defined as material in excess of 100 bpf, was not encountered throughout the majority of the soil test borings, however, soil test borings B-05 encountered a thin layer of PWR within the layer of dense sands. The sampled PWR consisted of silty sands (SM) and exhibited penetration resistances of 50 blows over 6 inches.

Measurable subsurface water was encountered in each of the soil test borings at varying depths of 1.5 to 4.5 feet below the existing surface. It should be noted that groundwater elevations will fluctuate at different times of the year through seasonal changes. The fine-grained soils encountered on the site are conducive to the formation of perched water conditions following periods of wet weather. Several of the soils encountered in this investigation classified as moist to saturated. Data from the specific borings are shown on the attached subsurface diagrams and boring logs.

RECOMMENDATIONS

General

The following evaluations and recommendations are based on information provided, our observations at the site, interpretation of the field samples obtained during this exploration, and our experience with similar subsurface conditions and construction projects. Soil penetration data have been used to estimate an allowable bearing pressure and associated settlement using established correlations. Subsurface conditions in unexplored locations may vary from those encountered. Should subsurface conditions adverse to those indicated in this report be encountered during construction, those differences should be reported to us so that these recommendations may be confirmed, extended, or modified as necessary. The following recommendations are to provide general guidance through the design and construction process.

Site Preparation

The first step in preparing the construction site should be to remove any trees, shrubs, and other materials that could interfere with the intended construction. This includes organic debris, soil that contains organic matter, and any other materials that could be harmful to the construction process. It is important to note that even though the test borings indicated topsoil depths of up to 4 inches, deeper stripping may be required in agricultural fields and wooded areas to remove organics and tree root bulbs. As a result, topsoil depths will vary across the site. During the stripping process, it is crucial to maintain positive surface drainage to prevent the accumulation of water. TME typically recommends stripping and grubbing to a minimum of 10.0 feet outside all proposed building pads and a minimum of 5.0 feet outside toe of structural fills.

After stripping and prior to fill placement or after achieving final grade in proposed construction areas, areas intended to support roadways, floor slabs, new fill, foundations, and retaining walls should be carefully evaluated by a geotechnical engineer. At that time, proof rolling of the subgrade with a 20 to 30 ton loaded truck, or other pneumatic-tired vehicle of similar size and weight, should be performed to identify any soft or unstable areas. Proof rolling should be performed during good weather and not while site is wet, frozen, or severely desiccated. Proof rolling helps locate soft, weak, or excessively wet soils present at the time of construction. Any unsuitable materials observed during the evaluation and proof rolling operations should be undercut and replaced with compacted fill or as directed by the project engineer.

Based on the results of the majority of the soil test borings, we anticipate repairs associated with instability will generally be on the order of 3.0 to 5.0 feet below existing surface. In some areas, we anticipate repairs associated with instability will generally be less than 12 inches provided wet weather grading is not attempted. Other isolated areas needing deeper repair may be encountered especially in the lower lying areas and drainage features throughout the site. Soil test borings B-01, B-02, B-03, B-05, and B-07 encountered a near surface layer of very loose sands or soft clays to depths of 3.0 to 5.0 feet below existing surface. Subgrade repair should consist of removal of soft and/or organic laden soils in areas intended to support roadways, floor slabs, new fill, and foundations, especially in building pads and areas where existing grade is near final grade, until firm bearing soils are exposed, followed by backfilling with an approved structural fill source. Prior to backfilling, repair areas should be evaluated by a geotechnical engineer to confirm fill placement is suitable. Specific recommendations will need to be provided during on site evaluation. The costs associated with removal of soft soils can potentially be excessive and should be budgeted accordingly.

Once the site has been properly prepared, fill placement and other at-grade construction may proceed. If a significant amount of fill will be placed on the site in any location, additional analysis may be needed to determine the extent fill induced settlements on the site.

Dewatering Considerations

As noted in the Subsurface Conditions section of this report, groundwater was encountered in all soil test borings at the time of drilling at varying depths of 1.5 to 4.5 feet below the existing ground surface. The contractor should be prepared to address groundwater if deep excavations (i.e., utility trenches or storm-water ponds) are expected as it is likely the excavated area will collapse immediately following the removal of material. Furthermore, wet or saturated soils will need conditioning in order to reach a specified moisture content to achieve desired degree of compaction. If desired, considerations can be given to dewatering prior to excavation in order to control the stability of the excavated area and the moisture content of the excavated materials. The means and methods of dewatering, if desired, should be determined by the contractor prior to excavation activities.

Controlled Structural Fill

With the exception of topsoil, the native onsite soils are suitable for reuse as structural fill assuming the moisture content of the soils can be controlled to be at or near optimum moisture content. As noted above, several of the surface clays sampled in this investigation classified as moist. If lightweight silts are encountered, moisture conditioning may be required to maintain optimal compaction more frequently than other heavier soils. Fill materials, including off-site sources, if required, should have a classification of ML, CL, SC or SM as defined by the Unified Soil Classification System. Other materials may be suitable for use as controlled structural fill material and should be individually evaluated by the geotechnical engineer. Controlled structural fill should be free of boulders, organic matter, debris, or other deleterious materials and should have a maximum particle size no greater than 3 inches. Fill soils in structural areas should ***not*** contain more than five percent (by weight) organic material, have a plasticity index (PI) greater than 15, or have a maximum dry density less than 90 pounds per cubic foot.

Fill materials should be placed in horizontal lifts with a maximum thickness of 8 inches loose measure. New fill should be adequately keyed into stripped and scarified subgrade soils and should, where applicable, be benched into the existing slopes. During fill operations, positive surface drainage should be maintained to prevent the accumulation of water and the surface should be sealed at the end of each work day by the use of a smooth drum roller to limit infiltration of surface water. It is the grading contractor’s responsibility to continually maintain the site during fill operations. We recommend that structural fill be compacted to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density for fill beneath buildings and beneath pavements, except at the final foot which should also be compacted to at least 98% of the recommended index. We recommend that all compacted fill be placed at moisture contents in the range of ±3% of the materials optimum moisture content as determined from the Standard Proctor density test. Both vibratory sheepsfoot and smooth-drum compaction equipment is suitable for compaction of soils encountered on this site. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 4 to 6 inches may be required to achieve specified degrees of compaction. Each lift of fill should be tested in order to confirm that the recommended degree of compaction is attained.

We recommend that the contractor have equipment on site during earthwork for both drying and wetting of fill soils to meet the above compaction/moisture requirements. Moisture control may be difficult during winter months or extended periods of rain. Additionally, proper drainage should be maintained during earthwork construction to prevent ponding. Attempts to work the soils when wet can be expected to result in deterioration of otherwise suitable soil conditions. If soils cannot be stabilized using conventional methods, additional modifications to the subgrade soils can be used to adjust the moisture content. These methods include lime or cement stabilization.

Where construction traffic or weather has disturbed the subgrade, the upper 8 inches of soils intended for structural support should be scarified and re-compacted. Each lift of fill should be tested in order to confirm that the recommended degree of compaction is attained.

Foundation Design and Construction

The proposed structures may be supported on a shallow foundation system bearing on soils that have been suitably prepared and approved per the Site Preparation and Controlled Structural Fill recommendations in this report. We recommend that foundations be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot (psf) provided adequate repairs are conducted. Wall footings should be a minimum of 18 inches wide and isolated column footings should be at least 24 inches wide. A minimum embedment depth of 18 inches is recommended for exterior footings in order to bear below normal frost depth.

Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practical, after they are excavated. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation. We recommend that all bearing surfaces be evaluated a geotechnical engineer using hand auger/dynamic cone penetrometer testing equipment or other suitable methods prior to fill or concrete placement. Any unsuitable material detected during this evaluation should be undercut as directed by our geotechnical engineer. The actual extent of undercutting, if necessary, should be based on field observations made by the geotechnical engineer at the time of construction. Typical repairs for soft or very loose soils involve over excavating to firm bearing and then backfilling with washed stone to design bearing elevation with uniformly graded #57 or #67 washed stone while the typical repair for highly plastic clays involves excavation to a depth of at least 3.0 feet below design grade regardless of soil firmness. If deep cuts are proposed during the grading process, soft soils may be exposed at or near the design bearing elevation and thus undercutting may be necessary.

Ground Floor Slabs

Ground floor slabs may be designed as a slab-on-grade supported by approved residual soils or newly placed controlled structural fill. Slab-on-grade support is contingent upon successful completion of the subgrade evaluation process as described in the Site Preparation recommendations in this report. Some additional repairs may be necessary due to the presence of soft near surface soils and highly plastic clays. The floor slab should be supported on at least 4 inches of ABC stone to provide a uniform well-compacted material immediately beneath the slab. The installation of a typically minimum 6 mil vapor barrier is recommended to protect against water vapor intrusion between the base course and the slab.

Floor slab construction should incorporate isolation joints along bearing walls and around column locations to allow minor movements to occur without damage. Proper jointing is important to control slabs from cracking. Cracking of concrete is typical and should be expected. The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. Utility or other construction excavations in the prepared floor subgrade should be backfilled to a controlled fill criterion to provide uniform floor support. Controlling the water-cement ratio of the concrete (after batching), and including fiber reinforcement in the mix can also help reduce shrinkage cracking.

We estimate that an assumed subgrade design modulus of 100 pci is appropriate for floor slab design calculations.

Pavement Design Considerations

Based on experience with similar projects in the area, a typical pavement structure for the site assuming a standard design life of 20 years would consist of 3 inches of asphalt over 8 inches of ABC stone in areas subject to channelized car traffic and occasional truck traffic provided all necessary repairs are conducted during the earthwork process to stabilize subgrades and ADT values are less than 500 vehicles per day (vpd). A more substantial pavement structure may be required for roadways with higher ADT values and/or heavier truck traffic such as collector streets or thoroughfares and boulevards associated with the project. This preliminary pavement thickness recommendation can be modified accordingly, if necessary, in conjunction with laboratory CBR testing, which is typically performed after or during site grading, incorporating traffic data and appropriate ADT values.

Performance of pavements will be extremely dependent on the condition of the subgrade and drainage considerations implemented in the design. All subgrades should be properly compacted to 98% of the standard Proctor maximum dry density immediately prior to base course stone placement. It is important to proceed with the placement of all roadway design elements in a timely manner. We recommend all pavement areas be proof rolled to identify any areas displaying movement. Unstable areas should be repaired as directed by the onsite engineer or qualified technician. Stabilization techniques such as placing bridge lifts, chemical stabilization, or using geosynthetics could reduce the amount of undercut or other repair needed. Proposed grades and the availability of dry fill will likely dictate the most suitable type of repair in pavement areas. All pavements should be graded to promote runoff of water. Any landscape areas involving irrigation or perched water conditions encountered uphill of pavement sections may require installation of some type of drainage system to reduce the potential for seepage of groundwater into the base course.

If means and methods for removal and replacing the very loose or soft surface soils is excessive, a cement stabilization process can be considered in lieu of traditional earthwork options such undercutting and backfilling, or geo-grid installation. A full depth reclamation (FDR) cement stabilization procedure can be used in order to stabilize the subgrade soils to achieve proposed subgrade in preparation for placement of the aggregate base course. If these methods are considered, TME suggests that a ratio of 4 to 5% of cement per weight of soils be maintained in order to provide adequate stability.

Some repair should be anticipated following construction related traffic use. If consideration will be given to placing an initial lift of asphalt with the understanding a final lift will be placed after traffic associated with construction subsides, some repair work will likely be necessary prior to placement of the final lift of asphalt.

BMP/SCM Structures

Although no detailed information has been provided, we understand that a BMP/SCM structure is proposed for site development. If any BMP/SCM structure is designed to perform as a permanent wet pond, the infiltration rate in the bottom of the pond should be tested after excavation to verify it will perform as specified. Alternately, the seepage losses can be measured in place after the first rains pond water in the basin. If seepage losses are found to be excessive for a wet pond, consideration should be given to having 12 inches of soil over excavated out of the bottom of the basin and be replaced with compacted highly plastic clays or approved low permeability material. Those clays should then be covered with a minimum of 8 to 12 inches of other soil to reduce moisture changes in the clays over the course of the year. In the event seepage losses continue in excess of desired volumes, several products are available to consider to chemically amend the soil or pond bottom to control seepage rates. Regardless of the thoroughness of the preliminary testing, the final infiltration rates tend to vary and thus post construction measurements are the most appropriate method to correctly gauge seepage losses.

Earthen dam failure in residential developments can frequently be traced back to the inability to provide suitable compaction around the haunches of the outlet pipe resulting in erosion along the pipe. Installation of a concrete cradle is recommended on any outlet pipe extending through an earthen dam to reduce the risk of failure in these locations.

Segmental Retaining Walls

Detailed information has not been provided to us regarding retaining walls. If any MSE (mechanically stabilized earth) segmental type retaining walls are proposed, TME typically suggests importing a select granular low plasticity backfill for any walls in excess of 5.0 feet in height or within possible influence of structural loading for use as backfill within the retaining wall reinforced zone. Although some of the sands that were encountered on site during this investigation will typically meet design specifications for material to be used in the reinforced zone of retaining walls, further testing, including Grain Size Analysis and Atterberg Limits, should be performed to ensure the material meets design specifications. TME recommends site grading, typically in the form of a drainage swale parallel to the top of the wall, which should prevent surface water from flowing over the face of the wall or ponding in the reinforced zone. Drainage measures should be included by the designer to intercept water between the fill interface and the residual soils to prevent the saturation of backfill materials.

Once wall locations have been established, we recommend that the plans be reviewed by a geotechnical engineer to determine if additional subsurface investigation may be recommended in those locations to provide important information to assist in the wall design and construction, such as bearing conditions for the wall foundation and reinforced zone and data to perform global stability analysis. TME recommends that adequate laboratory testing be performed to define soil strength parameters and characteristics for any proposed wall backfill material for the wall designer to use in determining the correct grid lengths and spacing for walls.

We recommend designing and generating drawings for any MSE walls during the planning stages of development to allow for informed decisions to be made regarding available backfill material, batter influences, grid length restrictions, grid conflicts with utilities, and various site grading challenges commonly creating negative issues during construction. TME can provide a design for segmental retaining walls upon request.

Slopes

Fill slopes for embankments should be maintained at no steeper than 2.5H:1V (Horizontal to Vertical) and constructed with suitable materials and proper means and methods in order to maintain long term stability of the embankment sections. We recommend that slope fill consist of structural fill only with no disposal of topsoil, highly plastic clays, or large rock fragments, and be placed per the Controlled Structural Fill section of this report, as proper compaction is critical to a slope’s longevity. Compaction of a slope face can be difficult, so it is recommended the grading contractor fill past the edge of the slope face during placement and compaction and then cut it back to the design geometry.

Following construction of the slope, it is essential that proper vegetation be established as soon as possible on the slope face for stabilization and to prevent erosion and ongoing soil loss. Several alternate products to provide temporary erosion prevention are also available if the time of year to establish vegetation is not seasonally appropriate. Slope stabilization vegetation types such as deep rooting grasses will provide protection for the surface once established. Many commonly used landscaping shrubs and plantings that are more aesthetic do not provide adequate protection of the slope face. Additionally, site grading, gutter downspouts, irrigation and other water sources should be controlled to prevent excessive volume of discharge over the slope at unintended locations.

Shallow sloughing at the face for slopes exceeding a 2.5H:1V is common in the area regardless of construction methods. If slopes steeper than 2.5H:1V are proposed for development, especially if they are supporting structures or in areas that will be inaccessible to future modification, consideration should be given to adding geogrid reinforcement to prevent slope failure. A reinforced steep slope (RSS) is a compacted fill embankment that incorporates the use horizontally placed geosynthetic reinforcement to enhance the integrity of the soil structure and should be designed by the project geotechnical engineer. If provided with geometry specific to onsite slopes, TM Engineering, Inc. can assist in RSS design.

Utility Installation/Temporary Excavation Stability

If excavations greater than 4.0 feet in height are anticipated for utilities, shoring and bracing or flattening (laying back) of the slopes may be required to obtain a safe working environment. Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (CFR Part 1926) excavation trench safety standards. The contractor is solely responsible for designing and constructing stable, temporary excavations and slopes. We recommend that all excavated soils be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation. In addition, surface runoff water should be diverted away from the crest of the excavated slopes to prevent erosion and sloughing.

In general, the soils encountered during this investigation are suitable for support of utility pipes. Fill placed for support of the utilities and backfill over the pipes should satisfy requirements in the Controlled Structural Fill section of this report.

Localized areas of soft or unsuitable soils not detected by our borings or in unexplored areas may be encountered once construction begins. Vertical cuts in these soils may be unstable and may present a significant hazard because they can fail without warning. Therefore, temporary construction slopes greater than 5.0 feet high should not be steeper than one horizontal to one vertical (1H: 1V) and excavated material should not be placed within 10.0 feet of the crest of any excavated slope.

CONTINUATION OF SERVICES

We recommend that TM Engineering, Inc. be given the opportunity to review the construction plans and project specifications when construction documents approach completion. This review evaluates whether the recommendations and comments provided herein have been understood and properly implemented. Our continued involvement on the project helps provide continuity for proper implementation of the recommendations discussed herein.

LIMITATIONS

This report has been prepared for the use of Ashton Woods for specific application to the proposed Harding Drive project in Goldsboro, North Carolina, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our recommendations are based on information furnished to us; the data obtained from the previously described subsurface exploration program, and generally accepted geotechnical engineering practice. The recommendations do not reflect variations in subsurface conditions which could be present intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our recommendations based upon on-site observations of the conditions. Should the location of the proposed building construction significantly be changed, TM Engineering should be notified so that we can determine if the recommendations within this report remain applicable.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork, pavement, and foundation construction to verify that the conditions anticipated in design actually exist.

SOUTH HARDING DRIVE CONCEPT LAYOUT - OPTION 2

SITE DATA TABLE

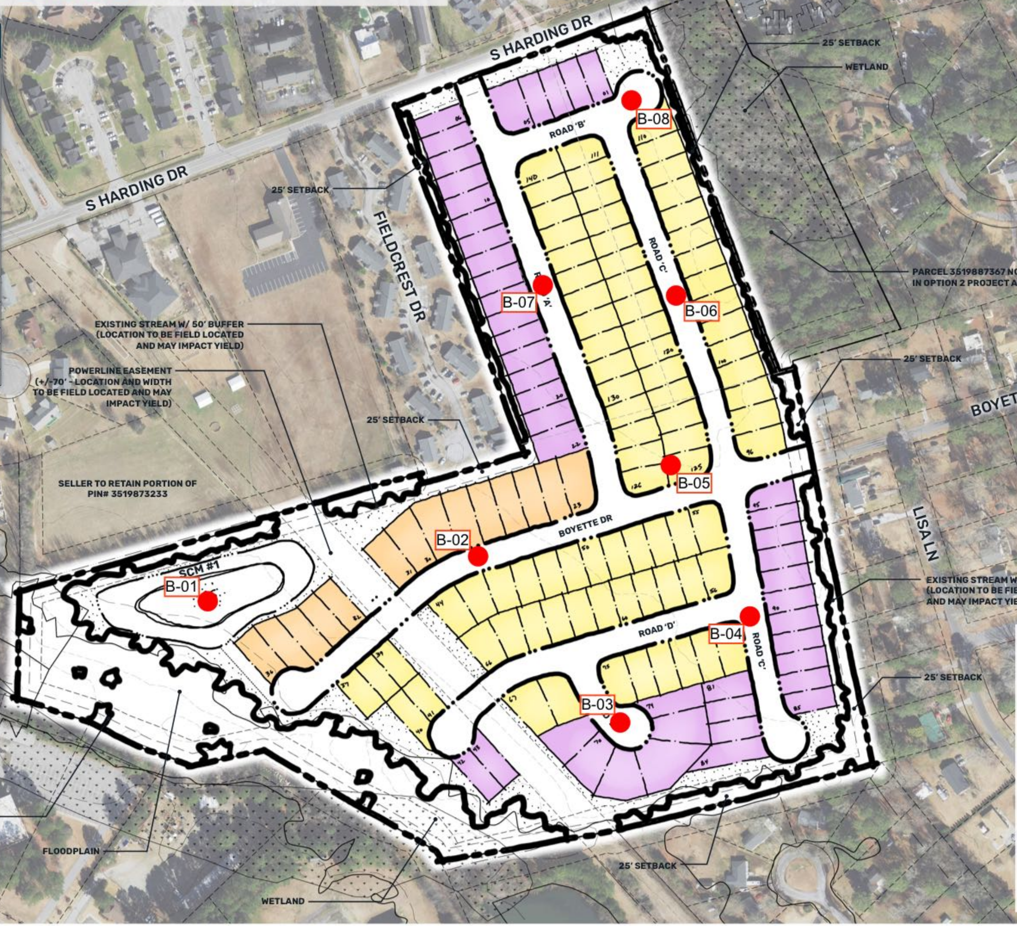
PIN(S)	3519873233 (+/- 28.25 ac), 3519881157 (+/- 2.37 ac), 3519883223 (+/- 4.00 ac), 3519885239 (+/- 4.53 ac),
Gross Site Area	+/- 39.15 acres
Net Site Area	+/- 31.65 acres (+/- 7.50 acres ROW)
Current Zoning	R-12 R-9 (seller to retain partial)
Proposed Zoning	PUD
Future Land Use Designation	Medium Density Residential
Open Space Required (20% Net Site Area)	+/- 6.33 acres
Tree Preservation Area Required	Not Required
Proposed 45'x110' FL SFD Lots (Glimmer)	+/- 45 lots (32%)
Proposed 49'x100' FL SFD Lots (Beacon, Solstice, Splendor)	+/- 81 lots (58%)
Proposed 49'x120' FL SFD Lots (Firefly)	+/- 14 lots (10%)
Total Proposed Dwelling Units	+/- 140 du
Min. Density (PUD Standard)	4 du/ac (4 du x 31.65 ac = 127 du min.)
Proposed Density	+/- 4.45 du/ac

DEVELOPMENT STANDARDS (UDO 5.3.7.4)

Min. Lot Area	5,880 sf (Established within PUD)
Min. Lot Width at Setback Line	45'
Front Setback (min./max.)	20'/25'
Side - Corner Setback (min.)	10'
Side - Interior Setback (min.)	5'
Rear Setback (min.)	20'
Perimeter Setback Required (min.)	25' (Maintained around entire perimeter of site per PUD)
Max. Cul-de-sac Length	800'
Parking Required	2 spaces/du

STREET SECTIONS

Road 'A'	60' ROW
Road 'B'	60' ROW
Road 'C'	60' ROW
Road 'D'	60' ROW
Road 'E'	60' ROW
Boyette Drive	60' ROW



CONCEPT PLAN NOTES

01 Concept layout is for planning purposes only and is subject to verification of all assumptions shown.

02 All base file information taken from GIS is subject to change unless otherwise stated.

03 Site rezoning and annexation is subject to jurisdictional standards and schedules.

04 Streams and wetlands shown are subject to State and USACE verification.

05 On site information including site area, boundaries, density, open space, and tree conservation calculations are subject to change unless surveyed boundary is explicitly referenced on plans.

06 A Traffic Impact Analysis (TIA) may be required in order to determine any required roadway improvements.

07 All assumptions shown herein are in accordance with current UDO standards as of the date shown on the plan. Changes to UDO standards, or jurisdictional text changes after that date may impact plan.

08 Sewer analysis needed to understand improvements required.

09 Storm drainage and grading analysis required to verify storm drainage requirements and improvements.

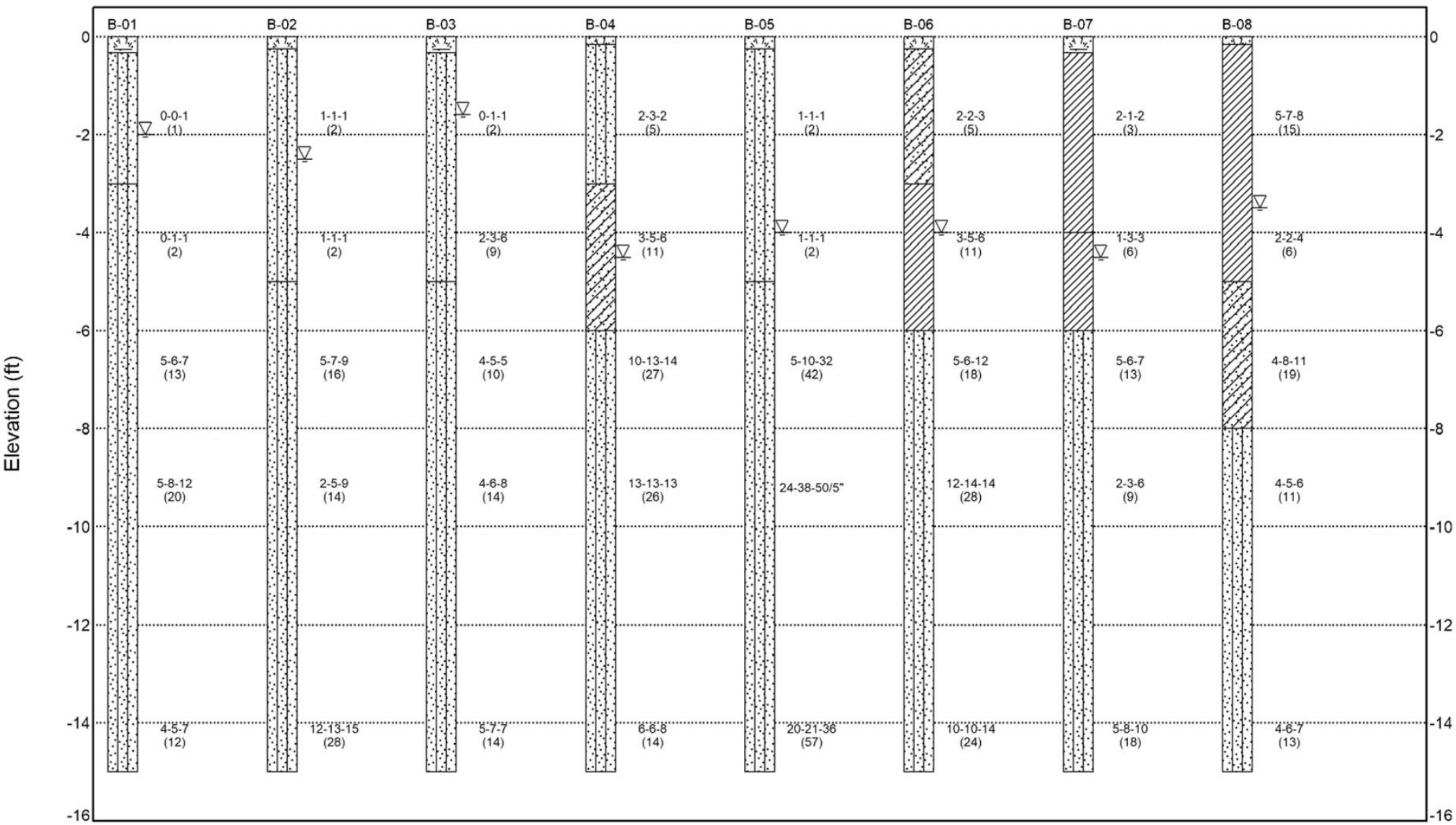
10 All storm ponds may be reduced or removed if Green Stormwater Infrastructure (GSI) is utilized.

TM Engineering, Inc.
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

SUBSURFACE DIAGRAM

CLIENT Ashton Woods
PROJECT NUMBER 232138E
PROJECT NAME Harding Drive
PROJECT LOCATION Goldsboro, North Carolina

Topsoil | USCS Clayey Sand | USCS Silty Sand | USCS Low Plasticity Clay



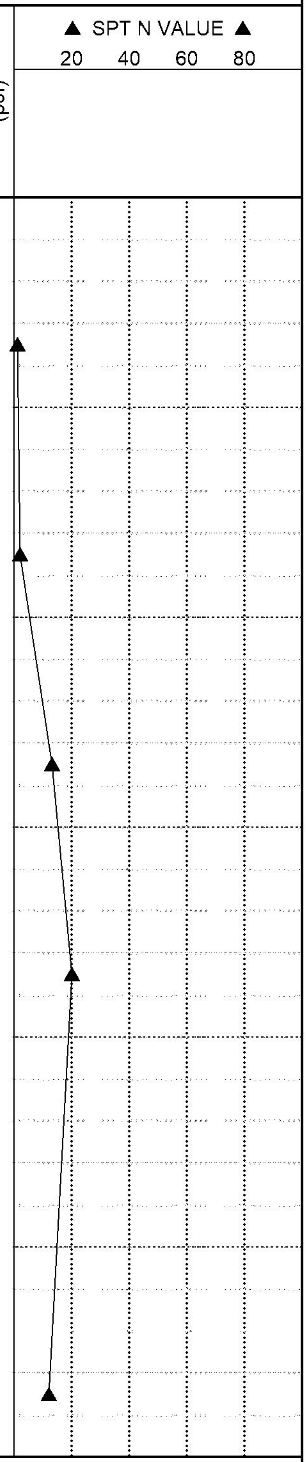
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-01

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/22/24 **COMPLETED** 1/22/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
▽ **AT TIME OF DRILLING** 2.00 ft / Elev -2.00 ft
LOGGED BY Doug/Kevin **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0		4" Topsoil					
		(SM) Very Loose Gray Silty Fine SAND (very wet)					
		▽	SPT 1		0-0-1 (1)		
2.5							
			SPT 2		0-1-1 (2)		
5.0		(SM) Loose to Medium Dense Gray/Brown/Tan Silty Fine to Coarse SAND (wet)					
			SPT 3		5-6-7 (13)		
7.5							
			SPT 4		5-8-12 (20)		
10.0							
12.5							
			SPT 5		4-5-7 (12)		
15.0							



Bottom of borehole at 15.0 feet.

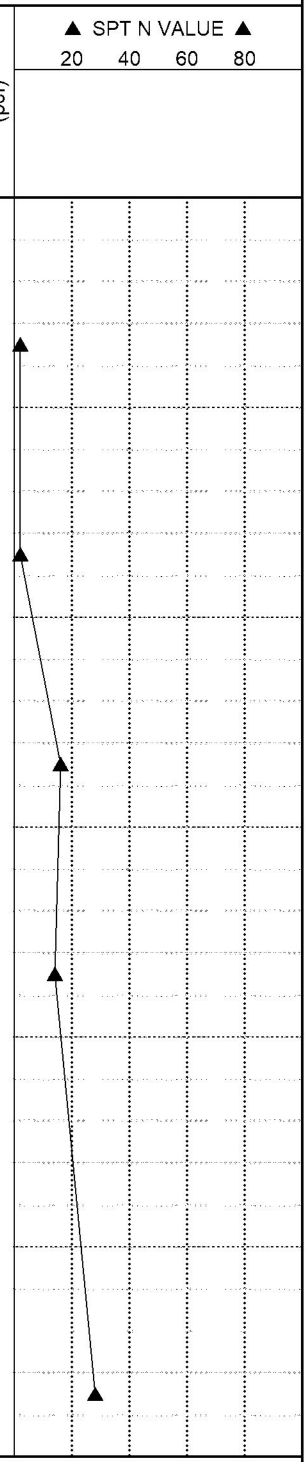
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-02

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
∇ **AT TIME OF DRILLING** 2.50 ft / Elev -2.50 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0		3" Topsoil					
		(SM) Very Loose Black/Dark Gray Silty Fine SAND (saturated)					
			SPT 1		1-1-1 (2)		
2.5		∇					
			SPT 2		1-1-1 (2)		
5.0		(SM) Medium Dense Gray/Tan Silty Fine to Coarse SAND (wet)					
			SPT 3		5-7-9 (16)		
7.5							
			SPT 4		2-5-9 (14)		
10.0							
12.5							
			SPT 5		12-13-15 (28)		
15.0							



Bottom of borehole at 15.0 feet.

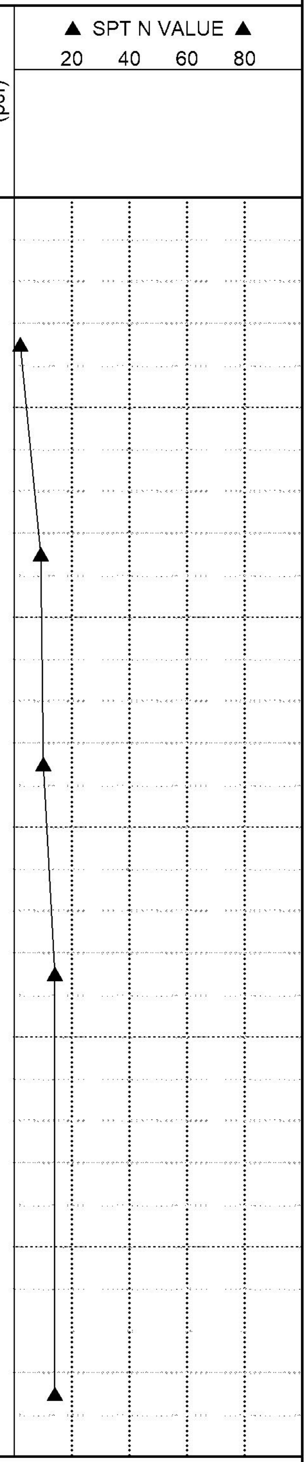
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-03

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/22/24 **COMPLETED** 1/22/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
AT TIME OF DRILLING ---
LOGGED BY Doug/Kevin **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0		4" Topsoil					
		(SM) Very Loose Gray Silty Fine SAND (very wet)					
	▽		SPT 1		0-1-1 (2)		
2.5							
		(SM) Loose to Medium Dense Gray/Brown/Tan Fine to Coarse SAND (wet)					
			SPT 2		2-3-6 (9)		
5.0							
			SPT 3		4-5-5 (10)		
7.5							
			SPT 4		4-6-8 (14)		
10.0							
12.5							
			SPT 5		5-7-7 (14)		
15.0							



Bottom of borehole at 15.0 feet.

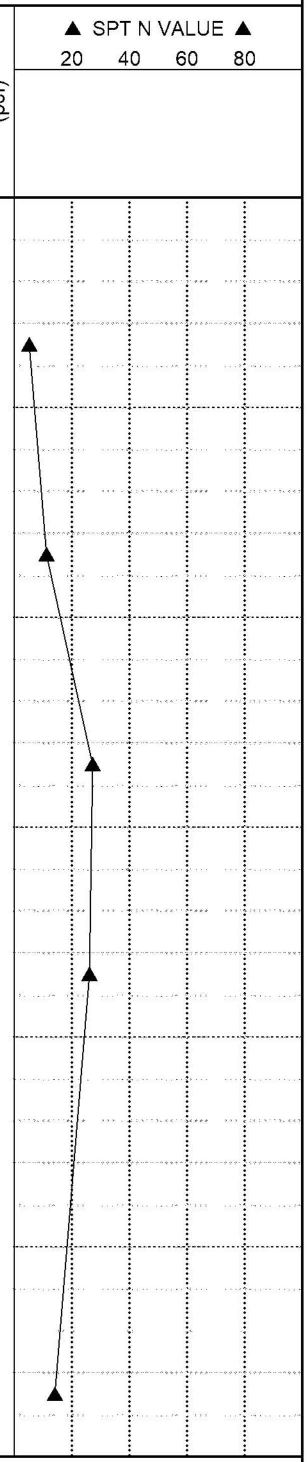
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-04

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
∇ **AT TIME OF DRILLING** 4.50 ft / Elev -4.50 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0	2" Topsoil					
	(SM) Loose Gray Silty Fine SAND	SPT 1		2-3-2 (5)		
2.5						
	(SC) Medium Dense Gray Clayey Silty Fine SAND ∇	SPT 2		3-5-6 (11)		
5.0						
	(SM) Medium Dense to Dense Gray/Brown Silty Fine to Coarse SAND (moist)	SPT 3		10-13-14 (27)		
7.5						
		SPT 4		13-13-13 (26)		
10.0						
12.5						
		SPT 5		6-6-8 (14)		
15.0						



Bottom of borehole at 15.0 feet.

103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

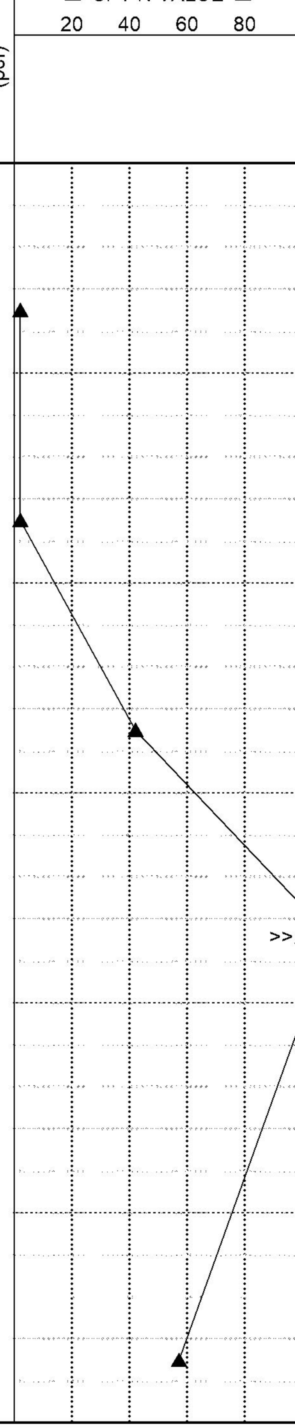
TM Engineering, Inc.

BORING NUMBER B-05

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
▽ **AT TIME OF DRILLING** 4.00 ft / Elev -4.00 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0		3" Topsoil					
		(SM) Very Loose Gray Silty Slightly Clayey Fine to Medium SAND (moist)					
			SPT 1		1-1-1 (2)		
2.5							
		▽	SPT 2		1-1-1 (2)		
5.0		(SM) Dense Brown Silty Fine to Coarse SAND (wet)					
			SPT 3		5-10-32 (42)		
7.5							
			SPT 4		24-38-50/5"		
10.0							
12.5							
			SPT 5		20-21-36 (57)		
15.0							

▲ SPT N VALUE ▲



Bottom of borehole at 15.0 feet.

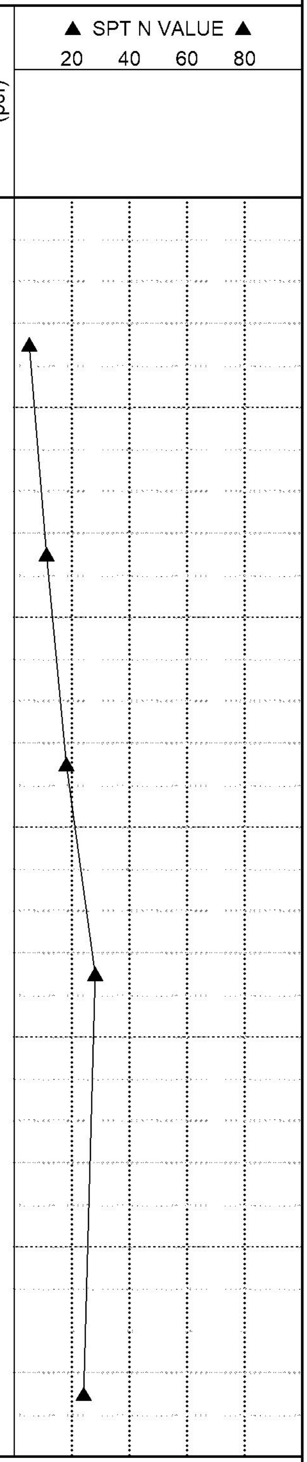
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-06

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
AT TIME OF DRILLING 4.00 ft / Elev -4.00 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0		3" Topsoil					
		(SC) Loose Brown Clayey Silty Fine to Medium SAND (moist)	SPT 1		2-2-3 (5)		
2.5							
		(CL) Stiff Gray Very Fine Sandy Silty CLAY (moist) ▽	SPT 2		3-5-6 (11)		
5.0							
		(SM) Medium Dense Tan/Gray/Brown Silty Fine to Coarse SAND (wet)	SPT 3		5-6-12 (18)		
7.5			SPT 4		12-14-14 (28)		
10.0							
12.5							
15.0			SPT 5		10-10-14 (24)		



Bottom of borehole at 15.0 feet.

103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

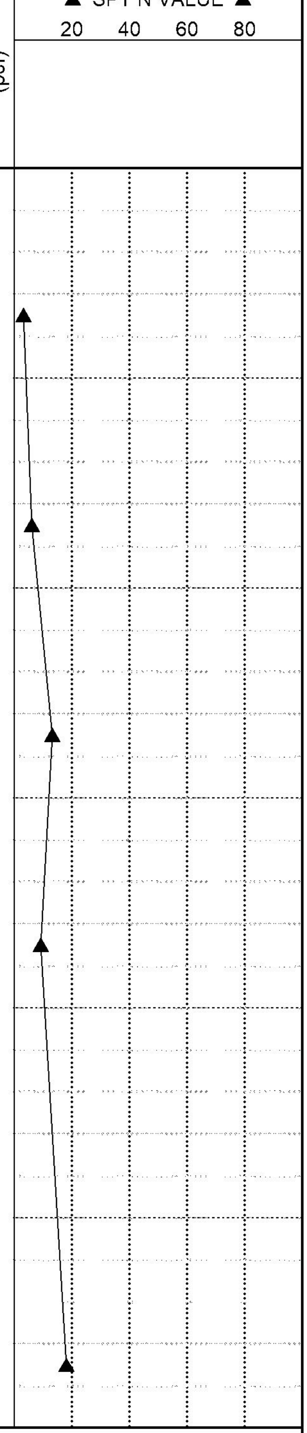
TM Engineering, Inc.

BORING NUMBER B-07

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
▽ **AT TIME OF DRILLING** 4.50 ft / Elev -4.50 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0	4" Topsoil					
	(CL) Soft Gray/Tan Fine Sandy Silty CLAY (wet)	SPT 1		2-1-2 (3)		
2.5						
	(CL) Firm Gray Fine Sandy Silty CLAY (moist) ▽	SPT 2		1-3-3 (6)		
5.0						
	(SM) Loose to Medium Dense Brown/Tan/Gray Silty Fine to Coarse SAND (wet)	SPT 3		5-6-7 (13)		
7.5		SPT 4		2-3-6 (9)		
10.0						
12.5						
15.0		SPT 5		5-8-10 (18)		

▲ SPT N VALUE ▲



Bottom of borehole at 15.0 feet.

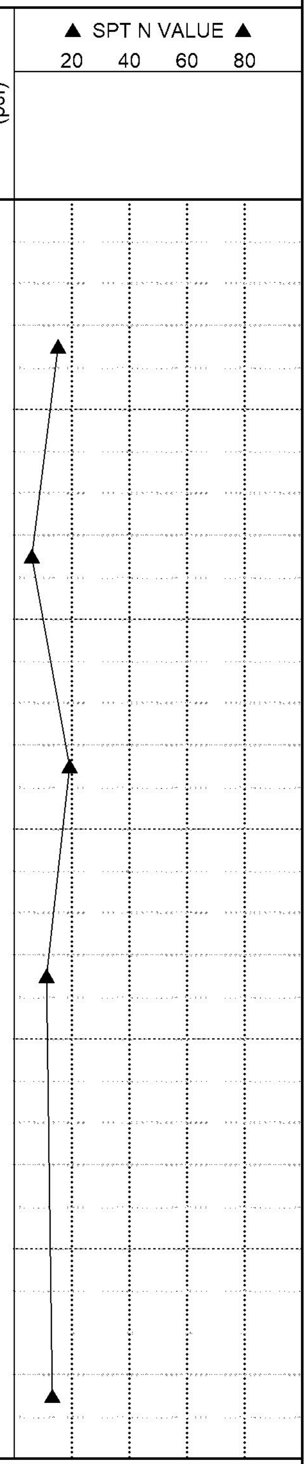
103 Hiawatha Court
Cary, North Carolina
Telephone: (919) 468-2545

TM Engineering, Inc.

BORING NUMBER B-08

CLIENT Ashton Woods
PROJECT NAME Harding Drive
PROJECT NUMBER 232138E
PROJECT LOCATION Goldsboro, North Carolina
DATE STARTED 1/24/24 **COMPLETED** 1/24/24
GROUND ELEVATION 0 ft **HOLE SIZE** 4
DRILLING CONTRACTOR Carolina Drilling
GROUND WATER LEVELS:
DRILLING METHOD SS
▽ **AT TIME OF DRILLING** 3.50 ft / Elev -3.50 ft
LOGGED BY Keith **CHECKED BY** BNM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0.0	2" Topsoil					
	(CL) Firm to Very Stiff Gray Very Fine to Medium Sandy Silty CLAY (moist)					
		SPT 1		5-7-8 (15)		
2.5						
	▽	SPT 2		2-2-4 (6)		
5.0	(SC) Medium Dense Gray/Orange Clayey Silty Fine to Coarse SAND (wet)					
		SPT 3		4-8-11 (19)		
7.5						
	(SM) Medium Dense Gray/Tan Silty Fine to Coarse SAND (wet)					
		SPT 4		4-5-6 (11)		
10.0						
12.5						
		SPT 5		4-6-7 (13)		
15.0						



Bottom of borehole at 15.0 feet.

Important Information about This

Geotechnical-Engineering Report

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

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

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

Understand the Geotechnical-Engineering Services Provided for this Report

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

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

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

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

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

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

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

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

Read this Report in Full

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

You Need to Inform Your Geotechnical Engineer About Change

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

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

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

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

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

This Report's Recommendations Are Confirmation-Dependent

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

This Report Could Be Misinterpreted

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

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

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

Give Constructors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

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

GEOPROFESSIONAL BUSINESS ASSOCIATION

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

NOTES FOR EXPLORATION LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D 2488)			SYMBOLS GRAPHIC	SYMBOLS LETTER
COARSE - GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		GW
				GP
		GRAVELS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		GM
				GC
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		SW
				SP
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SM
				SC
FINE - GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		ML
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CL
		SANDY OR GRAVELY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OL
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		MH
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CH
		SANDY OR GRAVELY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OH
HIGHLY ORGANIC SOILS				PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS CONTAINING AN ESTIMATED 10% FINES BY VISUAL CLASSIFICATION OR WHEN THE SOIL HAS BETWEEN 5 AND 12 PERCENT FINES FROM LABORATORY TESTS; AND FOR FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSSHATCHED AREA. FINE-GRAINED SOILS ARE CLASSIFIED AS ORGANIC -OL OR OH, WHEN ENOUGH ORGANIC PARTICLES ARE PRESENT TO INFLUENCE ITS PROPERTIES. LABORATORY TEST RESULTS ARE USED TO SUPPLEMENT SOIL CLASSIFICATION BY THE VISUAL-MANUAL PROCEDURES OF ASTM D2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

	DESCRIPTION		GRAPHIC SYMBOLS
ADDITIONAL DESIGNATION	TOPSOIL		
	MAN-MADE FILL		
	GLACIAL TILL		
	COBBLES AND BOULDERS		
RESIDUAL SOIL DESIGNATION	DESCRIPTION	"N" VALUE	
	HIGHLY WEATHERED ROCK	50 TO 50/1"	
	PARTIALLY WEATHERED ROCK	MORE THAN 50 BLOWS FOR 1" PENETRATION, AUGER PENETRABLE	

COARSE-GRAINED SOILS
(GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D1586

FINE-GRAINED SOILS
(SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SPLIT-SPOON	S-
SHELBY TUBE	U-
ROCK CORE	R-

WATER DESIGNATION

DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	
UPON COMPLETION OF DRILLING	
24 HOURS AFTER COMPLETION	

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.